Abstract

There are four contributions of this research: 1) confirmation of inconsistent use of terminology in the Computer Supported Cooperative Work (CSCW) research field; 2) the development of a hierarchical terminology technique that extends the idea of cognitive mapping into a hierarchy of concepts and dictionary of related definitions; 3) a taxonomy of terminology showing the boundary of the CSCW research field; and 4) a dictionary of definitions relating to the terminology in the taxonomy.

The investigation of prior research in this field found that there was a proliferation of terms all relating to support of groups, and there was a proliferation of software and systems that support groups. However, the terminology and definitions used by researchers were found to be inconsistent, with some terms being defined differently, but then used interchangeably. Inconsistency makes it difficult to determine what technology is being used in the research and where a research study fits into the research field.

Knowledge of any research field is mainly gained through reading published research documents. This research analysed published documents in Computer Supported Cooperative Work (CSCW) to determine the scope, structure and meaning of the terminology used in this research field. The research resulted in a hierarchy of terminology and a dictionary of definitions. Future research will determine the value of these structures for new researchers, experienced researchers, and practitioners.

During the investigation of prior research no technique was identified to undertake such a study. A hierarchical terminology technique (HTT), which is a form of content analysis process, was developed to structure a hierarchy of concepts to expose the relationships between terms. This technique includes terminology identification, analysis and presentation to show the scope of a research field and to present terminology and definitions to improve consistency. This technique can be used in other fields of study.

Making sense of Computer Supported Cooperative Work:

A taxonomy of terminology

by

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Certificate of Authorship and Originality of Thesis (Declaration)

The work contained in this thesis has not been previously submitted for a degree at Central Queensland University or any other tertiary institution. To the best of my knowledge and belief the material presented in this thesis is original except where due reference is made in text

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This thesis

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Chapter 1 Introduction

This research identifies and describes three issues associated with the Computer Supported Cooperative Work (CSCW) research field:

- the inconsistency of terminology and definitions;
- the inadequacy of classification of systems; and
- the lack of clarity in the scope of the research field.

These three associated issues form the research problem. As no suitable technique was identified in prior research, a new content analysis method, the Hierarchical Terminology Technique (HTT), was developed to identify and structure the terminology in order to address the problem of terminological inconsistency in this research field. The HTT could be used in other disciplines and fields to identify the problems in terminology and definitions and to produce terminology structures and definitions of terms to reduce the inconsistency of terminology use.

1.1 Terminology inconsistency

Researchers in the field of CSCW have reported that inconsistent terminology and definitions in the discipline negatively impact their research and the dissemination of their research findings (for example, Dennis, Quek & Pootheri 1996; Poole 1998; Greenlaw 1999; Turner & Turner 2002). Inconsistencies in the use of terminology and definitions have also been reported in the broader IS discipline (Alter 2000).

Inconsistencies with the use of terminology have been highlighted by researchers in other fields, such as marketing (for example, Hunt 1983; Ward 1995; Teas & Palan 1997), electronic negotiation (Strobel & Weinhardt 2003), health (for example, Chute 2000; Walsh 2005), collective action literature (Poteete & Ostrom 2004), and education (for example, Bruce & Levin 1997; LaPorte 2003). When studying education technologies, Bruce and Levin (1997) stated that experts often disagree about what constitutes the objects of their study, but avoid addressing their disagreements directly.

Analysis of prior research in the CSCW field confirmed that there is a proliferation of terms used to describe groups using technology for group work, and a proliferation of software and systems all purporting to support groups. Further, the terminology and definitions used by researchers have been found to be confusing as many terms were defined and used inconsistently, and different terms used interchangeably (for example, Bostrom & Anson 1988; Williams & Wilson 1997; Twidale & Nichols 1998). In this research *terminology* is used as an umbrella term which refers to the whole *problem*; ‘from classification to nomenclature, language labels to concepts’ (Chute 2000, p. 299).

The second problem concerns the inadequacy of classification and categorisation of computer systems developed and used for group work. These classification systems have been criticised for poor system definition, lack of clear characteristics that differentiate the categories, overlap of categories, and problems with expandability and adaptability (for example, Hein, Keenan & Reinke 1998; Zigurs & Buckland 1998; Bafoutsou & Mentzas 2002).

The third problem concerns the lack of clarity of the scope of the field. Authors comment about the scope of research fields, but little discussion is given on how to define the scope, or identify the breadth of the scope, of a research field (for example, Bannon 1992; Whitaker 1996).

CSCW is a multidisciplinary field across Information Systems (IS) and Computer Science (CS). The CSCW field includes research relating to support for communication (Galegher & Kraut 1992; Greenberg 2001), cooperative writing and editing (Hymes & Olsen 1992; Kirby & Rodden 1995), meetings (Streitz, Geibler, Haake & Hols 1994), decision making (Mark, Haake & Strietz 1995; Hofstede, Vermunt, Smits & Noorderhaven 1997; Baker 2002), learning (Koschman 1995b; Benbunan-Fich & Hiltz 1999; Greenlaw 1999; Cadiz et al. 2000; Guzdial, Rick & Kerimbaev 2000), shared media spaces (Gaver 1992; Heath, Luff & Sellen 1995; Gutwin & Greenberg 1999) virtual teams (Adams, Toomey & Churchill 1999; Johnson, Heimann & O’Neill 2001) and workflow (Bowers, Button & Sharrock 1995; Atkinson & Lam 1999; LaMarca, Edwards, Dourish, Lamping, Smith & Thornton 1999) as they relate to group work using computers.

Grudin (1991) described CSCW as denoting at least two kinds of entities: special computer products, often referred to as *groupware*, and a *forum* of computer scientists and other professionals who want to provide better computer support for people who are collaborating together on joint activities. Many authors use the term *groupware* as a generic term, to refer to the range of computer systems that support groups (for example, Ellis, Gibbs & Rein 1991; Greenlaw 1999; Mallach 2000). However, there is lack of agreement on the definition of groupware, or which system types should be included in this range of systems (Bannon 1992; Hinssen 1998).

These statements highlight some of the problems that occur when there is a lack of consistency in terminology in a research field. It is this inconsistency of definitions, usage of terminology and lack of clarity that prompted this research.

1.2 Research problem

The review of literature in Chapter 2 highlights the inadequacies and inconsistencies of the definitions and categorisations in CSCW, both issues having a negative impact on research and practice. The inconsistency of terminology and definitions, in the CSCW field, has made it difficult:

- to determine what specific technology had been used in each research study;
- to determine where each research study fits into the research field; and
- to understand the terminology in the CSCW field, in all environments.

As CSCW is interdisciplinary by its very nature, it is important that researchers have a clear holistic understanding of the terminology and scope of this research field.

Various authors have suggested the use of a taxonomy to address the issue of inconsistency of terminology. Hasselbring (1999) described the problem of inconsistency in computer science terminology and suggested the development of a taxonomy to resolve the confusion. Durkeheim and Mauss (1963 in Marradi 1990) also suggested taxonomies as a means to advance understanding. Letson (2001) agreed that taxonomies put content into context. Marradi (1990) suggested that a taxonomy, which is an approximation of reality, could be used to gain greater understanding in a field of study. Marradi went on to say that the reason for the structuring of terminology is to improve human knowledge that links the study of linguistics, ontology, taxonomy and communication. Linguistics, ontology, taxonomy and communication are discussed in Chapter 2 as they relate to this research.

Other authors have argued that a taxonomy of terminology should also have a dictionary of definitions (Neuman 1994; Cooper & Emory 1995; Landauer & Rowlands 2001; Ishida & Ohta 2002). When describing the philosophy of research, Neuman argued that: ‘People must share the terms for concepts and their definitions if they are to be of value’ (Neuman 1994, p. 36). Cooper and Emory (1995, p. 35) stated that ‘If words have different meanings to the parties involved, then they are not communicating on the same wavelength. Definitions are one way to reduce this danger’. These two statements specifically highlight the need for consistency in the use of terminology in research disciplines.

This study was undertaken to examine the concepts used in prior research to develop a comprehensive taxonomy of terms and definitions in CSCW, to show the scope of the field and to provide a structured flexible foundation on which other new knowledge about the field can be developed. The term *concept* has been used in this research as it has two parts: a symbol (word or term) and a definition (Neuman 1994). Neuman argued that social science concepts form a specialised language, and professionals all have specialised languages and they use this specialised language to ‘refer to the ideas and objects with which they work’ (p. 36).

The research problem was drawn from the issues described above.

Research Problem: To define the boundaries of CSCW, to develop a taxonomy of CSCW terms and to develop a dictionary of definitions of those terms in order to provide a consistent foundation for research and practice in the field.

From this research problem, four objectives were identified:

- To identify inconsistencies of terms and definitions used by researchers across the CSCW research field;
- To develop a taxonomy to show the scope of the CSCW research field;
- To develop a taxonomy of terms to show the relationship of the terms to one another; and
- To develop a dictionary of definitions as they relate to the terms used in the CSCW taxonomy.

This study has identified terms in such areas as technology, task and group as they relate to research into groups using computers for groupwork. This study also highlighted the lack of a suitable method for identifying inconsistencies and structuring terminology for greater clarity of terminology use in a research field. A new method, the hierarchical terminology technique (HTT) that uses content analysis and extends the idea of concept mapping to a hierarchy of terminology, was developed for this purpose.

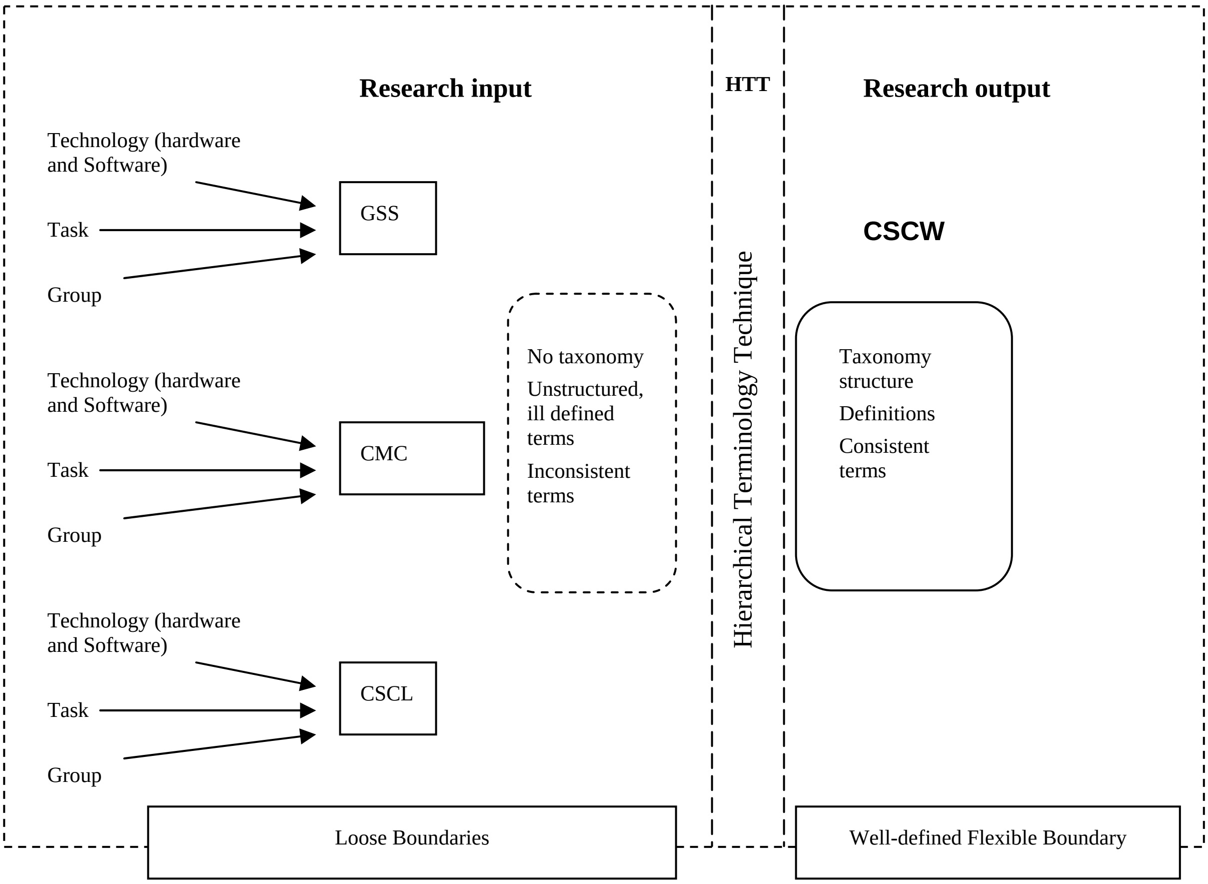
1.3 Research framework

The research framework (Figure 1.1) was developed from the literature review (Chapter 2). The framework relates the concepts of technology, task and group to each research subgroup and points to the lack of structure, lack of consistency, and lack of clear definitions for these concepts at the present time.

CSCW research encompasses three elements: *groups*, undertaking *group work*, with the use of *computer systems* for support (Grudin 1991). Grudin's description also suggested that CSCW is studied both from the system development perspective and the system use perspective. This research takes the 'system use perspective' and investigates the terminology and definitions used in research articles that relate to the use of CSCW systems for groupwork, including how such systems support the user, rather than research describing the development of these systems.

The research terminology concepts of Group Support Systems (GSS), Computer Mediated Communication (CMC), and Computer Supported Cooperative Learning (CSCL) (on the left of Figure 1.1) are examples of the research subgroups within the field of CSCW. The three elements identified by Grudin (1991), of technology, task and group, relating to each subgroup, are shown as the research input. On the right of Figure 1.1, the output of the study shows a well-defined, but flexible boundary with consistent terms, structure and definitions for the CSCW research field. The HTT process is shown between the input and output.

Figure 1.1: Conceptual framework



1.4 Methodology and Method

The review of the literature did not reveal a previously researched theoretical model or method for developing a taxonomy and dictionary of definitions for a particular research field. Thus it was necessary to develop a new method to undertake these activities. A study of taxonomic theory provided guidance in the development of a practical method for identifying terminology and structuring the terminology to show diagrammatically the scope of the CSCW research field. Spradley's (1979 in LeCompte 2000) semantic relationships were used to identify the relationships of terms within the text. The development of the Hierarchical Terminology Technique (HTT) (which extends the idea of cognitive mapping) and its description is an important outcome of this research.

This is an interpretive/descriptive study, using an unobtrusive data collection technique of analysing prior research literature. A computer-aided qualitative form of content analysis has been used to extract data about terminology, definitions, classifications and other groupwork issues from the published CSCW literature. The data were used to form interconnected groups or concept clusters, which holistically form a web of meaning. These groupings were then used to develop a hierarchical taxonomy of terms (Appendix D) and associated dictionary of definitions (Appendix E) to address the research problem.

1.5 Boundaries of the Research

As a holistic study of CSCW terminology had not previously been undertaken it was not originally apparent where the boundaries of the research, relating to article types or article dates, should be placed. However, in order to qualify for inclusion in this research the sourced articles required all three elements relating to CSCW: groups of people, who use computer systems, to undertake group work (Grudin 1991).

The term CSCW was not introduced until 1984 (Grudin 1991), but studies that included the three elements described above had been undertaken prior to this date. Some reflective studies by other researchers such as Pervan (1998) and Turner and Turner (2002) assisted with the determination of an approximate date for when the first articles (late 1970s) were published. As the analysis was completed in 2003 this determined the final year of data collection. Therefore, the boundaries of this research relating to data source included article types having the three elements of CSCW, the system use perspective, and published between 1978 and 2003 inclusive.

English is the language used for this study and only articles published in the English language have been used for analysis.

1.6 Justification and contribution of this research

The lack of standardisation of terminology and meanings as described above provided four reasons justifying this research.

- There is a need for a holistic review due to the inconsistency in terminology and definitions in this research field.

- There is a need for an improvement in information exchange and understanding among diverse multidisciplinary, geographically scattered researchers and practitioners.
- There is a need to add hierarchical relationships (broader terms, narrower terms) and related terms to controlled vocabularies for improved terminology use and information retrieval.
- There is a need to improve consensus between researchers and practitioners of the meaning and use of terms.

The output of this study contributes to the research discipline and to the body of knowledge in CSCW by the development of:

- a taxonomic structure that shows the relationship of each CSCW term to one another and clarifies the scope of the research field;
- an internally consistent set of terms and definitions in the form of a dictionary of CSCW terms that can be used as a foundation by other researchers and practitioners of the CSCW field. The dictionary also includes definitions from earlier articles to show the changes in definition of some terms over the history of the CSCW research field; and
- a new method (HTT) for the analysis and structure of terminology from documents. HTT is an extension of the idea of concept mapping to a hierarchy of terminology that shows the relationship of terms to one another. This method will be of benefit to many fields of study in particular in the areas of information sciences, ontology development in IS and health informatics.

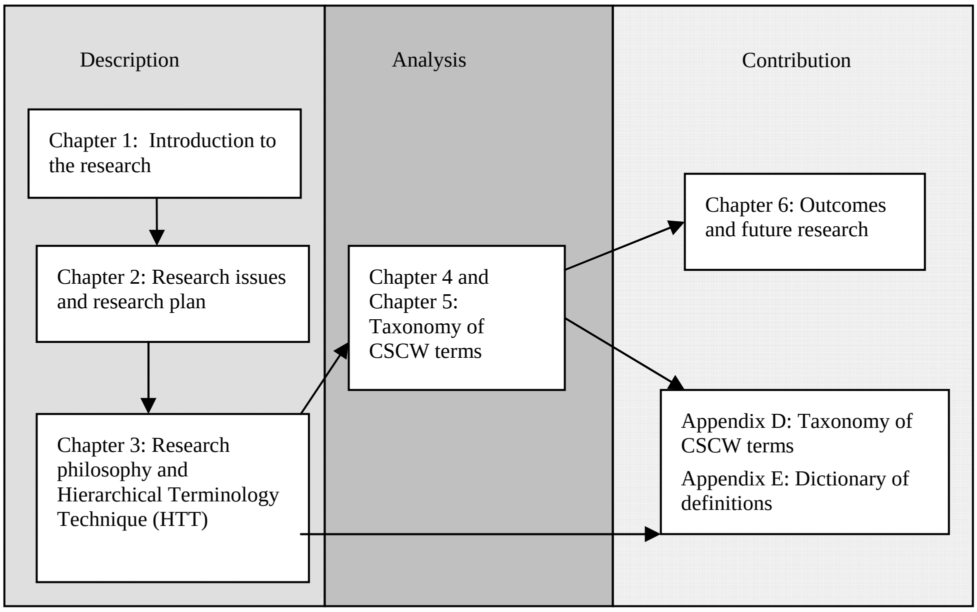
1.7 Thesis structure

The thesis structure is shown diagrammatically in Figure 1.2.

Chapters 2 and 3 provide a description of the research and the reasons for undertaking the research. Chapter 2 examines the research issues and research framework. The background to the research is described and includes a review of the fields of linguistics, epistemology and taxonomy as they relate to this study. Chapter 2 also includes an explanation of the development of the research problem. Chapter 3 describes the methodologies and methods and also presents the new HTT method.

Chapters 4 and 5 provide a description of the development of the taxonomy of terms and present the taxonomy that was developed from content analysing research articles, from 1978 to 2003, using the hierarchical terminology technique. Chapter 6 provides a discussion of the output of the research, contributions to knowledge, and future research.

Figure 1.2: Thesis structure



The thesis has five appendices:

- Appendix A: Coding form (which was used for manual collection of some data used to check for validity of the data collection technique).
- Appendix B: Keywords (used as search terms for finding relevant articles)
- Appendix C: References of articles (used in the analysis, arranged by date).
- Appendix D: Taxonomy of CSCW terms (the final taxonomy of terms sourced from articles from 1978-2003).
- Appendix E: CSCW Dictionary (The dictionary of terms and definitions includes acronyms and definitions of all discipline terms used throughout the chapters and in the resulting taxonomy of CSCW terms. It also includes historical definitions, and provides referenced quotes using some CSCW terms).

1.8 Summary

This chapter described the reason for undertaking this study. Justification was established for using a holistic approach to study the CSCW research concepts due to lack of understanding of the scope of the research field and the lack of consistency in the use of terms and definitions. An important outcome of this study is the development of a new method (Hierarchical Terminology Technique) for terminology identification, analysis and presentation.

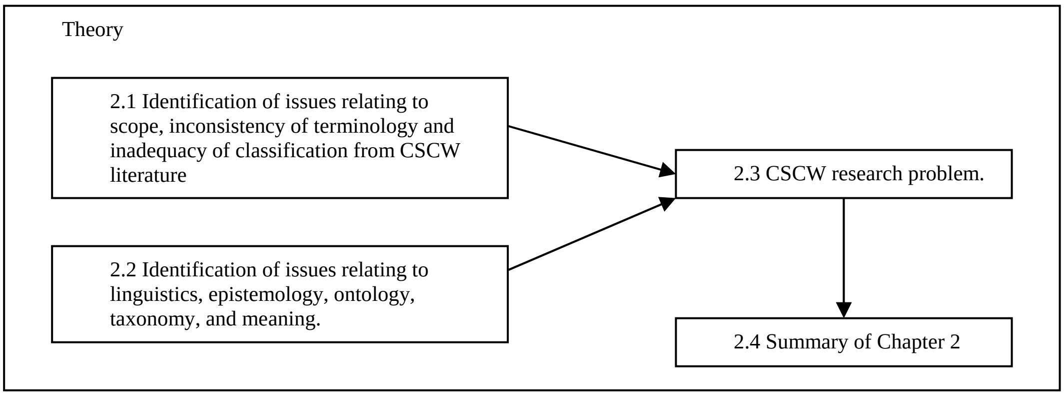
Chapter 2 Computer Supported Cooperative Work

> Although we think we govern our words … Certain it is that words, as a Tartar's bow, do shoot back upon the understanding of the wisest, and mightily entangle and pervert the judgement. So that it is almost necessary, in all controversies and disputations, to imitate the wisdom of the mathematicians, in setting down in the very beginning the definitions of our words and terms, that others may know how we accept and understand them, and whether they concur with us or no. For it cometh to pass, for want of this, that we are sure to end there where we ought to have begun, which is – in questions and differences about words (Francis Bacon (1561-1626) in Hacking 1975, p. 5).

The research problem of inconsistent terminology and definitions was introduced and described in Chapter 1. A research framework was then presented, the structure of the thesis was discussed and the justification and contributions of the research were highlighted.

The background to this research is presented in this chapter. The chapter structure is illustrated in Figure 2.1. Section 2.1 reviews the relevant literature in the discipline of Information Systems and the field of CSCW to highlight the research problem of inconsistency of terminology. This section also highlights the inadequacies of previous CSCW classification systems and the lack of scope of the CSCW research field which together focus the research problem. Comments from researchers from other disciplines are also presented to show that the problems with inconsistency in terminology use and definitions of terms, are not restricted to CSCW or IS research.

Figure 2.1: Chapter 2 structure



A review of linguistics and a discussion of epistemology, ontology and taxonomy are used to clarify the need for consistency of terminology and provide guidance in identifying a procedure and methods to assist with addressing the research problem (Section 2.2). The research problem and the use of taxonomy provide a foundation for the research framework and establish the significance and relevance of the research problem to be addressed. Three specific research tasks (SRT) used to address the research problem are then presented in Section 2.3. The chapter concludes with a summary (Section 2.4).

2.1 Terminology inconsistency

The problem of inconsistency of terminology is not new, and is not only applicable to the field of CSCW, but is an issue in many fields. This section describes the issue of inconsistency from a general IS perspective, a specific CSCW perspective and with examples that highlight the problems in other research fields. Section 2.1 is divided into five subsections:

- Section 2.1.1 reviews the comments by other authors regarding terminological inconsistency in the IS/IT disciplines, in general, and presents a number of authors' concerns regarding a lack of the consistent use of terminology and definitions that impact research and practice.
- Section 2.1.2 reviews the CSCW literature, in particular, to highlight the inconsistency issue relating to this field of study.
- Section 2.1.3 discusses comments from authors in other disciplines who describe the impact of inconsistent terminology.
- Section 2.1.4 reviews the classification systems used in CSCW research and highlights the inadequacy of these classification systems.
- Section 2.1.5 describes issues relating to the scope of the CSCW research field.

A summary of Section 2.1 is then presented which draws together the issues of inconsistencies in terminology and definitions, inadequacies of classification systems, and lack of scope, that together focus the research problem.

2.1.1 IS/IT Terminology inconsistency

A general problem with computer science terminology is that some terms are often used for different concepts and that the same concepts are denoted by different terms (Hasselbring, 1999). Defining the domain and core concepts of the IS discipline is a perennial topic at major IS conferences (Alter 2005). 'Business professionals typically lack an organised vocabulary for understanding systems in organisations', and confirm that ‘different researchers use different meanings for basic terms such as system, user, stakeholder, implementation and requirements’ (Alter 2005, p.3).

Inconsistent terminology use was described by Alter (2000) in the article entitled *Same words, different meanings: are basic IS/IT concepts our self imposed Tower of Babel?* This article presented numerous quotes from ten IS/IT articles to illustrate the differences in the use of eight basic concepts: system, user, stakeholder, IS, project, implementation, reengineering and solution. He argued that this inconsistency may be ‘a significant impediment to effective communication and to our ability to make sense of research findings’ (Alter 2000, p. 2). Alter contended that the range of different meanings and connotations associated with the most commonplace IS terms implied that the field of IS needed to pay more attention to basic concepts and how different people use them.

The *Tower of Babel* problem, where participants from different areas use the same terms in subtly different ways, had previously been described by Grudin (1994a). Grudin discussed the words *user* and *implementation* and pointed out the differences in the meaning of these terms in human-computer interaction and information systems fields. To address the ambiguity with the term *user* the IS field coined the term *end user* to describe a person at a terminal or keyboard to differentiate them from a person who uses the output from a computer. Grudin also noted that in software engineering, the term *user* can mean the users of particular tools, who are themselves developers. Similarly, *implementation* is synonymous with *development* or *coding* in HCI, but to the management information systems (MIS) world it describes the introduction of a new system into an organisation (Grudin 1994a).

The present state of the Information Systems Development (ISD) field was described as suffering from a widespread lack of clarity concerning its core concepts due to the use of ‘inaccurate language’ (Ulrich 2001, p. 56).

A major barrier to a researcher’s ability to integrate studies and build cumulative theory about IT jobs and IT workers is the inconsistency in terminology and conceptualisation of the profession of IT (Shaw, Pawlowski & Davis 2005). Shaw, Pawlowski and Davis’s research examined how an IT jobs taxonomy or IT jobs typology could be used to provide a standard framework to address the issue of inconsistency.

One of the main problems identified in the literature about COTS-based development (Commercial Off-The-Shelf) is that there is no common terminology (Franch & Torchiano 2005). Franch and Torchiano proposed a reference model that sets the basis for a COTS-based development ontology and terminology.

In summary, many authors of IS/IT studies have identified particular instances of inconsistency of terminology. They have highlighted that inconsistent terminology has an impact on effective communication, making sense of research findings, integrating studies, and building cumulative theory. They suggested that researchers should pay more attention to basic concepts and how they are used, and that the development of a taxonomy or ontology could provide a standard framework to address the problem.

2.1.2 Inconsistency of CSCW terminology

The term ‘groupware’ is the main focus of this section as it clearly highlights the problem of inconsistency in the CSCW field. However, a number of different and overlapping terms were identified in the literature that serve to illustrate the plethora and complexity of terms and to show the widespread problem of terminological inconsistency in this field of study. Some of the terms are used as minor headings to provide structure for this section.

Computer Supported Cooperative Work (CSCW) is a term that was introduced by Paul Cashman and Irene Greif in 1984 (Grudin 1991), and was used in 1986 as the title of a conference. CSCW is a multidisciplinary or interdisciplinary research field focused on the role of computer and communication technology to support group work. CSCW examines how people work together in groups and how computer technologies can support collaboration (Ishii, Kobayashi & Arita 1994). However, computer supported systems for group work were being developed and researched for a number of years prior to 1986 and this type of research has been, and still is being, referred to using a number of different terms.

Prior to 1986, research into *group work* using computers was mainly focused on the development of systems. The studies into group working were dominated by two areas:

- communication systems research, where the groups were usually distributed and used computer systems to communicate; and

- decision making systems research, where the systems were designed to provide collaborative support to groups of decision makers in a face-to-face environment.

Communication systems

Communication systems research started in the 1960s when Englebart developed an experimental collaboration system called NLS/AUGMENT that supported terminal linking, electronic mail, sharing of files, and ‘televiewing’ (Stefik, Foster, Bobrow, Khan, Lanning & Suchman 1987). This way of working was described as ‘the ability “to pass the gavel” among several people working together at separate terminals’ (Stefik et al. 1987, p. 45).

In the 1970s teleconferencing and computer conferencing applications, such as electronic mail, file sharing, editors, voting mechanisms, and archiving were being developed and researched. These systems did not provide structure for group problem solving processes (Hiltz & Turoff 1981; Stefik et al. 1987). Teleconferencing was developing slowly because of the high communication costs for distributing video images. At that time there were a small number of private nationwide digital networks in America, such as TELENET. The late 1970s and early 1980s saw an increase in the number of studies into conferencing which used computers rather than video. Computer conferencing became more popular when the Internet was made available to the public about 1987.

Hiltz and Turoff (1981) used both of the terms *computer mediated communication* and *computer based communication* to describe computer systems that supported communication between individuals and groups. Their studies considered the communication requirements of managers and described a need for something more than ‘simple message systems’ that were designed ‘by watching secretarial behaviour’ (Hiltz & Turoff 1981, p. 750). Their prototype system known as Electronic Information Exchange System (EIES) was ‘designed to study and explore the use of computers to facilitate human communication across a wide variety of applications’ (Hiltz & Turoff 1981, p. 741). The prototype was tested initially on scientific researcher communities. The design of EIES had its roots in the EMISARI system developed in 1971 that was purpose built to support management and staff reporting in a crisis management situation (Hiltz & Turoff 1981).

The term *groupware* was first coined in 1978 by Peter and Trudy Johnson-Lenz while working with Turoff and Hiltz at the New Jersey Institute of Technology (NJIT). Johnson-Lenz's definition of groupware was 'intentional group processes plus software to support them' (in Johnson-Lenz & Johnson-Lenz 1998, p. 34).

Decision making systems

The terms *group DSS* or *Group Decision Support System (GDSS)* were introduced in 1982 by Sprague and Carlson, at the University of Minnesota, who used the term group DSS to describe systems that supported groups of users who were involved in decision making. Group DSS research was an extension of Decision Support System (DSS) research that concentrated on single users making business decisions.

Group decision making was the focus of GDSS research. GDSS systems were developed to support organisational meetings through the use of structured group management techniques (Huber 1984). DeSanctis and Gallupe's (1985a, 1985b) articles described the concept of GDSS and identified GDSS components as hardware, software, people, and procedures. They stated that communication systems such as email, computer conferencing, audio and video conferencing may be integrated into the GDSS environment. The people component for GDSS included group members and a group facilitator. But as early as 1988 Bostrom and Anson argued that there was much confusion in the GDSS research literature due to the use of the term *GDSS* being used to represent different technologies.

Even though GDSS researchers were discussing the use of distributed systems for meeting support, during the 1980s, Jelassi and Beauclair (1987) pointed out that research studies of synchronous non-face-to-face sessions were conducted using teleconference systems and the asynchronous sessions were conducted using electronic mail (Jellassi & Beauclair 1987). Both these systems had been clearly described as computer mediated communication systems by Hiltz and Turoff (1981) and these systems were not able to provide any structured meeting support.

Groupware

The first CSCW conference in 1986 drew together researchers from a range of disciplines, who had an interest in groups working together with the use of computer technology. Grudin (1994a) described that first CSCW conference as a merging of issues, approaches and languages, and saw this merging of disciplines as providing exciting potential for cross fertilisation and for doing work with broad implications.

In 1994, Grudin (1994a) described some of the historical shifts, demographic patterns, and geographic distinctions in CSCW research. He presented a diagram (shown in Figure 2.2) to show that 'groupware fits in the software universe somewhere between single-user applications and information systems that support organisations' (Grudin 1994a, p. 1). The outer ring of Grudin's diagram showed organisational systems which were developed first, due to the high cost of computers and high potential for return on investment. The outer middle ring represented large projects of six or more participants who were provided with support from electronic meeting rooms and workflow automation systems. The inner middle ring represented small groups of no more than 4 users with support from computer-mediated communication systems. The inner ring (Figure 2.2) showed individual applications developed in the early 1980s when the spread of interactive and personal computing created a large market for individual user applications.

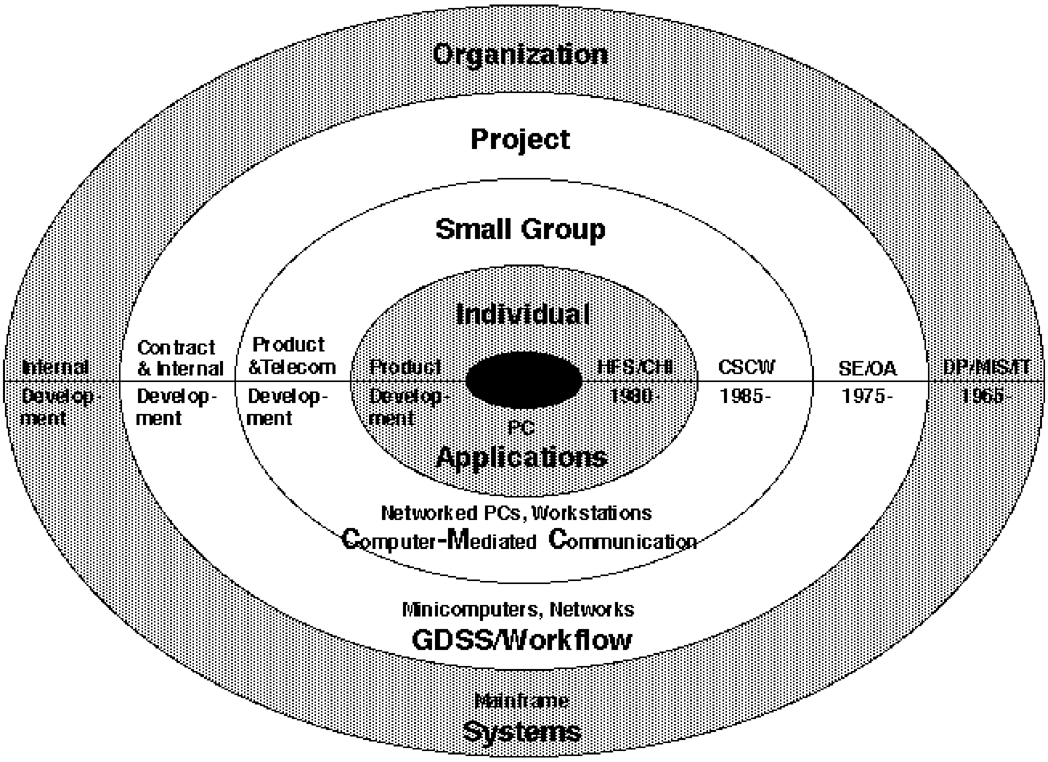
Systems in both the middle rings are called *groupware*. However, Grudin (1994a) pointed out that many terms were being used differently by different researchers and development communities including the CSCW research community.

In the early 1990s four conditions had emerged in workplaces to stimulate the development of systems that supported groups:

- computation inexpensive enough to be available to all members of some groups;
- a technological infrastructure supporting communication and coordination, notably networks and associated software;
- a widening familiarity with computers, yielding groups willing to try the software; and
- maturing single-user application domains that pushed developers to seek new ways to enhance and differentiate products.

(Grudin 1994a, p. 2)

Figure 2.2: US research and development contexts of CSCW and groupware



Source: Grudin (1994a p. 3)

Other key technological developments were:

- the phenomenon of the Internet;
- the evolution of desktop computing; and
- office information systems.

(Whitaker 1996, p. 5)

The Internet became available for use by the general public after 1987. This network infrastructure encouraged developers to incorporate web applications into group systems. In 1994 the terms ‘web groupware’ and ‘web-based groupware’ were introduced to define a new system called TCBWorks (Dennis, Pootherie & Natarajan 1998). These groupware systems used a web browser as an interface. Traditional groupware had been ‘focused primarily on private, often LAN-based, internal corporate networks’ (Dennis, Pootheri & Natarajan 1998, p. 65). These traditional systems required proprietary and often expensive software (Dennis, Pootheri & Natarajan 1998).

> The term CSCW has come to embrace a variety of research in such overlapping areas as workgroup computing, collaborative computing, groupware, coordination technology, augmented business teams, group decision support systems, and cooperative work support (Bannon 1997, p. 18).

Bannon (1997, p. 2) also argued that 'GDSS and CSCW research communities sometimes appeared to be oblivious to each other', and he confirmed that both CSCW and GDSS were poorly defined and the terms often used quite loosely.

When reviewing the CSCW research field, Twidale and Nichols (1998) pointed out that difficulties of interdisciplinary research can be caused by differences in terminology, as well as differences in worldview.

GSS research – for group meetings

One of the prolific areas of research in the CSCW field is GSS research with its main focus on group meetings. The term *group support system (GSS)* appears to have first been used by DeSanctis and Gallupe (1987) as a replacement for the term *GDSS* to show that these types of systems were no longer only being used for decision making (Pervan 1996). The term *GSS* was also used in a diagram by Dennis, George, Jessup, Nunamaker and Vogel (1988), but the term 'GSS' was not discussed or even mentioned again in that article. Hiltz, Dufner, Fjermestad, Ocker, Rana and Turoff (1996) argued that the term *GSS* had come to be used as more general and inclusive than *GDSS* that was often used to imply decision room, same time settings. Williams and Wilson (1997) stated that the term *GSS* remained difficult to define concisely.

Face-to-face GSS research was described as being divided into two fundamentally different viewpoints:

- the first approach was called *Decision Conferencing* (Phillips 1988 in Pervan 1996), that used a single workstation operated by a skilled analyst or facilitator and the participants did not require hands on access to the computer-based support; and
- the second approach was driven by communication and was usually called *Electronic Meeting Systems (EMS)* that operated with each participant having a workstation (Pervan 1996).

The term *electronic meeting system (EMS)* had been introduced by Dennis et al. (1988, p. 591) who stated that 'EMS are more than GDSS: they support more tasks than just decision making'. Dennis et al. described CSCW as more communication oriented and focussed on supporting document creation and critiqueing. They described GDSS as being more task oriented and confirmed that the distinction between these two classes of systems was blurring. They saw EMS as a term that described the overlap of GDSS and CSCW. However, in 1992 McLeod and Liker stated that electronic meeting systems are commonly labelled as Group Decision Support Systems (GDSS).

The term *EMSS (electronic meeting support system)* was defined as ‘a technology used to support group communication, information sharing, and process…during face-to-face…meetings’ (Applegate 1991, p. 25). Bonner and Basavaraj (1995) stated that electronic meeting systems (EMS) are GSS that have been specifically developed to support meetings. Mallach (2000) included electronic meeting systems as a category of group DSS.

In summary, the terms used for systems that support group meetings are on the increase, but there is no consensus of opinion about their meanings or the applications to which they refer.

Computer Supported Cooperative Learning

Computer Supported Cooperative Learning (CSCL) grew out of research into CSCW. The term CSCL was introduced in 1991 as the title of a workshop. The term CSCW is mainly used for the business environment and the term CSCL is used in the educational environment. However CSCL is considered a part of the CSCW research field.

CSCL is used to scaffold or support students in learning together effectively. The research in CSCL concentrates on the use of systems to support groups of learners (Koschman 1995b). CSCL focuses on the use of collaboration technology in education based on the importance of social interaction to learning. CSCL could be considered a separate research field except that many of the computer systems used in CSCL are also used in CSCW. The research in CSCW and CSCL thus covers not only the techniques of groupware but also their social, psychological, organisational and learning effects (Hsiao 2000). Many of the system development issues are the same and the user issues are often the same. It is only the focus of the task and the output that are different.

The descriptions of CSCW, GDSS and CSCL above highlight the differences in the focus or output of the respective group work. These descriptions are presented in Table 2.1.

Table 2.1: System focus

System type	Focus	Output	Reference
CSCW	Communication oriented	Document creation and critiquing	Dennis et al. 1988
GDSS	Task oriented	Decision making	Dennis et al. 1988
CSCL	Social interaction oriented	Collaborative learning	Koschman 1995

Source: developed for this research

Groupware as a generic term

By the end of the 1980s the term *groupware* started to be used as a generic term for many system types that were being developed for group support. In 1989 Grudin's definition of groupware referred to applications for small group interaction. 'Groupware is applied to applications that support interactions within groups of two or more people. The term does not refer to major systems designed to support entire organisations' (Grudin 1989, p. 246).

It has been argued by other researchers that *groupware* is a class of applications, for small groups and for organisations, arising from the merging of computers and large information bases and communications technology and that these applications may or may not specifically support cooperation. For example:

> Workgroup software applications are sometimes defined as those intended for small, narrowly focussed groups and sometimes as enterprise-wide strategic programs. A broader view sees groupware as a class of applications that emerges from the networking of computers and large databases. Communication, collaboration and coordination are the key goals of groupware (Ellis, Gibbs & Rein 1991, p. 38).

Alternatively, it has also been stated that 'groupware is any technology specifically used to make groups more productive' (Nunamaker, Briggs & Mittleman 1994, p. 2). 'Familiar groupware examples include email, bulletin boards, group schedulers, group decision support systems, workflow systems, collaborative authoring tools and screen sharing software' (Ishii, Kobayashi & Arita 1994, p. 83). Groupware has been defined as including hardware and software (Dennis, Quek & Pootherie 1996) and as an application (Byrne 1997). The term groupware also found its way into the GSS literature (Barua, Chellapa, & Whinston 1996).

Seven groupware descriptions are shown in Table 2.2 where it can be seen that some researchers considered groupware only in terms of application software, some as hardware and software, and others as a system which includes group processes.

Included in groupware systems are real-time (synchronous) systems and asynchronous systems (Roseman 1996).

Table 2.2: Systems defined as groupware

System term	Characteristics of system	Characteristics of environment	Author
Groupware	System, group processes, software		P. & T Johnson-Lenz 1978 in Ellis, Gibbs & Rein 1991
Groupware	Applications		Grudin 1989
Groupware	Applications	Networked computers, large databases	Ellis, Gibbs & Rein 1991
Groupware	Any technology to support group productivity		Nunamaker, Briggs & Mittleman 1994
Groupware	Hardware, and software	Groups working together	Dennis, Quek & Pootherie 1996
Groupware	Applications	Networked environment	Byrne 1997
Groupware	Networked based software, web pages, electronic bulletin boards, discussion lists, file sharing, synchronous or asynchronous	Shared hypermedia environment	Greenlaw 1999

Source: developed for this research

Some researchers have specifically stated that the term groupware is commonly used, but lacks a commonly accepted definition (Dennis, Quek & Pootheri 1996; Greenlaw 1999) and in one case groupware was described as the most slippery technology out there – no standards, no definitions, no agreement, no boundaries (Thé 1995).

Most researchers use the term groupware to include a range of group systems as shown in Table 2.3. Researchers, however, do not agree on which systems should be called groupware. Email is an object management application that focuses on organising and handling information without incorporating notions of role, process, and social interaction and for this reason some do not consider email applications as groupware (Grudin 1991). Greenlaw (1999) is one such researcher who does not consider Gopher, electronic mail, and list-servs or newsgroups to be groupware. However, Bannon (1992) when discussing groupware commented that, for some people, electronic mail is seen as ‘the clearest example of a groupware application that has made a significant impact in the work place’ (p.10). It was also argued that conferencing systems, email, listservs and newsgroups can be categorised as different forms of groupware (Dennis, Pootheri & Natarajan 1998).

Table 2.3: Systems specified as Groupware

System term	Systems specified as groupware	Author
Groupware	email or Usenet bulletin boards. Workflow and document management systems like Lotus Notes, TeamRooms.	Roseman 1996
Groupware	TCBWorks	Dennis, Pootheri & Natarajan 1998
Groupware	web pages, electronic bulletin boards, discussion lists, file sharing, synchronous or asynchronous	Greenlaw 1999
Groupware	Lotus Notes (Domino). Features of Notes include email, calendaring, discussion databases, document databases, workflow and web integration	Atkinson & Lam 1999
Groupware	email, newsgroups, videophones, or chat.	Van Slyke, Lou & Day 2002
Groupware	Notification Collage	Greenberg & Rounding 2001

Source: Developed for this research

A number of types of systems such as calendar programs, electronic mail, conferencing tools, GDSS, group document handling tools, and workflow tools had been included in a list of groupware products (Mallach 2000). However, Mallach pointed out that not all GDSS are considered to be groupware and argued that the concept of groupware covers more than a strict definition of GDSS by stating that a calendar program is groupware but not a GDSS and some products, such as *Lotus Notes*, may fit into more than one category of system because of their flexibility and the wide variety of features they provide. It is not surprising, therefore, that there is confusion, especially for the novice researcher in this field.

Workflow systems are another type of system where there is disagreement:

> Many authors do not rank workflow systems among groupware applications for several reasons, the main one being the argument that workflow systems cannot be used to support the relatively unstructured interaction within work groups (Hinssen 1998, p. 8).

However, it is seen by others as an integral part of the group work process (Hinssen 1998). Roseman (1996) described workflow and document management systems like *Lotus Notes* as the most commonly known groupware applications.

There is also disagreement over whether groupware should include synchronous and asynchronous systems, and one view is that systems that exclude reference to real time are not groupware applications (Gutwin & Greenberg 2000b).

Some researchers use different system names for the same application software. ‘Vendors, consultants, users, and university researchers all have used the term groupware to denote many different types of software, each of which supports very different types of group work' (Dennis, Pootherie & Natarajan 1998 p. 66).

Some authors have specified software applications that they consider groupware. Jessup, Valacich, Dennis and Wheeler (1996) and Byrne (1997) used the term groupware for *Lotus Notes*. Greenberg et al. (1999) classed *Teamwave Workplace* as a groupware product. Greenlaw (1999) provided a partial list of groupware applications which included *Lotus Notes*, *GroupSystems*, *Vision Quest* and a number of others, but stated that none of these systems allowed file sharing. Boutellier et al. (1998) mentioned *GroupSystems*, *TeamFocus*, *VisionQuest* and *Lotus Notes* when discussing groupware. However, *TeamFocus* and *VisionQuest* have also been called decision conferencing systems (Mallach 2000).

In 1986, DeSanctis and Gallupe wrote about *GroupSystems* as a Group communication system (GCS). However, since that time a number of researchers have discussed and used other terms to describe *GroupSystems*, for example, as an EMS (Nunamaker, Dennis, Valacich, Vogel & George 1991; Chen, Hsu, Orwig, Hoopes & Nunamaker 1994; Bonner & Basavaraj 1995), as a distributed GSS (Briggs, Nunamaker, & Sprague 1998), and as web-groupware (Dennis, Pootheri & Natarajan 1998). If a particular application belongs to all these system types does this mean that GCS, EMS, distributed GSS, and web-groupware are synonyms or are at different levels in a terminology hierarchy?

To summarise, the term *groupware* has been defined by many researchers since its introduction in 1978 and it appears that these definitions change as new systems are developed and introduced to the market place. Also there are a number of researchers who use different definitions for groupware. It appears that the majority of researchers in the CSCW field are now using it as a generic term to mean a whole range of systems that support groups. However, not all researchers agree on the definition of groupware, which system types should be referred to as groupware, or which applications should be included in groupware.

Although the issue of inconsistency had been identified and discussed by a number of researchers, no studies were found that provide a means of addressing this problem.

2.1.3 Inconsistency of terminology in other disciplines

Inconsistency of terminology is a problem in many fields of research. Some authors describe inconsistency in their discipline and some suggest ways of reducing or alleviating this problem.

In the Social Science literature on electronic negotiation, Gulliver (1979 in Strobel & Weinhardt 2003, p. 144) noted that ‘the social science literature is somewhat confused and contradictory about the definitions and applications of some basic concepts that are used in the study of negotiation’. Strobel and Weinhardt (2003, p. 145) discussed the need for the development of a taxonomy of electronic negotiation to:

- provide a common set of terms describing electronic negotiations with a well defined set of classification criteria; and
- help analyze and understand dimensions of electronic negotiation and their interdependencies.

In the Marketing literature, as early as 1976, Hunt (1976 in Ward 1995) commented about the problem with definitions. Ward (1995) highlighted the confusion in the use of the word ‘service’. Also Teas and Palan (1997), when examining the marketing terminology, focused on definitions and discussed the issue of confusion caused by ambiguity in relation to concepts in the marketing theory. Ambiguity ‘reduces the theoretical meaningfulness of language used to express theory’ and ‘reduces the degree to which theories can be precisely expressed, interpreted and empirically tested’ (Teas & Palan 1997, p. 5).

In the Collective Action literature, Poteete and Ostrom (2004, p. 216) whilst undertaking research for the International Forestry Resources and Institutions research programme, stated that ‘empirical research must overcome two major obstacles: conceptual inconsistency and the scarcity of comparable data’. They confirmed that these problems are particularly severe for interdisciplinary research, and further that the ‘problems relating to the comparability of concepts and data affect empirical research on any topic’ (Poteete & Ostrom 2004, p. 216).

In the Information Sciences literature, Ishida and Ohta (2002, p. 367) described an approach of ‘term relationship frequency (TRF) to identify documents in a rapidly growing academic discipline’. They stated that building terminology is one way of categorising term usage in an academic discipline.

The issue of inconsistent terminology has been identified as a major problem in many areas of Health, for example an article describing clinical classification and terminology, explained that health terminologies are often used casually, imprecisely, and even interchangeably (Chute 2000). Chute (2000, p. 298) argued that ‘nomenclatures can be nothing more than lists of recognised or sanctioned words and have little or no relationship to a system of classification’. Consistent terminology is a key to improved effectiveness and efficiency in health care (Chute 2000).

Walsh (2005), when researching speech pathology, stated that many experiences have led her to believe that speech pathology faces no greater challenge than inconsistent and inappropriate terminology. Walsh (2005) conceded that improving the appropriateness, accessibility and consistency of terminology in speech language pathology is an enormous and complex task.

In the Education literature, Bruce and Levin (1997, p. 1) described a new way of classifying education technologies and stated that ‘experts often disagree about what constitutes the objects of their study, but avoid addressing their disagreements directly. It is no surprise that discourse in the field appears disjointed and inconclusive’. They commented that a taxonomy can be a productive step in the process of understanding and explaining what we see by organising perceptions into categories and by reducing the complexity and richness of whatever is being categorised. LaPorte (2003) stated that part of the problem in making sense of qualitative research is related to terminology. LaPorte argued that the novice researcher has a difficult time entering the arena due to the elusive and inconsistent nature of the terminology used in *technology education* research.

To summarise, inconsistent terminology usage has been identified by many researchers from many fields of study. Some of the suggestions for improvement of the use of terms are to undertake a meta-terminology analysis and the development of taxonomies. In summarizing the difficulty associated with the task of improving consistency a quote by Pascal (1623-1662) highlights the situation:

> We do not go into the task of improving consistency knowing exactly how it will evolve, what insights the journey itself will yield, or whether we will triumph, but we are compelled by the evidence around us to struggle to improve the situation (Pascal (1623-1662) in Walsh 2005, p. 110).

2.1.4 CSCW classification systems

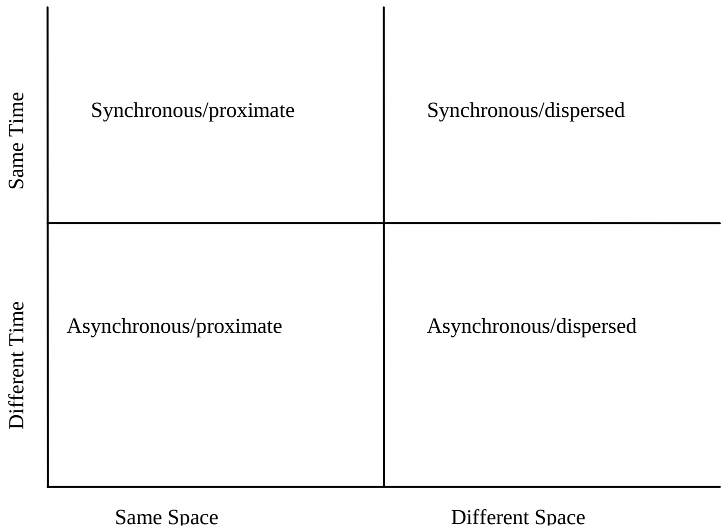
Classification is a way to organise and structure concepts and systems to improve consistency of use and understanding in the terms used in research fields. This section describes the classification systems that have been proposed in CSCW, GSS and groupware research and describes the inadequacy of these classification systems when considering the whole CSCW field.

The most influential papers that discuss classification of groupware systems from the early years of CSCW and GSS research are by DeSanctis and Gallupe (1985a), Kraemer and King (1988), and Dennis et al. (1988). During the 1990s the work undertaken by Coleman (1995) and Pervan (1996) provided more insight into the need for classification in this field. The work of Mallach (2000), Ward and Whymark (2001), and Bafoutsou and Mentzas (2002), continued the theme into the 21st century.

As early as 1985, DeSanctis and Gallupe (1985a) categorised the GDSS technology used for group decision making into four separate areas: decision room, local decision network, linked decision rooms and remote decision networks. In this categorisation, the purpose and configuration of the GDSS varies according to the duration of the session and the degree of physical proximity of group members. However, DeSanctis and Gallupe emphasised that the cells should not be considered as independent of one another but as ends of two continua and suggested that the decision room ‘may be thought of as the equivalent to the traditional meeting’ (p. 6). A local decision network (LDN) ‘could be developed to support group members as they work in their individual offices’ to deal with certain problems on a regular basis (p. 6). Teleconferencing is where ‘two or more decision rooms are connected together by visual and/or communication facilities’ (p. 7). Remote decision making requires ‘uninterrupted communication between remote *decision stations* in a geographically dispersed organisation which has a fixed group of people who must regularly make joint decisions’ (p. 7).

The well known classification scheme, the time/space matrix (sometimes known as the time/place matrix) (shown in Figure 2.3) provided a 2 x 2 grid showing modes of interaction using Groupware along the time and space dimension. Interaction can occur at the same time (synchronously), or at different times (asynchronously). Members can be located in the same place (proximate) or in different places (dispersed) (Johansen 1988).

Figure 2.3: Time/Space Matrix



Source: Adapted from Johansen (1988)

Examples of other GSS technology classifications are provided in Table 2.4. This table has been adapted from Zigurs and Buckland (1998) who commented that classification schemes for group support systems are as abundant as definitions of the technology.

Other classification schemes for groupware, CSCW, GDSS, EMS and GSS have been identified, and are summarised in Table 2.5. As demonstrated in Tables 2.4 and 2.5 the time/space (time/place) matrix that was developed by Johansen in 1988 has been used and extended by many researchers. The article by Fjermestad and Hiltz (1998), referred to in Table 2.4, discussed some of these classifications in terms of frameworks and agreed that the earliest GSS classification by DeSanctis and Gallupe in 1987 had been extremely influential in providing a common framework for research on GSS.

The time/space matrix was incorporated into a three-dimensional taxonomy (group size, group proximity, and time dispersion) of groupware environments by Dennis et al. (1988). More recently Applegate (1991), Lewis (1994), Pervan (1996), and Mallach (2000) have further developed the matrix, to include other dimensions or characteristics such as level of group output, type and usage. The time/space matrix has not only been used to show modes of interaction, but has been used to divide up types of technology and describe hardware communication requirements (Mallach 2000).

Table 2.4: GSS technology classifications

Author(s)	Classification Basis	GSS Technology Categories
(DeSanctis & Gallupe 1987)	Group size and proximity; patterns of information exchange for GDSS	Decision room, legislative session, local decision network, computer-mediated conference; level 1, level 2, level 3
(Johansen 1988)	Time and place configuration for groupware	Same-time/same-place, same-time/different-place, different-time/different-place, different-time/same-place
(Dennis, George, Jessup, Nunamaker & Vogel 1988)	Group process and outcomes, methods, and environment	Overall categories are not defined; each element of classification basis is further described (e.g., environment includes group size, participant location, and timing of meeting)
(Pinsonneault & Kraemer 1989)	Type of aid provided by the system	Group decision support systems, group communication systems
(DeSanctis & Poole 1994)	Structural features and spirit of technology	Overall categories are not defined; each element of classification basis is characterized by scalable dimensions (e.g., leadership, efficiency, etc.)
(DeSanctis, Snyder & Poole 1994)	Interface, functionality and holistic attributes	Overall categories are not defined; each element of classification basis is further described (e.g. functionality includes public display, anonymous voting, private messaging, etc.)
(McGrath & Hollingshead 1994)	Primary function of system (communication, information, or task support)	Group internal communication support system, group information support system, group external communication support system, group performance support system
(Vickers 1994)	Extent to which end users can control and/or modify system	Closed, closed/open, open/closed, open
(Rana, Turoff & Hiltz 1997)	Component parts of system, i.e., presence or absence of generic support features	Individual support, group process support, meta process support, group model support
(Fjermestad 1998)	Communication mode, design, process structures, and task support	Overall categories are not defined; each element of classification basis is further described (e.g. communication mode might be voice, text, video, etc.)

Source: Adapted from Zigurs & Buckland (1998, p. 320)

Various authors have argued that the time/space matrix is not adequate to differentiate the system types that support group work. Giffin (2002) commented that a limitation of classifying internet tools by time and distance is the decreasing relevance of these factors in the contemporary business workplace. Giffin went on to say that in 1991 Johansen would have considered anytime/anyplace technologies futuristic. Yet, the time/space matrix is still used by many authors in the CSCW field (Mallach 2000; Turban, Aronson & Liang 2005) as a starting point to describe the differences in system type.

Collaborative applications were reviewed by Bafoutsou and Mentzas (2002, p. 286) who provided ‘a matrix of nineteen features’: bulletin board, discussions, email, email notifications, online paging/messaging, chat, whiteboard, audio-video conferencing, task list, contact management, screen sharing, surveys/polling, meeting minutes/records, meeting scheduling tools, presentation capability, project management, file and document sharing, document management, and synchronous work on files/documents.

However, they did not provide any explanation of how they developed their final table of grouped systems, nor did they provide the characteristics of each group that differentiate between systems. Bafoutsou and Mentzas (2002) stated that the borders of their categories were not strict and some tools could fit in more than one category. Hein, Keenan and Reincke (1998) made the same comment about the twelve functional categories identified by Coleman (1995) regarding tools fitting into more than one category. Hein, Keenan and Reinke also stated that there is a problem with the expandability and adaptability of Coleman's classification scheme.

Table 2.5: Summary of further classification schemes from the CSCW field

Author	**Classification Basis**	**Technology Categories**	**Technology specified**
(Rodden 1991)	CSCW – 4 classes	Separated CSCW into four classes, messaging systems, conferencing systems, meeting systems and co-authoring systems.	Not specified
(Applegate 1991)	CSCW alignment model Only discussed in terms of EMS.	Classification of CSCW by time and place, level of support (communication sharing, information sharing and process) and degree of restrictiveness (normative and restrictive, customisable, non-restrictive).	Not specified
(Lewis 1994)	Time/Place and types of GSS		SS - GSS decision room, SD – Videoconferencing, DD – Computer conferencing, DS – Local network
(Gavish, Gerdes & Sridhar 1995)	10 dimensions of GDSS, group size, task type, group proximity, time dispersion, group structure and composition, time horizon, anonymity, meeting control, task complexity, groups objectives	Distributed group interactions	CM.sup.3
(Pervan 1996)	Time/Place, level of group output, type, and usage	GSS comprehensive model of group, task and support (GSS and facilitation) variables. 60 variables identified.	Decision conferencing (Equity, Hiview, SODA, Alternative Futures Assessment Process and Strategic Choice) and Electronic meeting systems (GroupSystems, SAMM, MeetingWorks)
(Dennis, Pootheri & Natarajan 1998)	Time dispersion, group proximity and group size – EMS		Not specified
(O'Brien 2000)	Groupware for enterprise collaboration	Electronic Communications Tools, Electronic Conferencing Tools, Collaborative Work Management	Numerous technologies specified
(Mallach 2000)	Time/Place as a communication grid to identify hardware requirements (Computers, storage devices, display devices)	Categorized GDSS in terms of how they deal with the content and information flow of decisions	Not specified

Source: Compiled for this research

From the discussion above, it can be seen that each classification scheme provided a way of differentiating and describing some systems in CSCW research but none clarify the differences between all the system types. For many classification schemes the reader does not know which characteristics of the systems have been used to differentiate between systems. Even when systems have been grouped into classes the definitions for these systems are not clear enough in themselves to immediately differentiate them from other system classes.

Other researchers have identified variables of CSCW and GSS research. Pervan (1996) identified 60 variables of GSS research in relation to group, task and support.

Some classification schemes considered different issues such as meeting systems (Dennis, Pootherie & Natarajan 1998), enterprise collaboration (O'Brien 2000) and where the interaction takes place (Befoutsou & Mentzas 2002).

From the literature above, six specific difficulties became apparent with regard to the present CSCW classification systems:

- None of the classification systems define all groupware systems.
- No holistic view of the CSCW field has been undertaken to identify all system types.
- The characteristics of the classes of systems are not clearly identified.
- The borders of the categories are not strict, so some systems fit in more than one category.
- There is a problem with expandability and adaptability of classifications.
- Classification systems are not adequate to differentiate the system types.

These six difficulties highlight the perceived problems with the present classification systems and provided a further reason to address terminology and definition inconsistency for this research.

2.1.5 CSCW research scope

The CSCW field has been discussed in both the business and education environments and some authors have stated that the scope of this field is not clear (Bannon 1992). Bannon provided no explanation of what he meant by *scope*. The term *scope* is defined in the Macquarie dictionary as 'to assess the extent, range, or ramifications of (a proposal, idea, etc.)' (Macquarie Dictionary Online 2003). Some authors have discussed the scope of a report and the scope of their particular research, but the scope of a research discipline or field is barely discussed. In addition, interdisciplinary research provides more complexity when considering scope.

Authors from other disciplines also comment about the lack of scope. Hunt (1976, p. 7 in Ward 1995), from the discipline of marketing, argued that there was a lack of scope in marketing and asked ‘What kinds of phenomena and issues do the various marketing writers perceive to be included in the scope of marketing?’

The term boundary is sometimes used in place of the term *scope* (for example, Whitaker 1996). ‘*Boundary* – something that indicates bounds or limits: a limiting or bounding line’ (Macquarie Dictionary Online 2006). Whitaker argued that the CSCW research community questions the precise boundaries of the term *CSCW* in relation to the label for group–oriented applications and the research and development field. Whitaker also discussed the scope of the term *groupware*. Authors have provided discussions regarding the conferences and journals relevant for CSCW and the research covered when discussing literature reviews (Ellis, Gibbs & Rein 1991; Whitaker 1996; Pervan 1998). Others provided an overview of some of the results of studies in CSCW.

Issues that could be considered when discussing scope of a research discipline or field include: research areas, terminology, computer systems, authors, research groups, institutions, concepts, classification systems, timelines, system or software development companies, themes and topics addressed, and research output. This research focuses on the scope of the terminology used by the researchers.

Research areas of the CSCW field include *communication systems*, *groupware*, *GDSS*, *GSS*, *EMS*, and *CSCL*. Other research areas that are relevant to CSCW are *face-to-face (ftf) teams* and *virtual teams* (who use groupware technology for their group work), *group research* (which focuses on the group characteristics), *facilitator research* (as facilitators are a requirement for some types of groupware systems), and *group tasks* such as group decision-making. All the terminology of these research areas need to be examined in relation to the scope of the CSCW field.

2.1.6 Summary of terminology inconsistency

In summary, different terms have been used by researchers for electronic group activities in the two research environments of business and education, generally as computer supported cooperative work (CSCW) for business systems and computer supported collaborative learning (CSCL) for educational systems. The research of CSCW and CSCL covers not only the techniques of groupware but also their social, psychological, organisational and learning effects (Hsiao 2000). CSCW has been shown to incorporate research in areas such as GSS, GDSS, EMS, and CSCL including groupware, meeting systems and collaborative learning. Some systems are used in both environments, while others are designed specifically for one or other environment.

Some authors stated that the terminology is used in different ways, and many say there are no agreed definitions, and no agreed terminology (for example, Greenlaw 1999, Turner & Turner 2002, Ward & Whymark 2001). Many researchers adopt definitions as used in prior research without perhaps considering whether these definitions actually describe the terms in enough detail to be useful to the reader, or how the definition of these terms overlap with the definition of other terms used in the research field.

There is inconsistency in the terminology and definitions used, and this has an impact on the comprehension by the reader of articles and there is also inconsistency when categorising the system types. Gopal and Prasad (2000) stated that inconsistency and fragmentation within GDSS research has obscured many of the important contributions it has made to scholarship in IT.

Section 2.1 described the inconsistency in terminology and definitions, and the lack of an adequate system classification for the CSCW field. It also highlighted the lack of understanding regarding the scope of the CSCW research field. No articles were found in this research field that studied the use of terminology in the whole field or identified a method to address this problem. Many were found reporting the need for this to be done. These issues are identified as the research problem and incorporated in the research framework in Figure 1.2 in Chapter 1.

The next section considers how the research problem described above fits within a philosophical context and within the relevant discipline areas that provide a means of addressing the research problem.

2.2 Linguistics, epistemology, ontology, and taxonomy

The research problem described in Section 2.1 considered the language terminology used within the research field, the classification of systems within the research field and the scope of the research field. Linguistics, epistemology, ontology, and taxonomy are described in the following sections as they relate to the research problem. Table 2.6 shows the definitions of relevant terminology from these disciplines.

Table 2.6: Definition of terms

Term	**Definition and reference**
Concept	Concept has two parts a symbol (word or term) and a definition (Neuman 1994).
Characteristic	A distinctive mark, trait, or feature; a distinguishing or essential peculiarity or quality (Oxford English Dictionary (OED) online 2003).
Classification	Classification: as an intellectual operation whereby the extension of a concept at a given level of generality is subdivided into several (two or more) narrower extensions corresponding to as many concepts at lower level of generality; this subdivision is obtained by stating that an aspect of the intension of each of the latter concepts is a different partial articulation of the corresponding aspect of the intention of the higher concept (Marradi 1990).
Communication	The imparting, conveying, or exchange of ideas, knowledge, information etc (OED online 2003).
Dendrogram	Dendro – combining form – tree Gram – indicating a drawing or something written and recorded Graphical representation of hierarchical structures (OED Online 2003)
Divisionis fundamenta	The basis of division (Marradi 1990, p.3).
Epistemology	The study of autonomous knowledge (Hacking 1975).
Linguistics	The science of language, including among its fields phonetics, phonemics, morphology, and syntax, and having as principal divisions descriptive linguistics, which seeks to describe and to develop explanatory models for languages as they exist, and comparative linguistics (or historical linguistics), which deals with linguistic change, especially by the study of data taken from various languages (Macquarie Dictionary online 2006).
Ontology (Theoretical form)	The form and nature of reality, how things are and how they work (Denzin & Lincoln 1994, p.108).
Ontology (Representational form)	An ontology defines a common vocabulary for researchers who need to share information in a domain' (Noy & McGuinness 2000, p. 1).
Taxon	A term used to denote any taxonomic category (OED online 2003).
Taxonomy	Adds hierarchical relationships (broader terms, narrower terms) and relate terms to controlled vocabularies for improved information retrieval (preferred terms, synonyms and near-synonyms (Chitty 2002).
Typology	The study of classes with common characteristics; classification, especially of human products, behaviour, characteristics, etc. according to type; the comparative analysis of structural or other characteristics; a classification or analysis of this kind (OED online 2003).

2.2.1 Linguistics

Linguistics is the scientific study of language. The philosophers of science have used language analysis to clarify the nature of scientific knowledge and method (Bormann 1980). Hacking (1975, p. 187) asked 'Why does language matter to philosophy?' and commented that ‘we express and communicate our ideas in language’. Hacking stated that:

> Language matters to philosophy because of what knowledge has become … no longer merely a tool by which experiences are shared, no longer even the interface between the knower and the known, but as that which constitutes human knowledge (Hacking 1975, p.187 in Bormann 1980).

One of the most influential philosophers of the twentieth century, Wittgenstein (in Richter 2004, p. 6) said of philosophy that it:

> … aims at the logical clarification of thoughts to clear up muddle and confusion … The meaning of any word is a matter of what we do with our language … rather than something hidden inside anyone’s mind or brain.

The inconsistency of terminology and what this means to any research discipline is considered through linguistics and the use of language.

‘The quest for objectivity in a practical sense eventually comes to the two requirements that researchers understand one another and that all qualified practitioners mean essentially the same thing’ (Oppenheimer 1956 in Bormann 1980, p. 11). Hacking (1975) when discussing the theory of meaning, considered the word *meaning* in terms of what it *signifies*, what it *refers to*, and the *common acceptance*. These are relevant issues when considering discipline terminology and definitions.

The dimensions of language are defined as syntactic, semantic and pragmatic (Borman 1980). Semantic is used to refer to the relationship between the objects under study and the symbols for them. In commonsense terms, the semantic dimension involves meanings (Morris 1938 in Bormann 1980). Max Weber discussed and analysed the issues of *understanding* and *comprehension* in both practical and theoretical terms in German philosophy of the human sciences (in Hacking 1975). Bormann (1980) confirmed that the minimum requirement for scientific communication is community agreement about the rules governing the semantic relations of the discipline’s language.

Weber (1990, p. 80) when discussing the definitions in the information systems research discipline stated:

> Even from an interpretive viewpoint of language and grammars, we still have to account for the regularities that we observe in human “speech acts” and behaviour (Winograd & Flores 1987, pp. 60-69). We can use our beliefs (interpretations/knowledge) of how these regularities occur to act purposefully to improve consensus about the meaning of a set of generic grammatical constructs.

Scholars conducting a scientific study of the semantic dimensions of the language might summarise their findings by compiling a dictionary (Morris 1938 in Bormann 1980).

In summary, the language we use in a research discipline is important to improve clarity of meaning and to share knowledge in verbal and written form. The compilation of a dictionary is seen by some researchers as a way to clear up muddle and confusion in the use of terminology. Likewise, a dictionary of CSCW terminology was seen as being appropriate to help improve consistency of the definitions and allow a better understanding of the meaning of the terms and concepts.

2.2.2 Epistemology

Epistemology and Ontology are often discussed when describing the paradigm chosen to undertake a research study from a theoretical perspective. For this research the relationship between epistemology, ontology, taxonomy, semantics and meaning are important to ground the research problem. The relationship between these terms is stated by quoting Newman (2002, p. 1):

> Epistemology tells us how ideas and concepts can exist. Ontology tells us what ideas and concepts do exist. Taxonomy provides us with a means for developing classification schemes for elements of an ontology in its representational form. Semantics provide a means for resolving the ambiguities of meaning resulting from less than perfect representation.

Epistemology, which is the study of autonomous knowledge, began quite recently, when it became recognised that knowledge is public (Hacking 1975). The nature of the relationship between the knower, the would be knower and what can be known are aspects of epistemology (Denzin & Lincoln 1994). Frege (1960 in Hacking 1975, p. 170) argued that there had to be ‘meanings beneath the sentences that are understood and are the actual bearers of belief and knowledge. Meanings make public discourse possible’.

2.2.3 Ontology

When ontology is discussed from a theoretical perspective it describes how things are and how they work (Denzin & Lincoln 1994). More discussion about ontology relating to the theoretical paradigm for this study is described in Section 3.1.

The term ‘ontology’ is also used in the Information Systems discipline in its representational form, as an explicit formal specification of the terms in the domain and relations among them (Gruber 1993). Ontologies have become common in IS generally and also on the World-Wide Web. Noy and McGuiness (2000, p. 1) stated that ‘many disciplines now develop standardised ontologies that domain experts can use to share and annotate information in their fields’. An example of this is SNOMED in Medicine (Price & Spackmann 2000). ‘An ontology defines a common vocabulary for researchers who need to share information in a domain’ (Noy & McGuinness 2000, p. 1).

‘What distinguishes different approaches to ontologies is the manner of specifying the meaning of terms’ (Uschold & Gruninger 2004, p. 59). Uschold and Gruninger (2004, p. 59) described ontologies on a continuum (Figure 2.4) from ‘lightweight ones that may consist of terms only, with little or no specification of the meaning of terms’ (to the left of the dotted line in Figure 2.4), ‘to rigorously formalised logical theories’ (to the right of the dotted line in Figure 2.4). They point out that when moving along the continuum from left to right ‘the amount of meaning specified and the degree of formality increases (thus reducing ambiguity)’ (Uschold & Gruninger 2004, p. 60).

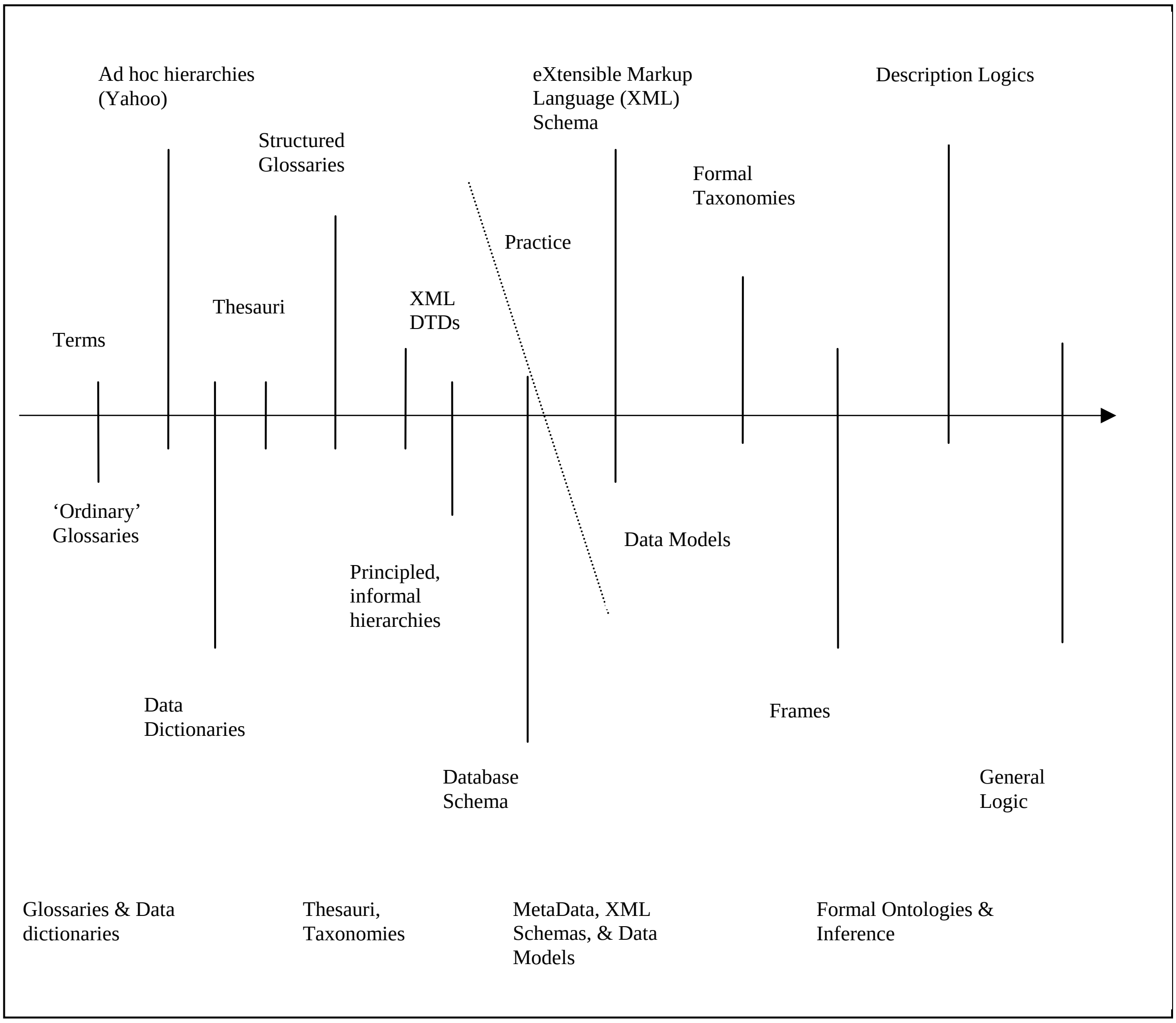
Uschold and Gruninger (2004) stated that full seamless connectivity between systems will not be achieved without addressing the reality of semantic heterogeneity. They confirmed that the problems of semantic integration remain the same: people use terms differently, and mapping and translation must take place across different communities.

The promise of ontologies is ‘a shared and common understanding of a domain that can be communicated between people and application systems’ (Fensel 2001 in Uschold & Gruninger 2004, p. 61). Ushold and Gruninger (2004, p. 63) identified important assumptions in order to make progress in automating semantic interoperability. Their assumptions were:

- that all parties use a single language for representing ontologies;
- that all members in a given community use:
    - a single shared ontology, or
    - a single shared upper ontology, with distinct domain ontologies, or
    - a shared interlingua ontology to map individual ontologies to and from;
- that semantic mapping among ontologies will be human-assisted, rather than fully automated; that mapping will be done between lightweight ontologies, with a limited role for automated reasoning; and

- that there is adequate infrastructure support for community repositories of both ontologies and inter-ontology mapping.

Figure 2.4: Kinds of Ontologies



Source: Adapted from Uschold and Gruninger (2004, p. 59)

The first assumption highlighted by Uschold and Gruninger (2004, p.63), '… that all parties use a single language for representing ontologies' is a key issue for this research. An identification of terms, how they are defined and the relationship between the terms in a discipline, or field has to be the first step in developing more sophisticated ontologies.

Uschold and Gruninger (2004, p. 63) claim that 'the **less** the following things are true:

- there is widespread agreement about the meaning of a term, and the syntax for expressing it,
- all the software is built by humans who correctly embed the agreed meaning of the term,
- all the databases and Web pages and applications use the term in the agreed way,

then the **more** necessary it is to have an explicit formal declarative semantics of the term that the machine can process to interpret the meaning of that term.

It is clear from the Information Systems literature that the term *ontology* is most often used when terms and definitions are considered for computer interoperability. However, the principles behind the purpose and development of an ontology are relevant for this research. Terminology in the domain and relations among the terms used in the CSCW research field can be identified and displayed showing the relationship between the terms.

It is interesting to note that when Noy and McGuiness (2000, p. 3) described the process of developing an ontology they did not provide an initial step of determining how ideas and concepts are gathered prior to including them in the classes. Their steps for developing an ontology included:

- defining classes in the ontology,
- arranging the classes in a taxonomic (subclass-superclass) hierarchy,
- defining slots and describing allowed values for these slots, and
- filling in the values for slots for instances.

Noy and McGuiness (2000, p. 1) specified reasons for the development of an ontology as:

- to share common understanding of the structure of information among people or software agents,
- to enable reuse of domain knowledge,
- to make domain assumptions explicit,
- to separate domain knowledge from the operational knowledge, and
- to analyse domain knowledge.

These five reasons for the development of an ontology described by Noy and McGuiness (2000) provide reasons to address the research problem, relating to the scope of the CSCW field, the terminology in use, and the lack of consistency.

2.2.4 Taxonomy and classification

'The objective of a taxonomy is not to facilitate action, but to advance understanding' (Durkheim & Mauss 1902/1963, p. 81 in Marradi 1990). Howard (1997, p. 1) provided a definition of taxonomy:

> A taxonomy is an approximation of reality that is used to gain greater understanding in a field of study … The characteristics of the data being classified may be imprecise and uncertain. Nevertheless, classification is an important and necessary process for systematic study.

The term *taxonomy* is derived from the Greek *taxis*, and is a particular science that deals with classification (Macquarie Dictionary Online 2003). As early as 1735 Carolus Linnaeus established the modern scientific classification system for plants and animals (Bruce & Levin 1997). The science of taxonomy has been mainly used for biology and zoology, but OED Online (2003) indicated that taxonomy is a classification of anything.

'The process and art of creating taxonomies' is 'back in vogue', to help address the problem of information overload (Chitty 2002, p.1).

Marradi (1990) posed the question of whether classification has to be considered as knowledge or as a preliminary to knowledge (see Gil 1981, in Marradi 1990). He argued that it can probably be answered with no drama according to what each person would say about familiarity with the vocabulary of a language: is that familiarity knowledge, or just a preliminary to knowledge of the statements that can be made in that language (Marradi 1990). For this research, the classification of concepts from a particular knowledge domain (CSCW) can be considered a preliminary to producing new knowledge about the domain.

A taxonomy should have classification categories with the following characteristics (Amoroso 1994 in Howard 1997, p. 34):

- mutual exclusivity – classifying in one category excludes all others because categories do not overlap
- exhaustive – taken together, the categories include all possibilities,
- unambiguous – clear and precise so that classification is not uncertain, regardless of who is classifying.
- repeatable – repeated applications result in the same classification, regardless of who is classifying
- accepted – logical and intuitive so that they could become generally approved
- useful – can be used to gain insight into the field of inquiry.

Classification schemes, typologies, and taxonomies do not make assertions and therefore cannot be judged true or false (Scheffler 1967). It is misleading to consider them 'a particular kind of hypothetical construct or hypotheses' (Sandri 1969, p. 104). However, as concepts they are tools for conferring organisation and stability on our thoughts about reality and like tools, they may be judged or found more or less useful for a particular purpose (Kemeny 1959).

Kwasnik (1999) argued that classification is a form of knowledge representation and that there is a relationship between classification and the processes of knowledge discovery and creation. The author goes on to say that each research community at various points must gather up the disparate pieces and in some way communicate what is known, expressing it in such a way as to be useful for further discovery and understanding.

Knowledge was described as being hierarchical (Landauer and Rowlands 2001). Every higher level concept is based on lower level information. Without knowledge of the hierarchy, one is left with only a vague notion of the meaning of a term.

In the area of knowledge management, developing shared terminology is also an important element in sensemaking. The participants in cross functional teams collaborating electronically are developing shared terminology of key terms and definitions in databases to improve their knowledge and collaboration (Rura-Polley, Baker & Hawryszkiewwycz 2002).

Oppenheimer (1956 in Borman 1980, p. 136) linked definitions, classifications and knowledge together by saying that:

> The difference among conventional definitions, descriptive definitions and concept laws are reflected in one of the major theoretical frameworks for all disciplines – that of classification. The setting up of classes in such a way that knowledge can be ordered, related and explained is dependent upon concept formation…The classification of knowledge in the sciences is the result of concept laws, or of descriptive definitions of considerable precision.

In summary, this section described how linguistics, epistemology, ontology, and taxonomy are relevant to the problem of inconsistent terminology in any field of study. It is argued that a dictionary of terminology would assist with consistency of the definitions and allow a better understanding of the meaning of the terms and concepts. The discipline of taxonomy and the art of classification have been described as a means to structure and represent terminology in a hierarchy to improve human knowledge.

2.3 Research problem

The research problem is based on a critical analysis of the literatures of CSCW, taxonomy, and classification. This review showed that there is inconsistency in terminology and definitions in the CSCW field within both the business and education environments. There is no taxonomy that provides a holistic view of the CSCW research field to include areas such as: groupware research, CMC research, GSS research, GDSS research, and CSCL research. Researchers, users and developers find it hard to describe and compare the implications of use and installation of CSCW systems because of these inconsistencies. This situation leads to the three research issues as follows:

- that there is inconsistent terminology,
- that the classification systems are inadequate, and
- that there is a lack of defined scope in the CSCW field.

A review of linguistics, taxonomy, epistemology and ontology assisted with the identification of approaches to structure terminology and presented an overview of the CSCW field. The various structuring methods considered for classification in this research have been drawn from the science of taxonomy (Pankhurst 1978).

The research framework for this research shown in Figure 1.1 illustrates the identification of terminology from the CSCW literature and the identification of issues relating to linguistics, taxonomy, and ontology, which together determined the research problem.

Research Problem: To define the boundaries of CSCW, to develop a taxonomy of CSCW terms, and to develop a dictionary of definitions of those terms in order to provide a consistent foundation for research and practice in the field.

Once the general research problem was determined the specific research tasks were developed in order to address the research problem.

Specific Research Task (SRT) 1: Identify the terms and definitions used in the CSCW literature.

An in depth literature analysis is used to identify the terms and definitions used in the CSCW field.

SRT 2: Use the CSCW terms to develop a taxonomy of CSCW terminology.

The terms identified in SRT1 are used as input to SRT2 to develop a hierarchical taxonomy showing the relationship of each term, to one another.

SRT 3: Compile definitions to construct a dictionary of CSCW terminology.

The terminology (concepts) used in the hierarchical taxonomy from SRT2, and definitions and additional descriptions of terminology identified during analysis from SRT1, were used to complete SRT3.

2.4 Summary of Chapter 2

Chapter 2 provided a review of the relevant literature in the CSCW field in order to identify the research issues. The review showed a lack of consistent terminology in the literature that perpetuated misunderstanding in the CSCW field of research. The review also demonstrated a lack of understanding of the scope of the CSCW research field.

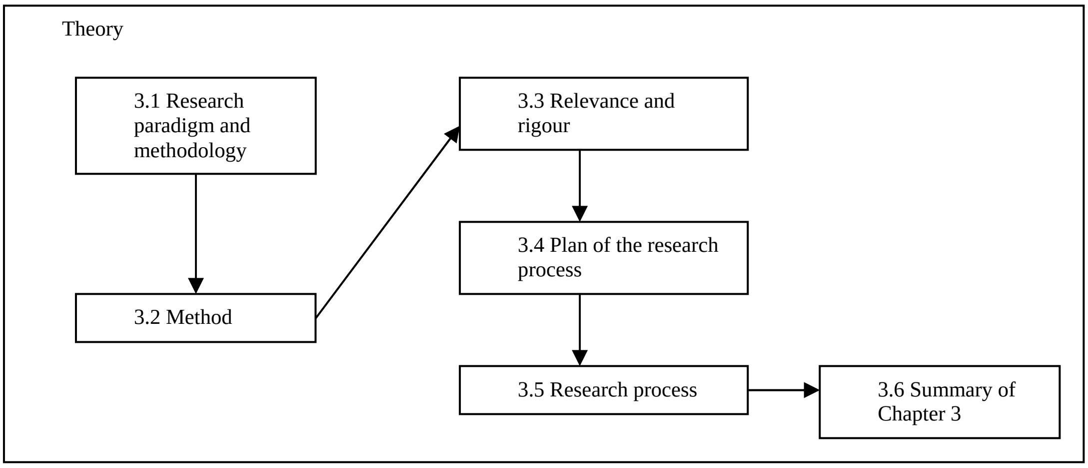
A conceptual framework was then constructed to identify the research problem from prior literature. The research problem was then considered in relation to the disciplines of linguistics, taxonomy, epistemology and ontology, in order to provide a means to structure terminology which would help to address the research problem. The identification of the problem and the identification of structured processes from these research disciplines were used to develop the specific research tasks.

Chapter 3 Research philosophy and methods

Chapter 2 described the relevant literature in CSCW to aid in identifying the research problem. Linguistics, epistemology, ontology and taxonomy were discussed in relation to inconsistent terminology and used to consider ways of addressing the research problem.

The philosophical perspective, methodology and methods that were used for data collection and analysis are described in this chapter. The chapter structure is presented in Figure 3.1.

Figure 3.1: Chapter 3 structure



Section 3.1 compares three major research paradigms and describes the paradigm and methodology considered appropriate for addressing this research problem.

A review of qualitative and quantitative methods is undertaken in Section 3.2 and the reasons for choosing a qualitative form of content analysis are described in general terms. Section 3.3 discusses the issue of quality of the research when using an interpretive methodology, relating to relevance and rigour. Relevance is considered from two perspectives: the relevance of the research problem to the CSCW research field and to practice, and the relevance of the methods chosen to the research problem. Rigour is described in terms of the rigorous and scholarly approach taken for this research. The use of an audit trail is described in Section 3.5 as it is the major approach taken to show rigour in this research.

Section 3.4 describes the plan of the research process including the stages of the Hierarchical Terminology Technique. Section 3.5 describes the use of an audit trail and follows with details of the stages of the research using content analysis for data collection and analysis in this study. The specific audit trail activities of the data collection and analysis process are described at each stage. Finally a summary of this chapter is presented in Section 3.6.

3.1 Paradigm

There is a need to consider the fundamental points of view of the researcher in order to identify a methodology that is useful for researching a particular problem (Kuhn 1970). Thomas Kuhn (1970) referred to the fundamental points of view characterising a science as its paradigms. A paradigm is a 'world view' or a set of basic beliefs or propositions (Patton 1990; Guba & Lincoln, 1994). Guba and Lincoln (1994, p. 107) commented that 'the beliefs must be accepted simply on faith as there is no way to establish their ultimate truth'. It is important to define and explore the researcher's position as an individual's underlying paradigm influences how he or she sees the world (Stanley & Wise 1983). For this research, a paradigm is defined as 'a model or framework' to provide us with 'ways of looking' (Babbie 1995, p. 32).

Scientists have developed a number of paradigms to understand social and organisational behaviour (Kuhn 1970), and the topic of research and the research objectives may indicate the advantage of a particular approach (Cavana, Delahaye & Sekaran 2001). No one paradigm is applicable to an unlimited range of subject matter (Rosenhead & Mingers 2001). Patton (1990, p. 38) also advocated a paradigm of choices 'rather than believing that one must choose to align with one paradigm or another'.

Sarantakos (1996) and Cavana, Delahaye and Sekaran (2001) divided research into three main paradigms: positivist, interpretivist and critical as shown in the columns in Table 3.2. Denzin and Lincoln (1994) discussed paradigms and stated that they can be summarised by the responses given to three fundamental questions: the ontological question, which refers to *reality* being objective, subjective, or multiple realities, the epistemological question, and the methodological question.

> Ontology – those questions that relate to ‘real’ existence and ‘real’ action are admissible in scientific inquiry. The form and nature of reality, how things are and how they work.
>
> Epistemology – What is the nature of the relationship between the knower and the would be knower and what can be known? The origin, nature and limits of human knowledge.
>
> Methodology – How can the inquirer (would be knower) go about finding out whatever he or she believes can be known? Not just any methodology is appropriate.
>
> (Denzin & Lincoln 1994, p. 108)

The principles shown in the first column of Table 3.1 have been specified as belonging to one of these fundamental questions of ontology, epistemology or methodology.

Table 3.1: Comparison of three major research paradigms

Principles	Paradigms		
	Positivist	Interpretivist	Critical
Assumptions (Ontology)	Objective world which science can measure and ‘mirror’ with privileged knowledge	Intersubjective world which science can represent with concepts; social construction of reality	Material world of structured contradictions and/or exploitation which can be objectively known only by removing tacit ideological biases
Aims (Ontology)	To discover universal laws that can be used to predict human activity	To uncover the social constructed meaning of reality as understood by an individual or group	To uncover surface illusions so that people will be empowered to change their world
Stance of researcher (Epistemology)	Stands aloof and apart from research subjects so that decisions can be made objectively	Becomes fully involved with research subjects to achieve a full understanding of subjects’ world	Involved with research subjects so that surface illusions can be identified, but urges subjects to change their world
Values (Epistemology)	Value free; their influence is denied	Values included and made explicit	Values included and made explicit
Types of reasoning (Methodology)	Deductive	Inductive	Deductive and inductive
Research plan (Methodology)	Rigorous, linear and rigid, based on research hypothesis	Flexible, and follows the information provided by the research subject	The imperative for change guides the actions of the researcher
Research methods and types of analysis (Method)	Experiments; questionnaires; secondary data analysis; quantitatively coded; documents statistical analysis	Ethnography; participant observation; interviews; focus groups; conversational analysis; case studies	Field research, historical analysis, dialectical analysis
Goodness or quality of criteria (Methodology)	Conventional benchmarks of ‘rigour’; internal and external validity; reliability and objectivity	Trustworthiness and authenticity	Historical situatedness; erosion of ignorance and misapprehensions; action stimulus

Source: Adapted from Lincoln and Guba (2000) and Gephart (1999 in Cavana, Delahaye & Sekaran. 2001, p. 10)

The two major paradigms, positivist and critical have been rejected for this research on the following grounds. The positivist paradigm, as described in Table 3.1, assumes there is an objective world that is factually based, with natural mechanisms or universal laws to discover, that can be used to predict human activity. It assumes that ‘all members of society define reality in the same way, because they all share the same meaning’ (Sarantakos 1996, p. 34). The CSCW research field is not underpinned by *natural* *mechanisms* and cannot be *objectively observed*. Moreover, the constructs and terms are ambiguous, hence the reason for this study. Positivist paradigms generally use a quantitative methodology. A quantitative study would exclude meaning and purpose (Denzin & Lincoln 1994). As the focus of this study is on meaning a positivist paradigm using quantitative methods would be inappropriate.

The critical paradigm, considers that reality is perceived to be in a state of 'conflict, tension and contradiction, resulting in a constantly changing world' (Sarantakos 1996, p. 35). Critical research assumes involvement of the researcher and encourages action to change the condition of peoples lives (Sarantakos 1996). Although the terminology and definitions in the literature do exist, the understanding and meaning of these concepts within the CSCW research field are *constructed* in the minds of the researchers. Reality exists in this instance through understanding of the concepts by the reader, but not through conflict. Also critical research suggests that the researcher becomes part of the research environment and the involvement of the researcher directly impacts the problem and the solution (Sarantakos, 1996). As this research is based on textual data that will suggest solutions to the problem, but is not intended to make changes to the environment through emancipation or empowerment, it is not considered to be part of the constructivist paradigm.

An interpretive approach has been used to study this phenomenon of inconsistency. Walsham (1995) stated that in recent years interpretive research has emerged as an important strand in information systems research. Interpretivism, can be traced to the German sociologist Max Weber (1864-1920) (in Lee & Newby 1983). The Interpretivist perspective recognises that the social world cannot be studied from the *outside*, but is constructed by social actors as they interpret the world (Lee & Newby 1983). Weber argued that 'social behaviour is subjective as it takes account of the behaviour of others. This goes beyond the positivist concern with what is observable to the senses' (Lee & Newby 1983, p. 174). Neuman (1994, p. 61) described interpretivism as being:

> … related to hermeneutics, a theory of meaning that is largely found in the humanities (philosophy, art history, religious studies, linguistics, and literary criticism). It emphasizes a detailed reading or examination of text, which could refer to a conversation, written words, or pictures.

'Interpretivism is about *contextualised meaning*'(emphasis in original) (Denzin & Lincoln 1998, p. 384). The inconsistency in terminology in the CSCW field is subjective in nature and the scope of the field is constructed by researchers and others as they interpret the world.

This study is also descriptive. A definition of a *descriptive study* is ‘to offer a profile or to describe relevant aspects of the phenomena of interest to the researcher’ (Sekaran 2000, p. 125). Descriptive studies that present data in a meaningful form help to understand the characteristics of a given situation. Dubin (1978, in Cooper & Emory 1995, p. 11) stated:

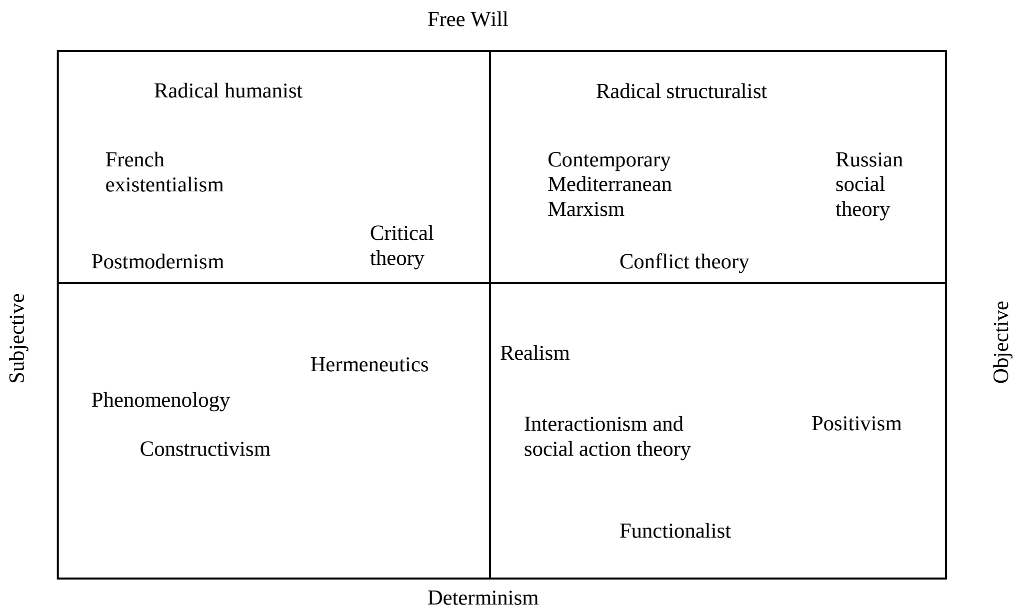
> In every discipline, but particularly in its early stages of development, purely descriptive research is indispensable. Descriptive research is the stuff out of which the mind of man, the theorist, develops the units that compose his theories. The very essence of description is to name the properties of things: you may do more, but you cannot do less and still have description. The more adequate the description, the greater is the likelihood that the units derived from the description will be useful in subsequent theory building.

As discussed in Section 2.5.1, the role of language is important in this study. Wittgenstein considered words as tools and sentences as instruments and the structure of language determines how we perceive the world (Jashapara 2004). Nonaka (1994) considered knowledge in terms of tacit and explicit, where tacit is *knowing how (doing)* and explicit is *knowing that (being)*. This research focused on one of Nonaka’s four modes of knowledge conversion: *explicit knowledge to explicit knowledge*. This mode of knowledge conversion suggests that new knowledge can be achieved through the combination of reconfiguring existing knowledge such as sorting, adding, recategorising and recontextualising explicit knowledge (Jashapara 2004).

Burrell and Morgan (1979) researched our understanding of the production of knowledge in the field of organisational studies. They produced a map of four *sociological paradigms*: functionalist, interpretivist, radical structuralist and radical humanist (Table 3.2). The two paradigms from Burrell and Morgan relevant for this study are interpretivist and functionalist. The interpretivist paradigm, as mentioned above, focuses on the understanding of reality through the realm of social construction and subjectivity.

‘The functionalist paradigm is concerned with a positivist, realist and social engineering perspective where organisational life is about creation and control and not letting matters fall apart’ (Jashapara 2004, p. 42). Parsons’ functionalism, relating to sociology, studied the roles of institutions and social behaviour in society and developed explanations of society in social terms. Although Parsons and functionalism ‘were more or less discredited and abandoned by the late 1980s' (Gingrich 1999, p. 1), some of the ideas of Parsons have been considered useful to the study of the CSCW field. Parsons took a holistic approach and focused on the macro level of institutions and structures existing in society as a whole. Parsons believed that the different parts of each society contribute positively to the operation or functioning of the system as a whole and the different parts of the system are considered in relation to each other, and to the whole.

Table 3.2: Four sociological paradigms



Source: Burrell and Morgan (1979 in Jashapara 2004, p. 42)

The functional approach in sociology tends to argue that there is consensus within the social system. Individual behaviour is governed by social norms or rules that are generally accepted and agreed upon. Parsons used structures as a functional method to assist the society to operate (Gingrich 1999). However, Jashapara (2004) considered that the primary structure of knowledge is past experience, and can be identified through abstraction.

In summary, the paradigms chosen for this research are interpretive, and descriptive, with elements taken from functionalism (Klein and Myers 1999). This research can be classified as interpretive as it is assumed that our knowledge of reality is gained only through social constructions such as language, consciousness, shared meanings, documents, tools and other artefacts (Klein and Myers 1999). The descriptive approach considers the relevant aspects of a phenomenon to assist with the understanding of a given situation.

Functionalism supports the holistic approach taken for this research. The functional approach considers the whole of a system and how the different parts of the system are related to the whole. In this research the functional approach is considered appropriate to argue that the study should take a holistic approach. This study was undertaken to identify the inconsistencies of terminology and definitions in the CSCW field, to develop taxonomic structures of the terms and systems, and to develop a dictionary of definitions. These structures could then be used to determine implications for research and practice.

When undertaking any research study it is necessary to distinguish between methodology and method. Methodology and the methods chosen for this study are described in the next section.

3.2 Method

Methodology is the philosophy or general principles behind the research based on a particular paradigm (Sarantakos 1996). Nunamaker et al. (1991) described methodology as a combination of process, methods, and tools that are used in conducting research. Keen (1991) stated that a research methodology needs to be relevant to the research question and rigorous in execution.

Qualitative methodologies are designed to help researchers understand people and the social and cultural contexts within which they live (Myers 1997). Kaplan and Maxwell (1994) argued that the goal of understanding a phenomenon from the point of view of the participants, and its particular social and institutional context is largely lost when textual data are quantified. Interpretive studies generally attempt to understand phenomena through the meanings that people assign to them and interpretive methods of research in IS are 'aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context' (Walsham 1993, p. 4). All qualitative modes of analysis are concerned primarily with textual analysis (whether verbal or written) (Myers 1997).

Methods are the strategies and techniques (Hall and Hall 1996), tools or instruments used by the researcher to gather and analyse evidence (Sarantakos 1996). Methods should fit into the theoretical and methodological model of the perspective that is chosen for the research. The activities undertaken in this study included:

- identifying the concepts used in the CSCW research field
    - to show the scope of the field, and
    - to develop a taxonomy in the form of a hierarchical structure;
- identifying and developing definitions, for the systems and terminology incorporated in the hierarchical structure, that were used to create a dictionary of CSCW terms; and,
- considering the implications of these tools for research and practice.

In this research 'content analysis' and the first stage in the hierarchical terminology technique (HTT) were used to identify the concepts that were used to develop the hierarchical structure (stage 2) and to identify the definitions that were used to develop the dictionary (stage 3).

Content analysis, which is a form of documentary research, was used when the researcher identified and interpreted information contained in documents. Content analysis can be undertaken using a qualitative and/or quantitative analysis of the content of texts, pictures, films and other forms of verbal, visual or written communication (Sarantakos 1996, p. 210). As the text documents used in this research exist over long periods of time, the technique was also used to extract historical insights (Weber 1990). Glaser and Strauss (1999) discussed historical data and stated that the library is often not considered as a source of real data and some researchers distrust their own competency in discovering and working with library materials as a source of primary data.

Lindkvist (1981, p. 26) distinguishes between three definitions of 'text'.

- Every semiotic structure of meaning (… such a concept includes not only language but music, architecture, picture event, and social action);
- Every linguistic means of expression (thus music, for example, is excluded for the text concept);
- Written language (which would exclude, for example, audiovisual languages such as transcripts of broadcastings).

This study used Lindkvist's (1981) third definition of *text* as meaning the *written language*.

Two major categories to content analysis were identified by Weber (1990): *conceptual analysis* in which documents are measured for the presence and frequency of concepts, and *relational analysis* (also known as semantic analysis) which measures how such identified concepts are related to each other within the documents. Other authors used the term 'semiotic analysis approach' (Denzin 1987; Manning 1987, Feldman 1995) to look at the use of specialised vocabularies in the data.

Relational analysis is a research tool used to determine the presence of certain words or concepts within texts or sets of texts. This research used relational analysis to look for meaningful relationships between concepts (Colorado State University 2002).

Schultz (1998, p. 1) stated that

> … semantic-based methods of content analysis are based on the claim that individual words and sentences are not the appropriate level of analysis when trying to establish the meaning of texts, because it is the pattern in which those individual text components are constructed that provided differences in meaning within texts.

Relational analysis was considered the most relevant approach for this research. Researchers identify and analyse the presence, meanings and relationships of such words and concepts, then make inferences about the messages within the texts (Colorado State University 2002). Relational analysis of prior literature has been used, in this research, as an unobtrusive way to extract data about terminology, definitions, frameworks and other groupwork issues.

As shown in Table 3.3, relational analysis approaches fall into 3 categories: affect extraction, proximity analysis and cognitive mapping. Affect extraction aims at providing an emotional evaluation of the emotional and psychological state of the speaker (Weber 1990). This is a quite specific form of content analysis that is not relevant for this research.

The second form of relational analysis, proximity analysis, measures the co-occurrence of concepts found within the text. In this approach, a length of words or sentences called a window is specified (Weber 1990). This approach does not identify differences of inconsistencies in the use of terms.

Table 3.3: Categories of content analysis

Content Analysis	Conceptual analysis	
	Relational analysis (semantic analysis)	Affect extraction
		Proximity analysis
		Cognitive mapping (mental models) (network based)
		Hierarchy of concepts

The third form of relational analysis, cognitive mapping or mental models, is an extension of the first two, representing the information visually for comparison. As the output of relational analysis is generally a large matrix of values, the cognitive mapping approach tries to compress this information into two dimensions (Weber 1990). This research extended the idea of cognitive mapping to a hierarchy of concepts to expose the relationships between terminology.

The focus of relational analysis is to look for meaningful relationships between concepts as such concepts are rarely used in isolation, but rather they form interconnected groups or concept clusters that form a web of meaning (Neuman 1994). In this research these groupings were used to develop a hierarchy of terms and associated definitions based on a classification system. The classification system was developed from the concepts identified in the relational analysis of the research in the CSCW field. The method of data collection, analysis and display used for this study is described in section 3.5 and has been named the Hierarchical Terminology Technique (HTT).

In this research, classification is the action or the result of classifying (Macquarie Dictionary Online 2003), or the arranging in classes, according to common characteristics or affinities; and assignment to the proper class (OED Online 2003). Classification schemes can include: superclasses, subclasses, attributes and values. Classification can be described as ‘division’ (Cohen and Nagel 1934 in Marradi 1990) and categorisation (Scheffler 1967/1983 in Marradi 1990).

Marradi (1990, p. 129) described classification as:

> (a) **Intensional classification** - an intellectual operation whereby the extension of a concept at a given level of generality is subdivided into several (two or more) narrower extensions corresponding to as many concepts at lower level of generality;

(b) **Extensional classification** - an operation whereby the objects or events of a given set are grouped into two or more subsets according to the perceived similarities of their states on one or (more frequently) several properties; subsets may be successively grouped into subsets of wider extension and higher hierarchical level;

(c) **Classing** - an operation whereby objects or events are assigned to classes or types which have been previously defined. In most instances, classes have been defined through an operation of type (a); however, they may also have been defined through an operation of type (b).

From a semantic point of view, **intensional classification** may be seen as a process of conceptual elaboration (Glaser 1978; Turner 1981). Concepts corresponding to individual classes are either formed or clarified by the definition of their boundaries with contigous (neighbouring) concepts. Each class concept has to be defined clearly, it specifies the 'necessary and sufficient conditions of membership' in the class 'by stating certain characteristics which all and only the members of the class possess' (Hempel, 1961/1965, p. 137). The majority of terms used by CSCW researchers in their articles were described using an intensional classification approach.

An unobtrusive or indirect research method (Sarantakos 1996) of content analysis using text from documents has been used for this research. Popping (2000) stated that the world of meanings, values, and norms are made accessible when undertaking text analysis on the content of a message. Text analysis is used to bring structure to an enormous amount of rather unstructured information. The advantages and disadvantages of the use of descriptions within documents as primary data were highlighted by Sarantakos (1996). The advantages described were:

- retrospectivity;
- quick and easy accessibility;
- spontaneity;
- low cost;
- sole source;
- high quality of information;
- possibility of retesting; and
- non-reactivity (Sarantakos 1996, p.208).

The limitations were:

- not necessarily representative of their kind;
- documents not easily accessible;
- documents not complete or up to date;
- reliability of some documents;
- demonstrated methodological problems, and

- documents are biased (Sarantakos 1996, p. 209).

The reasons for using an unobtrusive method for this study are that:

- CSCW researchers use written documents to communicate their research to the CSCW research community and other practitioners;
- the data required for the major portion of this study are already available in written documents;
- direct access to CSCW researchers (the experts) was limited, time consuming and expensive;
- the accessibility of written documents provides a much greater opportunity to access a range of expert knowledge across the CSCW field;
- the CSCW researchers come from a wide range of disciplines; and
- many CSCW researchers undertake research in a small component of the field, which would limit their understanding and knowledge of the terminology and definitions used across the whole field.

In summary, this research used an interpretive paradigm, a qualitative methodology, and a relational content analysis method called the Hierarchical Terminology Technique to classify the terminology used in the CSCW field.

Having described the paradigm, methodology and the choice of method used for this study it was important to consider how quality in an interpretive study could be assessed. Quality is considered in terms of relevance and rigour.

3.3 Relevance and Rigour

'Interpretivist inquiry is less about predicting and generalising behaviour, and more about interpreting intention and meaning in context' (Dodge, Ospina & Foldy 2005, p. 289). The assessment of quality in interpretive research must start from this distinction. For this research, quality was dependant on two dimensions, relevance and rigour (Dodge, Ospina & Foldy 2005; Pervan 1994b).

Relevance has been described in terms of practical significance and conceptual significance (Pervan 1994b). Practical significance includes contribution to practice, contribution to the research area through conduct of research, and presentation of the research. Conceptual significance includes coverage of significant literature, the use of theory, contributions to knowledge in the field and suggested future research (Pervan 1994b). Relevance refers to the potential of research (questions and findings) to enable practitioners 'to make informed choices about important practical problems and to implement solutions to them effectively' (Academy of management 2004). Relevance is not just about capturing a truth or a reality, but pursuing worthwhile human purposes (Reason 2003 in Dodge, Ospina & Foldy 2005).

The second dimension 'rigour' is described by Dodge, Ospina & Foldy (2005, p. 288) as referring to 'the accurate and systematic application of theory and methods', which 'ensures that the research process conforms to the public standards and agreements in a research community'. Pervan (1994b) described logical rigour as tight flow of ideas, links between literature review and method, and between method and results.

Before discussing, in summary, the specific issues of how rigour and relevance were handled in this research, a review of literature relating to quality of the research process is presented.

3.3.1 Quality of the research process

There has been much discussion about the terminology used for describing the quality of interpretive research. Some researchers discuss quality of research using the terms *validity* and *reliability* which are tools of an essentially positivist paradigm. Guba and Lincoln (1994) proposed different standards for judging quality and suggested: credibility; transferability; dependability; and, confirmability as paralleling *validity* and *reliability* (shown in Table 3.4). Guba and Lincoln considered that these four criteria better reflected the underlying assumptions involved in much qualitative research.

The credibility criteria (Internal validity) are used to establish that the results of qualitative research are credible or believable from the perspective of the participant in the research. Since from this perspective, the purpose of qualitative research is to describe or understand the phenomena of interest from the participant's eyes, the participants are the only ones who can legitimately judge the credibility of the results (Guba & Lincoln 1989). This research used an unobtrusive data collection method where no participants were directly involved, so credibility as defined by Guba and Lincoln was not an appropriate criteria to use.

Table 3.4: Criteria for judging research

Traditional criteria for judging quantitative research	**Alternative criteria for judging qualitative research**
Internal validity	Credibility
External validity	Transferability
Reliability	Dependability
Objectivity	Confirmability

Source: Adapted from Guba and Lincoln (1994).

Hoepfl (1997) explained that qualitative research is judged using special criteria for trustworthiness. Heopfl argued that judgements about usefulness and credibility are left to the researcher and the reader. Byrne (2001) described the term *credibility* in regard to reporting and documenting the processes and procedures of the study. Byrne (p. 904) stated that ‘it is incumbent on the researcher to report and document his or her analytic processes and procedures fully and truthfully so others may evaluate the credibility of the researcher and his or her findings’. Lincoln and Guba (1985, p. 290) also discussed *trustworthiness* in this context. They asked ‘How can an inquirer persuade his or her audience that the research findings of an inquiry are worth paying attention to?’

Transferability (external validity) refers to the degree to which the results of qualitative research can be generalised or transferred to other contexts or settings. From a qualitative perspective transferability is primarily the responsibility of the one doing the generalising (Guba & Lincoln 1989). Guba and Lincoln suggested that the qualitative researcher can enhance transferability by doing a thorough job of describing the research context and the assumptions that were central to the research. The person who wishes to *transfer* the results to a different context is then responsible for making the judgement of how sensible the transfer is (Guba & Lincoln 1989). In this research a thorough description of how this research has been undertaken is described. The advantages and disadvantages of the method has been explained, and a full explanation of the limitations of the research has been provided to give future researchers a means to establish quality of this research for transferability. In terms of external validity, no other studies have been located on this research topic thus concurrent validity appears to be low (Malhotra 1993).

The criteria *dependability* (reliability) emphasises the need for the researcher to account for the ever-changing context within which research occurs. Dependability replaces reliability used in positivist paradigms, which is based on the assumption of replicability or repeatability. This research used an unobtrusive data collection method where no participants were directly involved, so dependability as defined by Guba and Lincoln (1989) was not an appropriate criteria to use for this research as the social context was not researched. However, in 1985 Lincoln and Guba proposed one measure which might enhance dependability of qualitative research that is, the use of an inquiry audit in which reviewers examine both the process and the product of the research for consistency.

The fourth criteria *confirmability* (objectivity) refers to the degree to which the results could be confirmed or corroborated by others. Guba and Lincoln (1989) described a number of strategies for enhancing confirmability. Two of these strategies are particularly relevant for this study. 'The researcher can document the procedures for checking and rechecking the data throughout the study' (Guba & Lincoln 1989, p. 2). This approach would provide an audit trail consisting of raw data, analysis notes, reconstruction and synthesis products, process notes, personal notes, and preliminary developmental information (Lincoln & Guba 1985). After the study, a data audit can be undertaken that examines the data collection and analysis procedures and makes judgements about the potential for bias or distortion.

Other terms introduced by other researchers in place of *validity* are *plausibility*, *relevancy*, *representative*, *trustworthy*, or *worth* (Hammersley 1987; Guba & Lincoln 1989; Mishler 1990; Wolcott 1990; Denzin & Lincoln 1998). Terms introduced by other researchers for *reliability* are *coherence, openness, discourse* (Sarantakos 1996). Sarantakos (1996) discussed standards and professional practice for research and highlighted six issues which were: accuracy in data gathering and data processing, systematic and objective procedures, a relevant research methodology based on research objectives, appropriate interpretation of data, and accurate reporting of research findings in an unbiased manner, including a full explanation of the method employed.

More recently, Shank and Villella (2004) introduced four criteria for evaluating qualitative research, investigative depth, interpretive adequacy, illuminative fertility and participatory accountability.

> Investigative depth: Does the researcher uncover anything that was not already known or believed about the area in question. Do they discover something that is new (p. 49)?
>
> Interpretive adequacy: gives us a richer, more complex, yet understandable picture of the area under study (p. 50).
>
> The degree of divergence, subtlety and nuanced insight that we receive is one measure of the illuminative fertility of the findings. The other measure is in terms of the difference that our findings make in practice (p. 50).
>
> Participatory accountability: Researchers must do their best to operate in an ethical manner and to ensure that readers understand their actions, stances and efforts (p. 51).

Methods for data collection and analysis guide the discussion on rigour of the research process. The disdvantages or limitations of each method have been discussed in terms of how they affect quality and what can be done to reduce these problems (Chapter 2). Keen (1991) stated that the research methodology needs to be relevant to the research question and rigorous in execution.

Tesch (1990) suggested that text analysis is systematic and goal oriented leading to a result that others can accept as representing the data. However, the analysis process is subjective and different relationships could be considered appropriate by other researchers. Everything is done during the analysis process to describe the reasons for choosing the relationships that are shown in the final hierarchy to provide dependability.

3.3.2 Summary of Section 3.3

From the descriptions and suggestions made by other researchers, the following criteria for quality have been identified relating to relevance and rigour for this research:

Relevance:

- Relevancy of the problem to practice;
- Relevancy of the problem to the research field;
- Coverage of significant literature;
- Relevancy of the methodology and methods to the research problem;
- The use of theory;
- Contribution to knowledge in the research field;
- Suggested future research.

Rigour:

- Links between literature review and method;
- Research methodology based on research objectives;

- Full explanation of the methods employed;
- Accuracy of data gathering;
- Systematic and objective procedures for data processing;
- Appropriate interpretation of data;
- Links between methods and results;
- Tight flow of ideas;
- Accurate reporting of findings.

A number of these issues relating to rigour can be supported with the use of an audit trail. An audit trail was recorded throughout the research process. The audit trail was used as a means to track the workload and develop timelines. It also provided a checking mechanism to determine whether all activities had been completed. The description of the audit trail processes and procedures, in later sections, provide a means to show rigour in this research.

3.4 Plan of the research process

The research process illustrated in Table 3.5 shows the four stages that were undertaken to complete this study and address the research problem. Each stage in the research process comprised one or more steps, which are described in detail in the chapters specified in brackets in the table. The hierarchical terminology technique is made up of Stages 1-3. Stage 4 presents the terminology inconsistencies and describes the implications of the hierarchy and dictionary to future research and practice.

Table 3.5: Plan of the research process

Research Process
Stage 1: Identification of the terms through content analysis (Chapter 3).
Stage 2: Analysis and construction of CSCW taxonomy of terms (Chapter 4, 5 and Appendix D).
Stage 3: Development of dictionary of definitions (Chapter 3 and Appendix E).
Stage 4: Identification of terminology inconsistencies and implications of research (Chapter 6).

Other researchers have considered the process of data collection and analysis and have suggested steps to follow. Sarantakos (1996) described four steps of documentary research:

- Step 1: Identification of relevant documents

- Step 2: Organisation and analysis of the documents
- Step 3: Evaluation of the information
- Step 4: Interpretation of the data.

When discussing qualitative analysis Miles and Huberman (1994, p. 10-12) described three steps:

- Step 1: Data reduction which includes selection and condensation
- Step 2: Data display - in diagrammatic, pictorial and visual forms
- Step 3: Conclusion drawing and verification where displayed data are interpreted and meanings drawn.

Hierarchical Terminology Technique

This study has combined and modified the steps discussed by Miles and Huberman (1994) and Sarantakos (1996) and in stage 1 of the Hierarchical Terminology Technique has used three steps for data collection and analysis. The approach used in this study was iterative, in that the steps were not mutually exclusive and were not necessarily consecutive. The development of the hierarchical taxonomy in Stage 2 has two steps and the dictionary development in Stage 3 has three steps as listed below.

Stage 1: The three steps used for the content analysis were:

- Step 1.1: Identification of the relevant documents;
- Step 1.2: Condensation of the documents; and
- Step 1.3: Coding of the data.

Stage 2: The two steps in the development of the hierarchy taxonomy were:

- Step 2.1: Development of simple hierarchical tables; and
- Step 2.2: Development of hierarchy diagrams.

Stage 3: The three steps in the development of the dictionary were:

- Step 3.1: Collating of terms and definitions;
- Step 3.2: Formatting of the dictionary; and
- Step 3.3: Presentation of dictionary.

The final stage of the research, Stage 4, presents the identification of terminology inconsistencies and implications of the research output for research and practice.

These four stages provided clarity in describing the processes for this research and to address the research problem. The concepts of the CSCW literature were identified from the articles in Stage 1. Terminology and structures of terms that were identified in the articles through Stage 1 were used in Stage 2 to develop the hierarchical taxonomy of terms. The output from Stage 2 shows the breadth of terminology to display the scope of the terminology across the CSCW field, to address SRT1. The output from Stage 2 also shows the relationships of the concepts of the CSCW field to address SRT2.

The output from SRT1 and SRT2 were used in Stage 3 to develop a dictionary of CSCW terminology to address SRT3. Both the Taxonomy from SRT2 and the dictionary from SRT3 were considered in Stage 4 to determine some of the inconsistencies and the implications of the developed structures for research and practice.

Section 3.5 describes the research process. During each stage of the research process, audit activities were undertaken to improve rigour. Section 3.5.1 provides a summary of the audit activities and computer usage across the four research stages. Sections 3.5.2 to 3.5.6 describe the stages of the research in detail.

3.5 Research process

3.5.1 Audit trail

This section provides an overview of the audit trail and computer usage. Table 3.6 shows the audit activities and the computer programs used at each stage of the research process.

In Stage 1 articles were found, photocopied, and filed. Articles were then condensed to retrieve the relevant data and made into electronic documents using *MSWord.* The highlighted sections of the documents were copied into a worksheet using *MSExcel*, ready for coding. Coding was undertaken with the assistance of *AtlasTi* software. In Stage 2 the coded data were analysed and displayed using *MindManager*. In Stage 3 the dictionary was formatted and in Stage 4 the results were presented using *MSWord.*

The steps of the data collection and analysis have been described in more detail below. During each step a more detailed description of the audit trail and computer usage has been included to show how these support quality.

Table 3.6: Stages showing audit activities and computer program usage

Steps of the research	Computer usage	Tracking	Purpose
Step 1.1	WWW (Web browser) MsWord EndNotes MSExcel	Filing of all documents Notes kept of each activity Print out of all source documents Total of articles recorded by year.	For searching in databases, and on conference, and university web sites Used for recording notes and activities Used for recording and tracking articles Used to check sample size
Step 1.2	MSWord	Print out kept of all condensed documents	Transfer paragraphs from articles to word documents
Step 1.3	AtlasTi MSWord MSExcel	Hard copy of all coding forms filed with source documents Printout of coded data Print out of worksheet showing all terms and definitions collected from source documents	Highlighted text relating to classification, systems, structure, and definitions. Coded text saved in separate files Word document produced of all coded data Worksheet of terms and definitions
Step 2.1	MSExcel MindManager	Highlighted cells in matrix to show which portions of text had been used. Cross checked spreadsheet terms with use of terms in Chapter 4. Development and printout of hierarchy (see Appendix D)	Worksheet to track use of text. Worksheet used to develop hierarchy Used to display terminology hierarchy for publication
Step 2.2	MindManager MSWord	Development of terminology hierarchy Development and printout of dictionary (see Appendix E)	Final hierarchy of terminology Formatted dictionary
Step 3.1	MSExcel	Terms listed ready for structuring dictionary.	Definitions worksheet from step 1.3 used to identify terms and definitions for dictionary.
Step 3.2	MSWord	‘Sort’ and formatting of document	Terms put in alphabetical order and definitions formatted

Source: Developed for this research

3.5.2 Stage 1 – Content analysis

Step 1.1 - Identification of the relevant documents

As stated in Chapter 1, the literature review did not reveal a previous study of this kind in the CSCW field, so the boundaries of this research relating to data source were not originally apparent. In order to qualify for inclusion into this research the source documents required three elements: groups of people, who use computer systems, to undertake group work (Grudin 1991). The relevant documents for analysis in this research were those articles published between 1978 and 2003, which related to the ‘use of CSCW systems’.

The choice of articles for this study depended on availability, accessibility, and relevance. Sampling was considered necessary for this interpretive study as there was a requirement to have a range of published articles from across a number of years from a number of different authors.

The issue of sampling is discussed, followed by an explanation of where the articles were found. Sampling in qualitative research is not based on probability theory, and the size of samples is usually too small to reflect the attributes of the population concerned. However, for this research the sample size used was quite large to provide an overall representation of the research field. The unit of analysis in this study was either the written articles published in this field or the CSCW authors who research in this field. In either case, the size of the population is large and difficult to quantify.

There are a number of different types of sampling procedures used for qualitative studies. Three non-probability sampling techniques, snowball sampling (Cavana, Delahaye & Sekaran 2001), judgement sampling (Oppenheim 1992, p. 43) and serendipity sampling, were considered the most feasible methods, and were used in this research for obtaining articles across the relevant years.

Snowball sampling is often used when specific characteristics or knowledge are required in the population, but they are difficult to locate (Cavana, Delahaye & Sekaran 2001). In this research, sampling was commenced with finding a few articles by using general search, using keywords. A snowball effect was then used to identify other articles from reference lists from the original documents found. It is understood that this sample could be biased (Davidson & Layder, 1994). This bias is offset by the use of other sampling techniques such as judgement sampling.

A sampling method that relies on the researcher to obtain a wide representation of articles is called judgement sampling (Oppenheim 1992). Judgement sampling takes account of likely sources of difference in the views and experiences of the articles’ authors. ‘This may be the only feasible method in certain circumstances, when access to the population is difficult or restricted’ (Oppenheim 1992, p. 43).

Some reviews of previous literature in the field helped to identify further articles to find. Some conference web sites, such as CSCW and ECSCW conferences, were targeted directly to obtain articles that were relevant for this study. Articles were found by searching electronic libraries and electronic databases such as *Proquest*, *Emerald* and *Infotrac,* web search engines including *Google Scholar,* individual researchers' web sites and research group web sites. Web sites searched included Institute of Electrical and Electronics Engineers Computer Society (*IEEE),* Association for Computing Machinery (*ACM),* Australian Computer Society (*ACS),* and University web sites such as *University of Calgary* and *University of Arizona*. A list of keywords used as search terms has been attached at Appendix B.

Some articles were found 'by chance', referred to as serendipity. Some articles were found by colleagues, others were found when searching for other reference materials. Some articles were identified through discussions with colleagues.

When preparing the files, all articles were rechecked to confirm that they were suitable for this study. Some articles were considered unsuitable for inclusion during this check. One article was only a two-page discussion of a multimedia system that did not discuss the use of the system by groups and another article compared methodologies of the development of systems. Unsuitable articles were removed from the study.

A quantitative literature analysis was undertaken to determine the breadth and depth of articles retrieved. During this first part of the analysis phase it was noted that because Stage 1 was undertaken during 2001-2 only 3 articles had been retrieved for 2003. Also it was noted that very few articles were identified for 2001. Since it was considered that there should be a more even spread of articles across the years chosen, further articles for 2001 and 2003 were found and included in the sample (refer table 3.7).

Each article was analysed to determine whether it was a qualitative or quantitative study, or both, and whether it was a review, a conceptual paper or both.

The quantitative analysis of the documents showed that there were 382 articles with over 700 different authors, from 24 different countries, 47 different organisations and 167 different universities. Further, 158 articles were from 56 different conferences, and 193 articles from 97 different journals. The remaining articles were from web sites. The articles used for analysis are referenced alphabetically by year in Appendix C and also included in the full reference list for this thesis.

Table 3.7: Articles by year

Articles by year	Total	Qualitative	Quantitative	Both Qual & Quant	Review	Conceptual paper	Review and Conceptual
2003	17	5	7	2	1	3	1
2002	31	8	10	6	3	1	3
2001	23	6	5	2	6	2	-
2000	29	11	6	3	2	5	1
1999	32	14	2	-	6	6	4
1998	36	13	4	3	11	4	1
1997	12	2	3	-	4	2	-
1996	17	-	3	-	6	7	1
1995	37	6	4	2	11	13	1
1994	23	3	5	3	6	6	-
1993	15	7	3	-	-	3	2
1992	25	5	7	1	3	7	1
1991	15	1	-	-	6	5	3
1990	14	2	4	-	1	7	-
1989	8	-	1	-	6	1	-
1988	21	2	5	2	3	8	1
1987	5	-	-	-	4	1	-
1986	14	6	-	1	1	6	-
1985	2	-	-	-	1	1	-
1984	1	-	-	-	-	-	1
1983	1	-	1	-	-	-	-
1982	1	1	-	-	-	-	-
1981	1	-	1	-	-	-	-
1980	1	1	-	-	-	-	-
1978	1	-	1	-	-	-	-
Total	**382**	**58**	**39**	**16**	**45**	**35**	**12**

Source: Developed for this research

Audit trail and computer usage for step 1.1.

During the search for documents, notes were kept of the progress of the document retrieval. The notes kept in word processed files included:

- keywords used for article searches (Appendix B),
- databases that had been searched.
- a list of potential new references,

- article references that had been found,
- full-text articles that had been found and used for analysis (Appendix C).

As full text articles were found they were processed:

- Full text articles were saved electronically and printed (hard copy).
- Full text (hard copy) articles were transferred to electronic format ready for electronic analysis.
- References were recorded in *EndNotes.*
- Articles were coded using the coding forms, and
- Hard copies of full text articles were filed, along with the coding forms, alphabetically by author, in *Lever Arch* files.

Coding forms were used as a means to determine whether the articles were appropriate for this study and to collect relevant data, for sampling purposes, to be recorded in the *Endnotes* database. Paper versions of coding forms were developed and used to collect basic data from the articles. A random sample of these coding forms, was checked by an independent researcher to determine the validity of the data collection procedure. The data collected on the coding forms included the author, date, research type, theory or research framework, and variables discussed in the research such as time/place, team environment, and technology used. The coding forms were used as a means of checking for reliability of the data to ensure stability, reproducibility, uniformity and accuracy. These hard copy coding forms were used to transfer details of research type, time/place dimensions, and system type into the *EndNotes* database. An example of the coding forms used has been attached at Appendix A. As articles were found they were subjected to Step 1.2 of the process.

Once all articles were found and recorded the articles were counted, across the years. and recorded in a worksheet in *MSExcel* to check the sample size.

Step 1.2: Condensation of the documents

Condensation of documents depends on several factors, primarily related to the method of analysis and the purpose of the study. When methods such as content analysis are employed, organisation of the data as well as their analysis, become more sophisticated

(Sarantakos 1996). Berg (1995, p. 112) quoted Becker, Gordon and LeBailley (1984) when describing the condensation of documents:

> Organizing large quantities of notes is very time consuming and both physically and mentally exhausting. It is desirable, then, to amass these notes in some systematic fashion and perhaps to reduce their bulk for analytic purposes.

For this research, condensation refers to the extraction of relevant data from the published articles and the preparation of the relevant data into electronic format. Condensation of each document was time consuming, but necessary to reduce the quantity of text down to relevant data. Types of text, from the articles, that were not considered relevant, consisted of reference lists, methodology sections, and quantitative analysis sections. Parts of the articles that were considered relevant were literature reviews, definitions, concepts used, systems or applications specified and discussed, and variables used.

Some articles were found in PDF format that were not able to be changed to a word or text document. These were treated as hard copy documents. Some articles were only found in hard copy. It was necessary to transfer the hard copy documents to electronic format so that they could be analysed using the *AtlasTi* software for coding in Step 1.3. The articles were read and highlighted to identify the required text. Only the relevant sections described above were transferred to electronic format. Condensation of the documents took approximately 12 months.

Audit trail and computer usage for step 1.2.

Electronic document files were created to store the extracted data using *MSWord*. As additional articles were found they were recorded in the Endnote database and all articles (hard copy and soft copy) were filed.

Backup copies of all electronic files were stored on compact disc (CD) and a second hard drive, to prevent potential loss of data due to breakdown of computer equipment.

As the condensed electronic documents were completed they were subjected to step 1.3 of the research process.

Step 1.3: Coding of the data

As stated in Step 1.1, hand coding of the data from the condensed documents was undertaken to check that the documents were relevant for this study and to provide an overall picture of the breadth and depth of the sample of articles.

Some keywords needed for searching and for coding the data from the documents, were identified during the literature search and during the development of the research problem. Other codes were identified by reading through a sample of the documents. The identified codes were then used to automatically search for other instances within the documents. The electronic documents were coded, using the *AtlasTi* computer software. The types of data coded were: definitions, classifications, systems and terminology structures.

The terminology structures were identified by using Spradley's semantic relationships and the structures were then used to develop the hierarchy of terminology. Spradley (1979 in LeCompte 2000) used semantic relationships to assist with this process as shown in Table 3.8. These structures were then used in Stage 2 for the development of the terminology hierarchies.

Table 3.8: Spradley's semantic relationships

1. X is a kind of Y	7. X is a place for doing Y
2. X is a place in Y	8. X is used for Y
3. X is a part of Y	9. X is a way to do Y
4. X is a result of Y	10. X is a stage or step in Y
5. X is a cause of Y	11. X is a characteristic of Y
6. X is a reason for Y	12. X is a place for doing Y

Source: Spradley (1979 in LeCompte 2000)

The coded sections were scanned to create a list of terms. The list of terms, definitions and descriptions of terms and concepts were then used in Stage 3 for the development of the dictionary.

Audit trail and computer usage for step 1.3.

The electronic documents were searched to identify all the terms and definitions used in the CSCW research field. This search was achieved by developing hermeneutic units in *AtlasTi* software program that provided support for computer assisted coding.

Weber (1990) argued that while many research projects can benefit from computer-assisted coding, fully computerised coding systems are unlikely to be useful in anything other than the simplest texts because of a variety of issues (eg semantic variability and contextual information). ‘Auto coding’ was used for some of the terms and definitions where words such as ‘define’, ‘defined’ and ‘definition’ were specified in the documents. Manual coding was used where other descriptions of terms were used, by reading the documents and attaching codes.

All sentences and paragraphs showing structured text were copied into an *MSExcel* spreadsheet along with the citation source including; author, date, and page number. A sample from the spreadsheet is included in Table 3.9.

Output of Stage 1

The material collated during the data reduction process was stored in the spreadsheet files and word files and have been used as data for this analysis. A reference list of all articles used for analysis is presented, in date order, in Appendix C.

3.5.3 Stage 2 – Hierarchical taxonomy of terms

Step 2.1: Development of simple hierarchical tables

The terminology hierarchy was then developed in Stage 2 to display the data visually. Data that is displayed in diagrammatic, pictorial and visual forms should be viewed as an organised compressed assembly of information that permits conclusion drawing and/or action taking (Miles & Huberman 1994).

The procedure used to develop the hierarchy had two steps. In the first step, a table of terms was developed that showed the hierarchical relationship of terms from the spreadsheet file. This table format was acceptable for a small number of terms, but as the number of terms increased it became very cumbersome and difficult to manipulate the terminology and add more terms. This led to the need for the second step of the process. In the second step a display of the terms was developed in diagrammatic form using mind mapping software.

The two step procedure was used for every row in the data spreadsheet and an example of this procedure has been described in this section to avoid unnecessary repetition throughout Chapters 4 and 5. This example uses the terms from seven rows of the data spreadsheet (Table 3.9). The seven rows used in the example is only a small portion of the complete data spreadsheet which contains 775 rows of data. Table 3.9 has four columns showing the author and date of the quote, the upper level term, lower level terms, and the quotes from which the terms were drawn.

Table 3.9: Portion of data matrix showing quotes

	Authors and date	**Upper level term**	**Lower level terms**	Quote
1	Turoff and Hiltz 1978	communication systems	usage patterns	In this paper, we wish to present data on usage patterns collected by the *EIES* monitoring system, and our interpretations of what these data show about adaptation to this form of human communication (p660).
2	Turoff and Hiltz 1978	communication systems	EIES	The subjective reactions of users of *EIES* to this form of communication and to specific features of the system have been reported elsewhere (Hiltz, 1978a, 1978b). In this paper, we wish to present data on usage patterns collected by the *EIES* monitoring system, and our interpretations of what these data show about adaptation to this form of human communication (p660).
3	Hiltz, Johnson and Habke 1980	Communication	talking, listening and observing non-verbal behaviour	How does this form of communication change the process and outcome of group discussions, as compared to the 'normal' face to face (FtF) medium of group discussion, where participants communicate by talking, listening and observing non-verbal behavior, and where there is no lag between the sending and receipt of communication signals? (p75).
4	Hiltz, Johnson and Habke 1980	computerized conferencing variables	task type, group size,	The chief independent variable of interest is the impact of computerized conferencing on a communications mode upon the process and outcome of group decision making, as compared to face-to-face discussions. Two different types of tasks were chosen, and group size was set at five persons (p75).
5	Hiltz, Johnson and Habke 1980	computerized conferencing variables	problem type: human relations, ranking	A variable of secondary Interest is problem type. Much experimental literature indicates that the nature of the problem has a great deal to do with group performance. One type of problem that we used is the human relations case as developed by Bales. These are medium complex, unsettled problems that have no specific 'correct' answer. The second type was a 'scientific' ranking problem (requiring no specific expertise), which has a single correct solution plus measurable degrees of how nearly correct a group's answer may be (p.75).
6	Hiltz, Johnson and Habke 1980	Mode of communication	face-to-face vs. computerized conference. Problem type: human relations vs. scientific ranking problem	The experiments thus had a 2 x 2 factorial design (see figure one). The factors were mode of communication (face-to-face vs. computerized conference) and problem type (human relations vs. a more 'scientific' ranking problem with a correct answer). These factors constituted the 'independent variables.' Each problem-mode condition included a total of eight groups (p.75).
7	Hiltz, and Turoff 1981	User behaviour phases	Uncertainty, insight, incorporation, saturation	Phases of User Behavior One classical model of user behavior in interactive systems with which one can compare our data was developed by Bennett [2]. He generalizes user behavior into the 'uncertainty' phase, during which the learner has to overcome hesitancy and anxiety; the 'insight' phase, during which the user understands the general concept of the system and can make at least limited use of it for his or her own purposes; the 'incorporation' phase, when the mechanics of the interaction become second nature; and the 'saturation' phase where the system is perceived as inadequate for meeting new requirements users evolve as a result of experience (p.749).

The terms in columns 3 and 4 of Table 3.9 were used to structure Table 3.10 and Table 3.11. Table 3.10 shows the **communication system** terminology from the quotes to 1980 (from Table 3.9) and shows four levels of the communication systems (CMC) terminology.

Table 3.10: Communication systems terminology from Table 3.9

<table>
<tr><th>Level 1</th><th>Level 2</th><th>Level 3</th><th>Level 4</th></tr>
<tr><td rowspan="6">Communication systems
(CMC systems)</td><td>Computer System type</td><td>Computerized conferencing</td><td>EIES</td></tr>
<tr><td rowspan="2">Usage</td><td>Usage patterns</td><td></td></tr>
<tr><td>Communication modes</td><td>Face to face
Computer conferencing</td></tr>
<tr><td rowspan="2">Group</td><td>Communication activities</td><td>Talking
Listening
Observing non verbal behaviour</td></tr>
<tr><td>Group size</td><td></td></tr>
<tr><td>Task (Problem type)</td><td>Human relations
‘Scientific’ ranking</td><td></td></tr>
</table>

Each set of terms was analysed from the data spreadsheet to determine if it related to other terminology already in the table. For instance **communication modes** related to the **usage** of systems, so this terminology was linked to usage at level 2. **Communication activities** were considered to relate to the **group**, so this terminology was linked to group at level 2.

Table 3.11 shows **user behaviour phases** from the quote in row 7 of Table 3.9 by Hiltz and Turoff (1981) which as shown, was after 1980.

Table 3.11: Communication system terminology example showing user behaviour phases

<table>
<tr><td rowspan="4">Communication systems
(CMC systems)</td><td rowspan="4">User behaviour phases</td><td>Uncertainty</td></tr>
<tr><td>Insight</td></tr>
<tr><td>Incorporation</td></tr>
<tr><td>Saturation</td></tr>
</table>

Audit trail and computer usage for step 2.1

The printouts from the spreadsheet file of quotes describing structure were used to identify the terms to add to the hierarchy. As each section of text was used to develop the simple hierarchies they were marked in the *MSExcel* spreadsheet so that they could be tracked to avoid repeated use.

Step 2.2: Development of the hierarchical diagram

The procedure in the second step transferred the terminology and relationships from the tables into diagrammatic form. The second step was undertaken using mind mapping software (*MindManager*) to simplify diagram development and to better display the hierarchical structure format. For example, all levels of Table 3.10 were used to develop the hierarchical diagram shown in Figure 3.2.

As the number of levels in the hierarchy grew, not all terminology could be displayed at the same time on a single A4 page. The *MindManager* application provided a means to overcome this problem. The diagrams in *MindManager* were manipulated to display different branches and different levels along the branches.

Figure 3.2: Example hierarchical diagram developed from Table 3.10 displaying CMC terms to end 1980

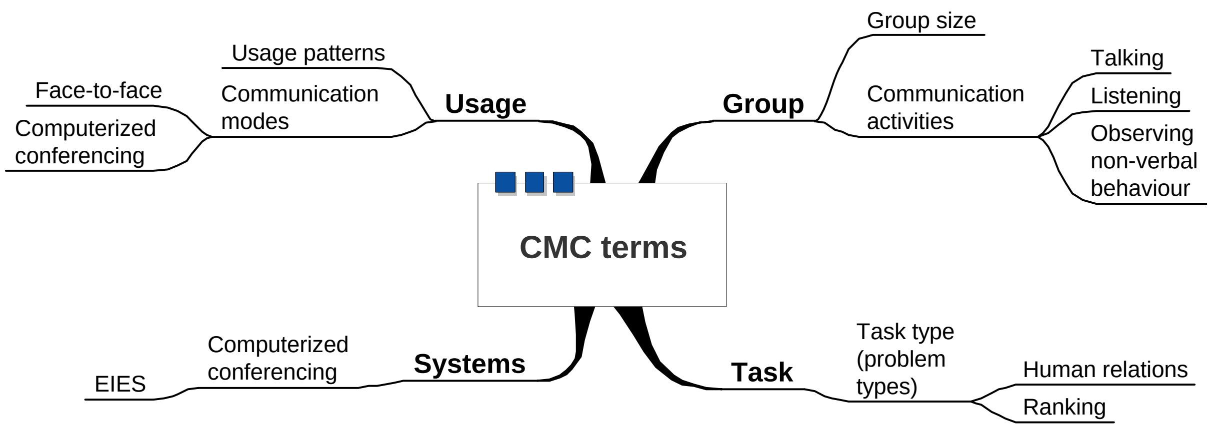
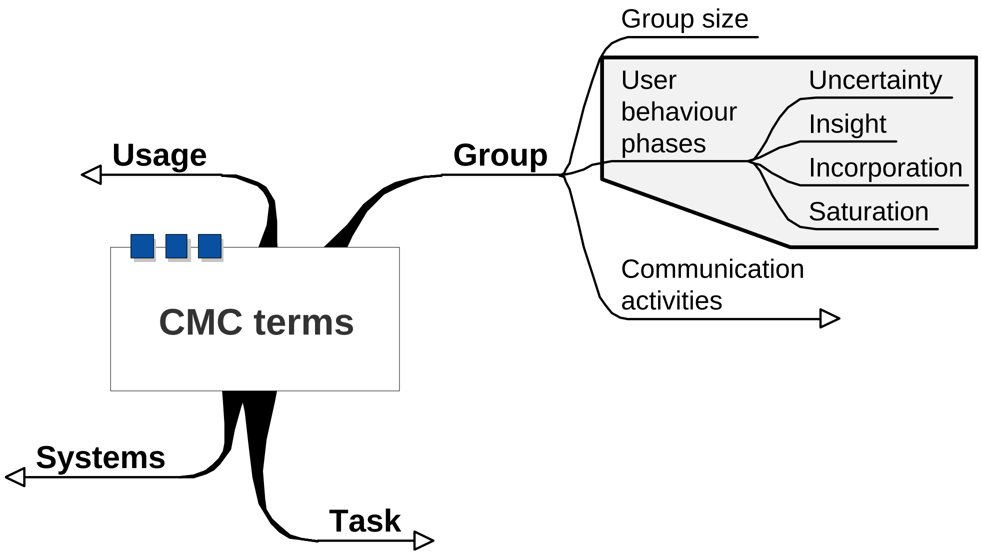


Figure 3.3 shows the additional terminology as shown in Table 3.11. When terminology in the lower levels is hidden, an arrow indicates that further terminology is linked at the lower levels. For example, an arrow on the line below a term, such as **task** and **communication activities**, (in Figure 3.3) indicates that further terminology is linked at the lower levels.

Figure 3.3: Example hierarchical diagram displaying additional terminology presented after 1980 from Table 3.9.



As terminology was added to the hierarchy it was necessary to display this as new terminology in the diagram without necessarily repeating terminology already described. The boundary and highlight around terms is used to show new terminology that has been added since the previous section. For instance the boundary and highlight around **user behaviour phases**, in Figure 3.3, shows that this terminology has been added from a quote referenced after 1980. The levels of the terminology in these tables and figures do not signify any ranking or rating.

Audit trail and computer usage for step 2.2.

The simple hierarchical tables were used to develop the terminology hierarchy in the *MindManager* software.

Output of Stage 2

The output from stage 2 was a hierarchical structure (the taxonomy of terms). The hierarchical structure for five eras from 1978 to 2003 is described in Chapters 4 and 5, and the final hierarchy showing all terminology relationships is discussed in Section 5.4 in Chapter 5 and presented in Appendix E. The hierarchical structure is used to show the scope of terminology use in this research field and the relationship of the terms to one another.

In summary, these two steps described the procedure that was followed to identify and structure all the terminology stored in the data spreadsheet. Figure 3.2 and Figure 3.3 provided an example of the format of the hierarchical diagrams used. The procedure in step 2.1 and 2.2 described in this section was followed throughout Chapters 4 and 5.to develop the final taxonomy of terms.

3.5.4 Stage 3 - Development of the dictionary

Step 3.1: Collating of terms and definitions

The text that was coded in Step 1.3 was searched for terms and definitions. All CSCW field related terms and associated definitions found in the coded text, were recorded in a spreadsheet of citations. It was found that a number of terms being used were not defined in the analysed articles. Although these terms and how they are used are included in the dictionary, the definitions have not been searched for elsewhere as this is beyond the scope of this research. Table 3.12 is an example from the dictionary spreadsheet showing six terms with definitions or descriptions and the sources of the quotes.

Table 3.12: Portion of spreadsheet showing definitions

Term	Definition 1	Source	Definition 2	Source
activity awareness	Activity awareness gives workers indications of what is happening and what has happened recently in collaborative activities.	Hayashi et al. 1999, p. 99	Activity awareness represents a lack of awareness about other's activities (what are they doing).	Jang et al. 2000, p. 28
adoption	Rogers' (1995) defines adoption as a process that may or may not lead to continued use. Recently, IT researchers have begun to report on some aspects of these important post adoption.	Pollard 2003, p. 172	Adoption can mean the decision to purchase, or the routine use of technology by end-users	Turner & Turner 2002, p. 4
affective reward	Affective reward is defined as the positive emotional response sometimes associated with goal attainment (33).	Siao 2003, p.19		
affordance	The affordances of physical workspaces allow people to maintain awareness of others' locations, activities, and intentions relative to the task and to the space-awareness that enables them to work together more effectively.	Gutwin & Greenberg 1996, p. 208	Affordances offered by media space systems for perception and interaction. Affordances are properties of the environment that offer actions to appropriate organisms (Gibson 1979).	In Gaver 1992, p. 17
anonymity	Anonymity (ie. Communicators do not know owners of expressed ideas in group interaction process)	Bostrom & Anson 1992 in Huang 2003, p. 19	Anonymity, on the other hand, enables group members to contribute comments without being identified, which may increase the motivation to participate.	In Dennis & Wixom 2001, p.3
assimilation	Assimilation has been defined as a process of successive alignment between group, task, and technology leading to mutual adaptation and ownership.	Applegate 1991, p.24		

Audit trail and computer usage for step 3.1

During the coding step (Step 1.3), the terms and concepts and definitions were listed in a spreadsheet. As definitions were found they were recorded in the spreadsheet, together with the source information; author, date and page number. Some particular instances of descriptive citations of terms and concepts, were also recorded in this spreadsheet.

Step 3.2: Formatting of dictionary

The first task of editing the dictionary was to review the spreadsheet of citations to identify the use of words likely to be included. A selection was made of the citations which most fully represented a word's life and most definitively and vividly illustrated its use and meaning. The terminology and citations in the dictionary were displayed from an historical perspective of how this terminology has been used in the CSCW discipline since 1978. The citations were chosen as being the most representational of the definitions and descriptions of the terms and concepts found during the content analysis. The spelling of words in the dictionary is English (Australian).

Each entry was designed to present the information in the most illuminating form. Entries range from simple one word entries, to complex multiple word entries. Where terms had more than one definition the terms were placed in the dictionary more than once. These terms were placed with a number after the term to show the number of different definitions for a particular word. An example of the dictionary format is shown in Figure 3.4.

The elements of an entry (not all of which may be required) appear in the following order.

Headword: The headword, the word which is the subject of the entry, appears at its head in bold roman. Subordinate items – combinations, collations, and phrases of which the headword is the main element, as well as derivatives, appear in their place in the entry in bold roman. Words which normally have an initial capital, as proprietary names retain the capital, all other initial letters being in lower case.

Figure 3.4: Example of dictionary format

activity awareness: Activity awareness gives workers indications of what is happening and what has happened recently in collaborative activities. **1999** Hayashi et al. (99) *Activity awareness gives workers indications of what is happening and what has happened recently in collaborative activities*. **2000** Jang et al. (28) *Activity awareness represents a lack of awareness about other's activities (what are they doing).*
adoption (1): Adoption means the decision to purchase. Adoption is a process that may or may not lead to continued use. **2002** Turner and Turner (4) *Adoption can mean the decision to purchase, or the routine use of technology by end-users.* **2003** Pollard (172) *Rogers' (1995) defines adoption as a process that may or may not lead to continued use. Recently, IT researchers have begun to report on some aspects of these important post adoption.*
adoption (2): Adoption is the routine use of technology by end users. **2002** Turner and Turner (4) *Adoption can mean the decision to purchase, or the routine use of technology by end-users.*
affective reward: Affective reward is the positive emotional response sometimes associated with goal attainment. **2003** Siao (19) *Affective reward is defined as the positive emotional response sometimes associated with goal attainment (Reinig & Briggs 1995).*

Definition: The definition may include cross-references to words which have main entries or are subordinate items. Definitions worded by the author from other sources are in normal font.

Cross reference: There are two main forms of cross reference: if a word is defined by another word in the dictionary or listed within the qualification 'see …' the synonymy is exact. If the cross-reference is introduced by 'see also …' the synonymy is not exact but the information provided under the referred to word, is complimentary or in some other way useful.

Citations: Sets of citations provide substantiation for the definition and illustrate the history of the word's use. Some words are more copiously exemplified than others, which may be a reflection of their amount of use. A citation is preceded by a date (of publication) and the name of the author of an article is given (Full references of sources are provided in the reference list). Page numbers are presented in brackets following the authors' names.

Every effort was made to record the earliest use of a word in this research field, and to provide a reasonably spaced sequence of citations to the year 2003. Citations for each entry are in date order from the oldest to the more recent. Citations are given directly from the source except that, in the interests of economy, ellipses have been used to show the removal of extraneous material. Care has been taken not to distort the authors' intent.

Acronyms used in CSCW research have been included in the dictionary and also listed at the front of the dictionary.

Audit trail and computer usage for step 3.2.

The development of the dictionary was undertaken at the same time as the development of the terminology hierarchy. The terms used in the hierarchy were cross checked against the terms and definitions in the dictionary to make sure that all terms used in the hierarchy were included in the dictionary.

Step 3.3: Presentation of dictionary

The aim of the dictionary is to provide an historical record of the use of terms used in the CSCW field. The purpose of the dictionary is to show the scope of the field and provide a consistent set of terms and definitions for use in the CSCW field of research. The dictionary is intended to cover the specialist vocabulary and document the history of words, with some terms established as being in common use. The essence of an entry in an historical dictionary is its citations, which help to establish the chronology of a word's use, to substantiate the definition or definitions, and illustrate the range of circumstances within which a word has been used.

Output of stage 3

The dictionary is presented in Appendix D. The dictionary consists of approximately 1200 main entries.

In summary, three stages form the Hierarchical Terminology Technique:

- Stage 1 Identified and prepared the terminology in spreadsheets ready for structuring the terminology in Stage 2 and developing the dictionary in Stage 3.
- Stage 2 the terminology was structured in a hierarchy format using Spradley's semantic relationships as a means to determine the relationships of the terms identified from quotes from within the documents.

- Stage 3 the dictionary was developed from the terms and definitions collected in Stage 1. The terms used in the dictionary were cross checked against the terms used in the hierarchy to determine accuracy and completeness.

3.6 Summary of Chapter 3

Chapter 3 identified and explained the research philosophy, the methodology and design structure used in this research. The research method developed to address the research problem is a form of content analysis. This new method has been described in this chapter and is referred to as the hierarchical terminology technique (HTT). This is a technique that extends the idea of concept mapping to a hierarchy of terminology.

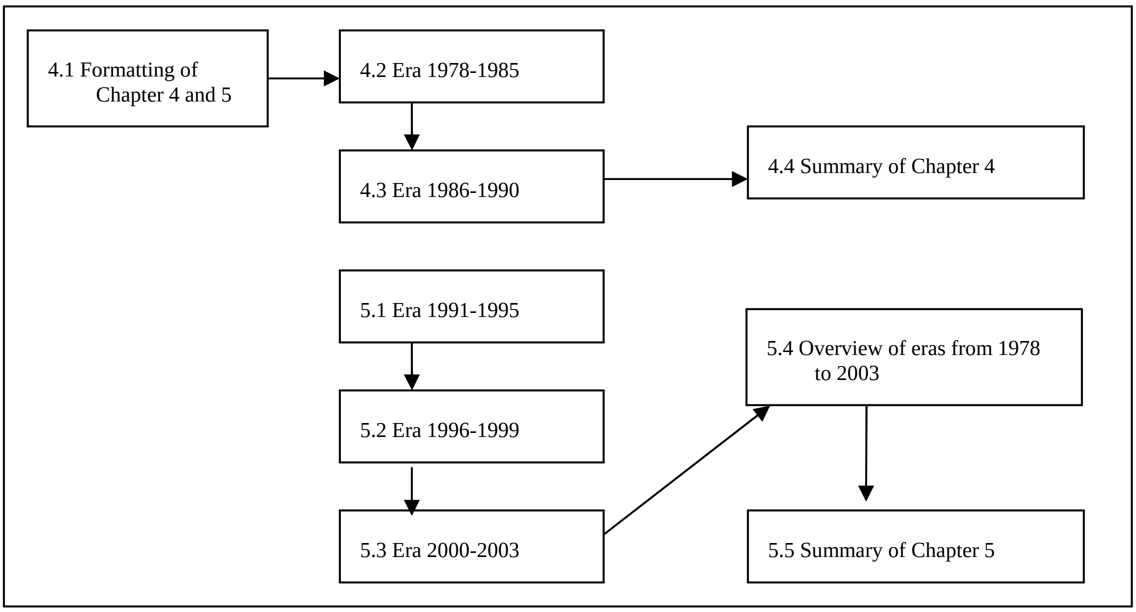
Chapter 4 Taxonomy of CSCW terms – 1978 to 1990

> Analysis is a pervasive activity throughout the life of a research project. Analysis is not simply one of the later stages of the research, to be followed by an equally separate phase of 'writing up results' (Coffrey & Atkinson 1996, p.11).

Chapter 3 identified the choice of research paradigm as both interpretive and descriptive, and described the use of a qualitative form of content analysis for data collection and for development of the taxonomy of CSCW terms. The chapter described a new content analysis process used in this research, which is referred to as the Hierarchical Terminology Technique (HTT).

Chapter 4 is the first of two analysis chapters, which describe how the CSCW taxonomy of terms was developed using HTT. The analysis chapters are divided into sections covering five time periods (eras) from 1978 to 2003 to give an historical viewpoint of when terminology was introduced to the CSCW research field. The first two eras from 1978 to 1985 and 1986 to 1990 are described in this chapter and Chapter 5 provides an overview of the final three eras from 1991 to 2003. The detailed description of the development of the hierarchical structure for the five eras is available from the author. Figure 4.1 shows the structure for Chapters 4 and 5.

Figure 4.1: Chapter 4 and 5 structure



Section 4.1 describes the formatting of Chapters 4 and 5. The eras from 1978 to 1985 are explained in sections 4.2 and 4.3. A summary of Chapter 4 is then presented in Section 4.4.

The procedure used to develop the hierarchical structures, and an example of this process has been described in Section 3.5.4 and 3.5.5. The next section provides a description of the formatting used in Chapters 4 and 5 to improve readability and tracking of the new terminology from the CSCW research field.

4.1 Formatting of Chapters 4 and 5

Formatting has been used in Chapters 4 and 5, from section 4.2 onwards, to improve readability, clarity and ease of identification. The terminology has been formatted using **bold** text to clearly show where new terminology is described. This 'bolding' also indicates that these terms have been included in the dictionary (Appendix E). Italics have been used to show system and software application names throughout the thesis. Australian English spelling has been used throughout this thesis and in the dictionary to improve consistency.

Particular systems or applications, which may be prototypes or commercial products, are sometimes described in articles used for analysis in this study, for example *Electronic Information Exchange System (EIES)*. Only those systems described in the analysed research articles and being used for research purposes have been identified and included in the taxonomy and dictionary.

Terms that are repeated in later references are not described in the analysis unless they have been identified as having a different meaning to the earlier use of the term. Thus, some articles are not referenced at all in the next two chapters although they are included in the original documents for analysis, as this research analysed the use of the terminology, rather than the results or output of other research.

Some authors have referenced other articles, which were not able to be sourced for this research. Where authors have referenced articles in the CSCW field these are included in the earlier sections, for instance, Jelassi and Beauclair (1987) referenced a study by Sprague and Carlson (1982) relating to GDSS. These terms have been included in the pre-1986 section. However, where analysed articles have used terms from referenced studies outside this research field, those terms are included in the sections that are most appropriate for the era of the CSCW article, for example, Schmidt, Montoya-Weiss and Massey (2001) referenced Nemeth and Staw (1989) when discussing *social influences*. The terms relating to social influences have been discussed and included in the era 2000-2003.

The next two sections describe the terminology and display the hierarchies of CSCW terms from 1978 through to 1990 from an historical perspective. The terminology described and displayed includes technology, groups, group processes, tasks, task outcomes, and environment. Where possible the descriptions in each section identify who introduced the terminology and why it was introduced. The definitions and descriptions of all terms included in the taxonomy were used to develop the dictionary. The development of the CSCW dictionary is described in Chapter 3, and the dictionary is presented in full in Appendix E.

4.2 Era 1978 to 1985

As explained in Chapter 3 and shown in Table 3.7, only eight articles were found for the years 1978 to 1985. However, to show where the research field began, these eight articles were analysed to identify terms in use at that time from research into groups using technology for groupwork. Many of these early authors brought with them experience and terminology from other disciplines.

As the articles from 1978 to 1985 were analysed it was found that two separate areas of study were being researched at that time, research into use of communication systems for group work (CMC), and research into decision support systems that supported groups (GDSS). Subsection 4.2.1 describes the terminology from the CMC research and Subsection 4.2.2 describes the terminology from the GDSS research. Subsection 4.2.3 provides a summary of section 4.2.

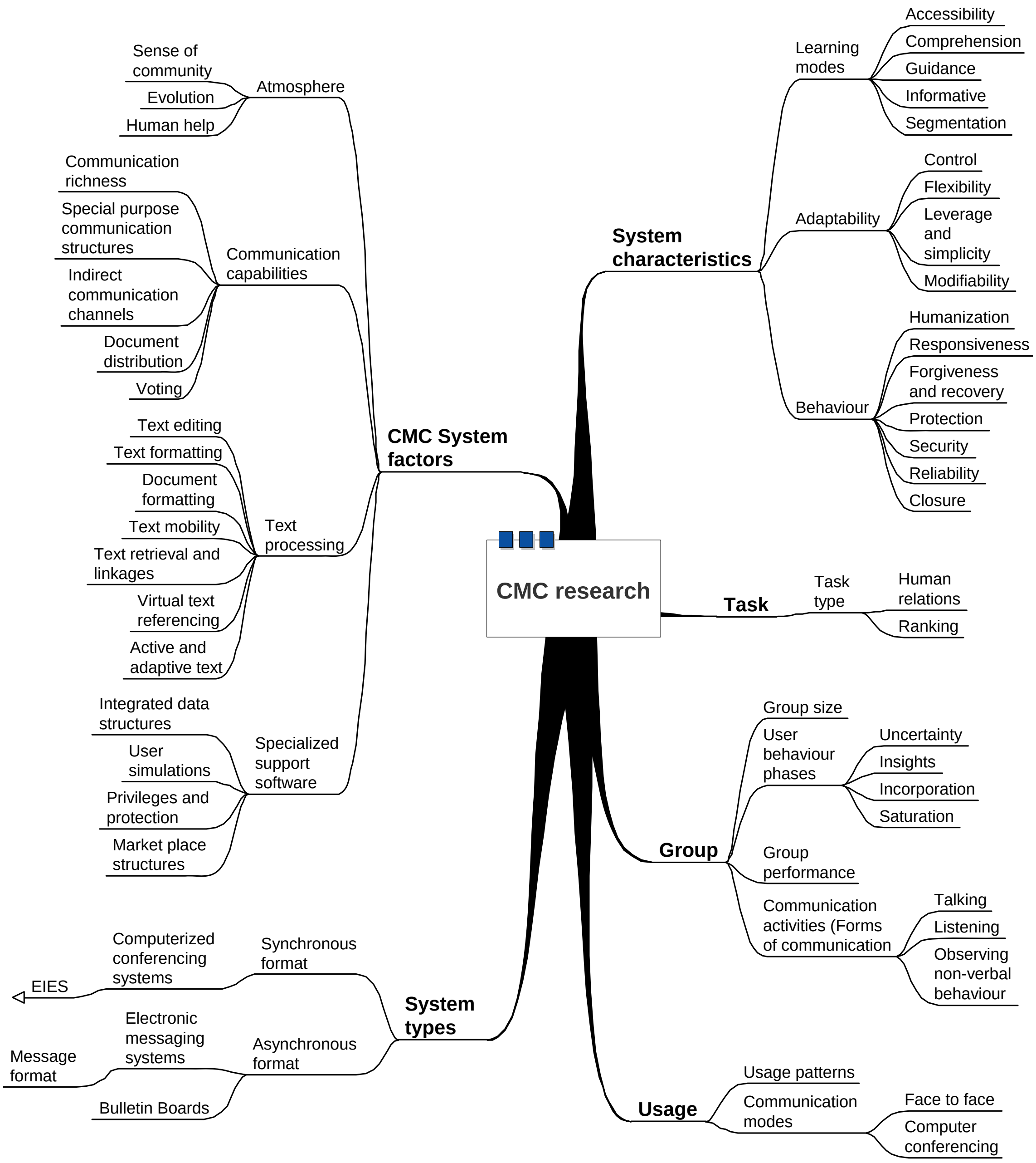
4.2.1 CMC terms to 1985

The hierarchy in this section was developed using the terminology from research into computer mediated communication for asynchronous distributed groups and retrieved from articles by Turoff and Hiltz (1978), Hiltz, Johnson and Rabke (1980), Peter and Trudy Johnson-Lenz (1980 in Bannon 1992), Hiltz and Turoff (1981), and Turoff, Hiltz and Kerr (1981) from the New Jersey Institute of Technology (NJIT). This hierarchy also includes the terminology used by Murrel (1983) from Bell Laboratories. Figure 4.2 shows the hierarchical structure of CMC terminology from 1978 to 1985.

The articles from authors who researched at NJIT described a **computer conferencing system** called *Electronic Information Exchange System (EIES*). This **computer mediated communication (CMC) system** was designed as a research tool for research scientists to communicate on joint research projects (Hiltz, Johnson & Rabke 1980). Turoff, Hiltz and Kerr (1981) used the term **interactive** to describe these types of systems. Turoff, Hiltz and Kerr stated that there were hundreds of CMC systems, but most were simple electronic message systems or micro-based community bulletin boards.

As shown in Figure 4.2, Turoff, Hiltz and Kerr (1981) described nineteen **system factors** (level 2) in four groupings related to atmosphere, communication capabilities, text processing, and specialized support software (level 3). They also defined a list of sixteen **system characteristics** (level 2) in three groupings related to learning modes, adaptability, and behaviour (level 3). The system factors and system characteristics were *EIES* design issues.

Figure 4.2: Hierarchy of CMC terminology from 1978-1985



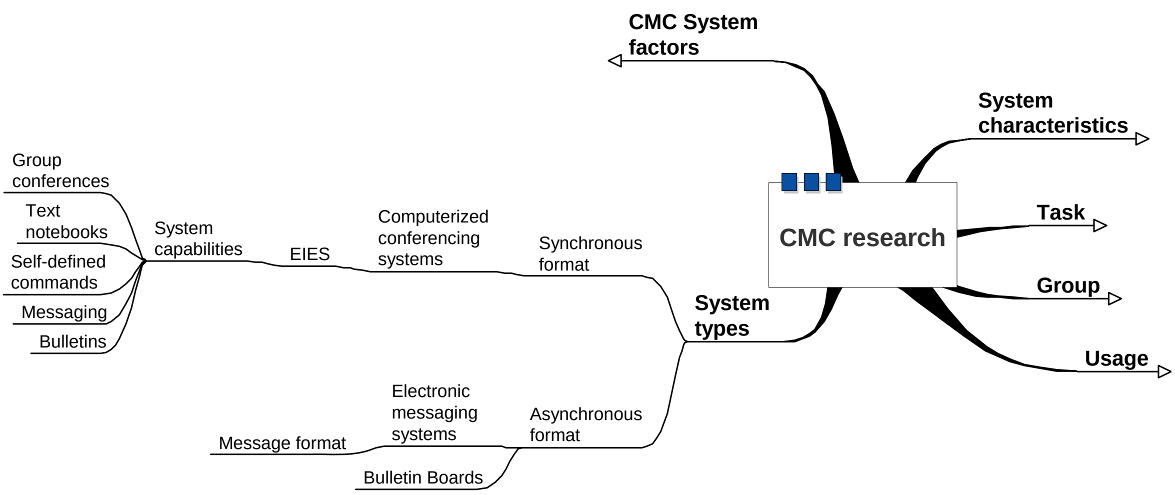
Some **system types** were described by Murrel (1983) who compared two communication systems (an **asynchronous communication message system** and a **synchronous conferencing system** with individual windows). Murrel studied the impact of system design, specifically, **message format** on group performance. Although this experimental group task was on decision making the author discussed the use of communication systems by the group, rather than group decision support systems.

The articles from NJIT also included terminology relating to the **task** or activity of the group, and the **group**. Hiltz, Johnson and Rabke (1980) researched **computer conferencing** variables, **group size** and two types of **task**, human relations, and ranking. They described the phases that users go through when using computer systems, referred to as **user behaviour** which they described as uncertainty, insights, incorporation, and saturation and the **forms of communication**, talking, listening and observing non-verbal behaviour which relate to group issues (Hiltz, Johnson & Rabke 1980).

Usage patterns collected by the *EIES* monitoring system were described by Turoff and Hiltz (1978). Hiltz, Johnson and Rabke (1980) discussed two **communication modes** of face to face and the computerised conference. Usage patterns and communication modes are both related to **usage** issues.

Figure 4.3 shows the additional terminology related specifically to EIES. The synchronous **system capabilities** for *EIES* were reported by Hiltz and Turoff (1981) as group conferencing, notebooks, self-defined commands, messaging, and bulletins.

Figure 4.3: *EIES* system capabilities terms to 1985 (expanded from Figure 4.2)



In summary Figure 4.2 and Figure 4.3 show the terminology used in research articles relating to communication systems (CMC) research from 1978 to 1985. The definitions of the terms identified in these figures are included in the CSCW dictionary at Appendix E.

4.2.2 GDSS terms to 1985

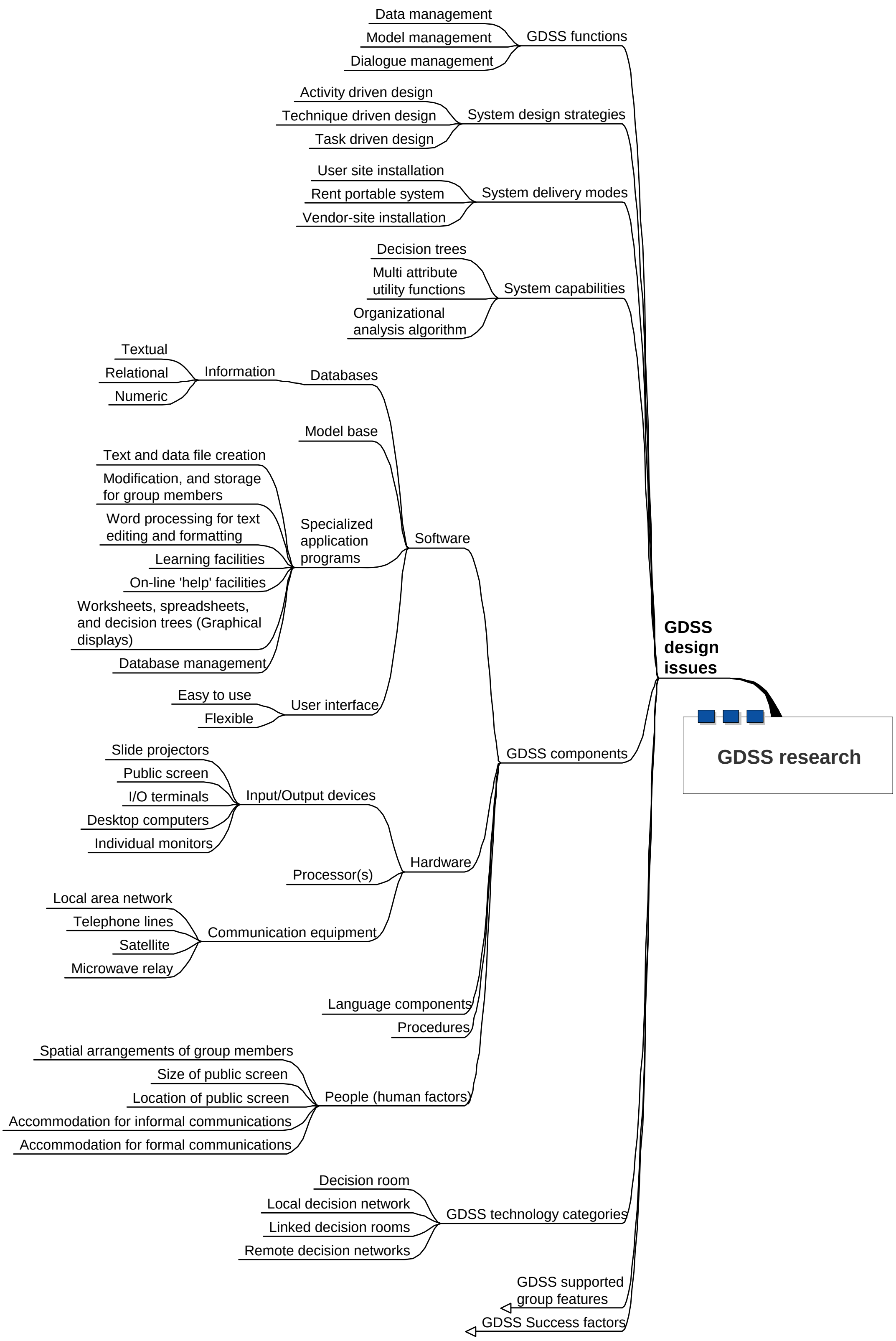
The next group of articles analysed were from 1978 to 1985 relating to the area of decision support systems that supported group meetings. These systems were referred to as Group Decision Support Systems (GDSS) or group DSS. Figures 4.4 to 4.6 show the hierarchical structure of terminology used in research into group decision support systems, and developed from the data collected from four articles, Sprague and Carlson (1982 in Jelassi & Beauclair 1987), Huber (1982 in Kraemer & King 1986), Huber 1984, and DeSanctis and Gallupe 1985a and 1985b. Since both of the DeSanctis and Gallupe articles provided the same information, only material from article 1985a was referenced throughout this section. These four articles described a number of GDSS design and development issues.

The following paragraphs discuss the terminology in Figure 4.4 starting from the top of the diagram. Sprague and Carlson (1982 in Jelassi & Beauclair 1987) from Indiana University and the University of Illinois respectively, described **GDSS** and specified the basic **functions** as data management, model management and dialogue management.

GDSS systems that could support organisational meetings were the focus of Huber's (1984) research. Huber described three **system design strategies**, activity driven design, technique driven design and task driven design; and three **system delivery modes,** user site installation, rent portable system, and vendor site installation. Huber also identified three design issues that related to **system capabilities,** decision trees, multi attribute utility functions and organisational analysis algorithms.

Four **GDSS components** were suggested by Huber (1984). These were **software**, **hardware**, **language components** and **procedures**. These four GDSS components were extended by DeSanctis and Gallupe (1985a) to included **human components** who described the components of a typical GDSS as **software** (database, model base, specialised application programs, user interface), **hardware** (input/output device, computer processor, and communication equipment), and **human components** (spatial arrangements of members, size of public screen, accommodation for informal communication, and accommodation for formal communication).

Figure 4.4: Hierarchy of terminology showing GDSS design issues from 1978-1985



Other details relating to GDSS components were also discussed in the articles by Huber (1984) and DeSanctis and Gallupe (1985a). Huber (1984) identified **information** as textual, relational or numeric. DeSanctis and Gallupe (1985a) suggested some **application software** that could be basic features of GDSS, which included text and data file creation, modification, and storage, word processing, learning facilities, on-line 'help' facilities, graphical display software such as worksheets, spreadsheets, and decision trees, and database management. Database management could include handling participant queries, createing subschemas, and access control.

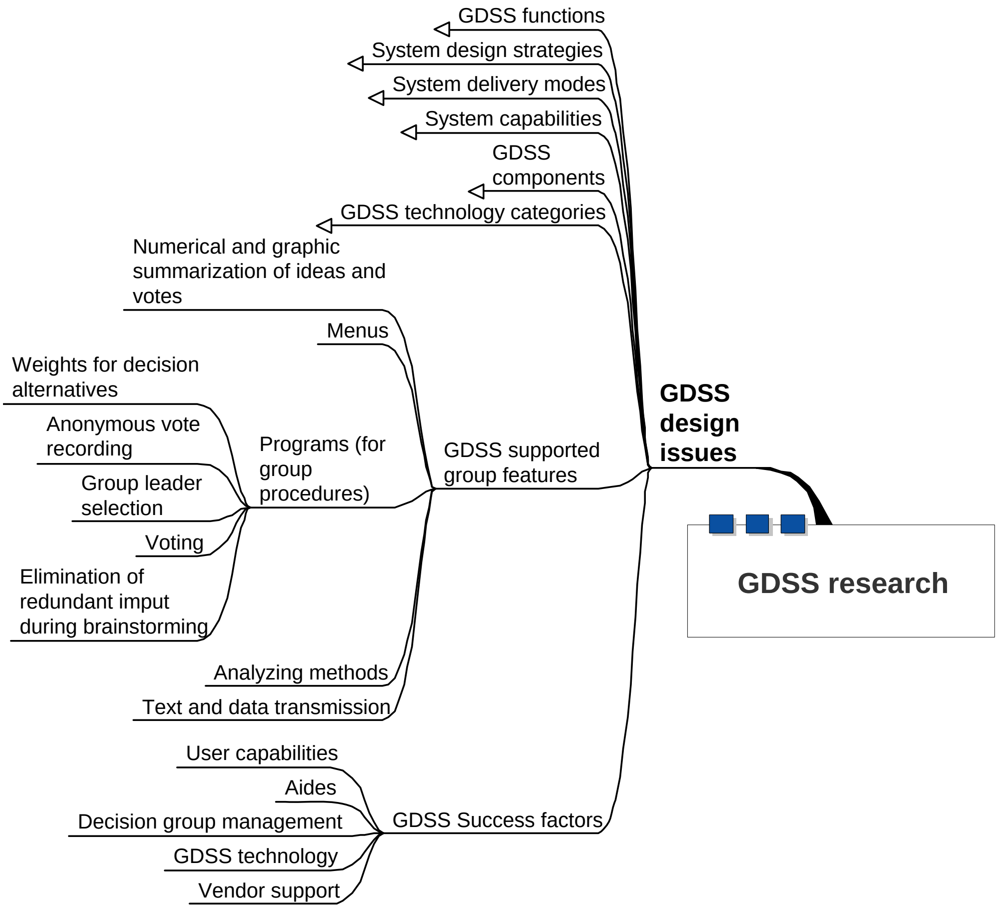
DeSanctis and Gallupe (1985a) considered that the **user interface** needed to be easy to use and flexible. Some types of **input/output devices** were identified, which were, slide projector, public screen, Input/Output terminals, desktop computers, and individual monitors. Some types of **communication equipment** included local area network, telephone lines, satellite, and microwave relay (DeSanctis & Gallupe 1985a).

Four separate **GDSS technology categories** (level 2) identified by DeSanctis and Gallupe (1985a) were decision room, local decision network, linked decision rooms and remote decision networks (level 3).

Figure 4.5 shows the hierarchy of terminology showing GDSS supported group features and GDSS success factors which are also GDSS design issues to 1985.

It was argued that the GDSS design needed to support **group features** (DeSanctis & Gallupe 1985a). These group features should be numerical and graphical summarisation of ideas and votes, menus, programs for group procedures, analysing methods, and text and data transmission. The **programs for group procedures** included weights for decision alternatives, anonymous vote recording, group leader selection, voting, and elimination of redundant input during **brainstorming**. Brainstorming and other idea generation techniques were popularised during the early 1950s. The structured brainstorming technique was developed by Alex Osborne (1953) as a methodology for stimulating creative thought within a group setting (Applegate, Konsynski & Nunamaker 1986).

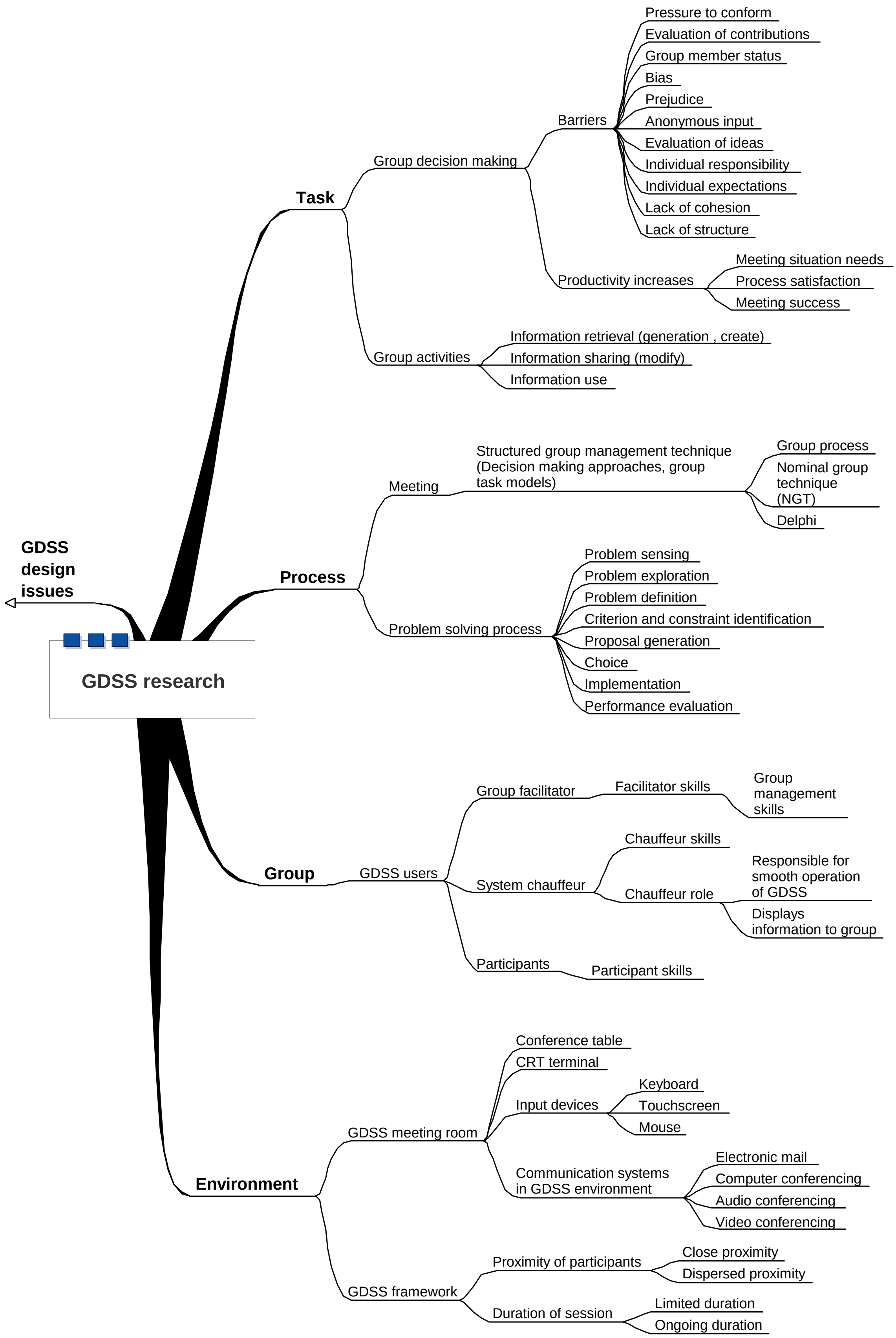
Figure 4.5: Hierarchy of terminology showing GDSS supported group features and GDSS success factors from 1978 to 1985



Five factors required for **GDSS success**, user capabilities, aides, decision group management, GDSS technology and vendor support were described by Huber (1984).

Next, Figure 4.6 displays the terminology relating to task, process, group, and environment as they relate to GDSS to 1985. A number of **barriers** to **group decision making** were described by DeSanctis and Gallupe (1985a). The barriers included pressure to conform, evaluation of contributions, group member status, bias, prejudice, anonymous input, evaluation of ideas, individual responsibility and expectations, lack of cohesion, and lack of structure. Huber (1982a in Kraemer & King 1986) suggested how GDSS might help **increase productivity** of decision meetings through meeting situation needs, process satisfaction, and meeting success.

Figure 4.6: Hierarchy of GDSS terminology showing task, process, group, and environment issues from 1978 to 1985



Three different **group activities**, information retrieval, information sharing and information use, were referred to by Huber (1984) who argued that appropriate software would enable each participant to create, modify and use the information.

Meetings are made more effective with the use of **structured group management techniques** such as *Nominal Group Technique* and *Delphi* (Huber 1984). These were also discussed by DeSanctis and Gallupe (1985a) who refer to them as **decision making approaches**, and added **group process** as a further approach.

The **problem solving process** was described in eight steps by Huber (1984). These steps included problem sensing, problem exploration, problem definition, criterion and constraint identification, proposal generation, proposal evaluation, choice, implementation, and performance evaluation.

Three types of **GDSS users** were group facilitator, group chauffeur, and participants (Huber 1984). Huber also considered **skills of the users** (facilitator skills, chauffeur skills and participant skills) and suggested that group management skills are critical to the effective use of GDSS. Huber argued that the skills decline when they are not used. DeSanctis and Gallupe (1985a, p.5) stated that the chauffeur was responsible for 'operating the GDSS hardware and software and displaying requested information to the group as needed'.

A typical **GDSS meeting room** environment consisting of a conference table, CRT terminal and **input devices** such as keyboard, touchscreen and mouse was described by Huber (1984). Other input and output devices were identified by DeSanctis and Gallupe (1985a) when describing the hardware requirements of a GDSS (as shown in Figure 4.4). DeSanctis and Gallupe also described some **communication systems** that might be integrated into the GDSS environment such as electronic mail, computer conferencing, audio conferencing, and video conferencing. They also provided a **categorisation of GDSS** (sometimes referred to as the GDSS framework) in terms of **proximity** (close and dispersed) and **duration** (limited and ongoing).

Although the term **groupware** was coined by Peter and Trudy Johnson Lenz in 1978 (Johnson-Lenz & Johnson-Lenz 1998), the earliest article found for this research that used the term groupware was Bannon (1986 in Bannon 1992). So the term groupware has not been included in the hierarchy in this section. Other terms describing system types were introduced by authors during later sections of this chapter.

4.2.3 Summary of analysis from era 1978-1985

Prior to 1986 researchers were focused on the design and development of Computer-Mediated Communication systems (CMC) (which were communication systems) and Group Decision Support Systems (GDSS) (which were group systems to support decision making), rather than on the interaction of groups using these systems. However, unsupported group work was being researched at that time and was later referenced by authors in the CSCW field (refer Pare & Dube 2000). None of the articles analysed in this first section discussed the development of theory or testing of theory.

The authors of the articles analysed in this section were Turoff, Hiltz, Kerr, Johnson, Habke and Peter and Trudy Johnson-Lenz at the New Jersey Institute of Technology; Huber, at the University of Texas; and DeSanctis and Gallupe at the University of Minnesota. Other authors were Sprague and Carlson from Carnegie Mellon University and Murrel from Bell Laboratories.

The eight articles analysed in this section comprised both qualitative and quantitative studies and focused primarily on particular systems and how design of these systems could be improved. The terminology used in the CMC research has been shown in Figures 4.2 and 4.3. The terminology used in the GDSS research is shown in Figure 4.4, 4.5 and 4.6. The definitions for the terms used in these Figures are presented in Appendix E.

4.3 Era 1986 to 1990

This section commences with the analysis of 11 articles from the first ever CSCW conference held in 1986 in the USA and then continues with the analysis of 51 articles from other conferences and different journals through to 1990, including the first European CSCW conference (1989) in Gatwick, London.

4.3.1 First CSCW conference 1986

In 1986, the first CSCW conference was held in Austin, Texas. This was the first conference to focus on groupwork using computer technology. This conference drew together researchers who had an interest in groupwork using computers, both from a communication and decision making perspective and from a *system design* and a *system use* perspective. Articles and researchers from both the CMC area and the GDSS area were drawn to this conference.

Only the articles that described the use of these systems and how that usage affected the design of these systems have been retrieved for analysis in this research. Articles concerning how systems were developed and/or implemented were excluded.

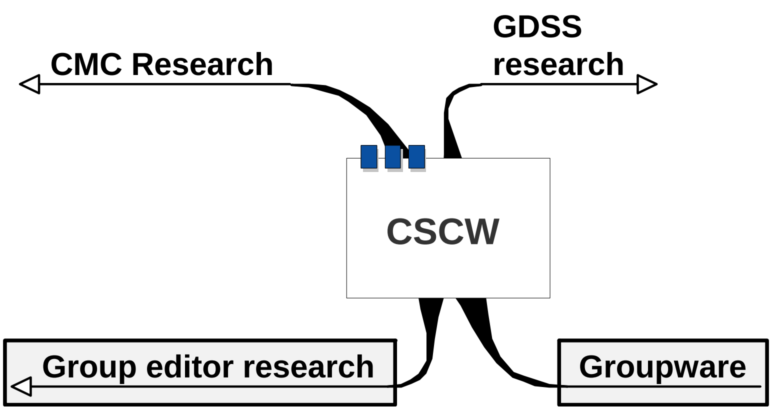
Authors at the first CSCW conference in 1986 were mainly from higher education research institutions and system development companies. The higher education authors included in this analysis were Applegate, Konsynski and Nunamaker from the Harvard University and the University of Arizona; Kraemer and King from the University of California; Lakin from Stanford University; and Foster and Stefik from the University of California and Xerox Palo Alto Research Centre in California respectively.

The authors from IT/IS development companies, included in this analysis, were Begeman, Cook, Ellis, Graf, Rein and Smith from the Microelectronic and Computer Technology Corporation (MCC) USA; Fanning and Raphael from Hewlett Packard Company (HP), USA; Greif and Sarin from the MIT Laboratory and Computer Corporation of America; Jarrell and Barrett from IBM, USA; Johnson, Weaver, Olson, and Durham from Aetna Life and Casualty Corporation and the University of Calgary; and Stasz and Bikson from The Rand Corporation.

This conference drew together research into CMC focusing on computer teleconferencing, and messaging systems, also GDSS focusing on problem solving and decision making in group meetings. Research using group editing systems were also considered part of the CSCW field by presenters at the conference.

As the CMC research and the GDSS research were considered a part of CSCW research, the CMC terminology shown in Figures 4.2 and Figure 4.3 and the GDSS terminology shown in Figure 4.4 to Figure 4.6, have been linked to the new hierarchical diagram in Figure 4.7. Level 1 terms in the previous diagrams are now at level two in the new diagram (Figure 4.7). Additional terminology that is introduced in this section is shown with an outline and highlighted in the figures, for ease of identification.

Figure 4.7: CSCW research to 1986



The term groupware was not used by authors at the CSCW conference. However, Bannon used the term groupware to describe more than CMC systems. It was used to consider systems from all four sectors of the time/space matrix (Bannon 1986 in Bannon 1992). Therefore, the term groupware has not been incorporated within the other terminology but attached as a link at the second level. The term groupware and other system type terminology are discussed in more detail at the end of this section.

The new terminology added in each section are discussed in display order from the top left of each figure. Figure 4.8 shows additional terminology relating to CMC research and Group Editor research to 1986, which is an extension of terminology from Figure 4.2 and 4.3. Figure 4.8 displays the terminology used by Lakin (1986) from Stanford University, whose article was one of the first to consider opportunities for research in the area of computer supported cooperative work for the manipulation of **text-graphics** on a computer screen. Lakin called this type of text-graphic performance **working group graphics**. He described the architecture and behaviour of a **graphics editor** that would provide features that were identified by the researchers by observing non-computer text-graphics groups.

Figure 4.8: Additional terminology relating to CMC research and group editor research to 1986 (expanded from Figures 4.2 and 4.3)

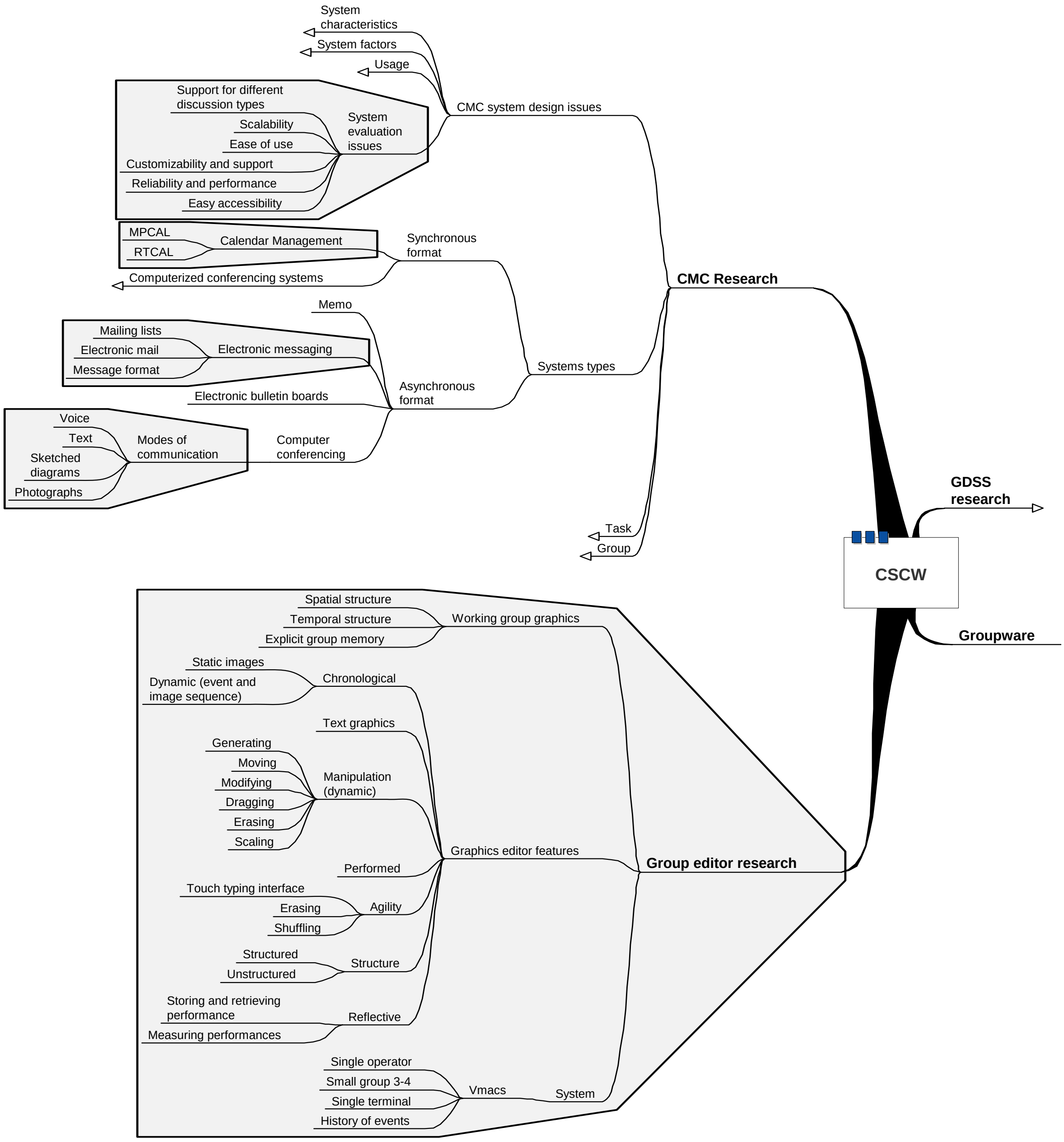
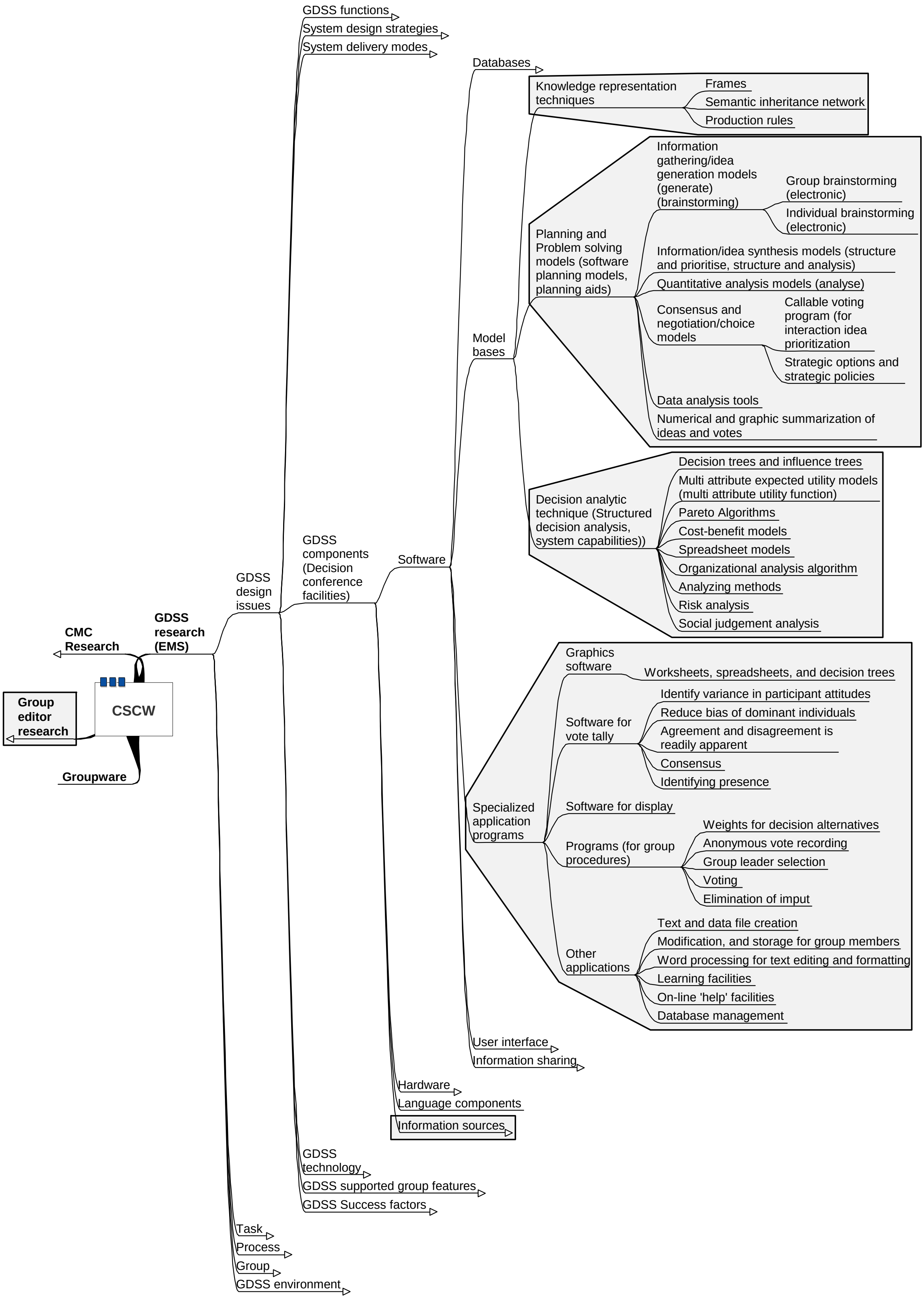


Figure 4.9 shows the additional terminology (expanded from Figure 4.4) relating to GDSS design issues to 1986, including knowledge representation techniques, planning and problem solving models, decision analytic techniques, specialised application programs, information sharing, and input/output devices as described below.

Figure 4.9: Additional terminology relating to GDSS design issues to 1986 (expanded from Figure 4.4)



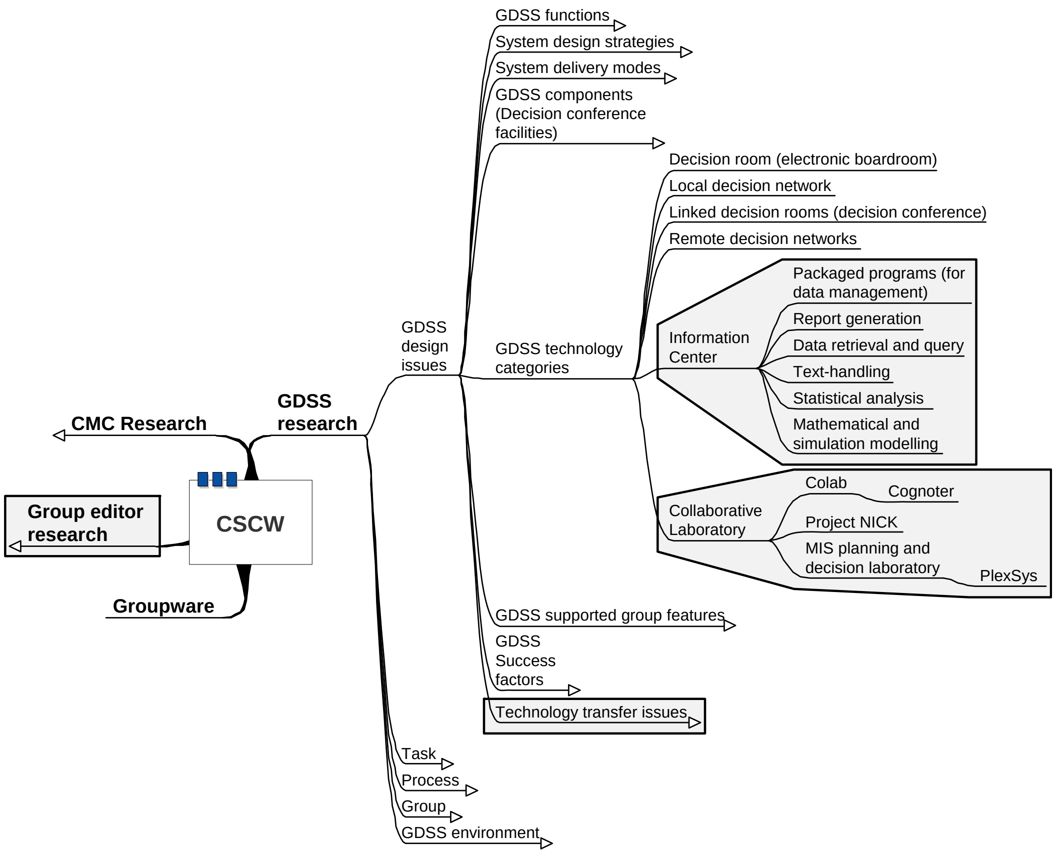
A range of models have been described by authors that may be incorporated into systems to support decision making. The research focus by Applegate, Konsynski and Nunamaker (1986) was on planning as a group decision making activity. Applegate, Konsynski and Nunamaker (1986) discussed four general classes of **planning and problem solving models** to support decision making that could be incorporated into GDSS. The software **planning models** suggested by Applegate, Konsynski and Nunamaker (1986) were information gathering/idea generation models, information/idea synthesis models, quantitative analysis models, and consensus and negotiation/choice models. Kraemer and King (1986) described group techniques and identified planning tools such as brainstorming, stakeholder identification and analysis, or organisation analysis. They also identified modelling tools such as decision trees, risk analysis, social judgement analysis or multi-attribute utility analysis.

Categories of decision modelling software, decision structuring techniques and decision analysis techniques were described by Kraemer and King (1986). They used the term **decision analytic techniques** for the same models that Huber (1984) had described as system capabilities. These terms have been shown in Figure 4.9 as linking to the model bases concept.

Kraemer and King (1986) also stated that **specialised application programs** such as graphics, vote tally and display are a part of the decision conference software facility. They explained that **voting systems** allow for rapid identification of variance in participant attitudes. Anonymous voting helps reduce bias of dominant individuals in the group. Agreement and disagreement on issues is readily apparent, consensus is enhanced and presence is identified. Other application program features described by DeSanctis and Gallupe (1985a) were included in Figure 4.4.

Figure 4.10 displays additional terminology (expanded from 4) for GDSS technology categories to 1986.

Figure 4.10: Additional terminology relating to GDSS technology categories and technology transfer issues to 1986 (expanded from Figures 4.4 and 4.5)



Information centre was described by Applegate, Konsynski and Nunamaker (1986), as a fifth category of GDSS adding to the four described by DeSanctis and Gallupe (1985a). Kraemer and King (1986), who distinguished types of GDSS by the nature of their underlying technology, also included information centres and added a sixth type of GDSS. Kraemer and King's six GDSS types included electronic boardroom, teleconferencing facility, local area group net, information centre, decision conference and collaboration laboratory. (Figure 4.11). Software typically provided in an information centre included packaged programs for data management, report generation, data retrieval and query, text-handling, statistical analysis, and mathematical and simulation modeling (Kraemer & King 1986).

The only **collaborative laboratories** identified by Kraemer and King (1986) were Colab at the Xerox Palo Alto Research Centre (Stefik, 1985) and the collaboration laboratory used during **Project NICK** at Microelectronic and Computer Technology Corporation (MCC), USA (Begeman et al. 1986). Foster and Stefik (1986), from the University of California and Xerox Palo Alto Research Centre in California respectively, described a meeting tool to be used in **Colab**. The collaborative tool, ***Cognoter*** was designed for organising ideas to plan a presentation. However, Applegate, Konsynski and Nunamaker (1986), at the University of Arizona, also described the development and use of a GDSS decision room called the **MIS Planning and Decision Laboratory**, which used the **PLEXSYS planning system**, as a research facility for the study of planning and decision processes in organisations.

The terminology relating to task and task outcomes to 1986 is extended in Figure 4.11 from Figure 4.6.

Barriers to group decision making had been described by DeSanctis and Gallupe (1985a) (as collated in Figure 4.6). These were extended by Begeman et al. (1986) who described **negative meeting issues** also known as **process losses,** these included poor communication, disagreement, frustrated efforts, lowered morale, and project failure. Kraemer and King (1986) also researched how GDSS might help increase productivity in decision meetings. They described three categories of problems relating to **barriers to successful use** of GDSS systems. These categories are technical problems, package problems, and decision making process problems. When describing effective group decision making, they used the term **productivity losses** and **meeting losses** which both affect the meeting outcome and GDSS use. **Productivity losses** include miscommunication, unequal consideration of ideas, dominance by individuals, peer pressure, loss of autonomy, member status, and lack of time. Kraemer and King stated that primary problems of **productivity losses** in meetings are information loss, information distortion, and sub-optimal decision making. Kraemer and King also argued that GDSS use helps to increase equality of participation, and discourages dominance by an individual or subgroup. Kraemer and King described other issues that could **reduce losses** including searching databases, doing analysis to answer questions, and displaying individual inputs.

Figure 4.11: Additional GDSS terminology from the CSCW conference 1986 relating to task (expanded from Figure 4.6)

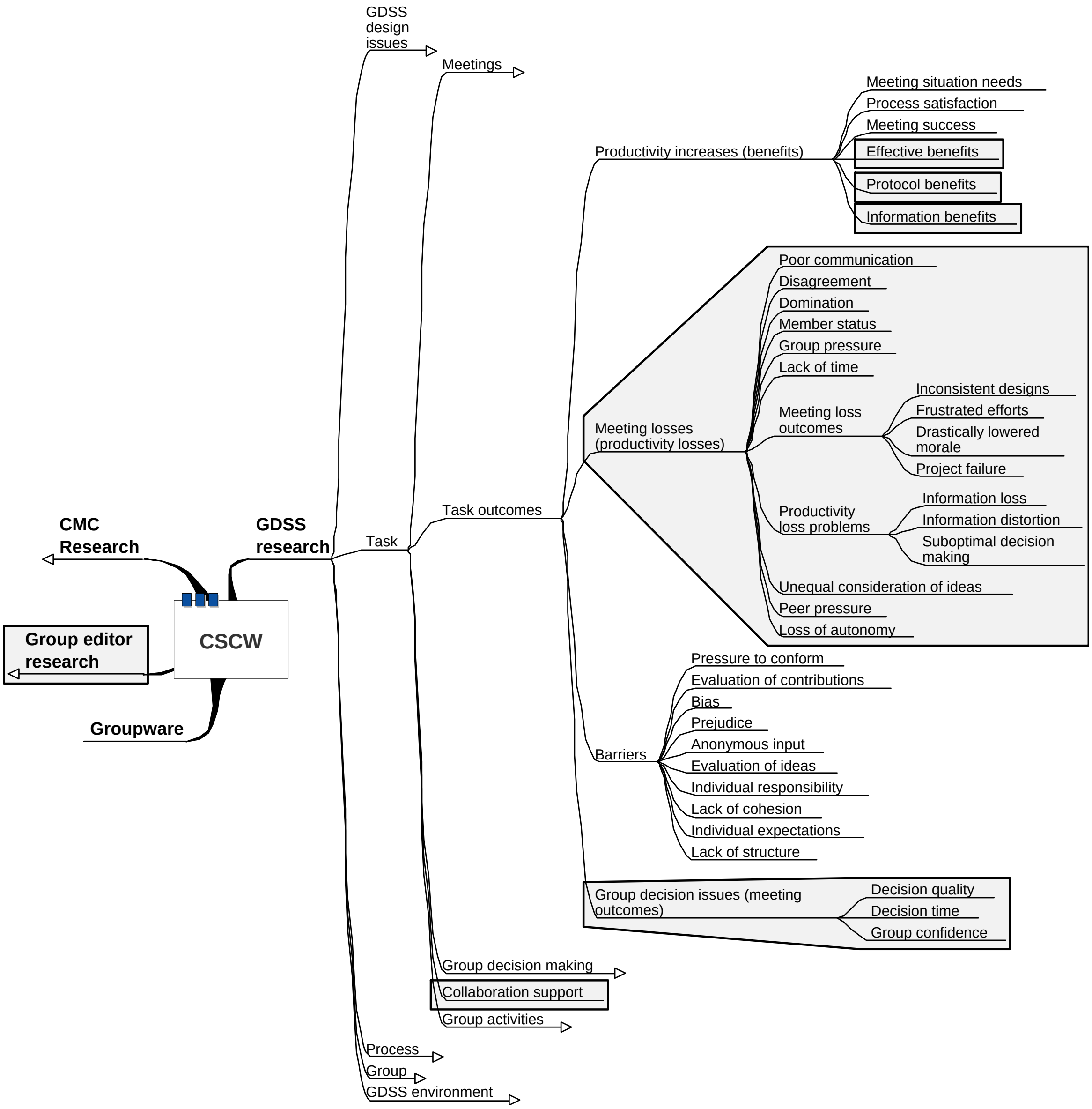
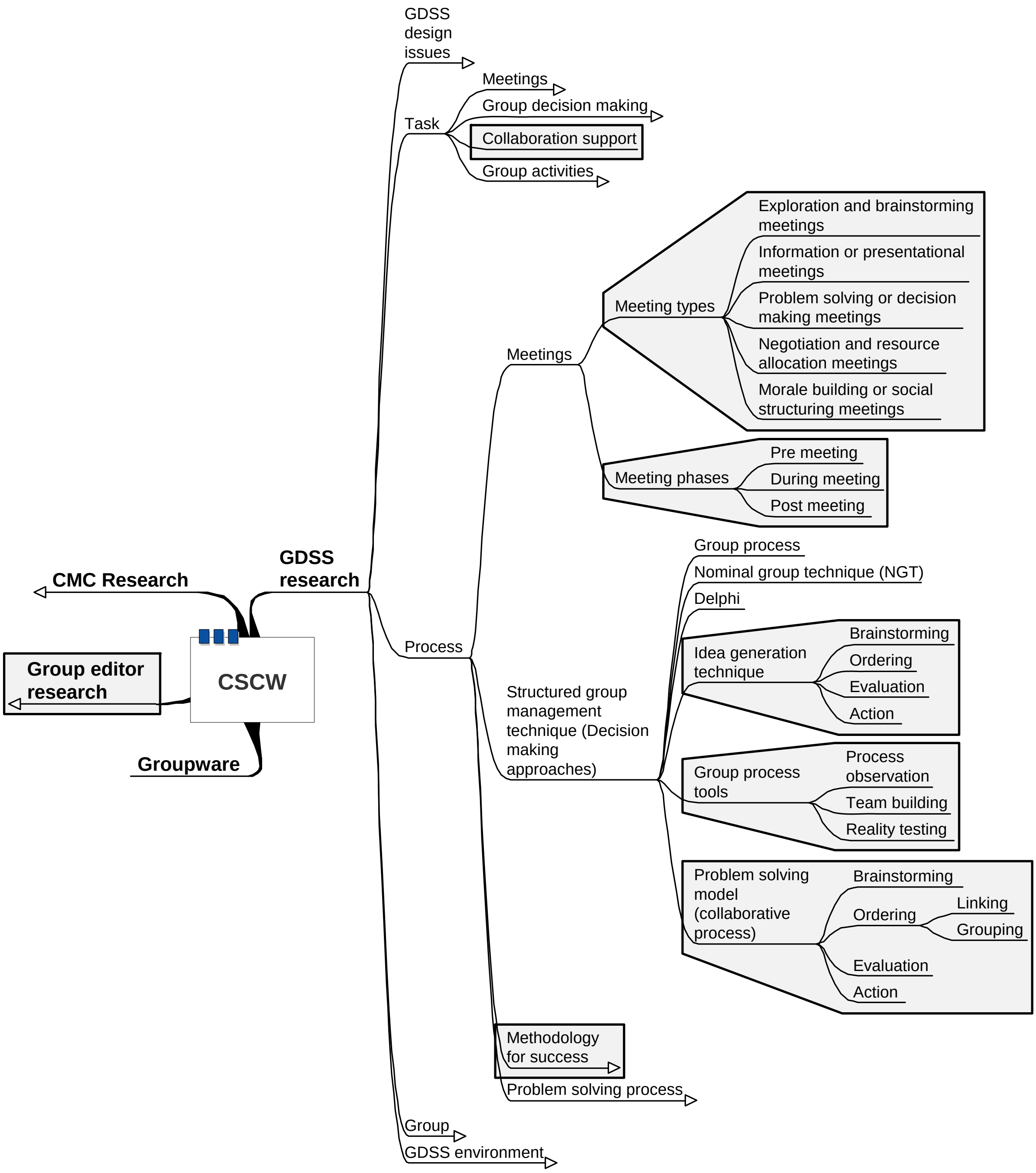


Figure 4.12 displays additional terminology relating to group process including some meeting types and phases, and structured group management techniques to 1986.

Meeting types include exploration and brainstorming meetings, information or presentational meetings, problem solving or decision making meetings, negotiation or resource allocation meetings, and morale building or social structuring meetings (Begeman et al. 1986). Begeman et al. (1986) described the decision room activities as **meetings**. They considered how the whole meeting process could be supported with group systems rather than just the decision making activity. They researched aids for all three **meeting phases** of pre-meeting, during meeting and post-meeting.

Figure 4.12: Additional terminology from the CSCW conference 1986 relating to group process to 1986 (expanded from Figure 4.6)



The terms used for **structured group management techniques** are included in the hierarchy from both a technology perspective (Figure 4.9) and from a group interaction perspective (Figure 4.12). If systems are not designed to cater for structured group management techniques then they will not support group processes. The techniques used by groups will impact the group behaviour and processes used for decision making.

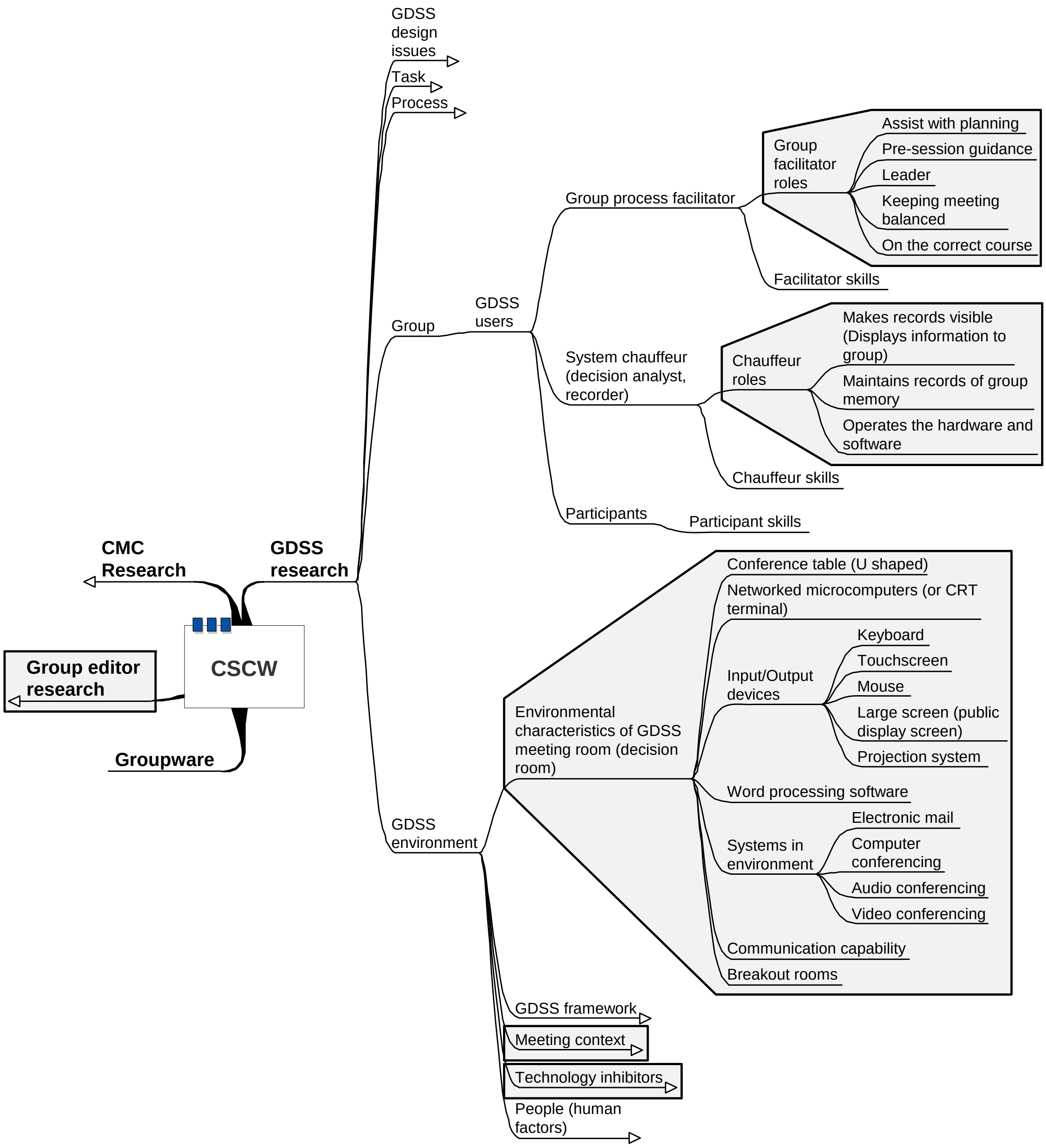
A three stage collaborative process was described by Foster and Stefik (1986) when discussing the *Cognoter* design. The three stages were brainstorming, ordering and evaluation. The brainstorming stage had many short descriptive ideas, member participation, flow of ideas encouraged, and no evaluation or deletion. The ordering stage consisted of linking and grouping. In the evaluation stage the final form of the presentation is determined. Johnson, Weaver, Olson, and Dunham (1986) discussed the **process of collaboration** through invention, evaluation and action. This is an extension of the problem solving model which includes generation of ideas and evaluation discussed by Huber (1984) and Foster and Stefik (1986), but Johnson et al. when discussing the process of collaboration, introduced 'action' as an additional process. Applegate, Konsynski and Nunamaker (1986) stated that Huber (1984) had discussed support for the idea generation phase of the problem solving process but this was not implemented in any of the existing systems.

Figure 4.13 extends the terminology relating to 'Group' and 'GDSS environment' to 1986.

Activities or **roles** of the facilitator and recorder (who are GDSS users) were described by Begeman et al. (1986). Kraemer and King (1986) used the term **group process facilitato**r instead of group facilitator to differentiate the group process role from the group technology support role. Huber (1984) used the term **chauffeur** instead of the term **recorder** for the person who provided technical support to the process facilitator. Kraemer and King (1986) used the term **decision analyst** to describe this role. Applegate, Konsynski and Nunamaker (1986) stated that planning session facilitators assist the group in their planning activities. They suggested that pre-session guidance by the facilitator was an important role for meeting success.

Begeman et al. (1986) identified **roles** of 'leadership' and 'keeping the meeting balanced' and 'on the correct course' when describing a group facilitator.

Figure 4.13: Additional GDSS terminology from the CSCW conference 1986 relating to group and the GDSS environment to 1986 (expanded from Figure 4.6)



The term environment was used to set the context for interaction, when describing the hardware, networks and software design (DeSanctis & Gallupe 1985a). Applegate, Knosynski and Nunamaker (1986) used the term **environmental characteristics** to describe the equipment in a decision room and suggested that the equipment should include networked microcomputers, a large screen, projection system and breakout rooms. Kraemer and King (1986) also identified some characteristics such as personal computer terminals for each participant, public display screen, computing/communication capability, communicating with group leader and word processing software.

4.3.2 Summary of 1986 CSCW conference article analysis

The first CSCW conference in 1986 drew together researchers from CMC, GDSS and Graphics editing. The 11 articles chosen for this analysis were presented by authors from American and Canadian universities including University of Arizona, University of California, MIT Laboratory and the University of Calgary, and American and Canadian IT development companies such as Xerox Palo Alto Research Centre, Hewlett Packard, IBM and the Rand Corporation.

Although the term groupware had been coined by Johnson-Lenz in 1980, prior to the first CSCW conference, no articles at that conference had used this term.

Terms for CMC, GDSS and group editor research were extended in Figures 4.8 to 4.13. Few links between CMC, GDSS, and group editor research were apparent. This is no surprise as very little inter group referencing was occurring in these published articles. Electronic meetings were being discussed in more detail and the group structures were being described more than in the articles before 1986.

4.3.3 After 1986 CSCW conference to 1990

This section analyses the use of terminology from 51 published articles to the end of 1990. Three of these 51 articles were published in 1986, but not presented at the CSCW conference. These three articles were authored by Bui and Jarke from the New York University, Hiltz and Kerr from the New Jersey Institute of Technology, and Malone, Grant and Turbak from the Massachusettes Institute of Technology.

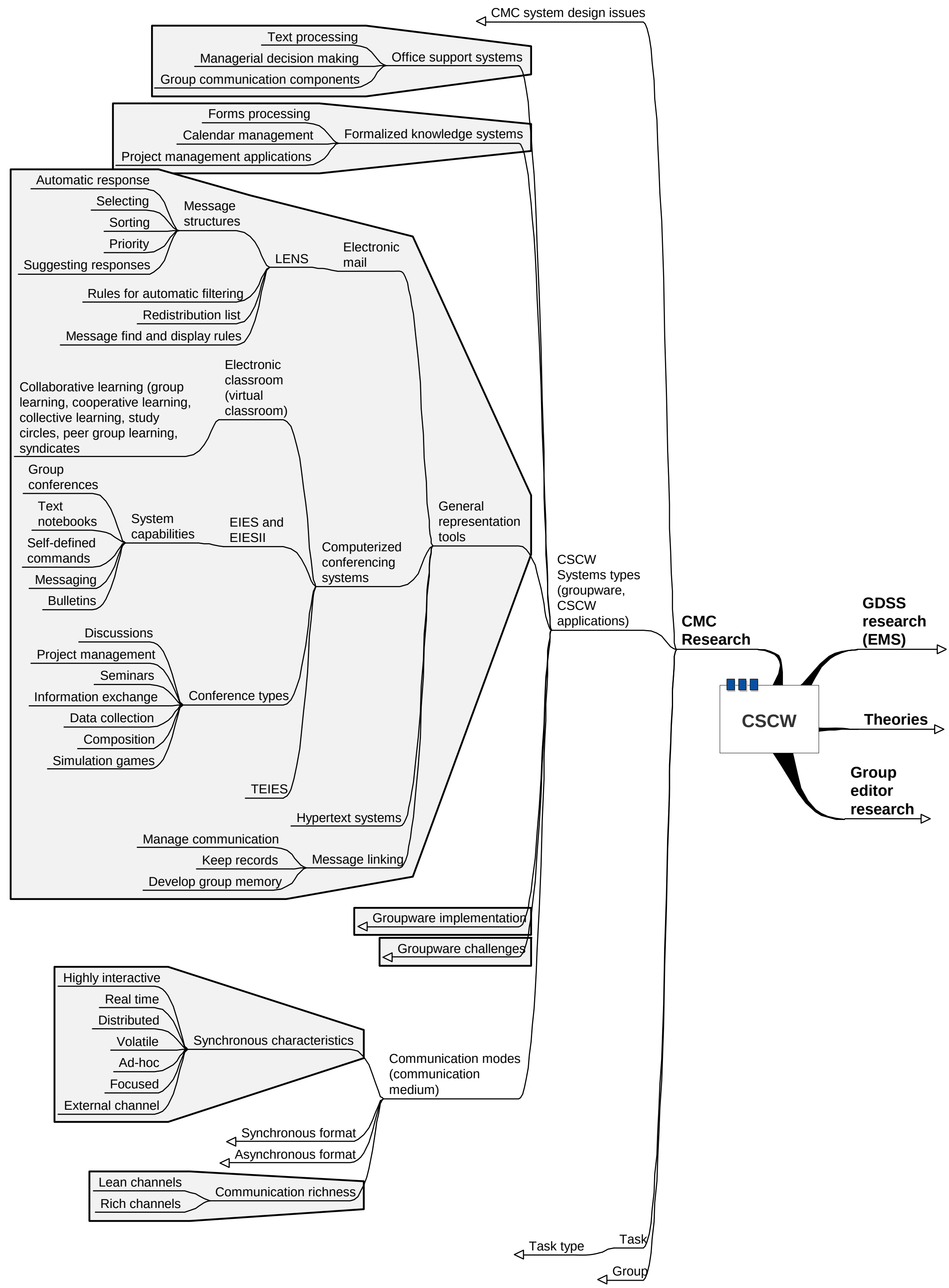
The additional terminology for this era is displayed in Figures 4.14 to 4.21.

Additional terminology showing types of communication systems, now referred to by some authors as groupware or CSCW systems, is included in Figure 4.14. Hiltz and Kerr (1986, p.149) continued their research into CMC, in an article published in the CHI proceedings which described a field experiment using four CMC systems. They included 'electronic mail, computerised conferencing systems, bulletin board systems and **office support systems** (text processing and managerial decision support systems with group communication components)'. It was not clear in the article whether this last system type mentioned is the same as a GDSS such as that described by Huber (1984).

Two categories of communication systems were identified by Malone, Grant and Turbak (1986) from the Massachusetts Institute of Technology. These categories were **formalised knowledge systems** that included forms processing, and calendar management; and **general representational tools** which included electronic mail, computer conferencing, and hypertext systems. Grudin (1988) discussed CSCW applications and identified the electronic meeting scheduler (electronic calendar), project management applications (distributed) and electronic mail.

Different **message structures** were researched by Malone, Grant and Turbak (1986) to determine how these could affect use of an email messaging system. This was the earliest dated article analysed that described research into message structures. Malone, Grant and Turbak described their system as an intelligent system to help people share and filter information communicated by computer-based messaging systems. The system, known as ***LENS***, was built on an email system and had four additional characteristics, which included structured messages, rules for automatic filtering, redistribution lists and message find and display rules. Malone, Grant and Turbak also described how semi-structured messages can help provide automatic aids for composing messages to be sent; selecting, sorting, and prioritising messages that are received; responding automatically to some messages; and suggesting likely responses to other messages.

Figure 4.14: Additional terminology for CMC system type to 1990 (expanded from Figure 4.8)



Virtual Classrooms were researched by Whitescarver, Mukherji, Turoff, Deblock, Czech, and Paul (1988) while Hiltz (1990) used the term virtual classroom to describe the use of computer support for **collaborative learning**. Hiltz gave other terms for collaborative learning; group learning, cooperative learning, collective learning, study circles, team learning, peer-group learning and syndicates. Hiltz also described an electronic classroom as being within the CSCW network. Hiltz described **benefits of virtual classrooms** such as better class attendance, greater expenditure of time outside the class, greater satisfaction with the course and increased wish to pursue subsequent studies on the topic.

The terms **lean channels** and **rich channels** were used by Daft and Lengel (1986 in Pauleen 2003) when referring to the different types of electronic communication. This had previously been identified by Turoff, Hiltz & Kerr (1981) as communication richness when discussing CMC factors. Sheffield (1989) discussed efficiency of the communication media and their ability to convey social and emotional information (media richness). Rice and Shook (1988) also discussed richness of information when describing the effect on outcomes.

During 1987 Jelassi from Indiana University and Beauclair from the University of Louiseville researched GDSS. They referenced DeSanctis and Gallupe’s (1985a) categories of GDSS, which were proximity and duration. They also identified some GDSS features of the decision room, referred to previously by DeSanctis and Gallupe (1985a) as GDSS categories. These GDSS decision room features were face-to-face, close proximity, synchronous, computerised support, and small group interaction. However, Jelassi and Beauclair (1987) stated that the non face-to-face synchronous sessions were conducted using teleconference systems and the asynchronous sessions were conducted using electronic mail. Both these system types had been described in earlier articles as CMC systems rather than GDSS. Jelassi and Beauclair (1987) was the first article analysed that showed a clear disagreement regarding the GDSS and CMC system terminology.

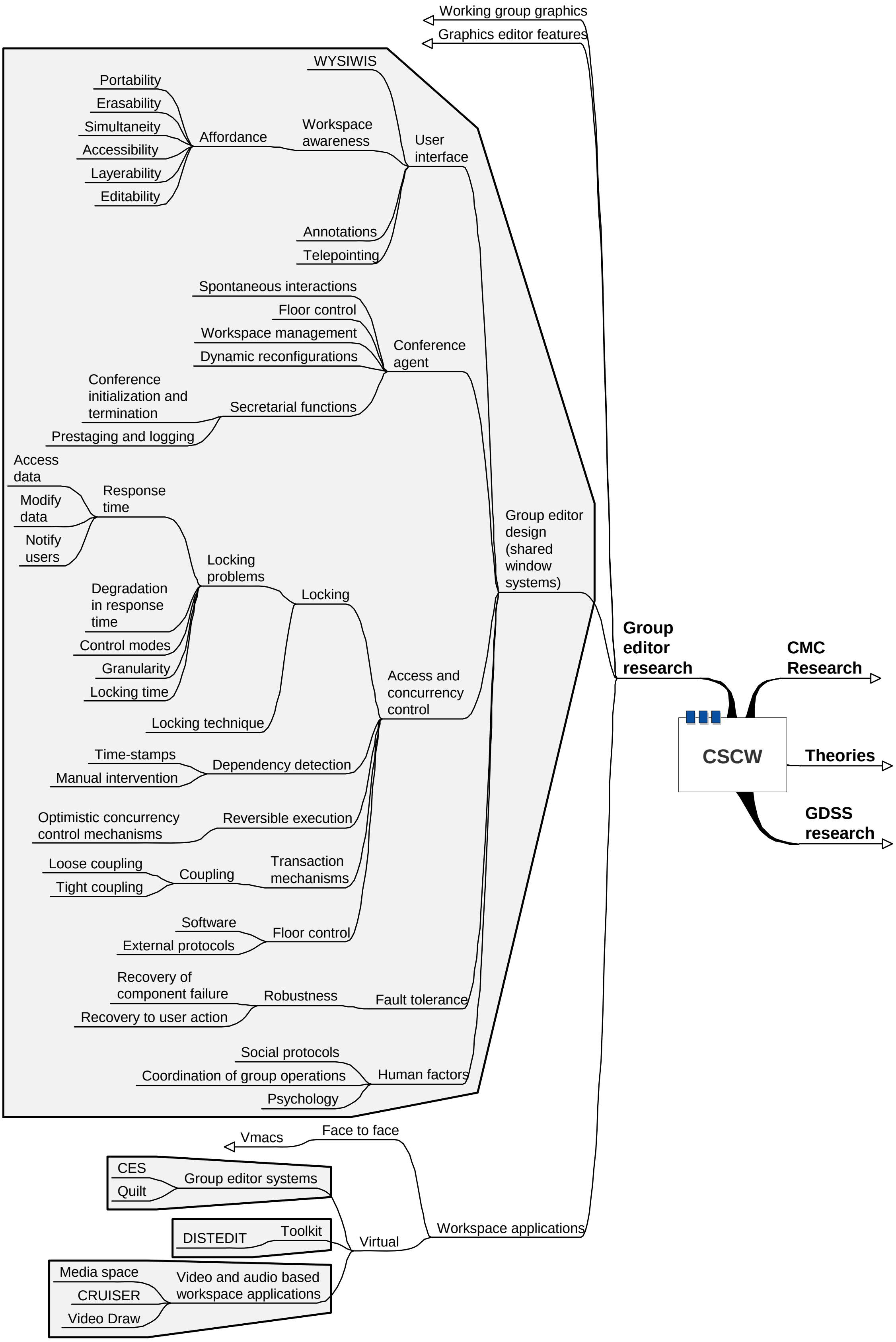
Additional terminology relating to group editor systems to 1990 is included in Figure 4.15. **Access control** and concurrency control had been identified by Greif and Sarin (1986) as not having been addressed by existing systems or applications. Ellis and

Gibbs (1989) agreed that one of the groupware challenges was access control. Lauwers and Lantz (1990) supports these statements by saying that a number of areas such as spontaneous interactions, shared workspace management, floor control, annotations and telepointing have not been adequately addressed.

Research into **concurrency control** was undertaken by Ellis and Gibbs (1989) who explained that some real-time computer-conferencing systems have **floor control** where access to the floor may be controlled by software or through an external protocol. Ellis and Gibbs suggested that one solution to concurrency control was **locking**. One locking technique is a tickle lock which allows a request to a locked resource to be granted if the current holder is inactive. Another technique is to provide participants with visual indicators of locked resources to decrease the likelihood of requests being issued for locked objects.

Concurrency control using **WYSIWIS** (What You See Is What I See) interfaces were discussed by Ellis and Gibbs (1989) who suggested three **problems with locking**: granularity (the amount of text which should be locked), locking time (when locks should be requested and released) and degradation in response time to access data, modify data or notify users of changes. Knitster & Prakash (1990) described the issue of **concurrency control**, fault tolerance, user interfaces, psychology, human factors and software design when discussing the DISTEDIT toolkit for building collaboration systems. DISTEDIT was the first system described in the articles as a developers toolkit.

Figure 4.15: Additional terminology relating to group editor systems to 1990 (expanded from Figure 4.8)



Additional terminology relating to GDSS research to 1990 is included in Figure 4.16 to 4.21. Further research into GDSS systems was undertaken by Bui, from the Naval Postgraduate School and Jarke, from the New York University. Bui and Jarke (1986) described a fourth component of a GDSS when describing the development of *Co-Op*, a distributed GDSS. They explained that a **Communication manager** component would be required for a distributed GDSS. The other three components of a GDSS were previously identified by Sprague and Carlson (1982 in Jelassi & Beauclair 1987) as ‘GDSS functions’. These were data manager, model manager, and dialogue manager.

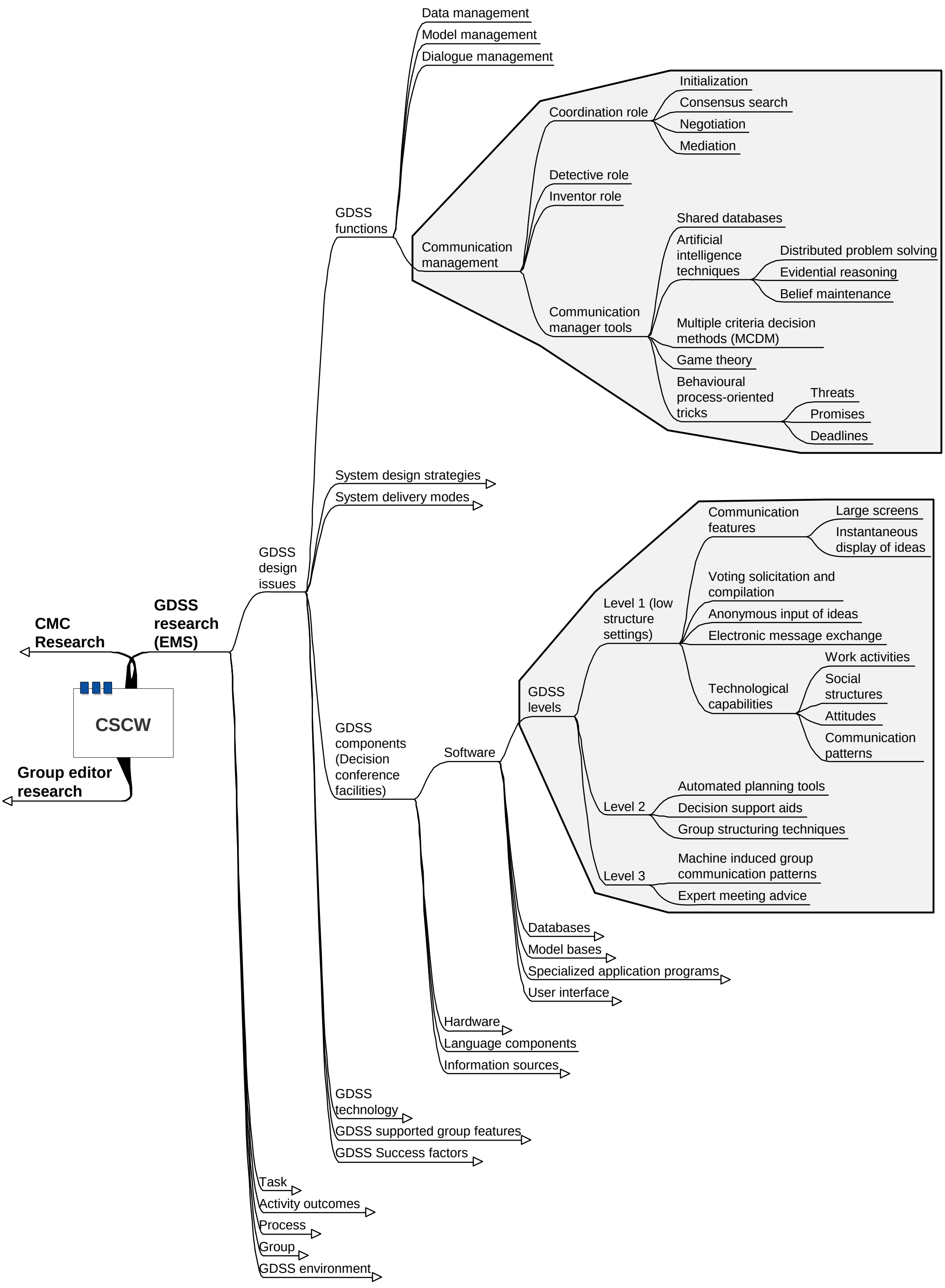
The earlier article by DeSanctis and Gallupe (1985a) discussed GDSS in general terms describing the components and features of these systems, while their article in 1987 considered a variety of different GDSS, and additionally described GDSS on three levels:

- **Level 1** GDSS might ‘provide technical features aimed at removing common communication barriers, such as large screens for instantaneous display of ideas, voting solicitation and compilation, anonymous input of ideas and preferences, and electronic message exchange between members’ (p593).

- **Level 2** GDSS might ‘provide automated planning tools, or other aids commonly found in individual decision support systems’(p593), such as PERT, CPM and Gantt, utility and probability assessment models such as decision trees, and risk assessment. Other GDSS features at level 2 could include statistical methods, MCDM, social judgement models, and automate Delphi, NGT, or provide an online tutorial. DeSanctis and Gallupe also suggested that group structuring techniques or consensus seeking techniques, such as NGT and the Delphi method, could be administered to groups within level 2 technology.

- The **level 3** GDSS might include ‘machine-induced group communication patterns and can include expert advice’ (DeSanctis & Gallupe 1985a, p.594), such as automated parliamentary procedure, rule-base facility for rule selection and application, or automated counsellor for giving advice on available rules and appropriate use.

Figure 4.16: Additional terminology relating to GDSS to 1990 (expanded from Figure 4.9)



The term **electronic meeting system (EMS)** was proposed and defined as a combination of 'the task-orientation of **GDSS** and the communication-orientation of CSCW' (Dennis et al. 1988, p.593). Dennis et al. further described CSCW systems as being driven by communication needs. Although Dennis et al. used the term GSS in a diagram describing the link between CSCW and GDSS, no discussion or even mention of this term was included in the article text and no articles prior to this have been found that used the term GSS. From the 1990s onwards the term GSS was used by a number of researchers when referring to computer systems that support groups. For this reason GSS have not been included in the figures in this era (1986-1990).

The term EMS, however, was adopted by other authors, for example, Rice and Shook (1988), from the University of Southern California, described EMS as a CMC system. George, Valacich, and Nunamaker (1990) considered that EMS could be either a decision room system or a distributed system. However, George, Valacich and Nunamaker's (1990) case study was about a particular EMS decision room in an organisation, so the term 'EMS' is included in the hierarchy. Other authors (DeSanctis & Gallupe 1985a) prior to 1988 had suggested that GDSS could include CMC capabilities, which we can assume Dennis et al. (1988) would have called EMS systems.

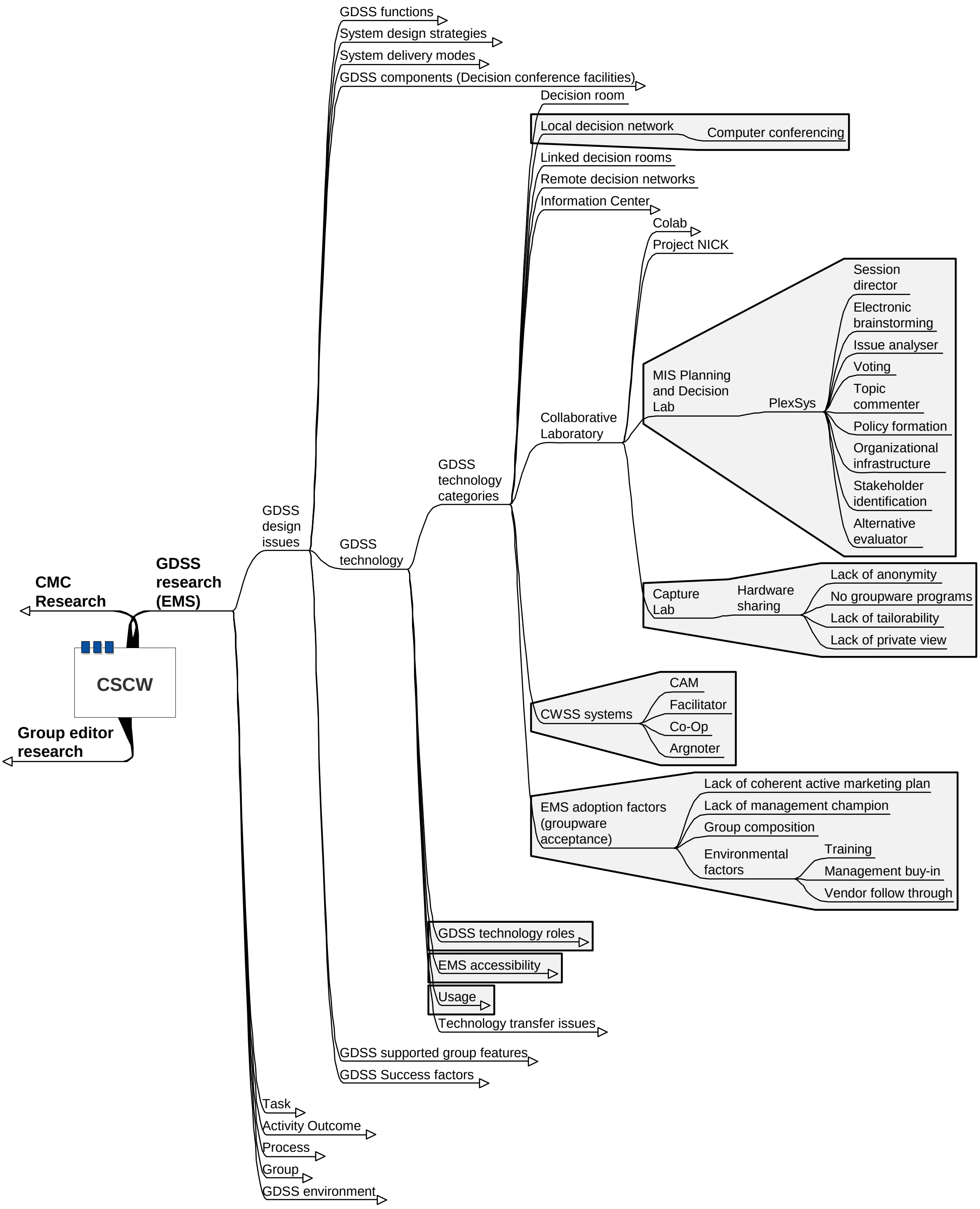
Figure 4.17 shows additional terminology relating to technology categories and technology roles of GDSS.

Tools in the **PLEXSYS toolkit** being researched at the MIS Planning and Decision Labs were described by Dennis et al. (1988). These tools included session director, electronic brainstorming, issue analyser, voting, topic commenter, policy formation, organisational infrastructure, stakeholder identification, and alternative evaluator.

Researchers from the EDS Centre for Machine Intelligence in the USA, undertook research in the **Capture Lab** and described the hardware sharing approach which allowed users to share any software that ran on the *Macintosh*, but they stated that it was not groupware (Halonen, Herton, Kass, & Scott 1990). Halonen et al (1990) did say, however, that groupware programs could be used in the hardware sharing environment. They provided examples of possible groupware systems, such as *gIBIS* an augmentation tool, *Quilt* a coauthoring tool and *SAMM* a GDSS. Halonen et al.

described the hardware sharing features as, simple user interface, easy shift between public and private work, flexibility and fewer implementation requirements. They discussed the limitations of sharing hardware which included lack of anonymity, does not provide groupware programs lack of tailorability and a lack of private view.

Figure 4.17: Additional terminology relating to GDSS technology categories and roles to 1990 (expanded from Figure 4.10)



A different term used by Bostrom and Anson (1988) from the Indiana University was **Collaborative Work Support System (CWSS)** which they used to describe systems to support groups. Bostrom and Anson (1988) provided examples of **CWSS systems**, *CAM*, *Facilitator*, *Co-Op*, *Plexsys*, *Cognoter* and *Argnoter*. These systems are described as GDSS by other authors (Bui & Jarke 1986, Dennis et al. 1988). It is interesting to note that no other articles were found that used the term **CWSS**.

The term **activity outcomes** has been introduced in this analysis, as a generic term to draw together all issues relating to productivity and meeting increases, and productivity and meeting losses, in the hierarchy at level 3 (Figure 4.18). As system design, task, process, group and environmental issues have an impact on outcomes, it was considered inappropriate, to split these issues and attach them to different branches across the hierarchy. Therefore terms associated with activity outcomes have been moved and linked to this branch in the hierarchy.

The effects of structured approaches were described by DeSanctis and Gallupe (1987). These effects included **meeting increases**, such as increasing member participation, focusing the problem, avoiding conformity pressures, and keeping the group on track. This has also been referred to as productivity benefits or increases or GDSS benefits (Kraemer & King 1986). Pinsonneault and Kraemer (1989) also described some GDSS process (**meeting) benefits** such as increased consensus reaching, increased confidence in the decision by the group members, increased satisfaction of group members with the process, and increased satisfaction of the group members with the decision.

Some **meeting outcomes** can be measured on many dimensions, including decision quality and timeliness, satisfaction with the decision, cost or ease of implementation, member commitment to implementation, and groups willingness to work together in future (DeSanctis & Gallupe 1987). DeSanctis and Gallupe (1987) suggested that **decision quality** could include creativity, decision-making, cognitive conflict, and mixed motive tasks. They also suggested that organisations must consider the balance between decision quality and satisfaction tradeoffs with regard to GDSS. Dennis et al. (1988) further discussed meeting outcomes that can be measured and added participant satisfaction with the process, level of group consensus, number of comments during the meeting, and the number of alternatives or issues considered.

Other measures identified by Dennis et al. (1988) included participant confidence in the outcomes, process time required, level of group consensus, number of comments during the meeting, and the number of alternatives or issues considered. Connolly, Jessup and Valacich (1990) spoke of the assessment of **effectiveness in meetings** through counts of numbers of ideas generated and quality of ideas such as expert evaluation or statistical rarity.

Other **outcomes of using an EMS** described by Rice and Shook (1988) were an increase in communication relating to number, diversity and communication direction, whether horizontal, vertical or cross organisational. They also discussed EMS relating to efficiency, through reducing delays in information exchange, improving maintenance of records and information received, increasing coordination of geographically dispersed groups, and improving users’ ability to process large amounts of information. Other group outcomes identified by Dennis et al. (1988) were equal quality decision, consensus, group decision, equal participation, non-task behaviour, tension release behaviour.

Additional **positive and negative impacts of GDSS use** were provided by Kiesler (1986 in Watson, DeSanctis, & Poole 1988). The positive impacts were higher quality decision, democratic approach, equality of participation, improved satisfaction. The negative impacts were information overload, heightened awareness of member viewpoints, greater objectivity, and an increased level of conflict. (Also see Kraemer & King 1986 previously) intended and unintended effects. Zigurs, Poole and DeSanctis (1988) also described **GDSS influence** aspects that have potential impacts, new channel of communication, channel is available to all, anonymity of the channel, inhibitions are lessened, and structure provided to group interaction.

Figure 4.18: Additional terminology relating to activity outcomes to 1990 (expanded from Figure 4.11)

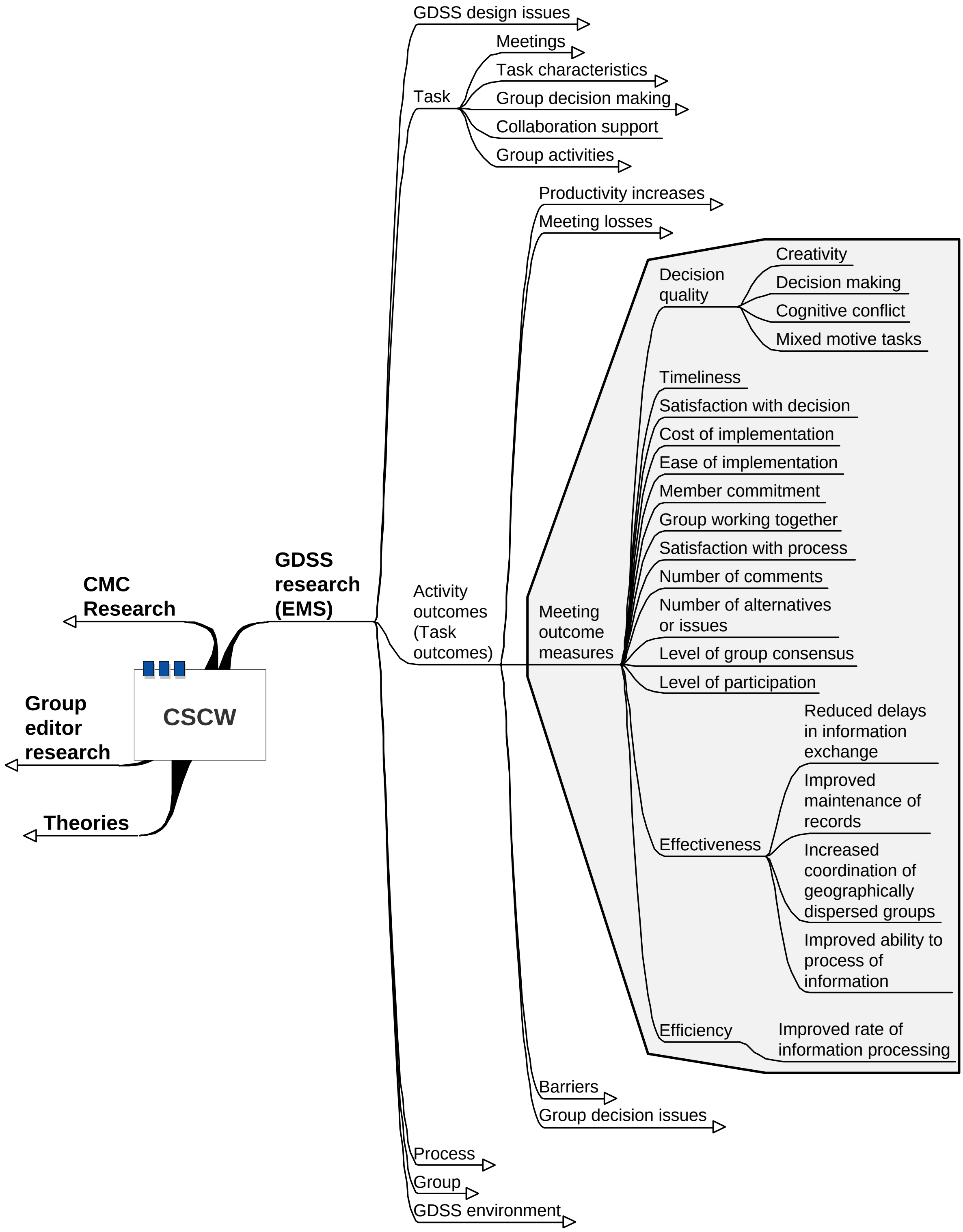


Figure 4.19 displays terminology relating to group behaviour characteristics to 1990.

Situational characteristics that included leader-member relations, position power, task structure were discussed by Fiedler (1978 in Lester, Ready, Hostager, & Bergman 2003). These situational characteristics relate to the Level 1 concepts of GDSS research previously identified in the hierarchical structure; **design issues** (technological support), **task** (task characteristics), **group** (personal factors and group structure), **environment** (situational factors). DeSanctis and Gallupe (1987) stated that the political dynamics of power and influence may change once technology is introduced to the process. Jelassi and Beauclair (1987) Connolly, Jessup and Valacich (1990) also discuss production blocking which are obstacles to contributions such as ideas which are forgotten or edited while their originator waits for an opportunity to speak (Lamm & Trommsdorff 1973 in Connolly, Jessup & Valacich 1990).

Some **group dynamic** issues such as seating arrangements, power position, loss of privacy, changes in protocols, and dominance of the screen, which could be considered as environmental issues were considered by Greenberg and Chang (1990).

Figure 4.19: Additional GDSS terminology for group behaviour characteristics to 1990 (expanded from Figure 4.13)

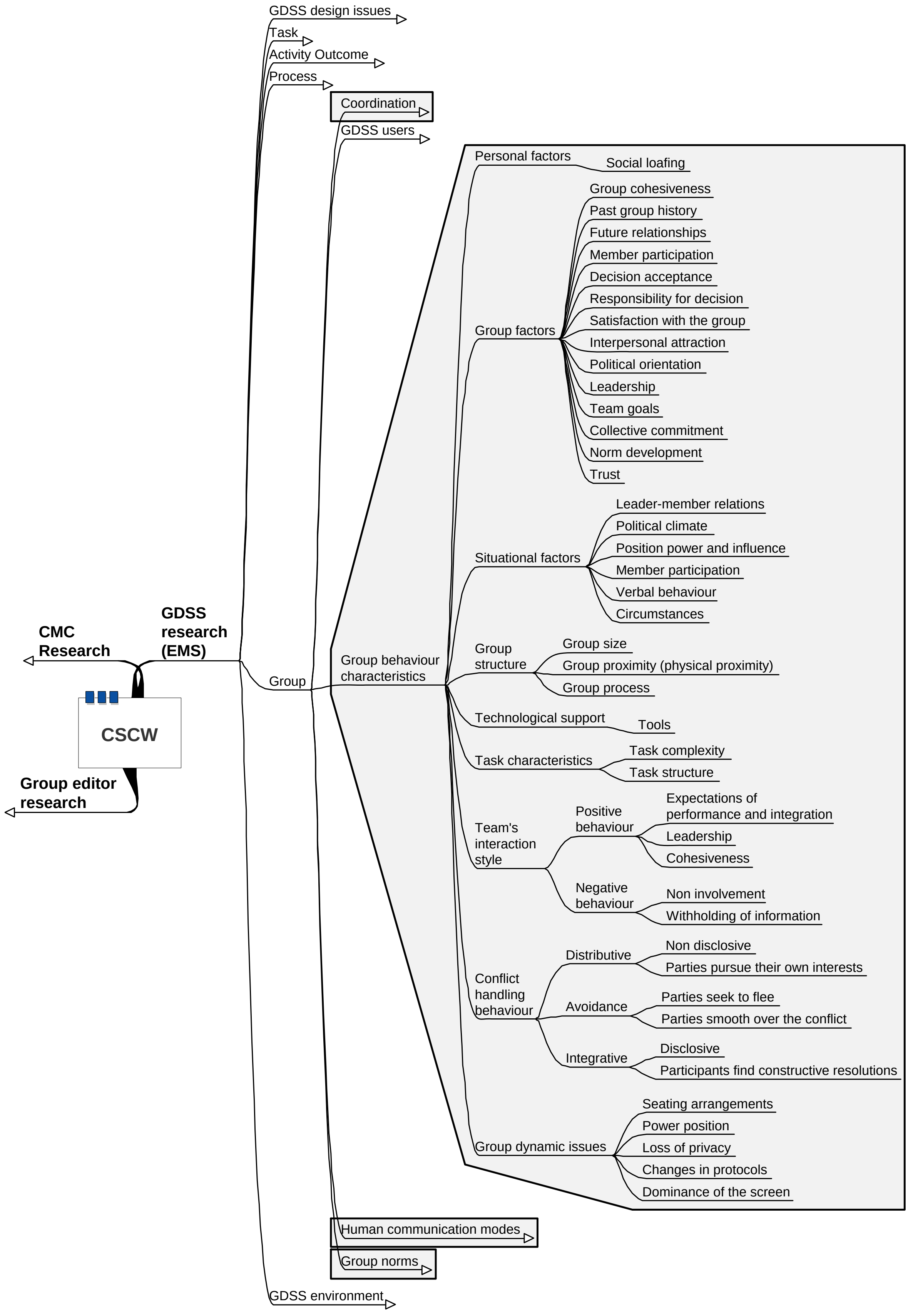
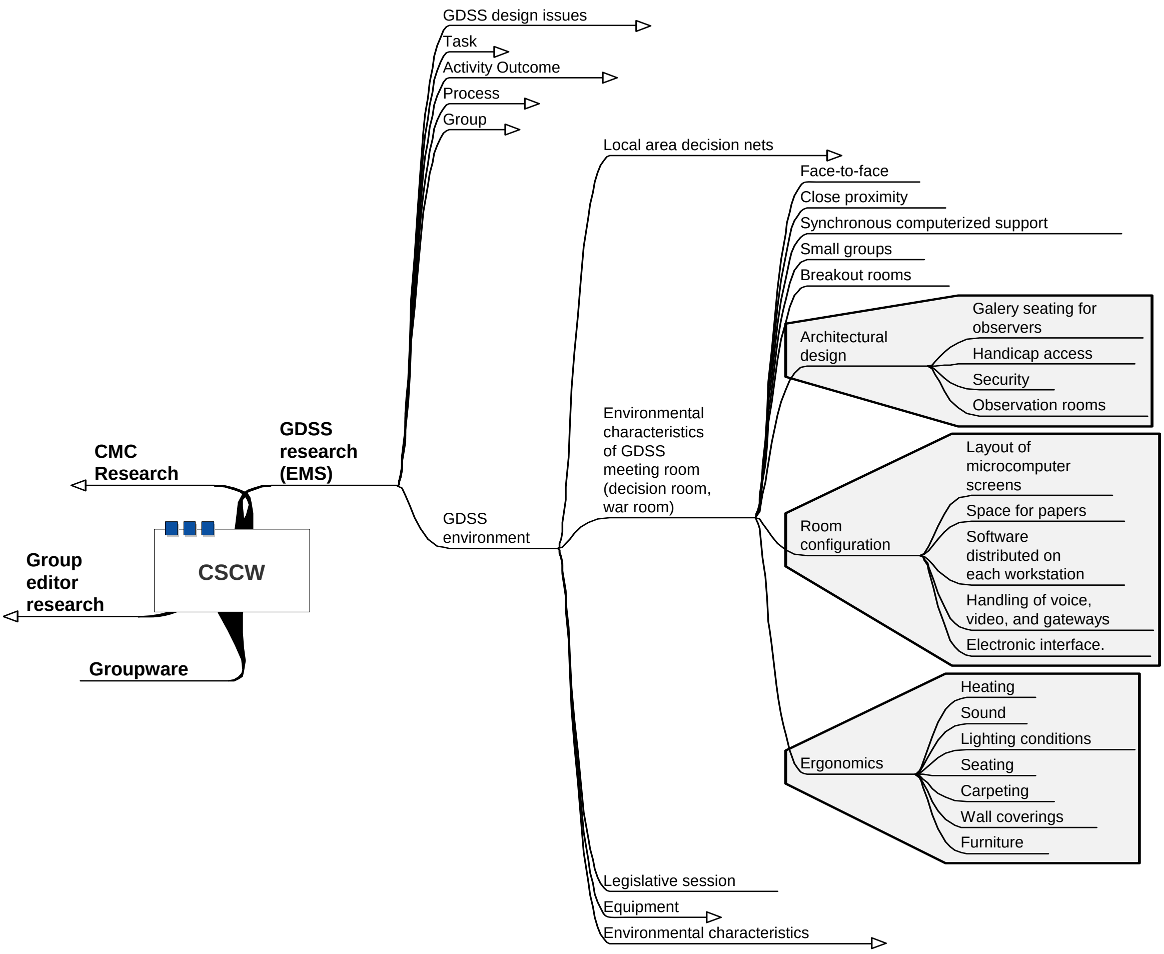


Figure 4.20 shows additional GDSS terminology relating to environment to 1990. Jelassi and Beauclair (1987) described **environmental characteristics** as including setting, scheduling, length of a session, organisational context and spatial arrangements. Dennis et al. (1988) identified three dimensions of **EMS environments:** participant location, meeting timing and group size. Participant location and meeting timing were previously described by Kraemer and King (1984), DeSanctis and Gallupe (1985a) and Applegate, Kosynski and Nunamaker (1986).

Most systems designed to support meetings are considered to exist in one of three environments: local area decision nets, decision rooms, or legislative sessions (Dennis et al. 1988). Jelassi and Beauclair (1987) described the decision room as a 'war room' which related to face-to-face, close proximity, synchronous computerised support and small groups.

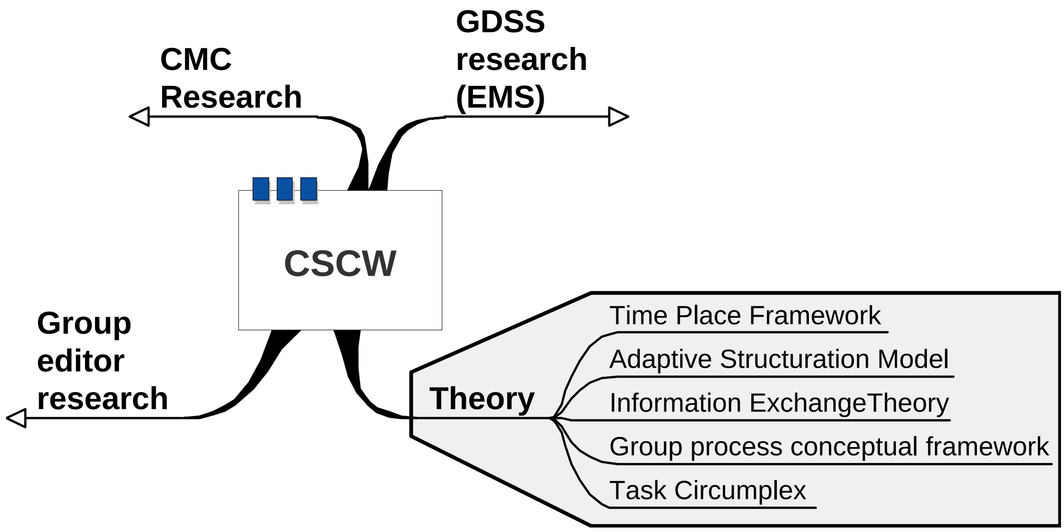
Figure 4.20: Additional GDSS terminology relating to environment to 1990 (expanded from Figure 4.13)



Some **ergonomic** issues were introduced by Dennis et al. (1988). The ergonomic issues included, heat, sound, lighting conditions, seating, carpeting, wall coverings, and furniture.

By the end of the 1980s, authors started to describe their research using a number of different theories (Figure 4.21).

Figure 4.21: CSCW Theory to 1990



Dennis et al. (1988) stated that the **adaptive structuration model** (DeSanctis & Poole 1987), proposed that outcomes depend on process and process is dependent on group, task, context, and environment.

Information exchange theory was developed by DeSanctis (1988).

> 'Information exchange theory incorporates both the economic and behavioural science traditions in its recognition of the importance of network characteristics and context in group interaction. Network characteristics, contextual factors, and the meaning of exchange are identified as determinants of the efficiency (minimum cost of exchanges), coordination (synchrony of exchanges), and effectiveness (quality of resulting products or outputs) of interpersonal exchange within the group'.
>
> (DeSanctis 1988, p.11)

Connolly, Jessup and Valacich (1990) described the **group process conceptual framework** by McGrath (1984). This included the group interaction process as a consequence of properties of the group members (evaluative tone), their patterned relationships (anonymity), the task situation and broader environment. DeSanctis and Gallupe (1987) also discussed McGrath's (1984) **Task Circumplex**.

4.3.4 Summary of analysis from era 1986-1990

By the beginning of 1990 authors were describing meeting support systems, group editor systems and CMC systems as groupware. Brothers, Sembugamoorthy and Muller's (1990) discussion of a meeting support system as groupware agreed with Bannon's (1986 in Bannon 1992) description of groupware as referring to more than CMC systems. Ellis and Gibbs (1989) also used the term groupware when discussing graphics editors.

Articles published in 1986 through to 1990 added terminology to the hierarchy as highlighted in Figure 4.11 to Figure 4.21. It seemed that at this stage of the development of the CSCW research field that GDSS was usually described as being related to face to face meeting support, even though the time/space framework had been described in some earlier articles. The time/space framework identified four categories of systems, same time/same place, same time/ different place, different time/same place and different time/different place.

Dennis et al. (1988) from the University of Arizona, introduced the term electronic meeting system (EMS) to refer specifically to GDSS systems that had CMC capabilities that allowed the systems to be used anywhere, anytime for meeting purposes, but all articles discussing research of systems for distributed meetings were using what had previously been described as computer mediated communication systems (email and conferencing systems) rather than GDSS systems that had integrated decision models.

Some integrated decision models and techniques were discussed by researchers and included as components in some GDSS systems. The research aimed to improve strategic and managerial decision making. Group interaction techniques were also being developed and supported by computer systems. Research into these systems was being undertaken at the University of Strathclyde (Ackerman 1989).

The first article that studied group editor systems including text graphics manipulation was by Lakin (1986) from Stanford University. Lakin used the term ‘working group graphics’ to describe text graphics performance by groups.

4.4 Summary of Chapter 4

This chapter commenced with a description of the text and diagrammatic formatting used in Chapters 4 and 5 to illustrate the hierarchy of CSCW terminology. It presented the development of the terminology structure in two eras, 1978 to 1985 and 1986 to 1990.

The research articles identified and analysed from 1978 to 1990 were mainly from American and Canadian institutions and organisations, however, some research from Europe has been included, for instance from the University of Strathclyde (Ackerman 1989).

The design and development of CMC and GDSS systems were the focus of the research prior to 1986. However, the first CSCW conference in 1986 drew these two separate groups together and also highlighted another area of research into collaborative group work, that of graphics editors and shared window systems.

Chapter 5 continues with the development of the CSCW hierarchy from 1991 to 2003.

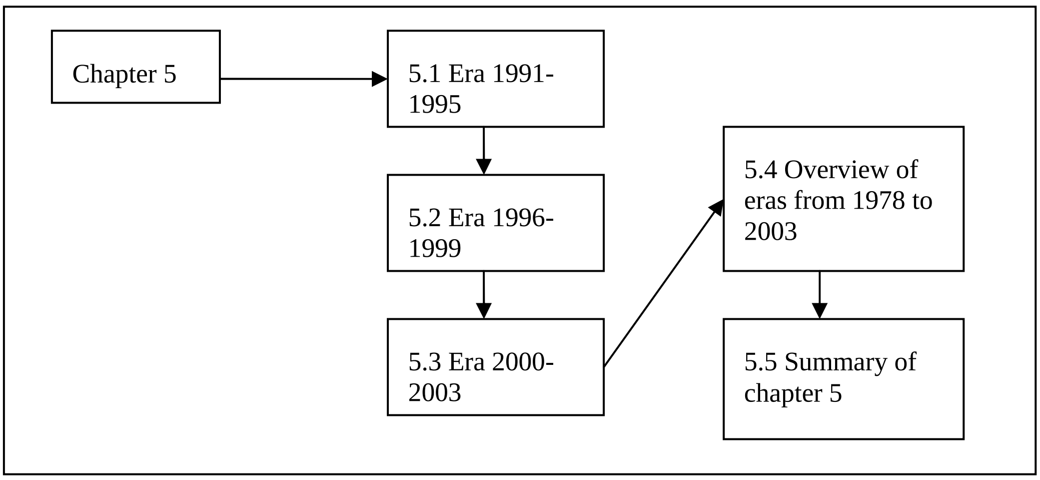
Chapter 5 Taxonomy of CSCW terms - 1991 to 2003

Chapter 3 established and described the analysis method used in this study and presented an example of the method in detail. Chapter 4 described the formatting used in Chapters 4 and 5 and then presented the development of the CSCW hierarchy for the terminology in use in the CSCW research field through to 1990.

Chapter 5 continues the presentation of terminology from 1991 to 2003. The articles from the three eras 1991-1995, 1996-1999, and 2000-2003 were analysed in the same manner as the articles from the two previous eras as described in Chapter 4. However, for the sake of clarity, the three eras from 1991 to 2003 are presented using a few examples only. The detailed data analysis and description of all terminology omitted from the dissertation is available from the author, on request. It is a very large document. The chapter concludes with a summary of CSCW terminology from the complete period of analysis (1978 to 2003). The complete taxonomy of CSCW terms is presented in Appendix D.

Figure 5.1 shows the structure of this chapter. Sections 5.1 to 5.3 present examples of the additional terminology in use from 1991 to 1995, 1996 to 1999 and 2000 to 2003. Section 5.4 provides an overview of the eras from 1978 through to 2003. A summary is then presented in Section 5.5. Additional terminology that has been presented in this chapter is shown in Figures 5.3 to 5.21.

Figure 5.1: Chapter 5 structure

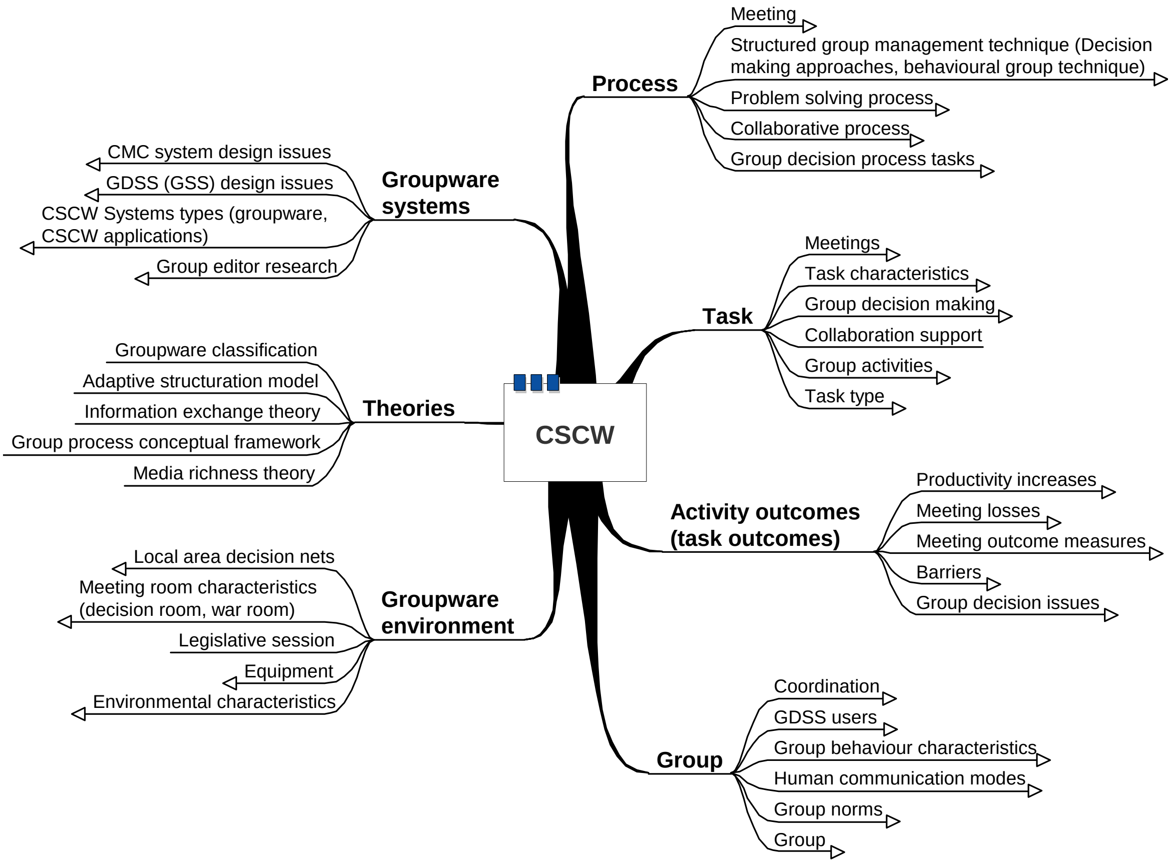


By the end of the 1980s the term groupware was being used by some researchers as a generic term to refer to a number of CSCW system types including CMC systems (Bullen & Bennett 1990), GDSS systems (Halonen et al 1990), and group editing systems (Ellis & Gibbs 1989; Halonen et al 1990). This provided a strong reason to use the term 'groupware' in the diagrams from 1990 onwards, to bring together terminology from CMC, GDSS and group editor research. This decision was also supported by other author's comments at that time, for example, Ishii, Kobayashi and Arita (1994) stated that familiar **groupware examples** include email, bulletin boards, group schedulers, group decision support systems, workflow systems, collaborative authoring tools and screen sharing software. Grudin (1994) also agreed that key examples of groupware that included CMC, GDSS and group editor systems were desktop conferencing, videoconferencing, co-authoring features and applications, email and bulletin boards, meeting support systems, voice applications, workflow systems and group calendars.

Note how the taxonomy in Figure 5.2 has been developed to incorporate the changes described above and is quite different from the earlier eras. CMC, GDSS and group editor systems terminology have been incorporated into the 'groupware systems' branch in the hierarchical diagrams. Issues relating to group, task, process and environment from GDSS, CMC and group editor system branches have been incorporated in the main branches for 'group', 'task', 'process', and 'groupware environment'.

Further, activity outcomes were referred to by terms such as productivity outcomes, task outcomes, meeting outcomes, group performance outcomes. These outcomes were related to system issues, task issues, process issues, group issues and environment issues. Thus, 'activity outcome' was added as a new main branch to the hierarchy and the terminology relating to outcomes, described in previous sections throughout Chapter 4, were brought together to show the importance and variety of outcome issues. The two levels of the adjusted hierarchy are displayed in Figure 5.2.

Figure 5.2: Adjusted structure for CSCW terminology at 1990



5.1 Era 1991 to 1995

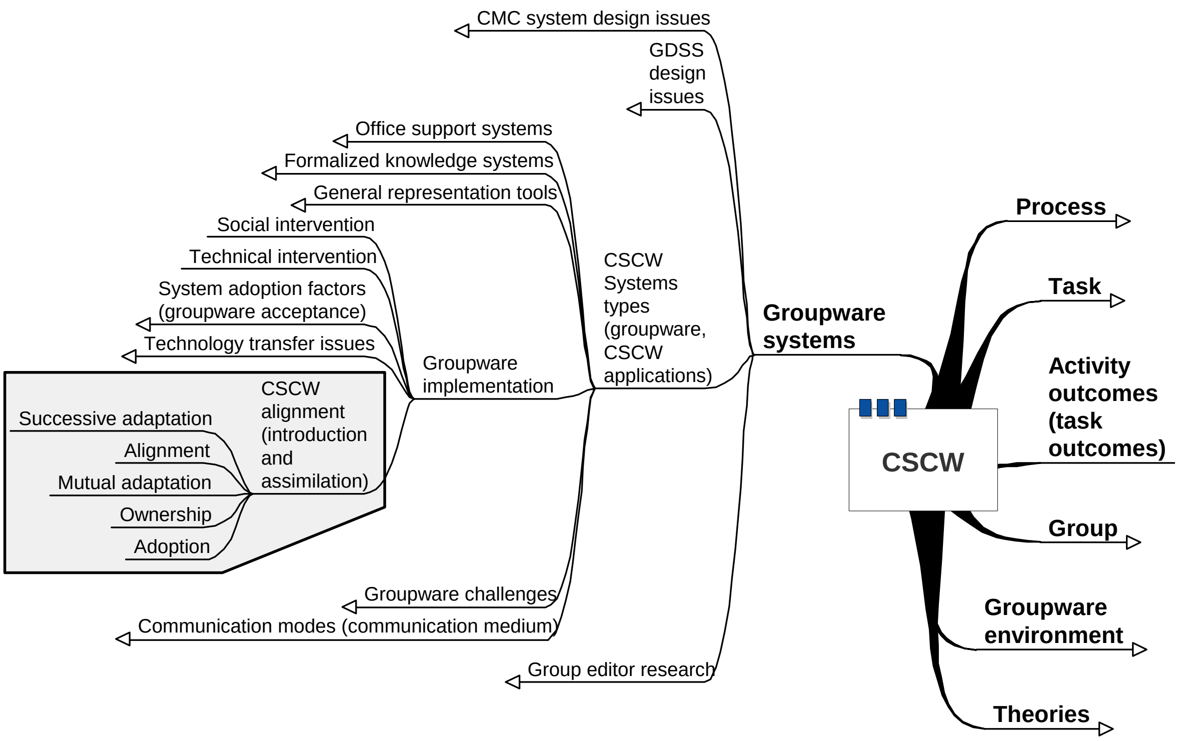
This section highlights examples of the additional terminology used in the CSCW research field from 1991 to 1995. The use of terminology is analysed based on 115 articles by authors from 16 countries and 90 institutions and organisations.

During the years 1991 to 1995 the Internet became a feasible option to use for improved synchronous and asynchronous communication. It provided a network infrastructure for communication and collaboration. Commercial vendors began to develop applications that exploited real-time communication capabilities. The study by Beauclair and Straub (1990 in Williams & Wilson 1997) indicated that distributed forms of GSS (electronic mail, video teleconferencing) had a higher adoption rate than their decision room counterparts.

5.1.1 New terminology analysis for era 1991-1995

Figure 5.3 displays additional terminology relating to GDSS design issues and groupware implementation to 1995.

Figure 5.3: Additional CSCW terminology relating to GDSS design issues and groupware implementation to 1995 (expanded from Figures 4.14 and 4.16)



The **introduction and assimilation** of CSCW systems into organisations was researched by Applegate (1991). Assimilation is the process of successive alignment and adaptation of group, technology and task, within an organisational and environmental context.

Figure 5.4 displays additional terminology relating to group editors to 1995.

Modes of awareness were described by Koch and Burger (1995 in Schlichter, Koch, & Burger 1997) as **coupling** which includes coupled and uncoupled, and **synchrony** which includes synchronous and asynchronous. The terms coupling and synchrony were also used by Fuchs, Pankoke-Babatz, & Prinz (1995 in Hayashi, Hazama, Nomura, Yamada, & Gudmundsen 1999) who described **workspace awareness** in terms of synchronous coupled, asynchronous coupled, synchronous uncoupled, and asynchronous uncoupled.

Figure 5.4: Additional CSCW terminology relating to group editors to 1995 (expanded from Figure 4.15)

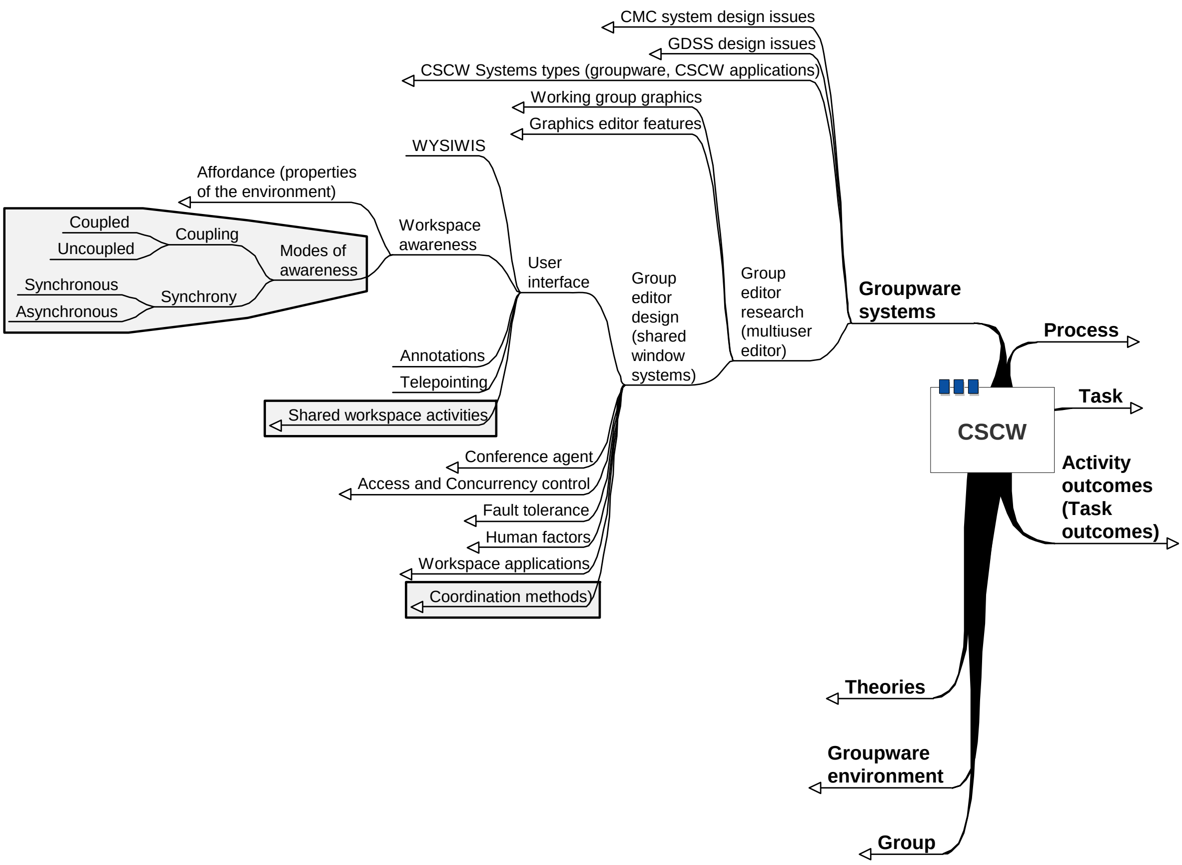
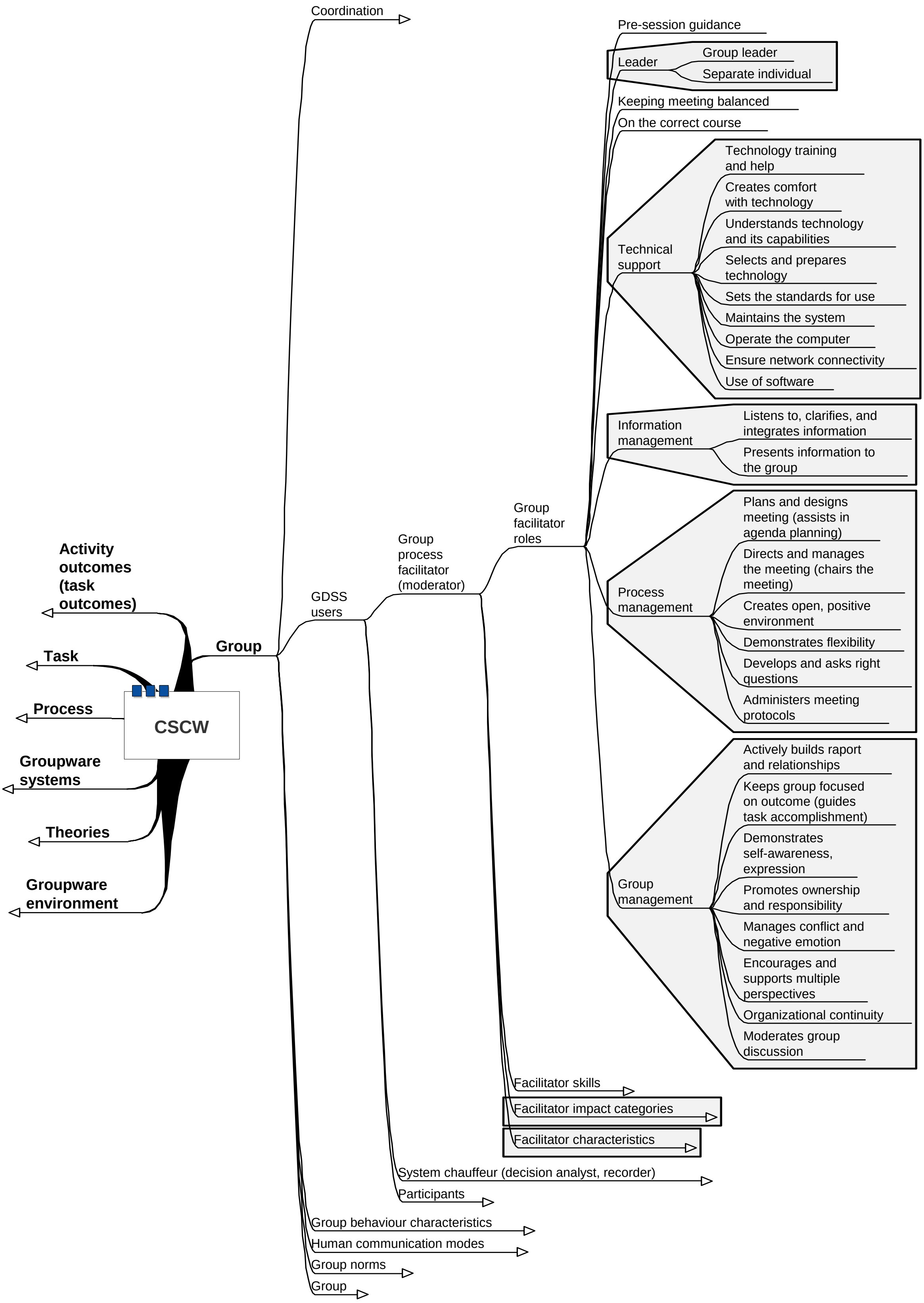


Figure 5.5 displays terminology to 1995 relating to the role of the facilitator in an electronically supported meeting. Some researchers considered that the human facilitator had been found to be a positive influential factor in GDSS usage (Clawson & Bostrom 1993 in Antunes & Ho 2001). However, other authors concluded that one danger of using a facilitator is that the contribution by the facilitator may negatively influence the substance of the discussion (Adkins, Walsh & Mittleman 1995; Brasher 1995).

Figure 5.5: Additional CSCW terminology relating to group facilitator roles to 1995 (expanded from Figure 4.23)



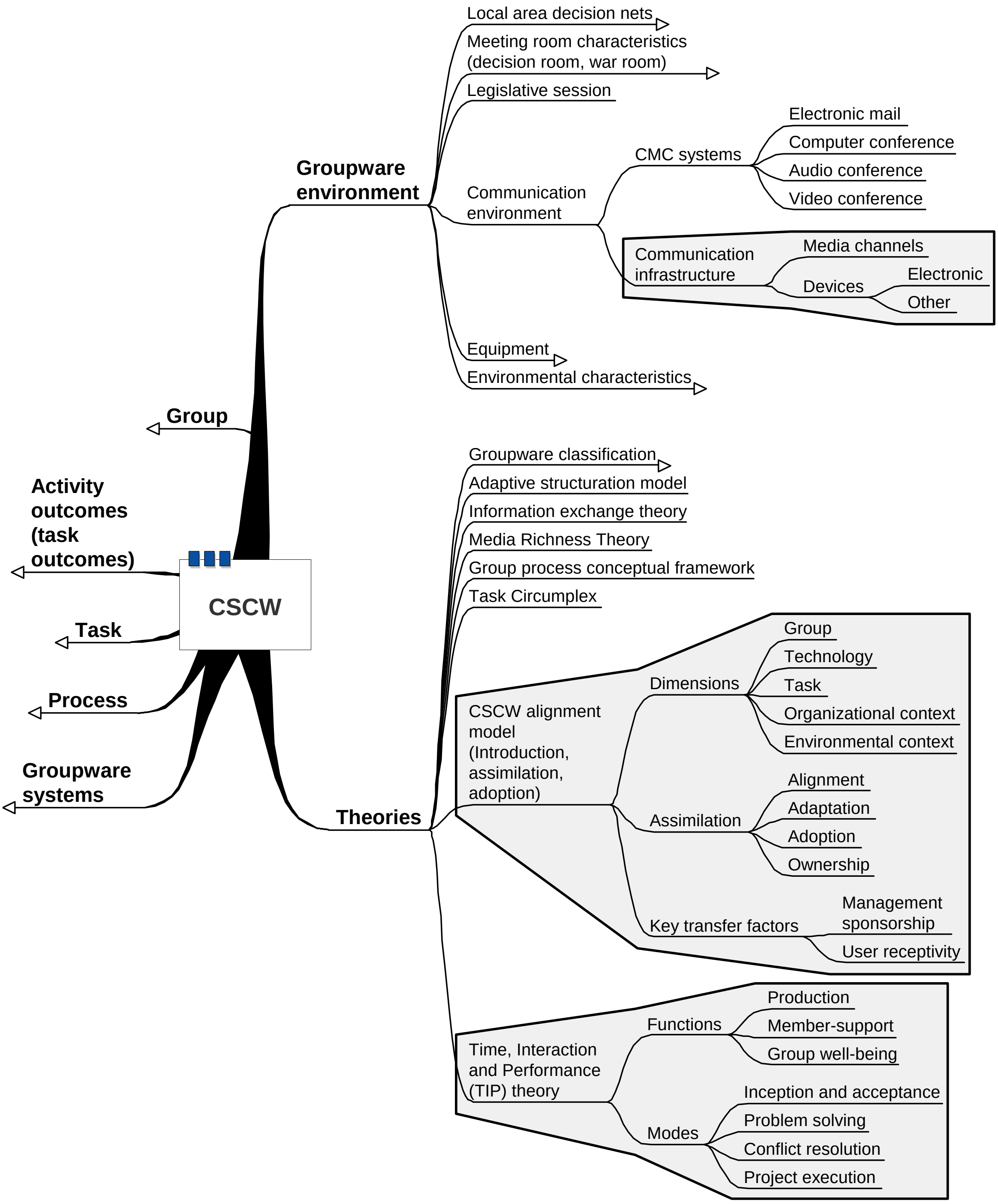
Some research was undertaken that considered the requirements for facilitation of electronic meetings from both the face to face and the distributed viewpoints. The role of the facilitator was found to change with the use of face-to-face technology. Lewis and Whiteley (1992) stated that there were facilitator roles, styles and models and facilitators required training and experience.

The critical dimensions and behaviours of the **facilitator role** in face-to-face computer supported environments were researched by Clawson and Bostrom (1993) and they identified 16 facilitator roles grouped into four categories:

- **Technology support –** GSS technology training and help. Technology training is differentiated according to the level of the user's experience. Training creates comfort with the technology. The technical trainer provides an understanding of the technology and its capabilities, and the technology specialist selects and prepares the technology for use.
- **Information management –** The facilitator as an information manager, listens to, clarifies, and integrates information, and presents the information to the group.
- **Process management –** The facilitator as a process manager, plans and designs meetings, directs and manages the meeting, creates an open, positive environment, demonstrates flexibility, and develops and asks the right questions.
- **Group management –** The facilitator as a group manager, actively builds rapport and relationships, keeps the group focused on outcomes, demonstrates self-awareness/expression, promotes ownership and responsibility, manages conflict and negative emotion, and encourages and supports multiple perspectives.

Figure 5.6 displays additional terminology relating to environment and theories. Environment is sometimes referred to as infrastructure. The CMC system terms related to the environment have been moved from the CMC design issues branch (attached to the groupware systems branch) in the hierarchy, to the groupware environment main branch under 'communication environment'.

Figure 5.6: Additional terminology relating to environment and theories to 1995 (expanded from Figures 4.20 and 4.21)



When researching CSCW technology, Applegate (1991) discussed the time/place issue of CSCW systems and developed theory known as the **CSCW alignment model** to study the introduction, assimilation and adoption of CSCW systems in organisations which could lead to mutual adaptation and ownership. Assimilation is dependent on alignment of three dimensions: groups, task and technology. ‘Adoption means the willingness to use an innovation, which may or may not lead to true ownership’ (Applegate 1991, p.19). Applegate considered the key transfer factors as management sponsorship and user receptivity.

Time, Interaction and Performance (TIP) theory describes work groups as time-based, multi-functional and multi-modal social systems. TIP theory suggests that a team with no past history that is working on a challenging problem with much technological and environmental uncertainty, such as a global virtual team, will have to engage in all functions and modes to avoid detrimental effects on performance. The three functions are production, member-support and group well-being. The four modes include inception and acceptance of the project, problem solving, conflict resolution, and project execution (McGrath 1991 in Jarvenpaa & Leidner 1998).

5.1.2 Summary of analysis from era 1991-1995

At the beginning of the 1990s researchers started using the terms groupware, CSCW, and GSS as generic terms for many of the computer systems that supported groups. Rodden (1991 in Barua, Chellapa & Whinston 1996) separated CSCW systems into 4 system types, messaging systems, conferencing systems, meeting systems and co-authoring systems. This grouping provided a reason in this analysis to link the CMC system design issues, meeting systems to include GDSS and EMS design issues, co-authoring systems or group editing systems and conferencing systems under the CSCW banner. However, there is a cross over of terminology for some of these system issues as many meeting systems are also described as conferencing systems.

The CSCW alignment model (Applegate 1991) and the Time, Interaction and Performance Theory (McGrath 1991 in Jarvenpaa & Leidner 1998) were the only theories identified as having been developed in the CSCW field in this era. The results of this analysis support the comments made by Whitaker (1996) who stated that theorisation in CSCW circles began to wane about the time *Lotus Notes* appeared. ‘Theory began losing out to technical details after the CSCW 1990 (Los Angeles) and ECSCW 1991 (Amsterdam) conferences’ (Whitaker 1996, p.8).

The earliest identified use of the term ‘workflow’ in the analysis was in the Ishii, Kobayashi and Arita (1994) and Grudin (1994b) articles. Workflow started to be used as a more descriptive term for cooperative work and coordinated work where loosely coupled groups undertake work to achieve a common purpose. Workflow management systems had been developed and used to support this work activity.

The number of new terms introduced between 1991 and 1995 is much lower than the previous era (era 1986-1990), which may show that the CSCW field had started to become more stable in relation to the terminology used by the researchers and the systems available to the researchers.

5.2 Era 1996 to 1999

Section 5.2 highlights examples of the additional terminology used in the CSCW field from 1996 to 1999. The terminology was identified from 97 articles by authors from 16 countries and 91 institutions and organisations.

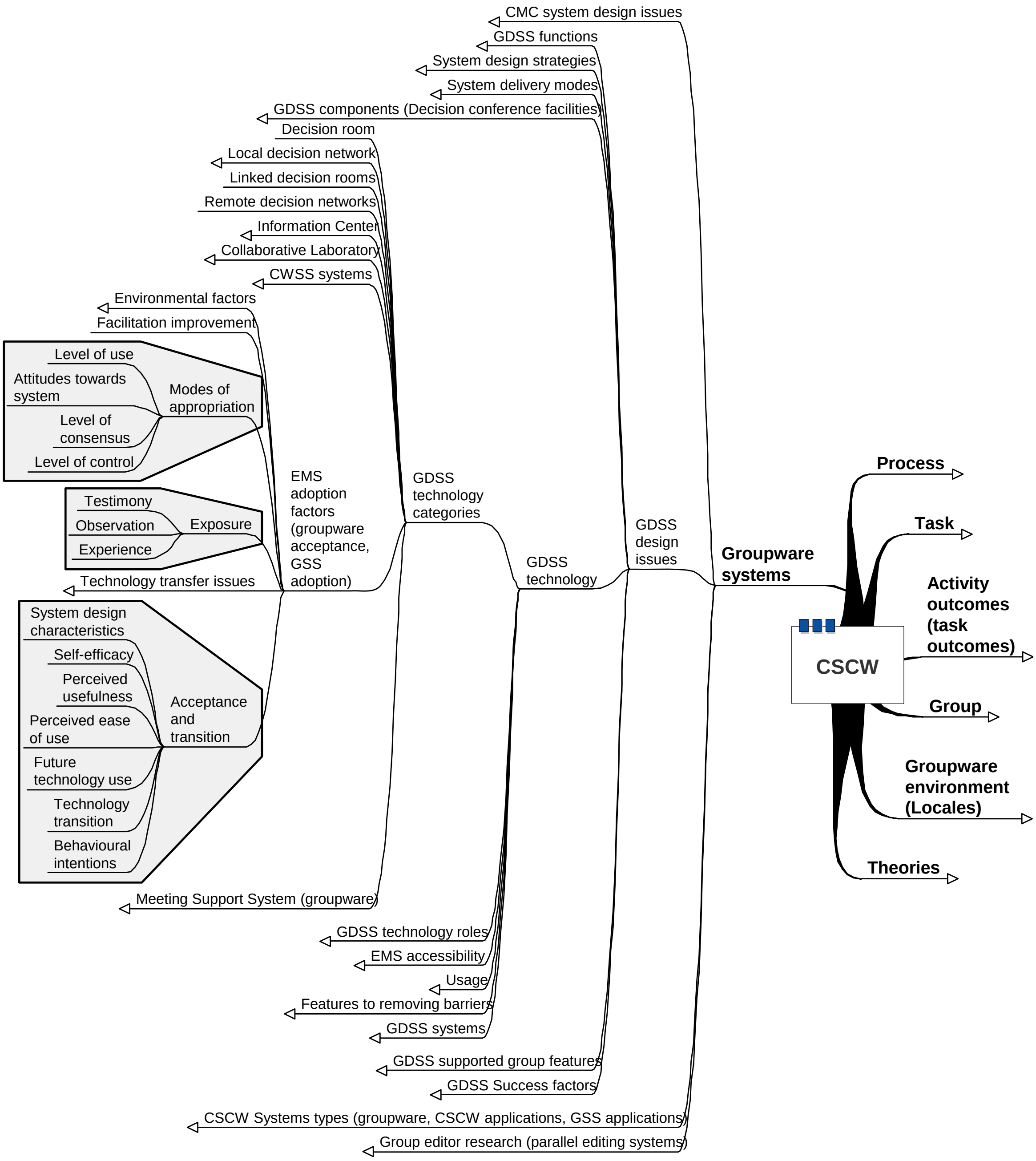
During the era 1996 to 1999, authors started using terminology to describe the impact of the Internet. It was about this time that the term ‘virtual’ started to be used to describe teams working at a distance. The terms ‘distributed’ and ‘remote’ had been used to describe these activities in earlier years.

Dennis, Quek and Pootherie (1996) stated that the internet provided an inexpensive alternative to client-server technology. Through the WWW interface the Internet suddenly became accessible to a global community without barriers of language, culture or geographical distinction. Tung and Turban (1998, p.175) stated ‘the rapid growth of the intranets and the Internet and the development of supportive software such as *Netscape Communicator*, are likely to accelerate the trend of people working in dispersed groups’. None of the articles in this analysis prior to 1996 were discussing the web or the Internet relating to collaboration. However, some authors did discuss distributed teams (for example, Turoff & Hiltz 1978; Cook et al 1987; Ishii 1990; Knoll & Jarvenpaa 1995).

5.2.1 New terminology analysis for era 1996-1999

Figure 5.7 displays additional terminology relating to GDSS technology categories to 1999.

Figure 5.7: Additional terminology relating to groupware system design issues to 1999 (expanded from Figure 5.3)



Research was being undertaken to consider the adoption of groupware systems into organisations. Hiltz et al. (1996) described four **modes of appropriation**, level of use, attitudes towards GSS system, level of consensus, and level of control. Briggs, Nunamaker and Sprague (1998-9) considered **exposure** to new technology which includes testimony, observation, and experience.

Acceptance and transition (Briggs, Nunamaker & Sprague 1998/9) of groupware or GSS is related to actual system use which is a function of behavioural intentions. Briggs, Nunamaker and Sprague (1998/9) described net value as having a number of dimensions: cognitive, economic, political, social, affective and physical.

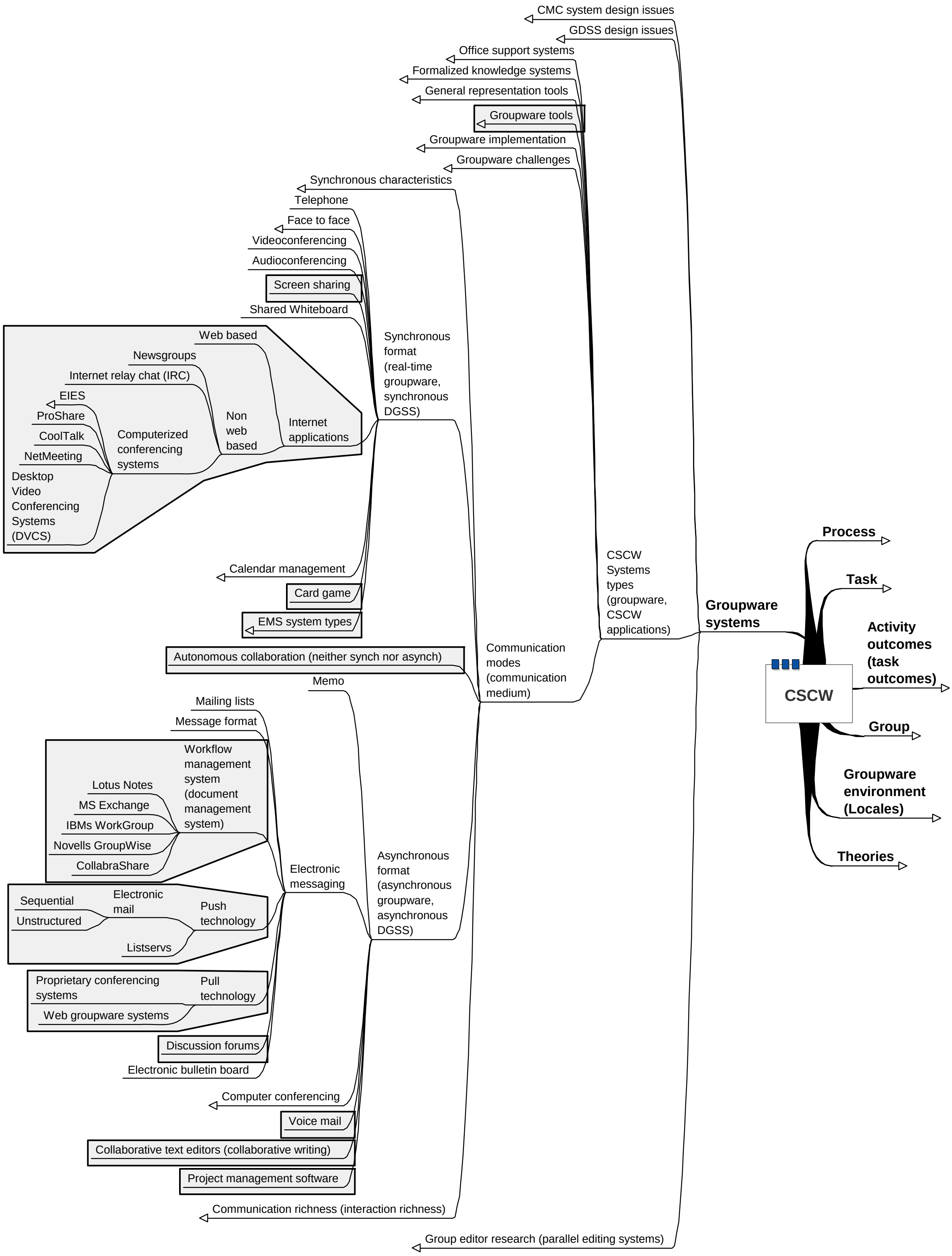
Figure 5.8 displays additional terminology relating to synchronous and asynchronous groupware and the Internet to 1999. The **Internet** was described by Cockburn and Greenberg (1998) as a network infrastructure for real-time communication. They stated that **Internet Applications** could include audio and video conferencing, shared electronic whiteboards, and collaborative text editors. They identified some real-time communication applications that ran on the Internet such as ProShare, CoolTalk, and NetMeeting. Internet applications such as Newsgroups and Internet Relay Chat (IRC) were discussed by Barua, Chellapa and Whinston (1996). These Internet applications did not support multimedia or hypertext linking capabilities like the web (Barua, Chellapa & Whinston 1996).

Asynchronous DGSS such as email, voice-mail, and messaging workflow management systems such as *Lotus Notes* were discussed by Tung and Turban (1998). Roseman (1996) called these systems Groupware. Other **workflow management systems** such as *MS Exchange*, IBM's *WorkGroup*, Novells *GroupWise*, and *CollabraShare* were described as groupware products by Schlichter, Koch and Burger (1997).

Push and pull technology were defined as:

- **Push technology** 'in that the sender of the message determines who receives it, not the receiver(s)' (p.66).

Figure 5.8: Additional terminology relating to CSCW system types to 1999 (expanded from Figure 5.3)



Pull technology ‘in that users select which messages to read. This ability to select messages and the limited structure offer some improvements in the reduction of information overload’ Dennis, Pootherie and Natarajan (1998, p.66).
Push technology includes email, and listservs. Pull technology includes proprietary conferencing systems, and web groupware systems. Dennis, Pootherie and Natarajan (1998) described email as sequential and unstructured.

Figure 5.9 displays additional terminology for visualisation techniques and editing systems to 1999.

‘The idea of attaching awareness to artifacts was extended to asynchronous use in TimeWarp’ (Edwards & Mynatt 1997 in Adams, Toomey & Churchill 1999, p.5). Group documents are **shared artefacts** that are jointly authored by a group of authors (Schlichter, Koch & Burger 1997). Characteristics of shared artefacts are different views, and different working modes such as individual work and collective work.

Visualisation techniques used in groupware systems, such as **radar overviews**, **fisheye views**, and **transparent layers** were described by Greenberg (1999b). Transparent overviews can be used for collaborating groups to stay aware of one another’s actions in a distributed groupware setting (Greenberg, Gutwin & Cockburn 1996 in Zanella & Greenberg 2001).

Different systems have been designed that use the four coordination methods of parallel, pooled, sequential and reciprocal, described by Turoff et al. (1993) (and originally displayed in Figure 5.4). **Parallel editing systems** described by Nunamaker et al. (1996) included *Quilt*, *SharedBook*, *ShrEdit*, *GroupSystems*, *GroupWriter*. Nunamaker et al. also discussed a **reciprocal editing** system known as *MULE* that had a common document, mutual adjusting, and reciprocal editing. **Sequential editing system** could be Markup tools such as *ForComment*, *Microsoft Word*, and *Lotus WordPro* (Nunamaker et al 1996/7).

Figure 5.9: Additional terminology for visualisation techniques and editing systems to 1999 (expanded from Figure 5.4)

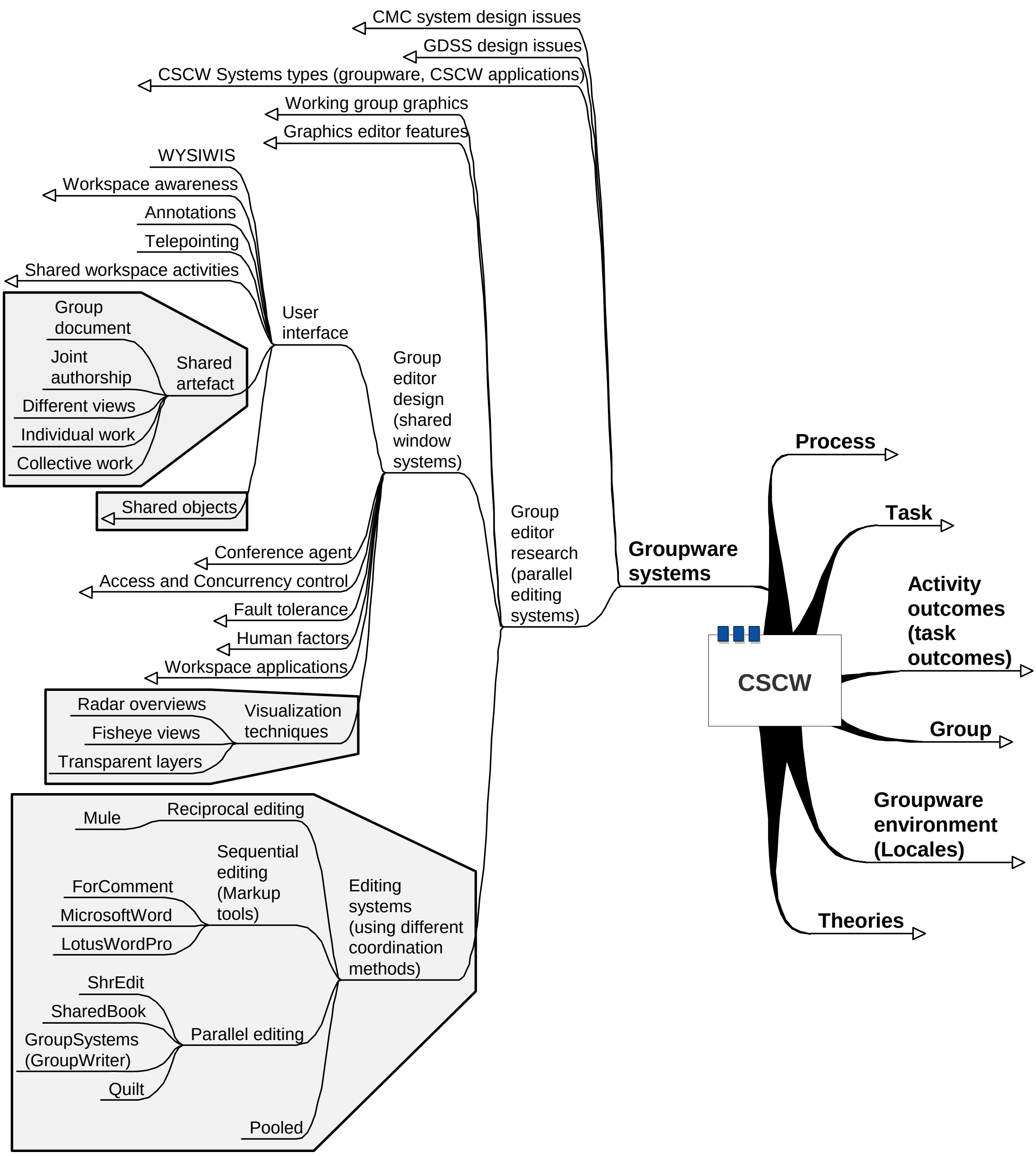
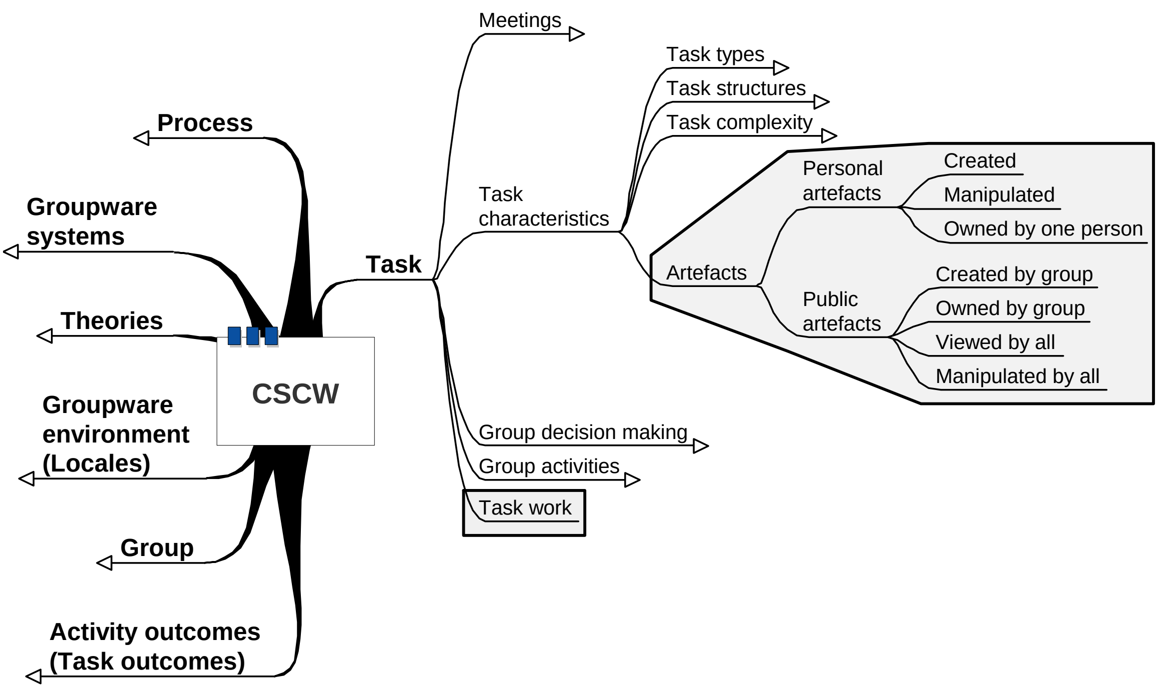


Figure 5.10 displays additional terminology relating to task to 1999.

Figure 5.10: Additional terminology relating to task to 1999 (expanded from Figure 5.5)

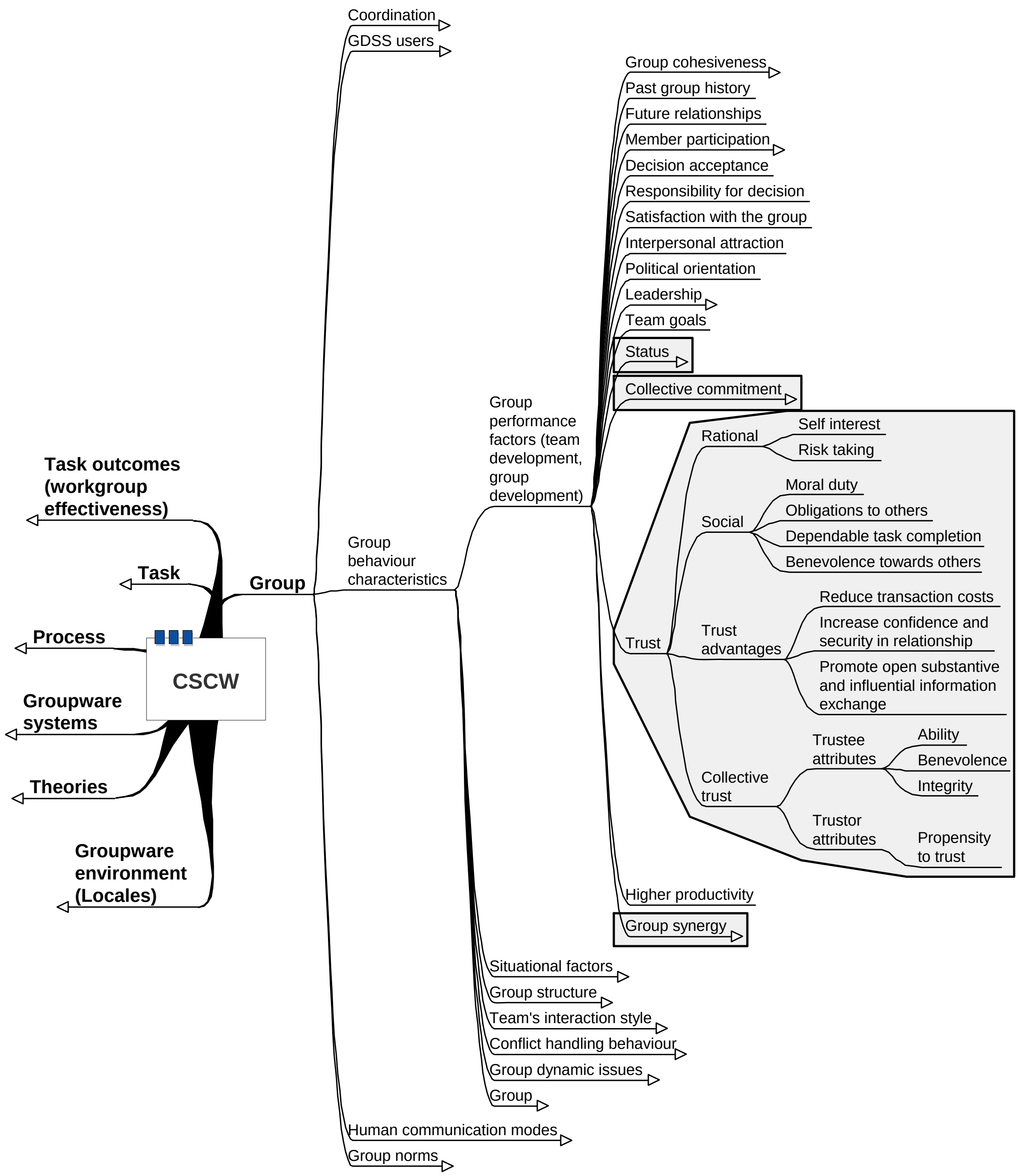


In a shared physical workspace, artefacts act as stage and props for rich person-to-person interaction (Gutwin & Greenberg 1996). A **public artefact (artifact)** is information held by a computer that is seen, heard and acted upon by people inhabiting the area around the computer. Public artefacts are created by the group, owned by the group, and viewed and manipulated by all (Greenberg, Boyle & LaBerge 1999). Schlichter, Koch and Burger (1997) described a group document as a simple example of a shared (public) artefact. **Personal artefacts** are things created, manipulated, and owned by one person (Greenberg, Boyle & LaBerge 1999).

Figure 5.11 displays additional terminology relating to group performance factors to 1999.

'Trust is based on the expectation that others will behave as expected' (Jarvenpaa, Knoll & Leidner 1998, p.30). The antecedents of **t**rust in a global virtual setting were explored by Jarvenpaa, Knoll and Leidner (1998) 'Trust is reported to reduce transaction costs, increase confidence and security in the relationship, and promote open, substantive, and influential information exchange' (p.29).

Figure 5.11: Additional terminology relating to group development to 1999 (expanded from Figure 5.7)



Trust can be viewed from a rational or social perspective. **Rational trust** focuses on self interest. Trust enables people to take risks. **Social trust** centres on moral duty and obligations to others. Trust is based on a trustee and a trustor. The **trustee attributes** are ability, benevolence and integrity. **Trustor attributes** are propensity to trust which is influenced by cultural, social, developmental experiences and personality type (Jarvenpaa, Knoll & Liedner 1998).

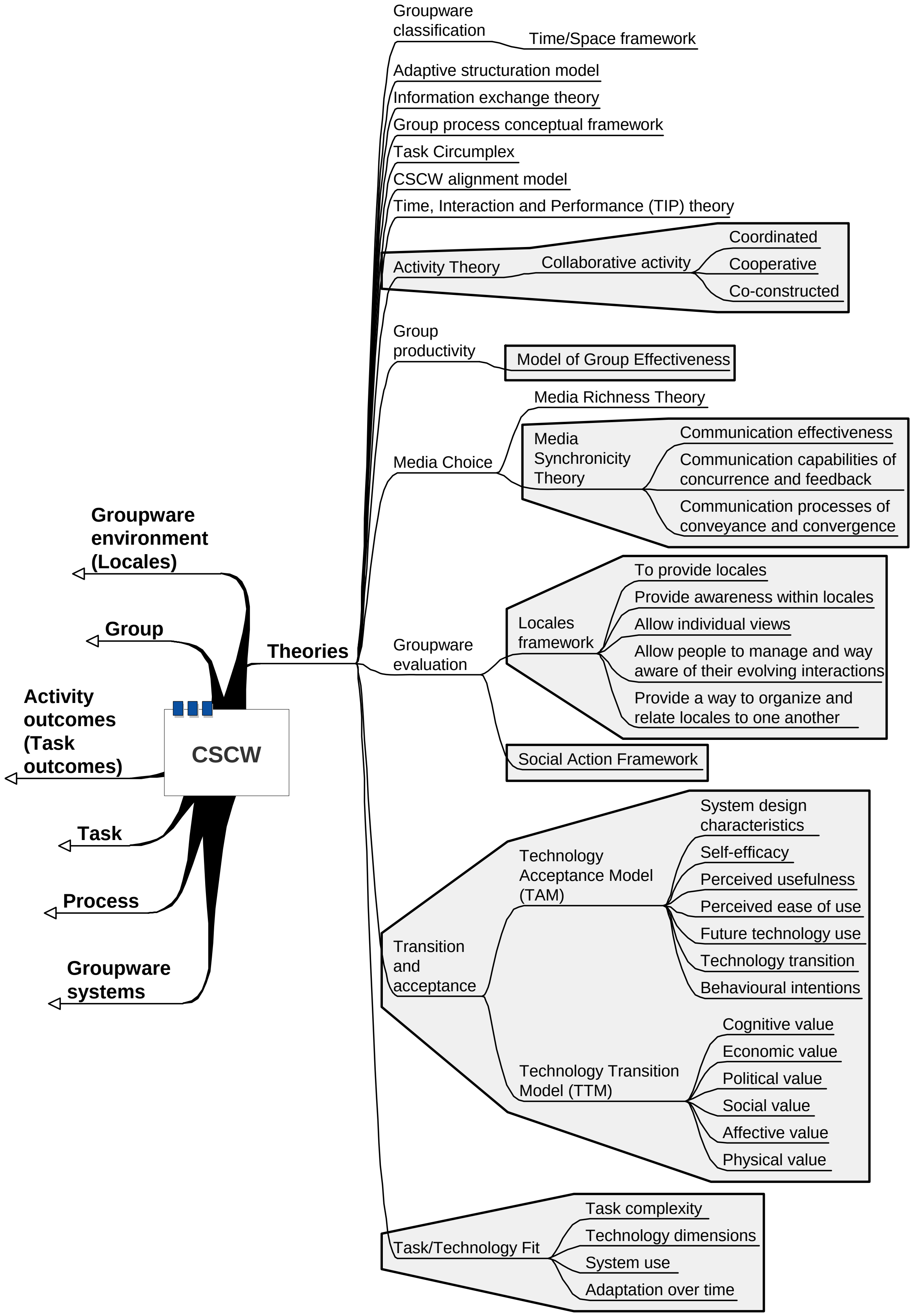
Collective trust is based on other team member's perceived ability, integrity, and benevolence, as well as the members' own propensity to trust. The outcome of research strategies suggested the presence of 'swift' trust (Jarvenpaa, Knoll & Liedner 1998). Two important dimensions of trust are dependable task completion, and benevolence towards others (Furst, Blackburn & Rosen 1999).

Figure 5.12 displays additional terminology relating to theories to 1999.

Tung and Turban (1998, p.176) stated that 'because distributed group support systems is a new research area, there is very little theoretical or empirical research on the topic'. Many researchers, however, (Cook et al. 1987; Nunamaker et al. 1991, Hiltz et al. 1996; Pervan 1998; Turban & Aronson 2001) use DeSanctis and Gallupe's (1987) **time/space framework** as a starting point for classifying groupware or GSS systems.

Activity Theory is a 'social psychological theory focusing on the developmental transformations and dynamics in collective human activity' (Bardram 1998, p.91). **Activity Theory** is used as a base for understanding the dynamics of collaborative work activity. Activity Theory was described by Bardram (1998) as having a three level hierarchy structure of collaborative activity (Engstrom et al. 1997 in Bardram 1998). The three levels of collaborative activity that were identified were coordinated, cooperative and constructive (Bardram 1998; Bertelson & Neilson 1999). Bardram discussed the nature of cooperative work in relation to workflow systems and described communication as the primary way in which collaborative activities are accomplished by humans in a social setting.

Figure 5.12: Additional terminology relating to theories to 1999 (expanded from Figure 5.8)



Media Synchronicity Theory (MST) is ‘the extent to which the environment encourages individuals to work on the same activity, with the same information, at the same time…MST proposes that communication effectiveness results from matching the communication capabilities of concurrence and feedback to the communication processes of conveyance (the exchange of information) and convergence (the development of a shared meaning about information)’ (Dennis, Pootherie & Natarajan 1998 in Baker 2002, p.81).

Technology Acceptance Model (TAM) was developed by Davis Bagozzi and Warshaw (1989 in Briggs, Nunamaker & Sprague 1998/9) to predict future technology use after the first hour of exposure. ‘TAM is a causal model of actual use, the key indicator of success for technology transition’. A number of studies have shown that TAM is valuable for predicting user acceptance and use. TAM variables include system design characteristics, self-efficacy, behavioural intentions, actual technology use, perceived usefulness of the technology, and perceived ease of use (Briggs, Nunamaker & Sprague 1998/9a).

Briggs, Nunamaker and Sprague (1998/9a) studied technology acceptance and GSS transition and developed the **Technology Transition Model (TTM).** ‘Transition is the period of time that starts when some person in an organisation expresses interest in using a new technology and that ends when a community of users has become self-sustaining’ (p.2). ‘TTM posits that actual system use is a function of behavioural intentions (B). It posits, however, that B will be a multiplicative function of perceived net value (v) and perceived frequency of net value (F)’ (p.4). **Perceived net value** may include usefulness which is the degree to which a user believes the technology will enhance job performance. They stated that **net value** has a number of dimensions, including cognitive, economic, political, social, affective and physical. **Cognitive value** may include demands on attention (cognitive effort over time). Cognitive value can be technical, access and conceptual. **Economic value** may include more efficiency and thus higher profits, or it might cause a prospective user to lose a job. **Political value** may include power shifts. **Social value** may affect personal relationships of prospective users. **Affective value** may include less frustration or more feelings of loneliness and physical value may impact such things as eye strain or noise level (Briggs, Nunamaker & Sprague 1998/9).

5.2.2 Summary of analysis from era 1996-1999

The use of virtual teams appeared to be increasing during this era (Furst, Blackburn & Rosen 1999). By 1996 research had begun to 'identify specific competencies for the global virtual work environment including cross-cultural communication, process facilitation, creating and sustaining remote team work and managing information technology' (Hutchins 1996 in Holton 2001, p.37). However, the increase had not been accompanied by research efforts to better understand the social and psychological contributions to effective virtual teams (Furst, Blackburn and Rosen 1999).

More than 75 web groupware systems, mainly web conferencing systems, were available and most had debuted since 1996 (Dennis, Pootherie & Natarajan 1998). Dennis, Pootherie and Natarajan (1998) compared traditional Internet systems (email, listservs, and usenet newsgroups) with web-based groupware. Systems, such as *Lotus Notes* (WFMS), *GroupSystems* and *VisionQuest* (brainstorming and decision oriented systems) required proprietary, often expensive, software. Also by the mid 1990s, The University of Georgia had become a centre for researching web-based groupware. *TCB Works,* developed at the University of Georgia, had a client-server architecture and required *Netscape* or other compatible browser (Dennis, Quek & Pootherie 1996).

Other institutions that were notably researching the Internet, web and cyberspace were University of Texas, Indiana University, Washington State University, in the USA; University of Calgary, Canada; and Spring Analytica, Switzerland.

Workspace and communication awareness were the focus of Gutwin, Greenberg, Chang, and Roseman from the University of Calgary, Canada. Visualisation techniques such as radar overviews, fisheye views, and transparent layers were being researched to provide awareness of others in a distributed synchronous environment. Schlichter, Koch and Burger (from Technische Universitat, Germany) and Hayashi, Hazama, Nomura, Yamada, and Gudmundsen (from FujiXerox, Japan) also studied workspace awareness.

Types of shared artefacts that are jointly authored were described by Schlichter, Koch and Burger (1997). Joint authoring is undertaken in group editor systems.

Group editor systems may be synchronous or asynchronous. Workspace awareness is important to synchronous group editor systems.

‘Push’ and ‘pull’ terms were defined by Dennis, Quek and Pootherie (1996). They described how information overload can be reduced by using pull technologies.

Interaction richness was described and considered in terms of how lean and rich channels support collaborative work.

Facilitation had previously been researched during face-to-face meetings. During this era the art of facilitating virtual teams started to be investigated.

Mobile activities were being described by researchers from Sweden, Norway and America. Bergqvist et al. (1999) discussed mobile meetings. Fagrell, Ljungberg and Kristoffersen (1999) explored support for knowledge management in mobile work. Greenberg, Boyle and LaBerge (1999) researched the use of *SharedNotes* to transfer artefacts between PDAs and shared public displays. *SharedNotes* also allowed distributed real-time meetings.

More theory was being developed and started to be used in CSCW research. Activity Theory was used as a base to study the dynamics of cooperative work (Bardram 1998). Hackman’s model of group effectiveness for face-to-face teams, was used as a starting point to develop a theory for virtual team effectiveness (Furst, Blackburn & Rosen 1999). Media Synchronicity Theory (MST) was used to describe the extent to which the communication environment encourages individuals to work on the same activity, with the same information, at the same time (Dennis, Pootherie & Natarajan 1998 in Baker 2002).

Theory was being developed for groupware evaluation such as Locales Framework (Greenberg et al 1999), Mechanics of Collaboration (Gutwin & Greenberg 1999), and Social Action Framework (Ngwenyama & Lyytinen 1997). Technology acceptance and transition were being researched and the theory included Technology Acceptance Model (Davis, Bagozzi & Warshaw 1989 in Briggs, Nunamaker & Sprague 1998/9) and Technology Transition Model (Briggs, Nunamaker & Sprague 1998/9). Also Task/Technology Fit, which was developed by Zigurs and Buckland

(1998), focused on task complexity and technology dimensions as related to system use and adaptation over time.

5.3 Era 2000 to 2003

As explained in Chapter 3 and shown in Table 3.7, one hundred articles were analysed for the four years from 2000 to 2003. This section highlights examples of the additional terminology from these 100 articles from authors from 78 different institutions or commercial enterprises, across 16 different countries.

5.3.1 New terminology analysis for era 2000-2003

Figure 5.13 displays additional terminology relating to groupware systems design issues to 2003.

GSS adoption and diffusion characteristics were described by Pollard (2003) who included human factors, internal organisational context, external organisational environment, and GSS management activities. Pollard (2003) explained that **continued use issues** included perceptions, experience, attitudes, communication behaviour, and environment. These were perceived as **human factors**. Adoption and diffusion of systems into organisations had been researched and presented in previous eras using different terminology, for example, Applegate (1991, p.15) used the terms ‘introduction’ and ‘assimilation’ when discussing a research framework for CSCW technologies that are ‘new to the world’. Grudin (1988) discussed environmental factors that impacted ‘groupware acceptance’ such as user training, management buy-in and vendor follow-through. Other authors described ‘acceptance and transition’ when researching system use, for example, Davis, Bagozzi & Warshaw 1989 in Briggs, Nunamaker & Sprague 1998).

Two factors were identified that produce collective adoption of synchronous groupware. The first was to absorb costs associated with ‘acquiring new skills, purchasing hardware and software, and exercising “communication discipline” - meaning regularly reading and responding promptly to communications. Second, there must be variation in user abilities to contribute to and benefit from use of interactive communication systems.’ (Markus 1990 in Herbsleb et al. 2002, p.171).

Adoption requires a critical mass of users who demonstrate the utility of the groupware to others (Herbsleb et al 2002). Adoption was described, by Turner and Turner (2002), as the decision to purchase, and the routine use of the technology which were both considered **internal organisational context** factors.

Figure 5.13: Additional terminology for groupware system design issues to 2003 (expanded from Figure 5.9)

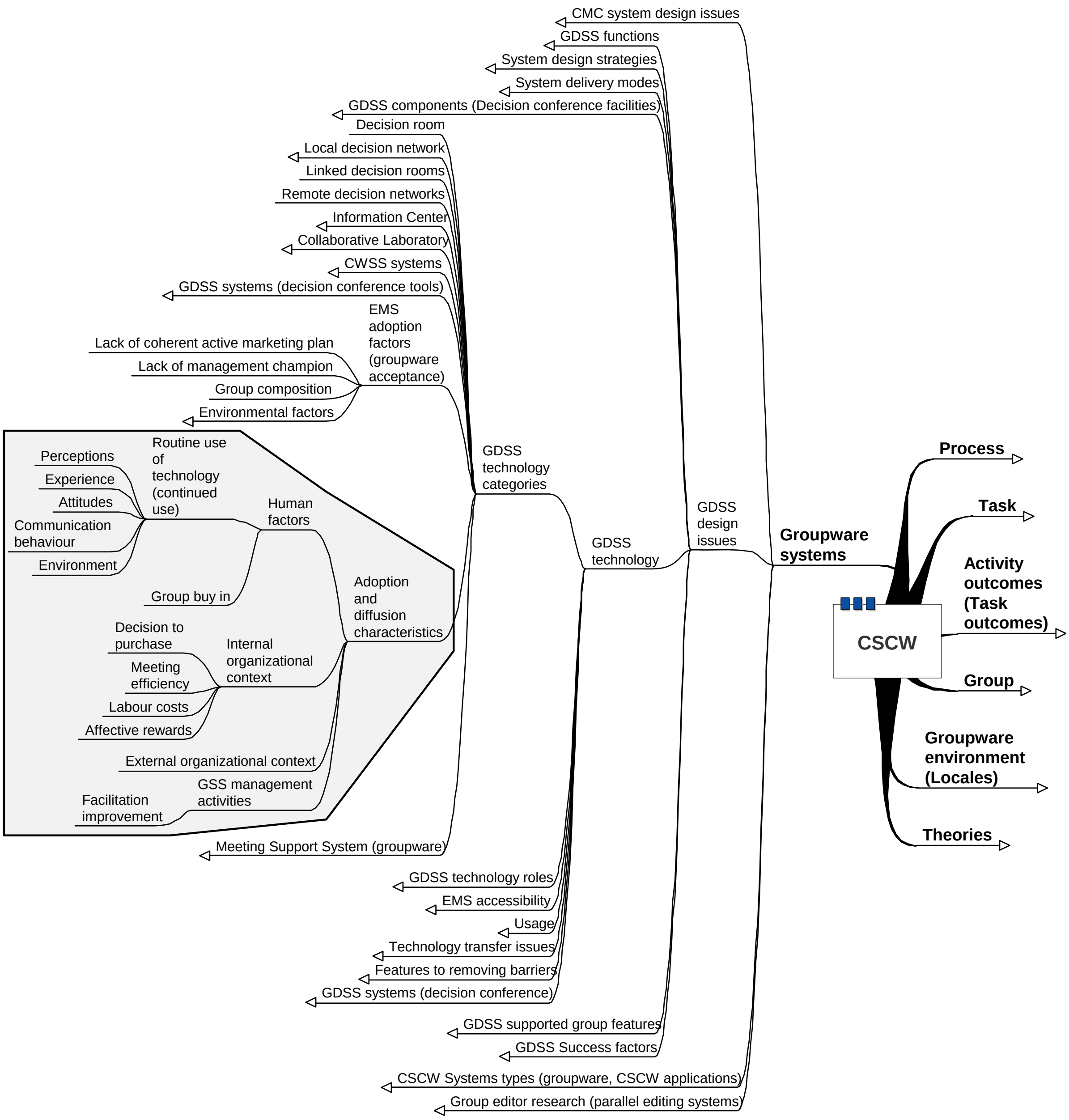


Figure 5.14 displays additional terminology relating to workflow systems and social interaction spaces to 2003. **Workflow management system (WFMS)** characteristics include workflow queue, scheduling, a routing system, and a tracking system for task performance metrics such as task completion time (Greasley 2003).

Social interaction spaces which included digital cities, community networks, portals (eBay, Slashdot), electronic bulletin board systems, newsgroups, and mailing lists were described by Girgensohn and Lee (2002).

Figure 5.14: Additional terminology relating to workflow systems and social interaction spaces to 2003 (expanded from Figure 5.10)

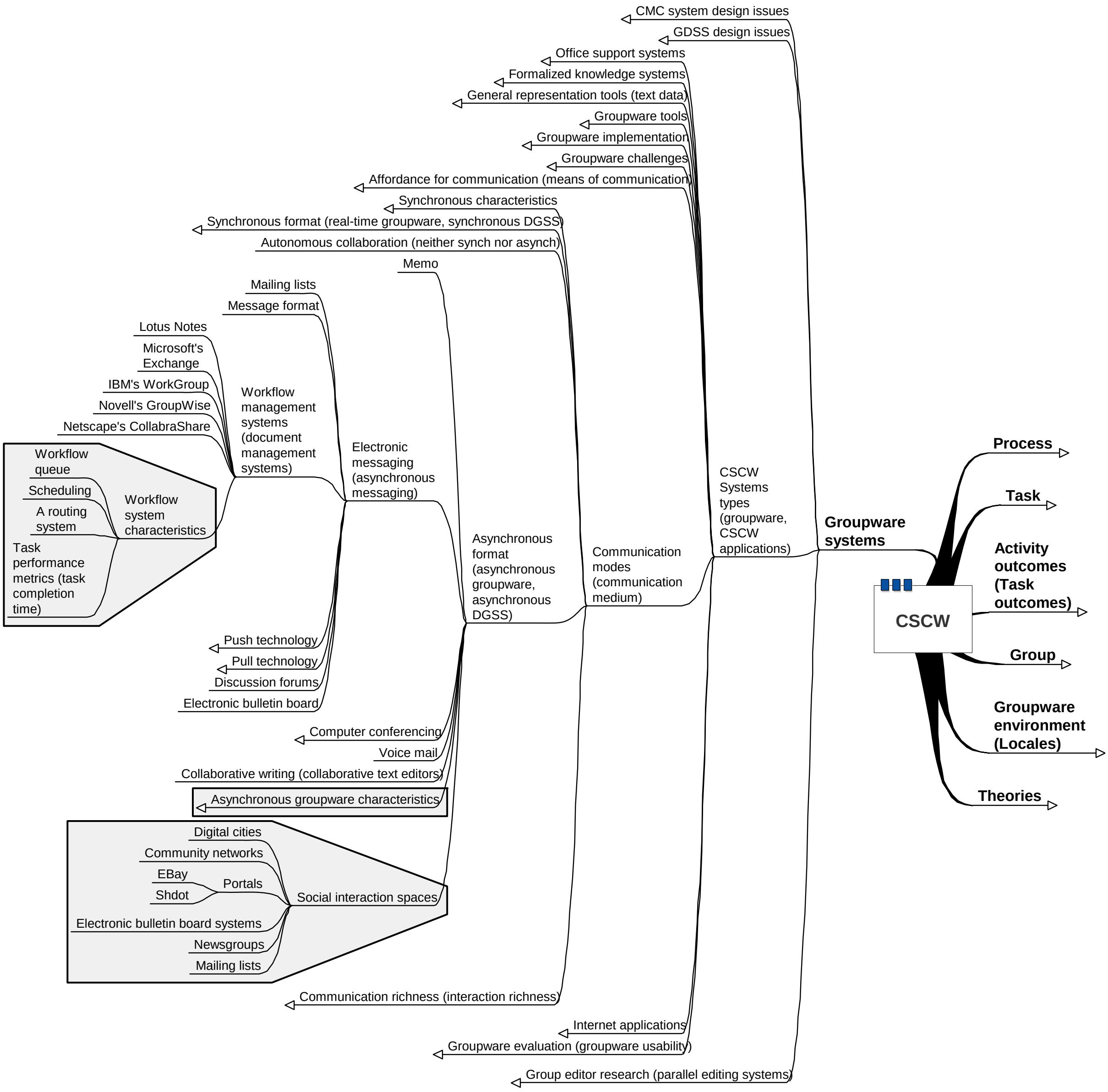
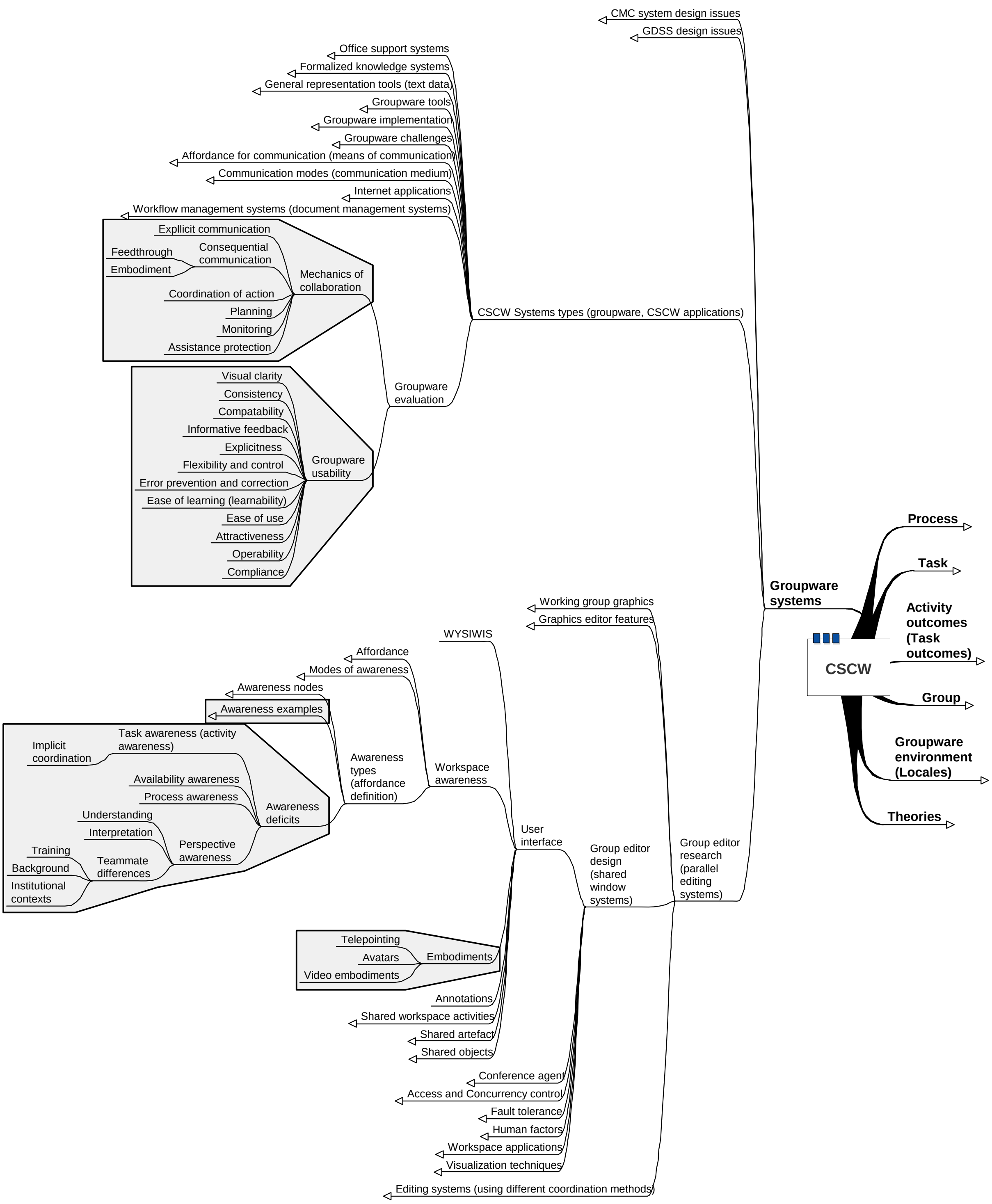


Figure 5.15 displays additional terminology relating to group editors to 2003.

Figure 5.15: Additional terminology relating to group editors to 2003 (expanded from Figures 5.11 and 5.12)



Mechanics of collaboration included explicit communication, consequential (implicit) communication (feedthrough, embodiment), coordination of action, planning, monitoring, assistance, and protection (Gutwin & Greenberg 2000; Potts-Steves et al. 2001).

Evaluation of an existing GSS was studied by Siao (2003). Siao identified nine **usability dimensions** known as the usability framework. The dimensions are visual clarity, consistency, compatability, informative feedback, explicitness, flexibility and control, error prevention and correction, ease of learning, and ease of use. The components of **usability** are learnability, operability, attractiveness, and compliance (ISO/IEC 9126-1 (CD proposal) in Sikorski 2002).

Awareness deficits include activity awareness, availability awareness, process awareness, and perspective awareness. **Perspective awareness** refers to understanding, interpretation, and teammate differences such as training, backgrounds, and institutional contexts) (Jang, Steinfield & Pfaff 2000).

Embodiments can be telepointers, avatars and video embodiments. **Telepointers** are the simplest form of embodiment, and show the location of each team member's mouse cursor. **Avatars** are embodiments that represent people with stylised pictorial representations of actual bodies. **Video embodiments** are video images of team members with the representation of the computational workspace (Gutwin & Greenberg 2002).

Figure 5.16 displays additional terminology relating to satisfaction measures to 2003.

Satisfaction measures can be taken relating to satisfaction with facilitator, agenda, software, task, meeting process, and meeting outcome (Lester et al. 2003). Martz and Shepherd (2003) added participant satisfaction to this list of satisfaction measures.

Figure 5.16: Additional terminology relating to productivity resources and satisfaction measures to 2003 (expanded from Figure 5.6)

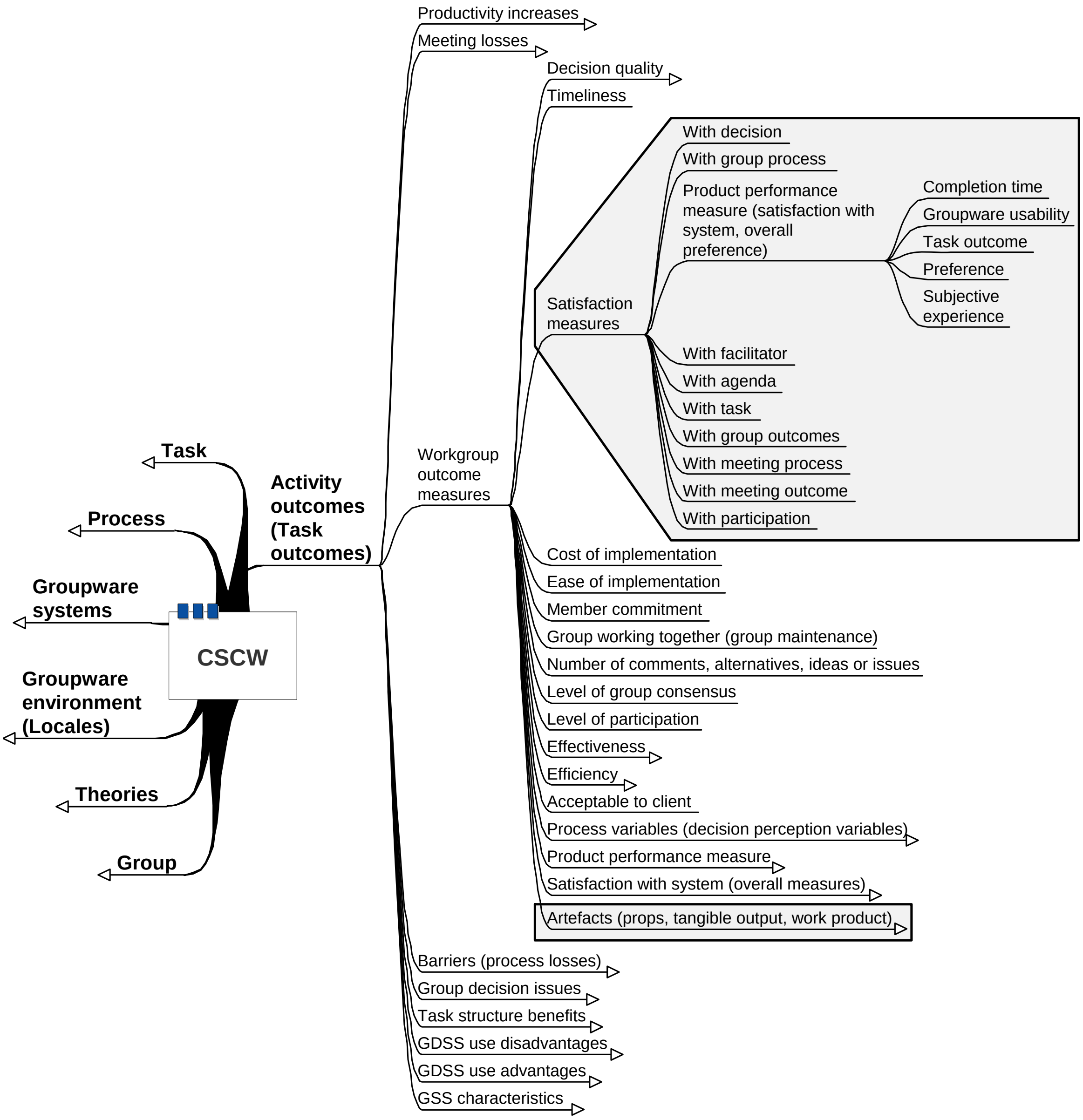


Figure 5.17 displays additional terminology relating to activity or task outcomes to 2003

Previous studies have shown that GSS have had an impact on **meeting outcomes** that included ‘meeting efficiency, group buy-in, labour costs, and affective rewards’ (Siao 2003, p.3). Also, time to decision and decision quality were used as surrogate measures of group **Information sharing effectiveness** by Ngwenya and Keim (2003). **Quality of meeting outputs** can be calculated by measuring the number of ideas, the number of unique ideas, and the levels of consensus (Corbitt & Martz 2003). **Performance** is described in terms of effectiveness (decision quality or number of ideas generated), efficiency (time to complete the task), and participant satisfaction (the process or outcome) (Dennis & Wixom 2001).

Sikorski (2002) when developing an online dictionary for human computer interaction (HCI) defined **usability outcomes** as effectiveness, efficiency, and satisfaction (ISO 9241-11 in Sikorski 2002). **Effectiveness** included accuracy, and completeness (ISO 92041-11 in Sikorski 2002). **Efficiency** related to the resources expended (ISO 9241-11 in Sikorski 2002). Sikorski (2002) from (ISO 9241-11) described **satisfaction** in relation to comfort and acceptability of system use.

Efficiency and effectiveness characteristics contributed to an organisation's reduction of costs, professional appearance, reputation, and fostering of teamwork in employees. Efficiency and effectiveness capabilities improve group decision-making, communication, collaboration, knowledge sharing and distribution, idea generation or brainstorming and distance learning (Stough, Eom & Buckenmyer 2000 in Bose 2003). Effectiveness in new product development was researched by Schmidt, Montoya-Weiss and Massey (2001) who compared different modes of communication: individual, face-to-face teams and virtual teams. They explained that the social influences, normative influence, and informational influence, all contributed to **conformity in teams** (Deutsch & Gerard 1955 in Schmidt, Montoya-Weiss & Massey 2001).

Some **Process losses** were identified by Dennis and Wixom (2001) during a meta-analysis of GSS research and a discussion of the support parallelism and anonymity provide to participants. These process losses were production blocking, negative evaluation, apprehension, pressure to conform, and reluctance to contribute. Some group dynamic problems (**group losses**) such as social loafing, lack of focus, evaluation apprehension, and production blocking were described by Wood and Blyth (2002). **Flaming behaviour** is also a group loss and includes rude compulsive messages and expressions of extreme views. (Kielsler & Sproul 1992 in Handel & Herbsleb 2002).

Figure 5.17: Additional terminology relating to activity or task outcomes to 2003 (expanded from Figure 5.6)

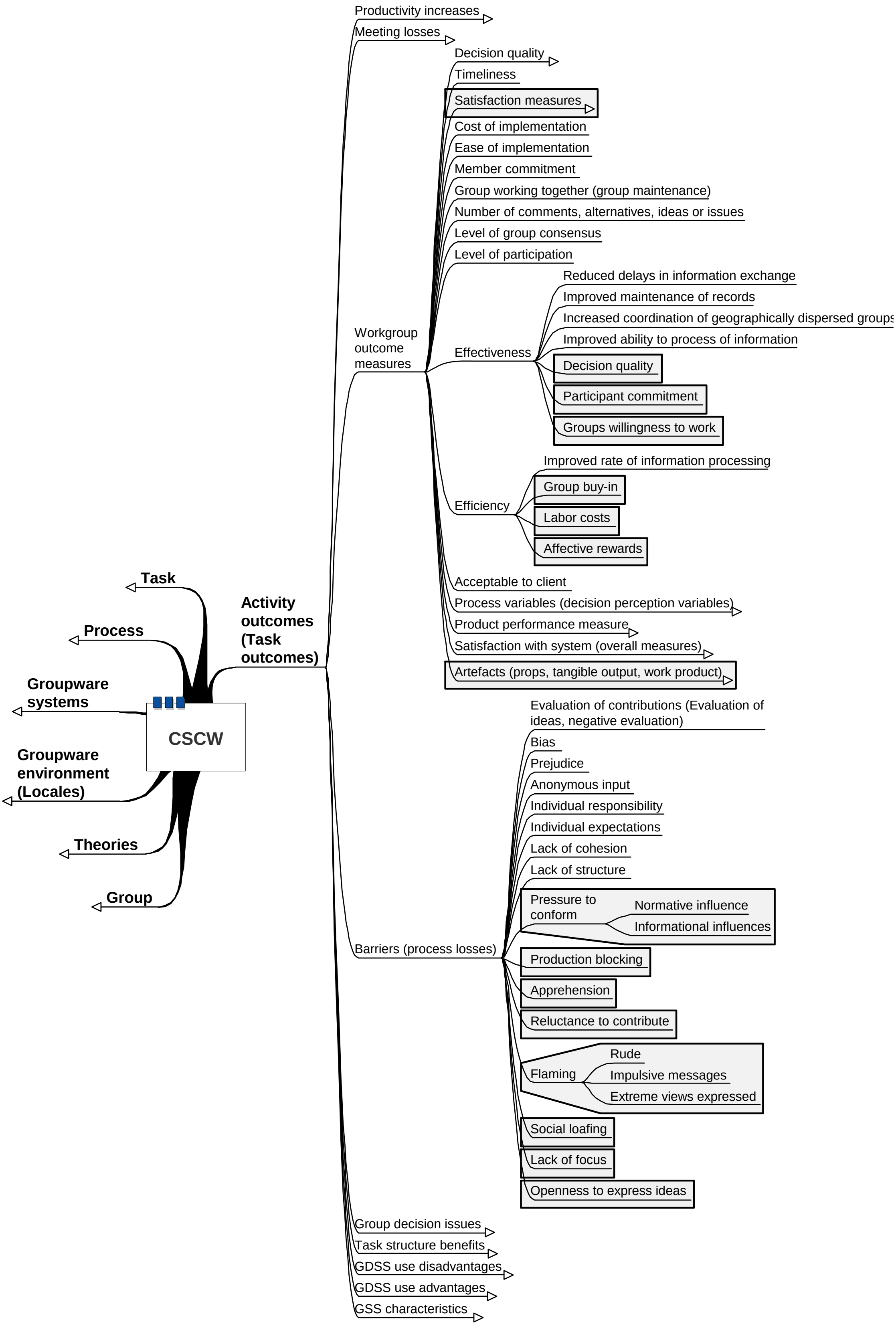
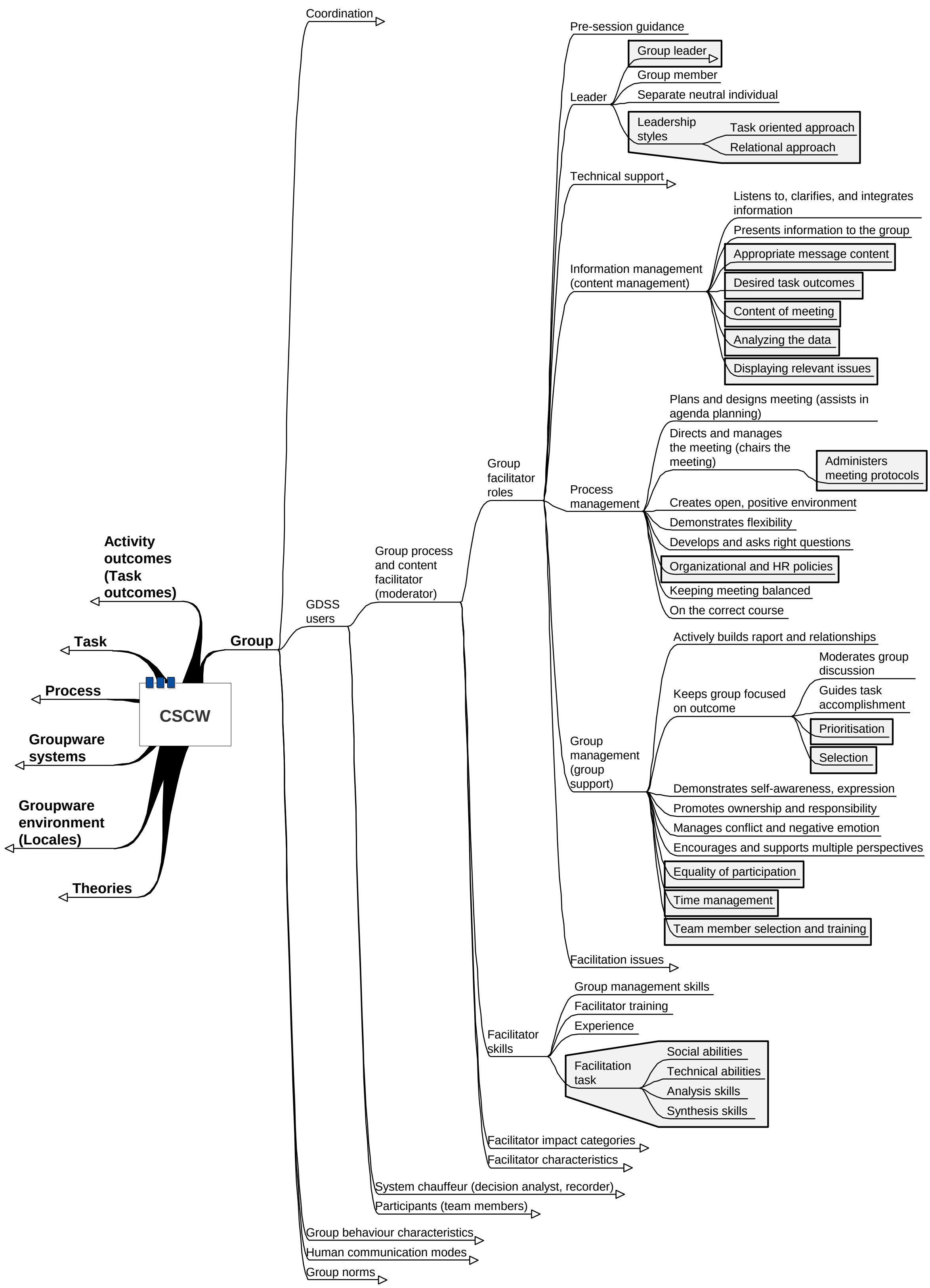


Figure 5.18 displays additional terminology relating to group facilitation to 2003.

Figure 5.18: Additional terminology relating to group facilitation to 2003 (expanded from Figure 5.15)



Two **facilitator leadership styles**, task-oriented style and relationship style were identified and researched by Hostager et al. (2003). Task oriented style is where facilitators emphasise a task focus by adopting a cold impersonal and directive facilitation style and by rigidly adhering to the script of a task-oriented agenda. Relationship style is where facilitators can focus on people or relationships by displaying a warm, personal and participative facilitation style and by guiding the group through a process oriented agenda in a flexible manner. Lester et al. (2003, p.321) referred to Fiedler (1978) when describing the **characteristics of the leader** of a group, these were leader-member relations, position power and task structure.

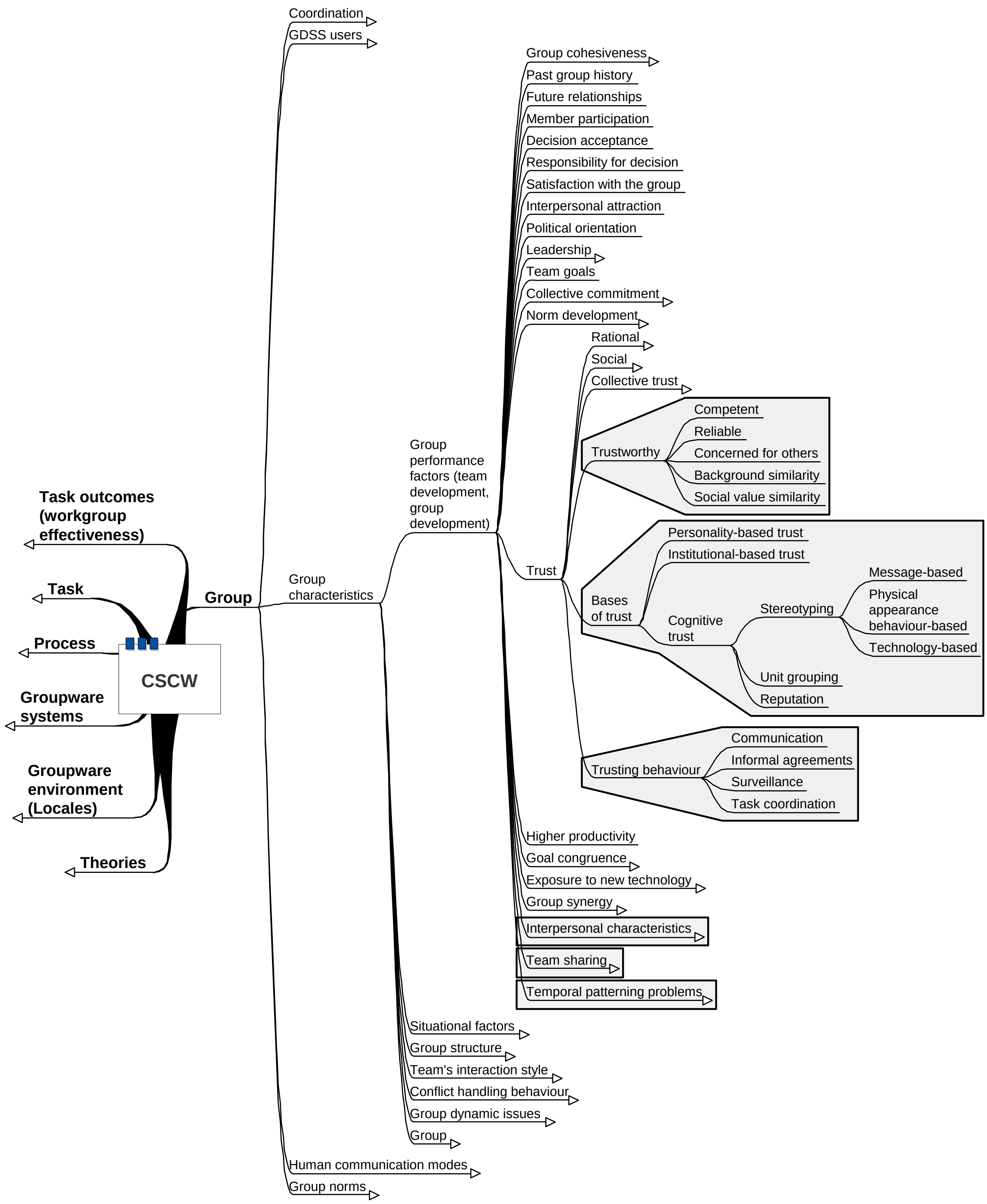
Facilitator strategies may include the selection and use of appropriate communication channels, and appropriate message content. Other strategies are team member selection and training, organisational and HR policies, team's desired task outcomes, and biases towards communication channels (Pauleen & Yoong 2001). DeVreede, Niederman and Paarlberg (2002) undertook a study to evaluate GSS facilitators from the participant's viewpoint. They described the facilitator role as both process and content facilitation. **Process facilitation** provides structure and general support to groups during meetings. Group support focuses on issues such as equality of participation, keeping members on track, and time management. **Content facilitation** focuses on content of meeting, analysing the data, and displaying relevant issues (DeVreede, Niederman & Paarlberg 2002).

Facilitation task encompasses **'**social and technical abilities, analysis and synthesis skills, making use of planning, and flexibility, which opens multiple opportunities for computational support' (Antunes & Ho 2001, p.5).

Figure 5.19 displays additional terminology relating to group to 2003.

Trust is a major factor that impacts the cohesiveness of virtual team members. but there are no instruments that measure the different bases of trust. Three **bases of trust** have been identified, personality-based trust, institutional-based trust, cognitive trust. Cognitive trust is divided into stereotyping, unit grouping and reputation categorisation. **Stereotyping** can be of three distinct types, message-based, physical appearance/behaviour-based and technology-based (Sarker, Valacich & Sarker 2003).

Figure 5.19: Additional terminology relating to group to 2003 (expanded from Figure 5.11)



Trust and openness are social variables (Fjermstadt & Hiltz 2001 in Corbitt & Martz 2003). **Trusting behaviour** was described by Currall and Judge (1995, in Morris, Marshall & Rainer 2002) as communication, informal agreements, surveillance, and task coordination. When a person is **trustworthy** they may be seen as competent, reliable, concerned for others, have a similar background, and have a similar social value (Greenspan et al. 2000). **Trust measures** of ability, benevolence, integrity of the trustee, and trustors propensity to trust described by Sarker, Valacich and Sarker (2003), had previously been described by Jarvenpaa, Knoll and Leidner 1998 as trustee attributes.

Figure 5.20 displays additional terminology relating to virtual teams and group behaviour to 2003.

Virtual team characteristics include having a clear elevating goal, results-driven structure, competent team members, arms-length commitment, specialist climate, standards of excellence, external support and recognition, and principled leadership (Thomsett 2000e). Lurey (2000, p.120) found that virtual team members need everything to be reinforced in a much more structured, formal process.

Goal agreement, communication quality, appropriate communication technology, and communication effectiveness including communication frequency, communication quality and social communication are critical to the **success of virtual teams** during negotiation sessions (Davison, Fuller & Hardin 2003). Virtual teams are often temporary, culturally diverse, geographically dispersed, and electronically communicating workgroups (Pauleen & Yoong 2001).

Group process refers to two broad categories of group behaviour, namely, maintenance behaviours and task behaviours. **Maintenance behaviours** are required to build and maintain group synergy and momentum and includes open communications, level of collaboration and participation, level of conflict, and level of trust. **Task behaviours** are needed to solve problems and include information processing, consensus generating, and decision making (Gladstein 1984 in Pare & Dube 2000). **Group behaviour** such as socialising, norming, and conflicting may be occurring when groups are interacting during decision making (Huang 2003).

Figure 5.20: Additional terminology relating to virtual teams and group behaviour to 2003 (expanded from Figure 5.15)

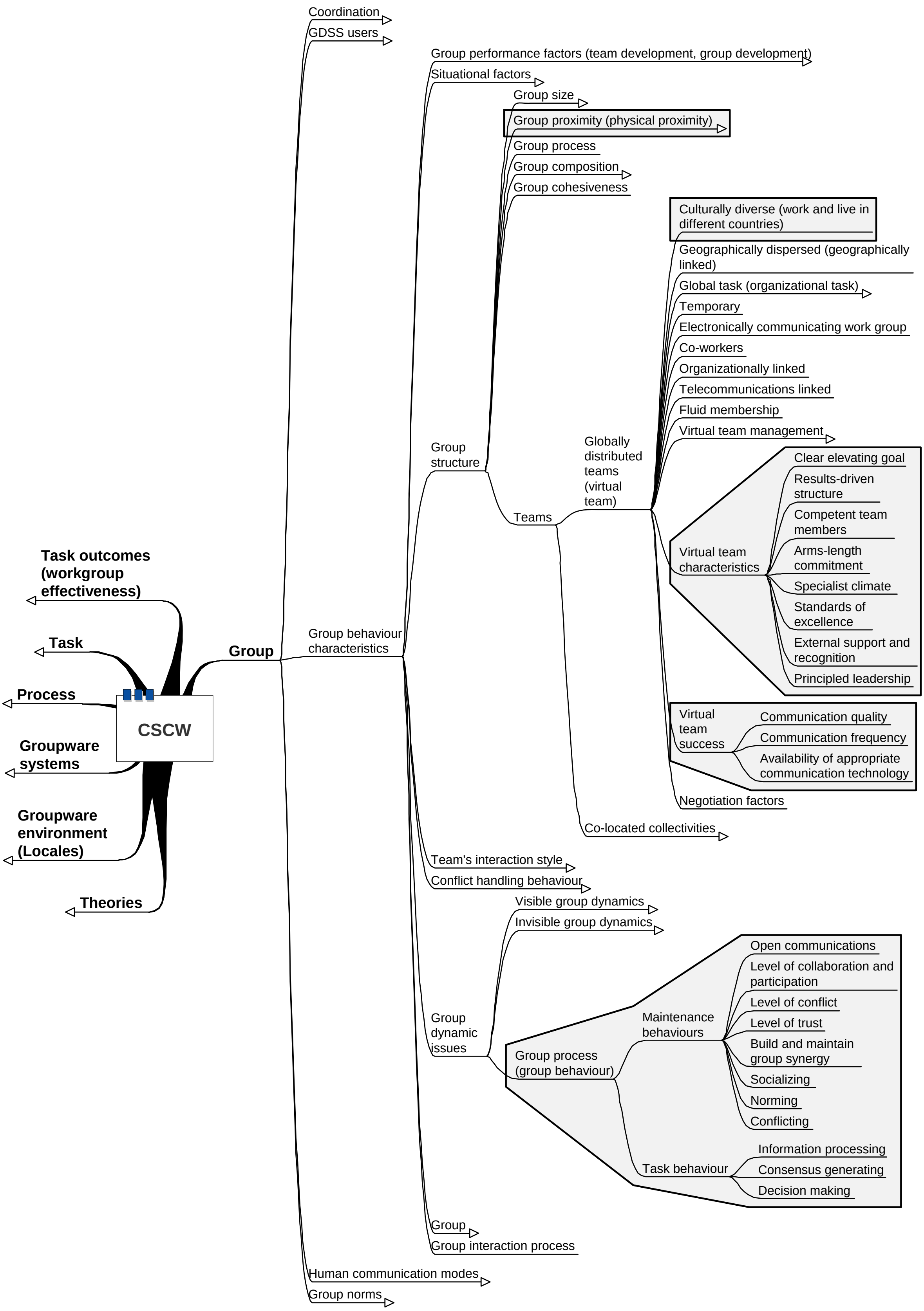


Figure 5.21 displays additional terminology relating to theory to 2003

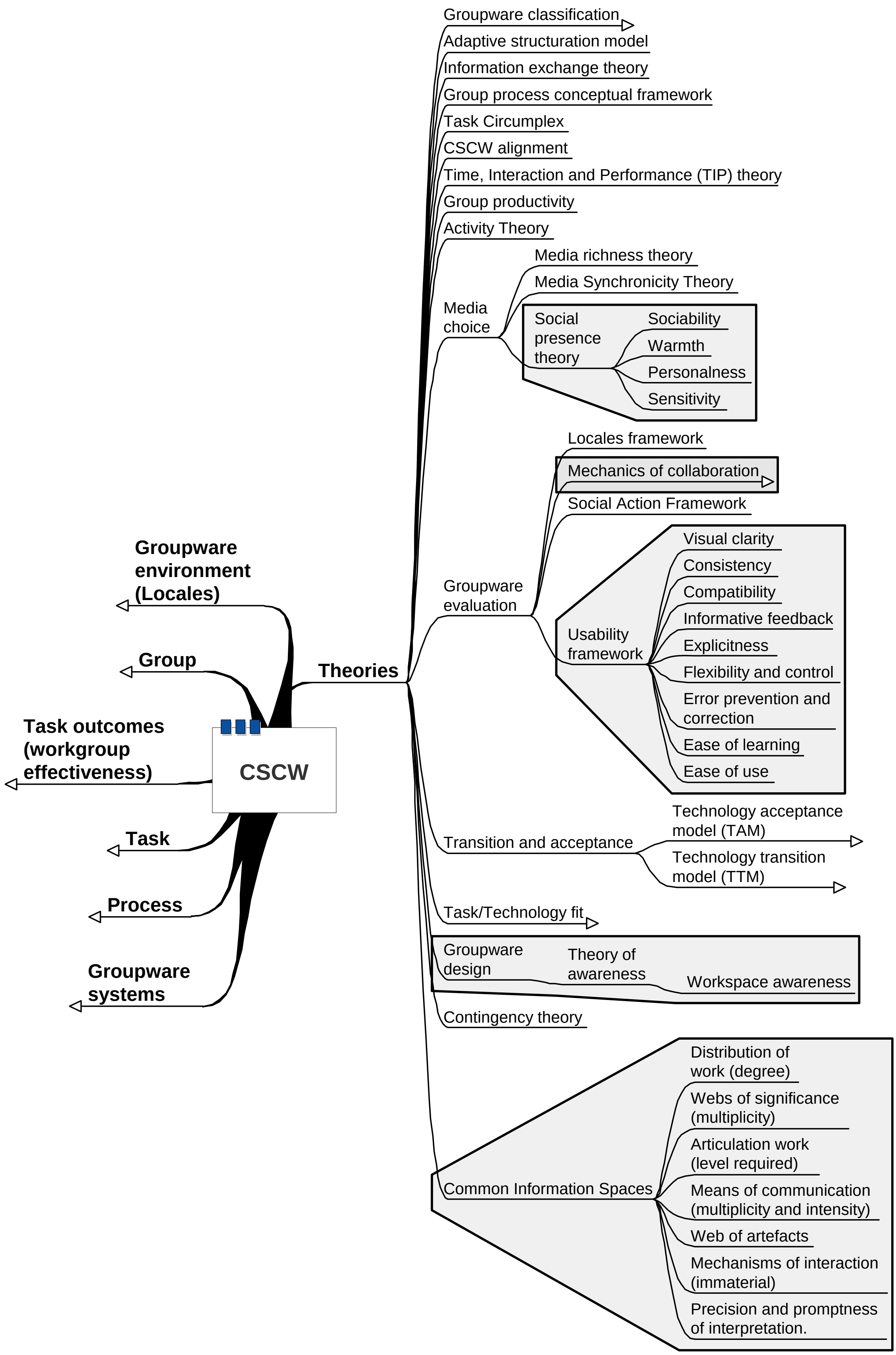
Social presence theory was used in Baker's (2002) research into the effects of synchronous collaborative technologies on decision making. Originally developed by Short, Williams and Aristic (1976 in Baker 2002), it is a theory of group interaction based on social presence and includes factors such as sociability, warmth, personalness, and sensitivity.

Groupware are difficult to evaluate as there are no discount usability evaluation methodologies (Baker, Greenberg and Gutwin 2001). Baker, Greenberg and Gutwin used the **mechanics of collaboration** framework to discover problems in shared visual work surfaces for distance separated groups using real-time systems. They stated that 'Despite the increasing availability of groupware most systems are awkward and not widely used' (Baker, Greenberg & Gutwin 2001, p.123).

Siao's (2003) research studied how and when GSS tools were used. They evaluated an existing GSS. They developed a **usability framework** with nine dimensions. These dimensions were visual clarity, consistency, compatibility, informative feedback, explicitness, flexibility and control, error prevention and correction, ease of learning, and ease of use.

'A descriptive **theory of awareness** for the purpose of aiding groupware design, focusing on one kind of group awareness called workspace awareness' was developed by Gutwin and Greenberg (2002, p.411). They presented a descriptive theory of awareness for small groups in shared workspace. The main structure of the descriptive theory is a framework of workspace awareness that organises the concept and that 'informs designers as they analyse work, situations and consider the design of awareness support' (p.441).

Figure 5.21: Additional terminology relating to theory to 2003 (expanded from Figure 5.18)



Common Information Spaces (CIS) was proposed as a conceptual framework to provide analysis of cooperative work. Seven parameters are suggested for CIS which are:

- the degree of distribution of work;
- the multiplicity of webs of significance;
- the level of required articulation work;
- multiplicity and intensity of means of communication;
- the web of artefacts;
- immaterial mechanisms of interaction;
- the need for precision and promptness of interpretation (Bossen 2002, p.176).

5.3.2 Summary of analysis from era 2000-2003

Most GSS studies prior to 2003 had been conducted in face-to-face decision room settings (Huang, Wei & Lim 2003). However, it had become commonplace for teams to work across distance (Handel & Herbsleb 2002), so common that new terminology such as virtual teams and globalwork (O'Hara, Devereaux & Johnson 1994 in Handel & Herbsleb 2002) were becoming widely accepted. However, Huang, Wei and Lim (2003) commented that virtual teamwork had been inadequately studied, especially virtual team building. Teams and groups in the workplace were continuing to increase in number (Corbitt & Martz 2003).

Increasingly, virtual teams are being supported with Internet and web-based applications. This is confirmed by Baker (2002, p.79) who stated that 'the use of collaborative technologies continues to grow as accessibility increases and costs decline'. Baker (2002, p.80) confirmed that some of the 'more recent studies have focused on the use of Internet and web-based applications to support teams in virtual environments'. Institutions that were researching collaboration using the Internet, web and cyberspace were Georgia Institute of Technology, Michigan State University, City University of Hong Kong, Washington State University and University of Wisconsin.

A number of terms are being used by researchers for systems that support group meetings. These systems have been used mainly in a business environment but are starting to be used in an educational environment. These terms are group decision support systems (GDSS), group support systems (GSS), electronic meeting systems (EMS), decision conferencing, and distributed group support systems (DGSS).

Both synchronous and asynchronous technologies are available to support virtual groups/teams. Synchronous systems are usually used for virtual team meetings and asynchronous systems for pre-planning and follow up discussions. Of the 100 articles in this section, 69 articles reported research in virtual teams, 10 reported research in meetings, but there were no articles reporting research on graphics editors.

Theories and conceptual frameworks that were developed in this era are Gutwin and Greenberg’s (2002) Theory of Awareness, and Siao’s (2003) Usability Framework. Other frameworks that were used as a base for the study of teams using technology were Common Information Spaces (Randall 2000 in Bossen 2002), and Social Presence Theory (Short, Williams & Aristic 1976 in Baker 2002).

5.4 The use of CSCW terminology across the years 1978 to 2003

This section summarises the issues that impacted the development and use of terminology across the five eras from 1978 to 2003.

Initially the research being undertaken to support group work was in the design and development of systems. During the first era 1978-1985 research was undertaken in two distinct areas that appeared to have no commonality. These were in:

- the use and development of systems for communication (CMC), and
- the use and development of systems for decision making (GDSS).

The first CSCW conference, held in 1986, drew together people interested in CMC, GDSS and graphics editing research. Graphics editing systems lead to co-authoring systems. About the beginning of the 1990s the term ‘groupware’ was being used by authors to describe systems that included communication systems, decision making systems, and group editing systems.

Communication systems included messaging systems which were generally asynchronous and conferencing systems which were usually synchronous.

Asynchronous systems included email, mailing lists and bulletin boards. Synchronous systems included computer conferencing and calendar management systems.

Decision making systems were originally developed as face-to-face systems with integrated decision models. A range of decision models were integrated into the systems that were used to improve strategic and managerial decision making. Group interaction techniques were also being researched and some of these techniques were integrated into decision making systems. Many of these decision making systems were tested and used in collaborative laboratories and relied on a facilitator to run the meetings.

By the end of the 1980s systems that integrated communication and decision making to allow distributed individuals to work as a group at a distance were being developed. These systems were called Electronic Meeting Systems by some authors. Adding to the confusion, they were also being called conferencing systems.

Prior to the development and use of electronic systems, meetings were considered as a face-to-face synchronous activity. Electronic systems provided a platform that allowed meetings to be synchronous or asynchronous and face-to-face or virtual. Electronic meetings were being considered as having three phases: pre-meeting, in-meeting and post-meeting. The meetings were also being categorised by the amount of structure in the activity and the degree of sharing within the group.

As systems were integrated to allow distributed group decision making, the role of the facilitator changed. Also, many more studies of team work were being undertaken as the dynamics of teams were seen to be even more important when teams were required to work across distances.

Channels of communication were being described as either lean or rich. Interaction richness was compared with traditional group communication issues such as visual, audio and sound, and used to describe the ability of the systems to convey social and emotional information. Research was being undertaken to determine if the richness of the channel impacted the effect on meeting outcomes.

Research and development of group editor systems for small face-to-face groups were being undertaken in the mid 1980s. Group editor functions were then integrated into some of the systems being used for decision making with distributed teams.

The term ‘workflow’ was introduced in the 1990s, and the term ‘coupling’ was used as a means to differentiate between decision making activities and workflow activities. ‘Coupled’ or ‘tightly coupled’ refers to situations where the group members have to cooperate (work closely with one another) to achieve a common goal. ‘Uncoupled’ or ‘loosely coupled’ refers to situations where the task is coordinated (members of the group work separately) to achieve a common goal.

At the end of the 1980s and beginning of the 1990s, the Internet and the use of the web were becoming more prominent. Systems were being developed that provided support for distributed teams. The terms ‘virtual’ and ‘global work’ started appearing in the CSCW literature about the mid 1990s. The increase in virtual teams created a range of new issues for study such as virtual team building, cross-cultural communication, process facilitation, creating and sustaining remote team work and remotely managing information technology. Many of these issues have been inadequately studied, especially virtual team building (Huang, Wei & Lim 2003).

The environment within which group work is undertaken has changed over the years. Pre-1986 communication was mainly via telephone and ‘snail mail’ (regular postal mail) as only a small number of people had access to email. A few systems to support decision making were being studied in laboratory settings, but the majority of decision making in organisations was undertaken in face-to-face situations with no technology support. Some decision making activities were undertaken using teleconferencing. Intranets then started to be used which allowed people within an organisation to communicate via computer systems. The Internet supported systems provided a means to undertake synchronous and asynchronous activities from any networked computer and at anytime. By the late 1990s, mobile telephones and mobile computer systems had become available for people to use for group interaction, anywhere, and at any time.

As shown in Table 5.1, CSCW research is undertaken in many institutions across the world especially in USA, Canada, Europe and Australia. Many of these groups have an established record of research, for example at the University of Arizona; New Jersey Institute of Technology; Massachusetts Institute of Technology; Harvard Business School; Indiana University; Claremont University; University of Colorado; University of Baltimore; University of Georgia; University of Maryland; University of Michigan; University of Minnesota; and the University of Texas, in the USA; University of Calgary, in Canada; City University of Hong Kong; Copenhagen Business School, Denmark; University of Strathclyde, UK; Delft University of Technology, The Netherlands; and Curtin University, Australia.

Table 5.1: Main CSCW Research groups

Institution	Main authors	Date of first analysed article	Focus
University of Calgary, Canada	Boyle, M. Cockburn, A. Greenberg, S. Gutwin, C.	1983	*GroupLab*, shared workspaces and workspace awareness
University of Arizona	Briggs, R. George, J.F. Nunamaker, J.F. Jr. Valacich, J.S.	1991	*GroupSystems*, development and use
Curtin University, Australia	Pervan, G. Whiteley, A	1992	GSS research review and Facilitation
City University of Hong Kong	Davison, R. Vogel D.	1998	GroupSystems
University of Minnesota	DeSanctis, G. Gallupe, R.B. Gopal, A. Prasad, P Sprague, R.M.	1987	*SAMM*, GDSS
New Jersey Institute of Technology, USA	Fjermestad, J. Hiltz, S.R. Turoff, M.	1978	*EIES* and asynchronous teamwork
University of Texas	Ellis C.A. Huber, G.P. Jarvenpaa, S.L. Knoll, K.E., Leidner, D.E. McGrath, J.E.	1984	Collaboratory, *GROVE*
University of Mississippi	Aiken, M	1995	*TeamFocus*, and review of GSS
University of Georgia	Dennis A.R. Natarajan, V.L. Pootheri, S.K.	1995	*TCB Works*, web groupware
University of Michigan	Finholt, R.A. Olsen, G.M. Olsen, J.S.	1992	Collaboratory, Group editor, Adaptive groupware
University of Strathclyde	Ackerman, F. Eden, C	1989	*SODA*, Multiple user groups.
Georgia Institute of Technology	Guzdial, M	2000	CSCL, CoWeb
Southern Illinois University	Koschmann, T.D.	1995	CSCL, Collaborative learning

Source: Compiled for this research

Research into systems that support groups and research into groups that use computer systems for groupwork, were also undertaken by a number of companies across the world. Xerox has research laboratories in the USA, UK, and Japan. IBM has laboratories in Canada and the USA. Other companies in the USA are Bellcore, AT&T labs, Lotus Development Corp, Microsoft and MCC. In Asia there are NTT Human Interface Laboratory in Japan and Zing Technology in Australia. In Europe there is GMD-FIT in Germany. This list of companies is not complete, but reflects the organisations that were identified from the articles analysed in this study.

Researchers from around the world have been studying the use of groupware technology for groupwork. They have focused on such activities/tasks as meeting support, joint software application development, project planning, collaborative learning, workflow management and collaborative authoring.

The first theories that were identified for the CSCW field (during this analysis) were the CSCW alignment model developed by Applegate (1991) and the Time, Interaction and Performance (TIP) Theory developed by McGrath (1991 in Jarvenpaa & Leidner 1998). Virtual team effectiveness theory (Furst, Blackburn & Rosen 1999) and Media Synchronicity Theory (Dennis, Pootherie & Natarajan 1998 in Baker 2002) were developed by the end of the 1990s. A number of theories were developed for groupware evaluation, these included Locales Framework (Greenberg et al 1999), Mechanics of collaboration (Gutwin & Greenberg 1999) and Social Action Framework (Ngwenyama & Lyytinen 1997). Task/Technology Fit was developed to consider the task complexity and technology dimensions. Theories proposed in the final era were Theory of Awareness (Gutwin & Greenberg 2002), Usability Framework (Siao 2003), and Common Information Spaces (Randall 2000 in Bossen 2002).

5.5 Summary of Chapter 5

Content analysis and HTT were used to develop the hierarchical structure for each section. Chapters 4 and 5 were presented from an historical perspective for eras 1978-1985, 1986-1990, 1991-1995, 1996-1999, and 2000-2003. This provided a means to show the development of this research field and the introduction of different terminology across the years.

Chapter 5 provided an overview of the development of the hierarchy of terminology using examples in the three eras from 1991 to 2003. The complete detailed analysis of each era from 1991 to 2003 is available from the author. The final taxonomy of

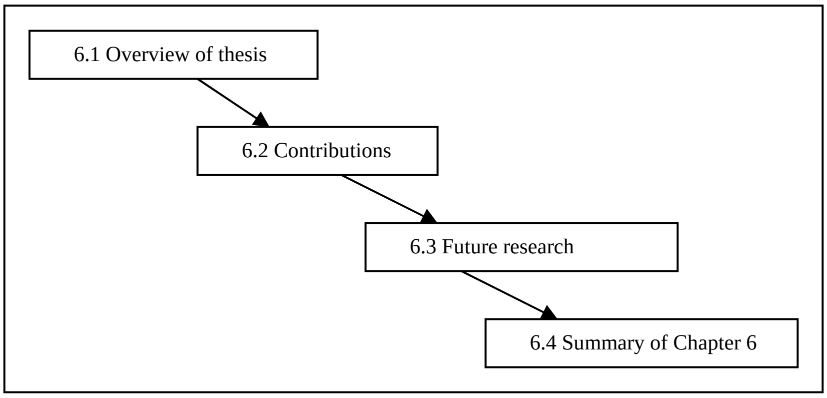
CSCW terms is presented in Appendix D as it is too large to present on an A4 page within this chapter. The completed taxonomy of CSCW terms displays the scope of the terminology used in 382 articles from this research field. A taxonomy of terms is of little value without the definitions of the terms used within the taxonomy. The development of a dictionary was described in Chapter 3 and presented in Appendix E.

Chapter 6 discusses the outcomes and future research.

Chapter 6 Outcomes and future research

Chapter 6 provides an overview of the thesis and describes the four contributions made by this research. The final section provides a summary of the chapter and thesis.

Figure 6.1: Chapter 6 structure



6.1 Overview of thesis

Chapter 1 laid the foundations for this research by identifying the research problem based on the comments made in the research literature from the CSCW field relating to inconsistent use of terminology. An overview of the research problem and the research tasks were discussed in section 1.2.

Research articles from 1978 to 2003 of studies where groups were undertaking groupwork with the use of computer technology were analysed for this research. The sample consisted of 382 articles.

Justification for the research was provided by the need for an *holistic review of the literature in the CSCW field* due to inconsistencies in terminology and definitions used, the need for an *improvement in information exchange* among multidisciplinary researchers, the need to *show the relationships between terms*, and the need to *improve consensus* between researchers regarding the meaning and use of terms.

The review of literature in Chapter 2 identified issues relating to scope, and inconsistency of terminology. The literature on linguistics, epistemology, ontology, taxonomy and meaning were reviewed as they related to the problem of inconsistency of terminology. The review of literature highlighted and suggested approaches to address the research problem. The output of the literature review was used in Section 2.3 to develop a research framework and to focus the research problem.

Section 2.3 presented the research problem and identified three specific research tasks (SRT) to address the research problem.

- The first task (SRT1) was to identify the terms and definitions in the CSCW literature.
- The second task (SRT2) was to use the CSCW terms identified in SRT1 to develop a taxonomy of CSCW terminology.
- The third task (SRT3) was to compile and construct a dictionary of CSCW terminology and definitions.

Chapter 3 discussed the philosophical basis for the research and justified the use of an interpretive and descriptive methodological approach. The reason for choosing an unobtrusive data collection method was discussed and the analysis method was then explained. The Hierarchical Terminology Technique (HTT), developed for this research, was then described. The use of Spradley's semantic relationships, as a step in the HTT, was explained.

An example of the HTT used for structuring the hierarchy was described in Sections 3.5.4 and 3.5.5. Chapter 4 discussed the first two eras of the analysis from 1978 to 1985 and from 1986 to 1990. Summaries of these two eras were discussed in sections 4.2.3 and 4.3.4. Chapter 5 gave an overview of the last three eras of the analysis from 1991 to 1995, 1996 to 1999, and 2000 to 2003. Summaries of these three eras were discussed in Sections 5.1.2, 5.2.2, and 5.3.2. A summary of terminology use across the years 1978 to 2003 was then presented.

6.2 Contributions

This section identifies and describes the four main contributions of this research which are:

- confirmation of the inconsistent use of terminology;

- the Hierarchical Terminology Technique (HTT);
- a taxonomy of terms; and
- a dictionary of CSCW terminology.

Each contribution is discussed in relation to the context of this and previous research. The implications to theory and practice of each contribution are highlighted and the limitations of the contributions are then discussed. Finally, future research opportunities are presented.

6.2.1 Contribution 1 – Confirmation of Inconsistent use of terminology

Previous authors had indicated that there was inconsistent use of terms. This contribution is a much more comprehensive review of the use of inconsistent terminology than those of previous authors. The review of literature was described in Sections 1.1, 1.2 and 2.1 and highlighted the authors who described the problems presented by inconsistent use of terms and definitions in CSCW research (for example, Bannon 1997; Greenlaw, 1999; Gopal & Prasad 2000; and Turner & Turner 2002). Inconsistencies were described as causing confusion, contradiction, and ambiguity.

The critical analysis of the literature highlighted the term ‘groupware’ that had been defined in different ways by many different authors. The research tasks undertaken in this study identified a number of other terms where different definitions had been used. A number of different words had also been used to mean the same thing.

During the process of developing the taxonomy of terminology and the dictionary of terms and definitions, a number of examples of inconsistencies were apparent. Examples of terms included:

- The term ‘uptake’ could mean acquisition, adoption, acceptance, implementation, assimilation, routinisation or use or a combination of these.
- The term ‘adoption’ could mean ‘the decision to purchase’ or ‘the routine use of technology by end users’.

- The term ‘distributed’ can have three dimensions: temporal, spatial and technological. In other words it can refer to different time, different places or to a distributed system on different servers.
- The term ‘teleconferencing’ can mean audio conferencing, video conferencing or computer conferencing or a combination of these.
- ‘Structured group management techniques’ are also referred to as group behavioural techniques, behavioural group techniques, group problem solving techniques, process techniques, group structuring methods, decision making approaches, structured group processes, and decision structuring techniques. Examples of these techniques include Delphi and Nominal Group Technique (NGT).

Thus, considerable evidence was accumulated to confirm inconsistent use of terminology as a problem in CSCW research. The review and analysis of literature highlighted the widespread inconsistencies of the use of terms and definitions in CSCW research. These inconsistencies have made it difficult for researchers and practitioners to determine what specific technology has been used in each study, to determine where each research study fits the research field, and to understand the terminology in CSCW to support collaboration. This research has further strengthened the literature concerning and supporting this observation.

Implications for theory and practice

Section 2.1.1 described how inconsistent terminology affects theory development (for example, Teas & Palen 1997; Shaw, Pawlowski & Davis 2005). Section 2.1.1 also described the inconsistenct use of terminology across different research groups, software users, and software developers. Some researchers describe the widespread lack of clarity in IS development due to inaccurate language (Ulrich 2001). Other researchers in the CSCW field and developers of CSCW systems were not aware of the inconsistency issue.

As noted in section 2.1.3, ‘ambiguity reduces the theoretical meaningfulness of language used, to express theory and reduces the degree to which theories can be precisely expressed, interpreted and empirically tested’ (Teas & Palen 1997, p.5).

Inconsistency in the use and definition of terminology within GDSS research was described in section 2.1.6. This inconsistency has obscured many of the important contributions these studies have made to scholarship (Gopal & Prasad 2000). Inconsistenct use of terminology has also been described as a significant impediment to effective communication (Alter 2000) which impacts research and practice.

This contribution will improve awareness of the problem of inconsistenct use of terminology in the CSCW field.

Limitations of contribution 1.

Identifying the problem of inconsistency in terminology use is only the first step in solving the problem. Researchers need to be made aware of the problem and be prepared to develop and agree on some standards in the use of terminology to reduce ambiguity.

6.2.2 Contribution 2 – Hierarchical Terminology Technique (HTT)

As described in Section 1.4, the review of literature did not reveal a previously researched theoretical model or method for developing a taxonomy of terms and dictionary of definitions to address problems of inconsistent terminology in any research field. The lack of an established process or method for analysing and displaying terminology to show relationships of terminology is also explained in Section 3.2.

A new method called the HTT was developed in order to address this research problem. HTT uses a form of relational content analysis which extends the idea of cognitive mapping to a hierarchy of concepts to expose the relationships between the terminology and a dictionary of definitions to help improve consistency.

Section 3.4 describes the three stages in the HTT process. The first stage consists of a content analysis of the articles. The second stage consists of developing a hierarchical taxonomy of terms, and the third stage consists of developing a dictionary of terms and definitions.

Implications for theory and practice

The HTT which can be used to show the structure of terminology use and the scope of terms and definitions, will be of benefit to many fields of study in particular in the areas of information sciences, ontology development in IS and health informatics. The HTT could also be used for dynamic application in organizational contexts when similar problem characteristics arise.

Limitations of contribution 2

This analysis technique uses an unobtrusive method of data collection from documents. Section 3.2 describes limitations of unobtrusive data collection methods.

This technique has only been used for this study and would need to be applied to other studies to determine its value in other situations.

The HTT is very time consuming, which may impact the opportunities for use.

As stated in Section 3.3.1 the analysis process used in the HTT is subjective and different relationships could be considered appropriate by other researchers.

6.2.3 Contribution 3 - Taxonomy of terms

The taxonomy of CSCW terms from 1978 to 2003 is presented in Appendix D.

Some ways of addressing the issue of inconsistency of use of terminology were described in section 2.1.3 by authors from other disciplines (for example, Bruce & Levin 1997; Ishida & Ohta 2002; Strobel & Weinhardt 2003). A suggestion to address the research problem was to undertake an holistic study of the terminology used in a field of research, in order to develop a taxonomy, ontology or dictionary (for example, Morris 1938 in Bormann 1980; Gruber 1993; and Uschold & Gruninger 2004).

The lack of definition of the term ‘scope’ and the lack of clarity of the ‘scope’ of the CSCW field were described in section 2.1.5. The scope of the CSCW field is unclear (Bannon 1992, Whitaker 1996) and no articles were found that defined the term ‘scope’, or clarified what is meant by the term ‘scope’ in relation to a research field. A search of the literature showed that CSCW is multidisciplinary covering research of groups using computers, relating to communication, cooperative writing and editing, meetings, decision making, learning, shared media spaces, virtual teams and workflow.

This research focused on the scope of the terminology used by the researchers in the CSCW field. The analysis of articles in this research field showed that the scope of CSCW terminology covers seven main branches: groupware systems, groups, processes, tasks, activity outcomes, environments and theories. Appendix D and E of this thesis show the scope of the CSCW terminology and the extent and variety of definitions.

The use of taxonomy and classification to address the research problem was described in section 2.2.4. The process to develop the taxonomy of terms was described in Section 3.5.5 and Chapters 4 and 5.

Implications for theory and practice.

A taxonomic structure that shows the relationship of each CSCW term to one another and clarifies the scope of the research field contributes to the research discipline and to the body of knowledge.

The CSCW hierarchy diagrams can be used in future research to display the concepts in different areas of the CSCW field.

Limitations of contribution 3.

The taxonomy was developed by analysing prior research in this field. It is recognised that it was not possible to retrieve all relevant articles in the timeframe.

The articles were found across many disciplines and in many different journals and conference proceedings, making it difficult to locate all relevant articles.

This research analysed articles between 1978 and 2003. New terminology used in this field of research since 2003 has not been included in the hierarchy as it is beyond the scope of this research.

This research used large quantities of qualitative data and it is possible that some relevant material from the analysed articles has been overlooked.

The inherent problem of cost and time to travel prevented the researcher from accessing the authors and system developers directly to discuss terminology used, although it might have been possible to collect some information through electronic media. However, directly accessing only some authors would have introduced bias to the results.

These limitations are acknowledged but they do not detract from the significance of the contribution.

6.2.4 Contribution 4 – Dictionary of CSCW terminology

The dictionary consists of approximately 1200 main entries and is presented at Appendix E. A discussion of linguistics in the context of this research is presented in Section 2.2.1

A spreadsheet of citations, terms and definitions from CSCW research articles was developed during the content analysis process. This data were collated and formatted to form the CSCW dictionary.

Implications for theory and practice

As described in section 2.2.1 a dictionary is seen as a way to clear up muddle and confusion in the use of terminology, to help improve consistency of definitions and allow a better understanding of the meaning of terms and concepts.

The historical citations in the dictionary help to establish the chronology of the word’s use and illustrate the range of circumstances within which a word has been used. The dictionary helps to show the scope of the terminology in the CSCW field and provide a consistent set of terms and definitions.

An identification of terms, how they are defined, and the relationship between the terms in a discipline or field has to be the first step in developing more sophisticated ontologies.

Limitations of contribution 4

Although CSCW terms, definitions and descriptions, found during the analysis in the specified literature have been included in the dictionary, other definitions of these terms have not been searched for elsewhere as this is beyond the scope of this research.

The definitions identified and used in this research and presented in the dictionary may be inaccurate or incomplete due to the inexperience of the authors of the analysed articles or their lack of knowledge of the field.

Experience of the researcher and personal bias may also influence the compilation of the dictionary.

6.3 Future research

A literature analysis could be undertaken in other research fields to improve awareness of the problems of inconsistency in the use of terminology.

The development of the Hierarchical Terminology Technique has opened up future areas of related research, a few examples are itemised:

- The use of HTT to show the relationship of terms and the scope of other research fields.
- The development of taxonomic hierarchies to show the conceptual links between different disciplines.
- The use of the HTT process to aid in the search for articles in Information Science.
- The use of the HTT to support the development of computer ontologies for interoperability.

This research analysed articles between 1978 and 2003. Terminology and definitions used in this research since 2003 have not been included as they are beyond the scope of this research. This research was undertaken on a part-time basis and the data collection from articles was completed in 2004. Also some terms that were identified were not defined in the analysed articles. Definitions for these terms would need to be found in order to complete the dictionary. Further research work is needed to bring the dictionary up to date.

The taxonomy of CSCW terminology and the dictionary of definitions need to be standardised and accepted by researchers in the CSCW research field if they are to help reduce the ambiguity of terminology use. A study is needed to determine the appropriateness, accuracy and usefulness of these structures to other researchers and practitioners. Definitions may need to be standardized. Some IS research fields, such as Knowledge Management, have already developed ISO standard definitions.

6.4 Summary of chapter 6

This chapter provides an overview of the thesis and presents the research problem and the four main tasks completed. It presents and describes the four main contributions of this research.

This research has highlighted the problems associated with inconsistency of terminology in a particular research field. The output of the hierarchical terminology structure and dictionary of terms, have potentially far reaching implications for theory and practice. More research is required to improve consistency of terminology use in the CSCW field and across many other discipline areas.

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Appendices

Appendix A: Code Form

1. **Time/Place**
    a. Ftf
    b. Virtual
    c. Synch
    d. Asynch
2. Type.
    a. Review
    b. Concept
    c. qualitative research
        i. case study
        ii. interpretive
        iii.
        iv. ..
    d. quantitative research
        i. survey
        ii. experiment
        iii. case study
        iv. ..
3. **Team environment - Organization type**
    a. Commercial
    b. Social
    c. Educational
    d. Government (civil)
    e. Government (military)
4. Team Environment
    a. Intra organization
    b. Inter organization
5. Technology used
    a. Email
    b. Chat
    c. Conferencing – audio
    d. Conferencing – video
    e. Conferencing – GSS
    f. Bulletin Board
    g. ..
    h. ..
6. Support
    a. Organizational support
    b. Technical support
    c. Facilitation
7. Theory or research framework
    a. Foundation discipline
    b. Theory used
8. Results & outcomes
9. Future research
10. Other keywords
    a. Design team
    b. Participation
    c. Team building

Items 1 through 5 via keyword only.

Item 6 via keyword and abstract.

Item 7 via abstract.

Item 8 lists main issues raised by author

Example:

Review, commercial, intra organization, email, chat, video, strong organizational support, limited technical support, no theory, design team.

Appendix B: Keywords used as search terms

Keywords

Asynchronous group
Asynchronous system
Collaborative computing
Collaborative learning
Collaborative systems
Communication systems
Computer mediated communication
Computer supported cooperative learning
Computer supported cooperative work
Computer supported collaborative work
Computer supported systems
CSCL
CSCW
CSCW in education
Distance education system
Distance group support
Distance learning
Distributed CSCW
Distributed group support
Distributed groups
Distributed groupware
Distributed support system
Dynamic Learning communities
Dynamic learning systems
Education support systems
Electronic meeting system
Electronic facilitation
Email
EMS
Facilitator
Facilitation
GDSS
Group
Group and education
GroupSystems
Groupware
Groupware applications
Groupwork
GSS
Meeting systems
Messaging systems
Online collaboration
Online group support
Synchronous systems
Team support system
Teamwork
University of Arizona
Virtual group education
Virtual learning environment
Virtual teams
Virtual workspaces
VLE
Web-based groupware
Web-based GSS

Databases

ABI Inform
ACM Online
Emerald
InfoTrac
Ingenta
ProQuest
Uncover

Appendix C: References of articles used in the analysis

These articles are arranged in *date order* and divided into five eras as laid out in Chapters 4 and 5.

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Appendix D: Hierarchical taxonomy of CSCW terms

Taxonomy Contents List

Introduction

The figures presented in this appendix show the hierarchical taxomony that has been developed during analysis of the research articles. The terminology identified and structured during this analysis consists of more than 1200 terms which cannot be legibly displayed on one printed sheet. *MindManager* software has been used to structure and present the hierarchy. This software provided a means to create multi-maps to display large numbers of terms.

Figure D-1 is a legend that displays how the twenty figures (maps) presented in this appendix link together. This legend has been used on each page to show where each figure belongs in the overall hierarchy. The legend on each page clearly shows where that map fits in the hierarchy by the figure name being blacked out.

Figure D-2 displays the first of the twenty maps. The arrows on the maps show that there is another map linked to this term. Below each arrow the attached figure number is indicated.

Figure D-1: Legend

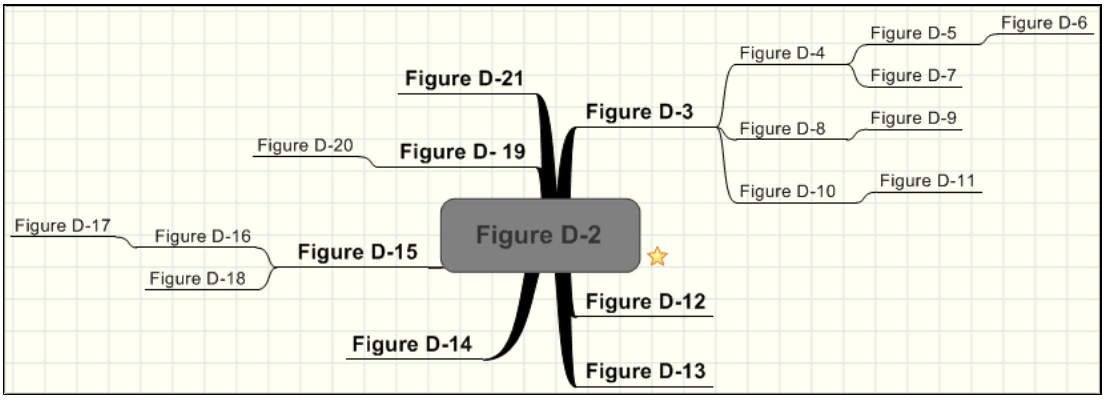
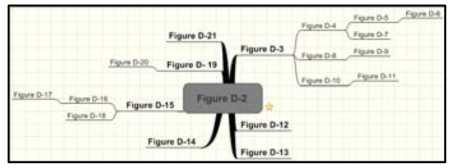


Figure D-2: CSCW overview



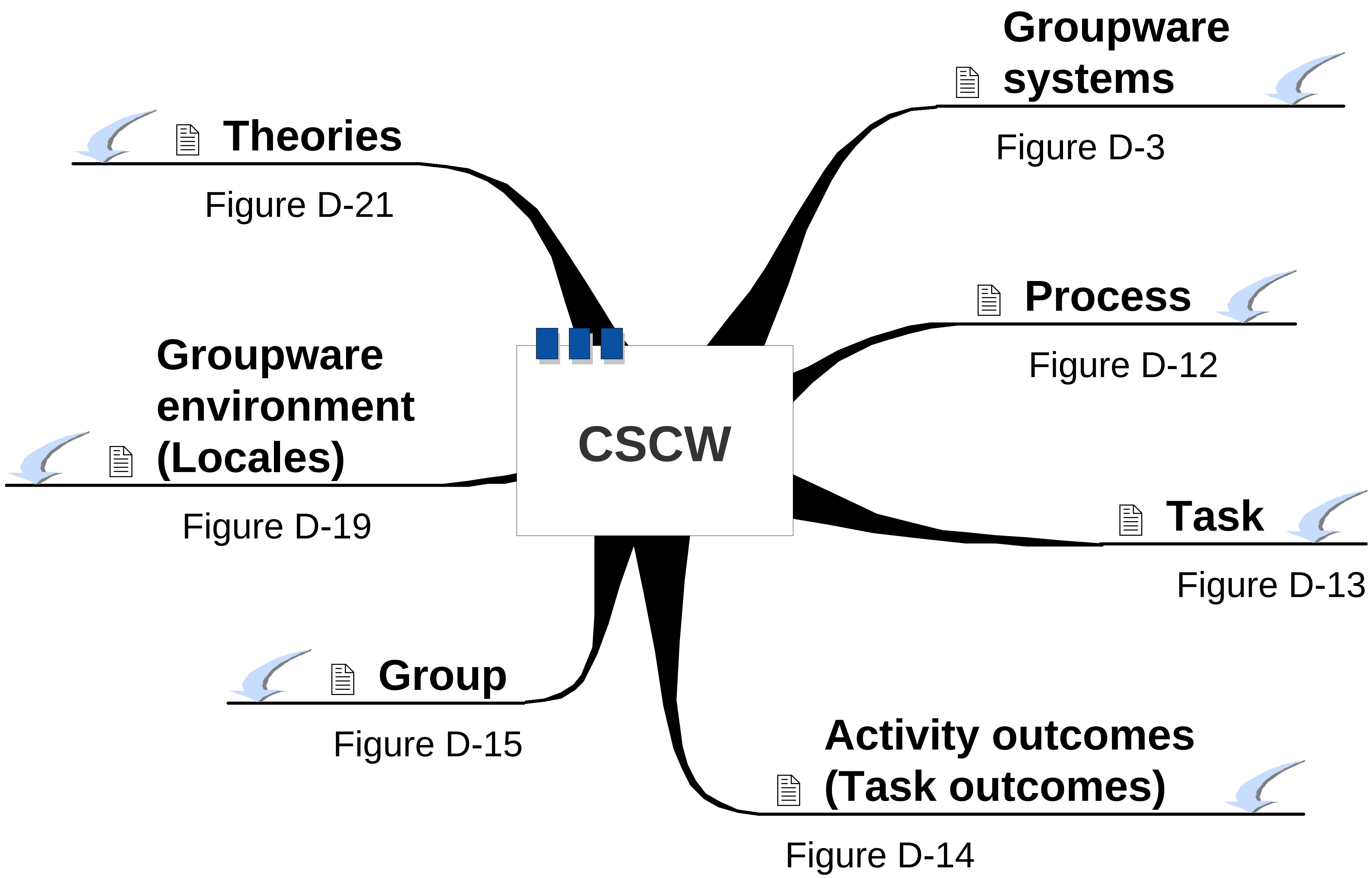
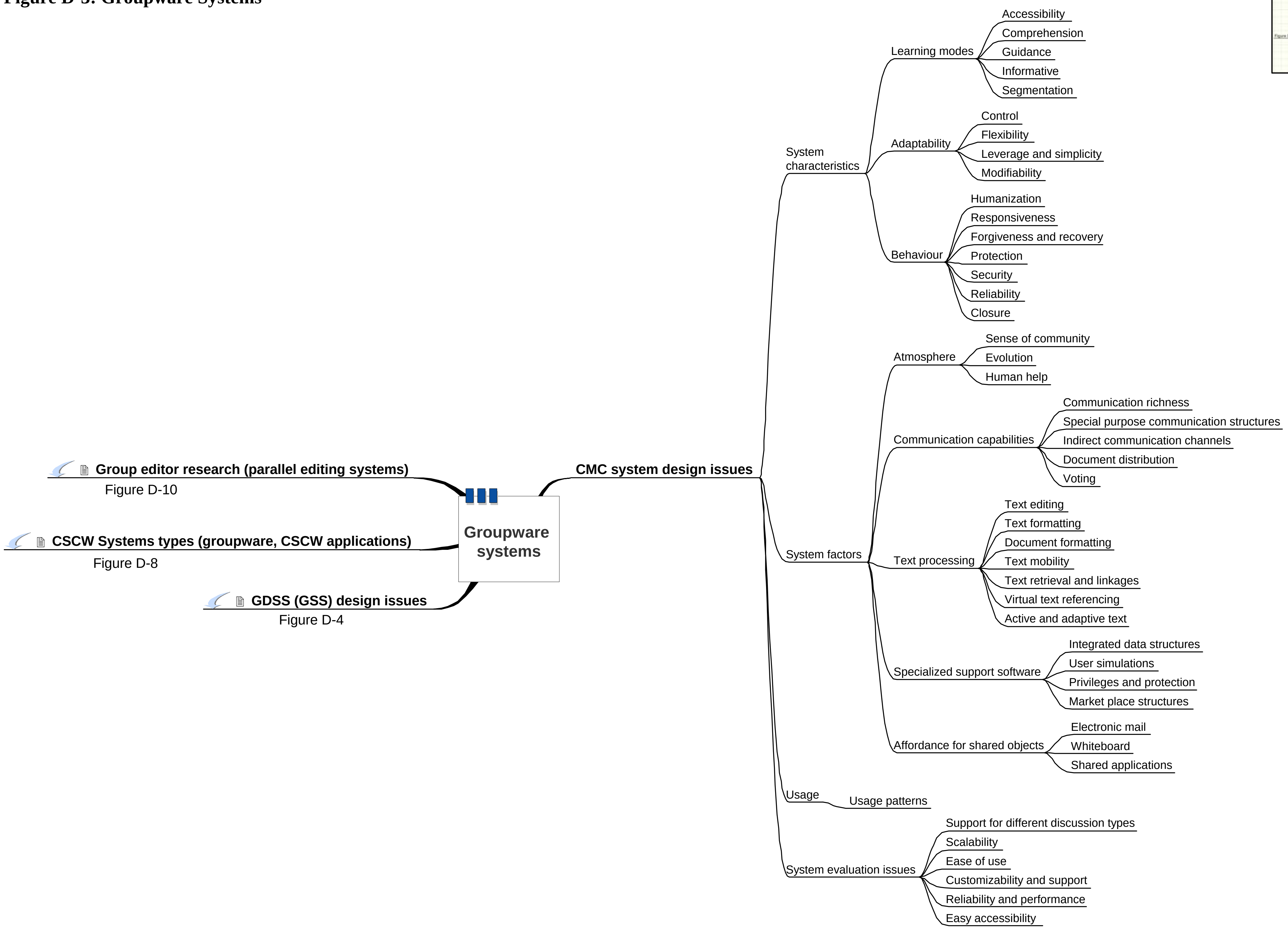


Figure D-3: Groupware Systems



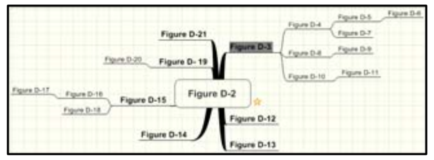


Figure D-4: GDSS design issues

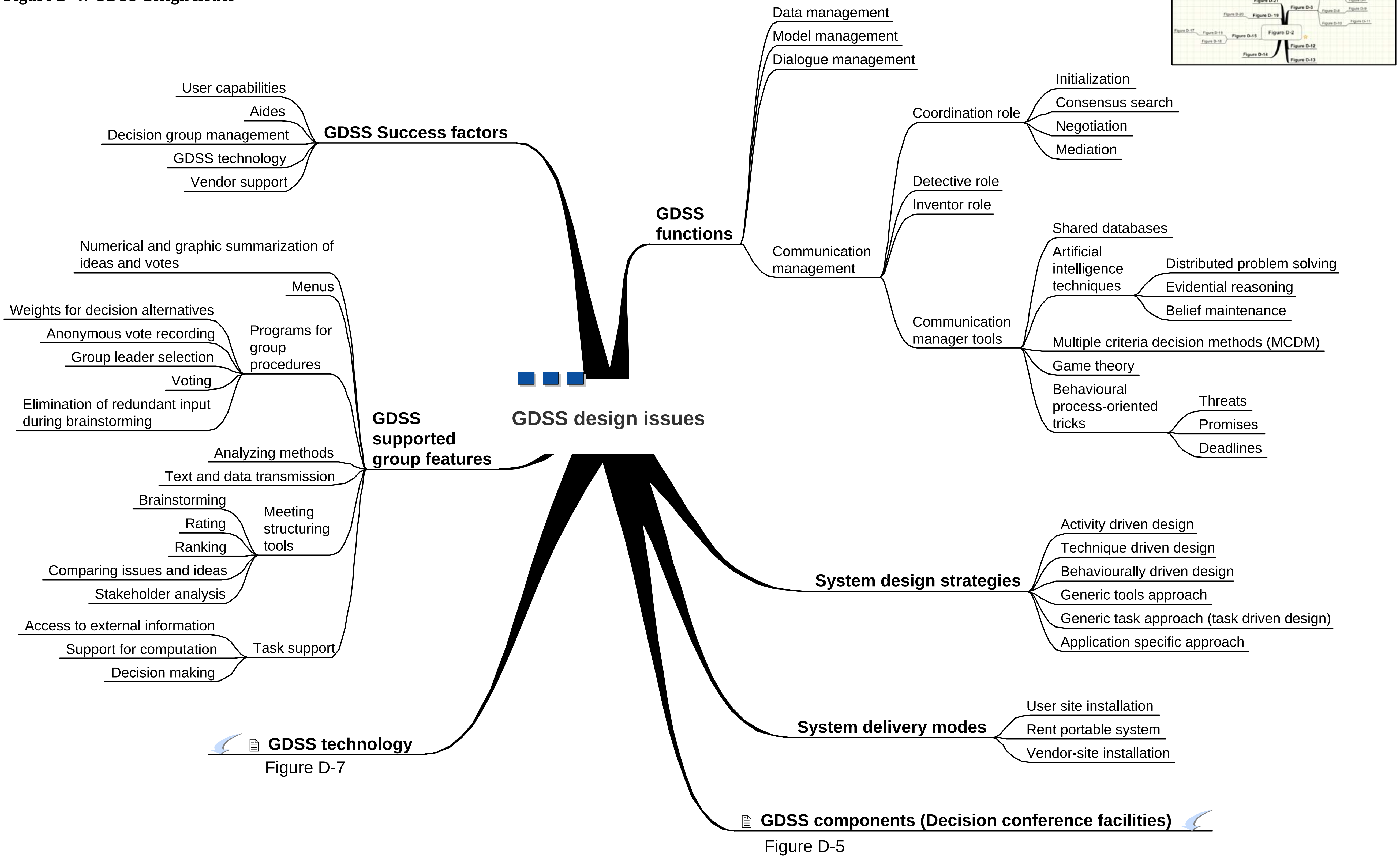
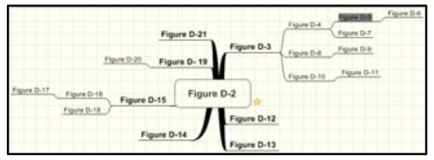


Figure D-5: GDSS components (Decision conference facilities)



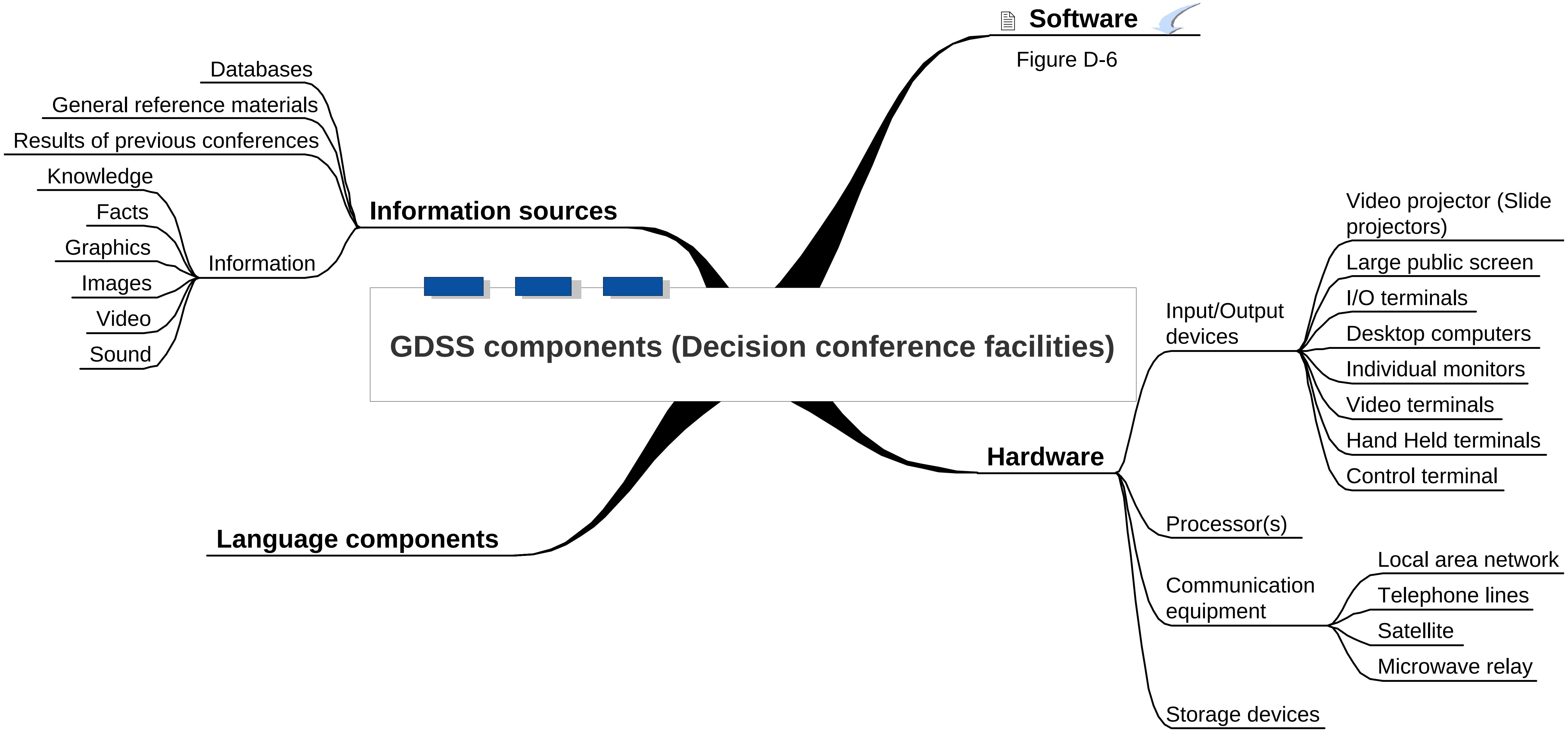


Figure D-6: Software

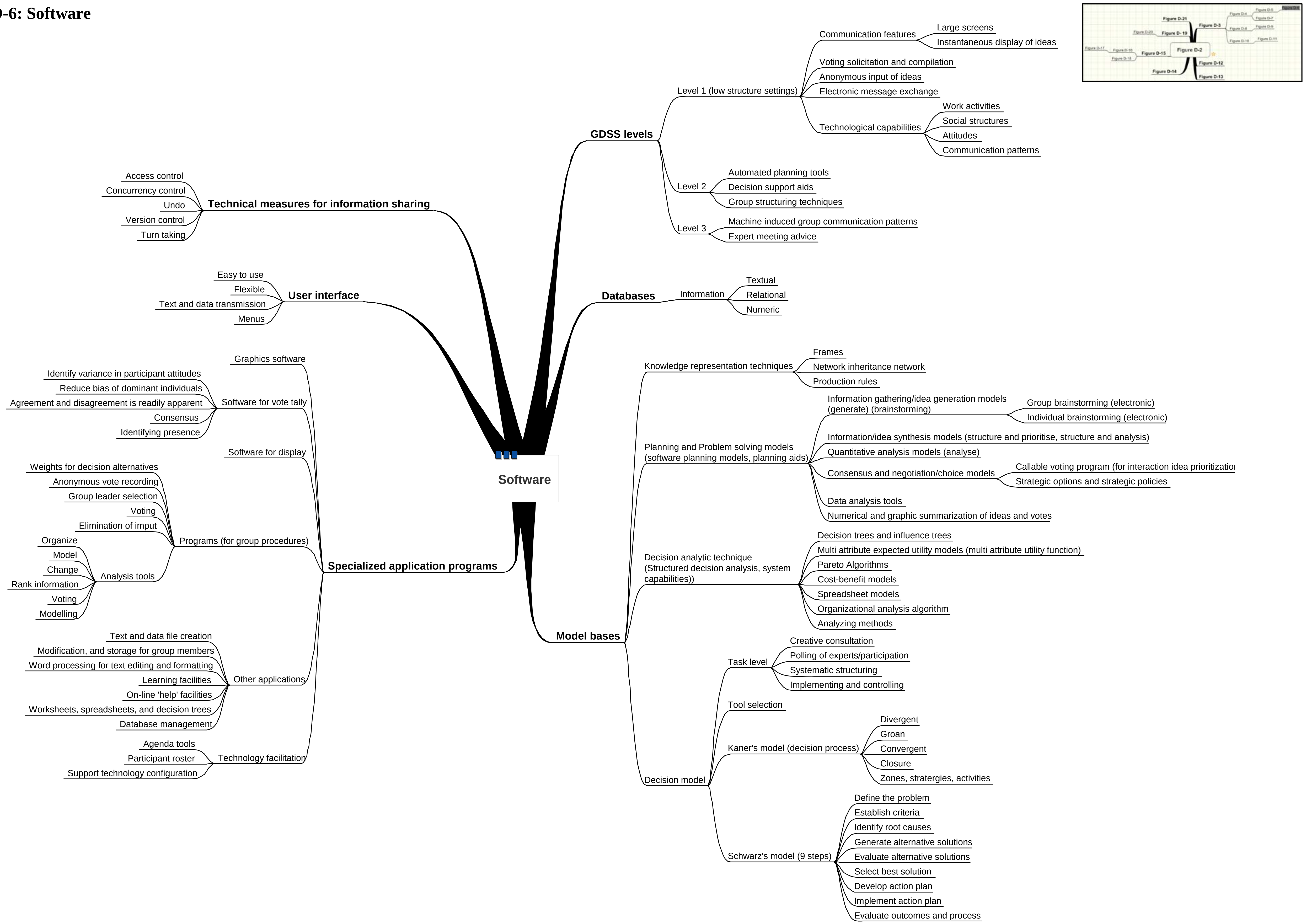


Figure D-7: GDSS technology

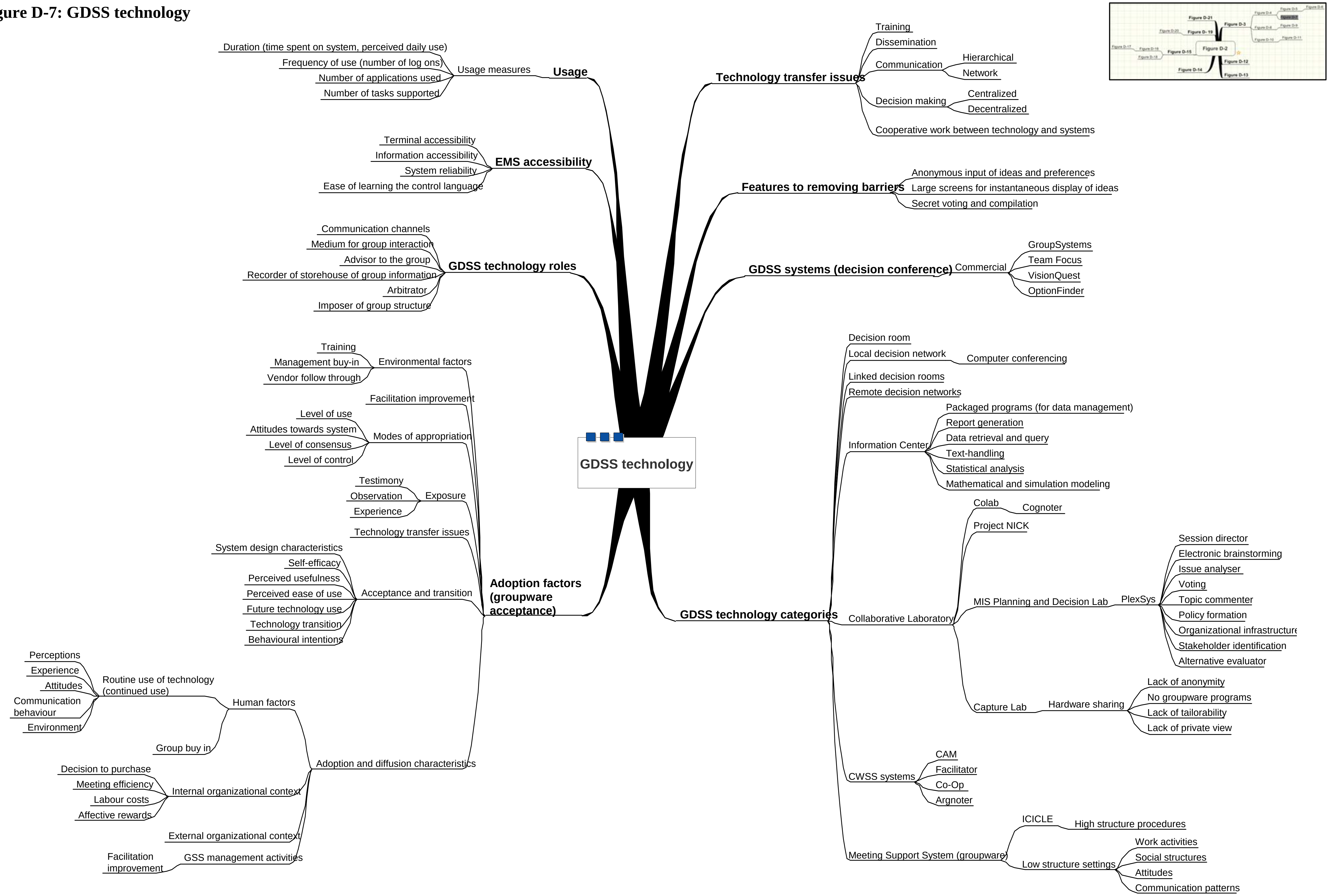


Figure D-8: CSCW system types (groupware, CSCW applications)

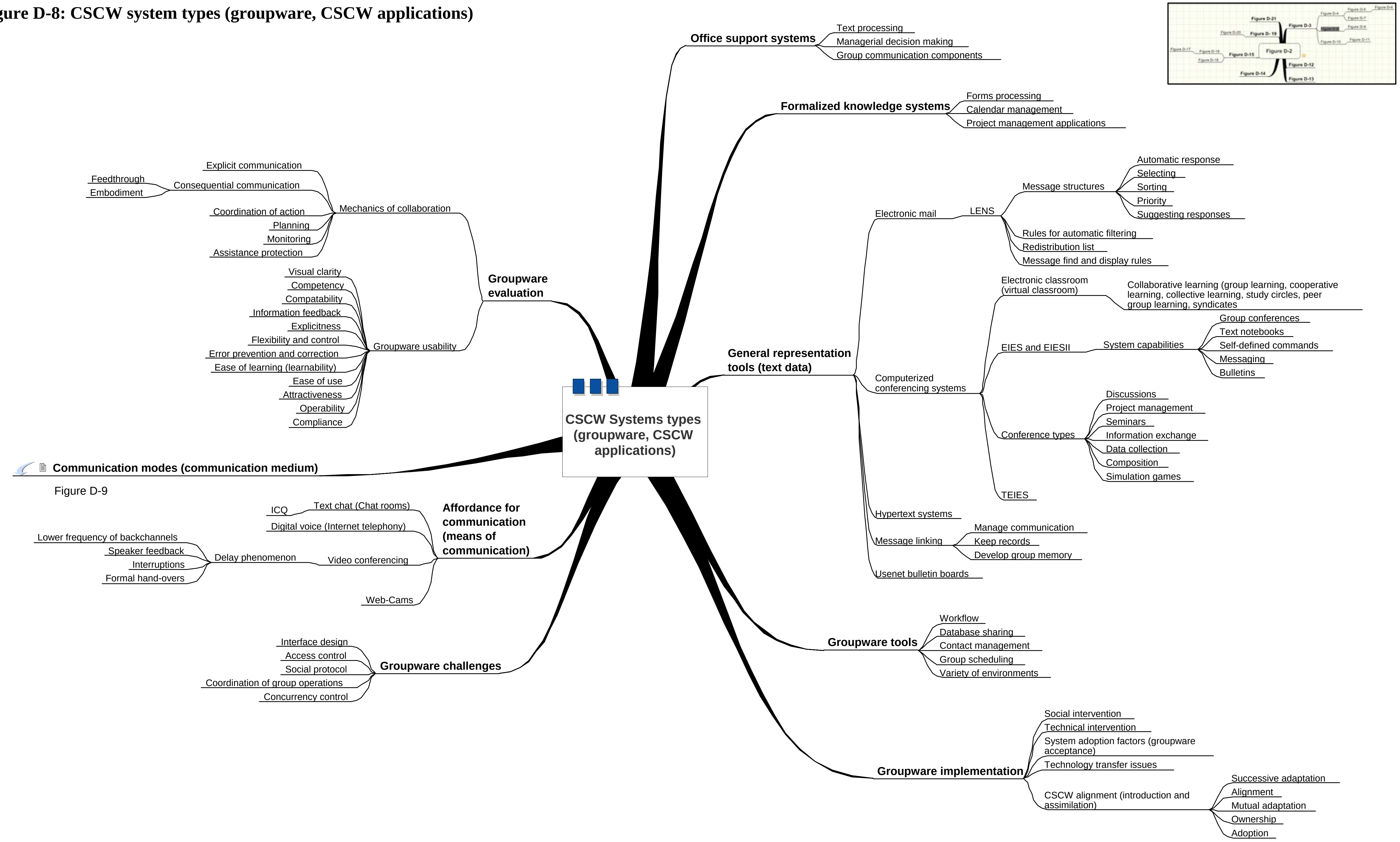


Figure D-9: Communication modes (Communication medium)

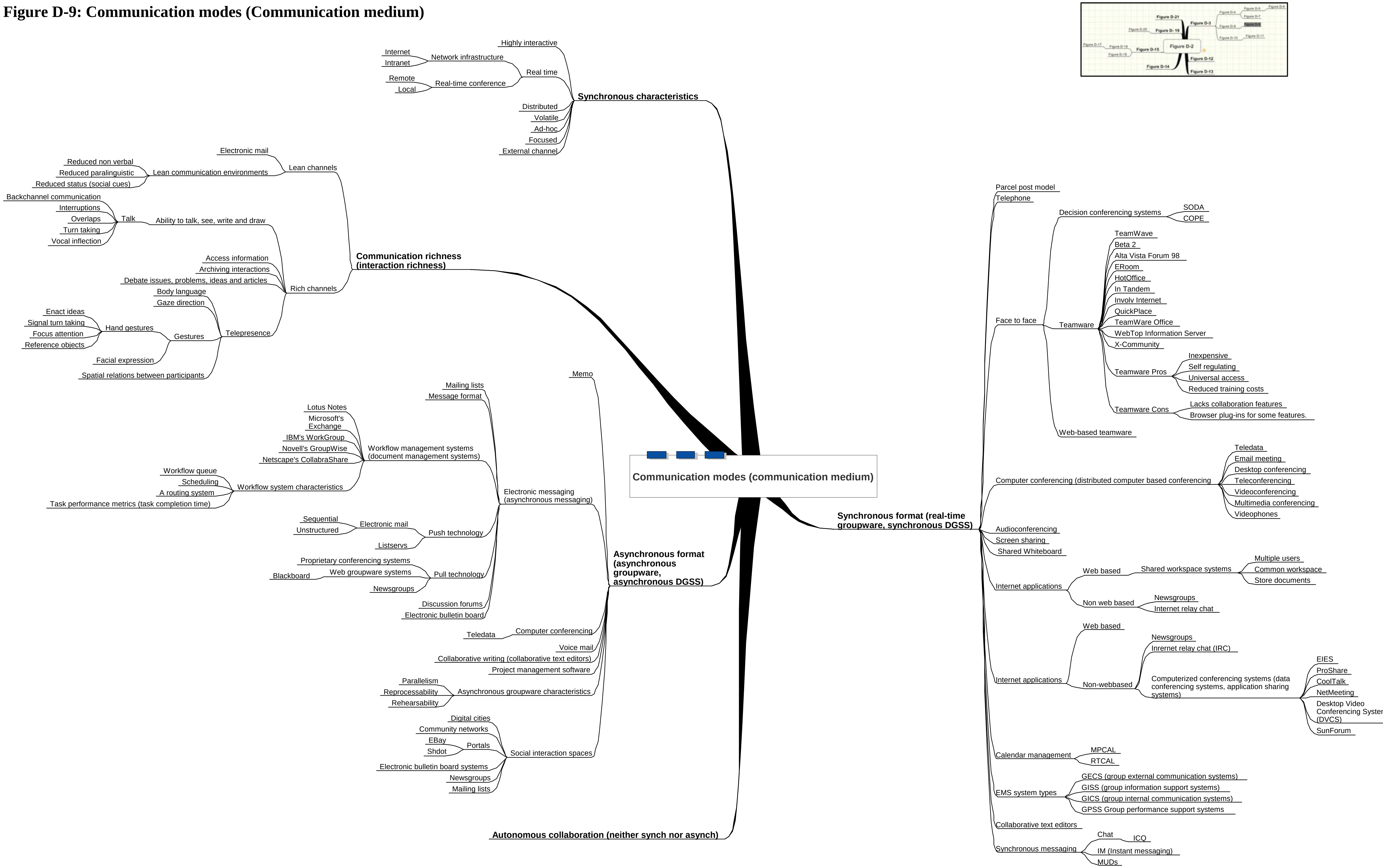
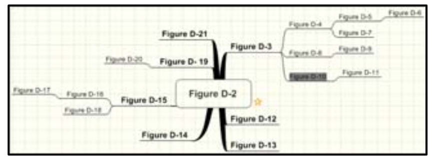


Figure D-10: Group editor research (Parallel editing systems)



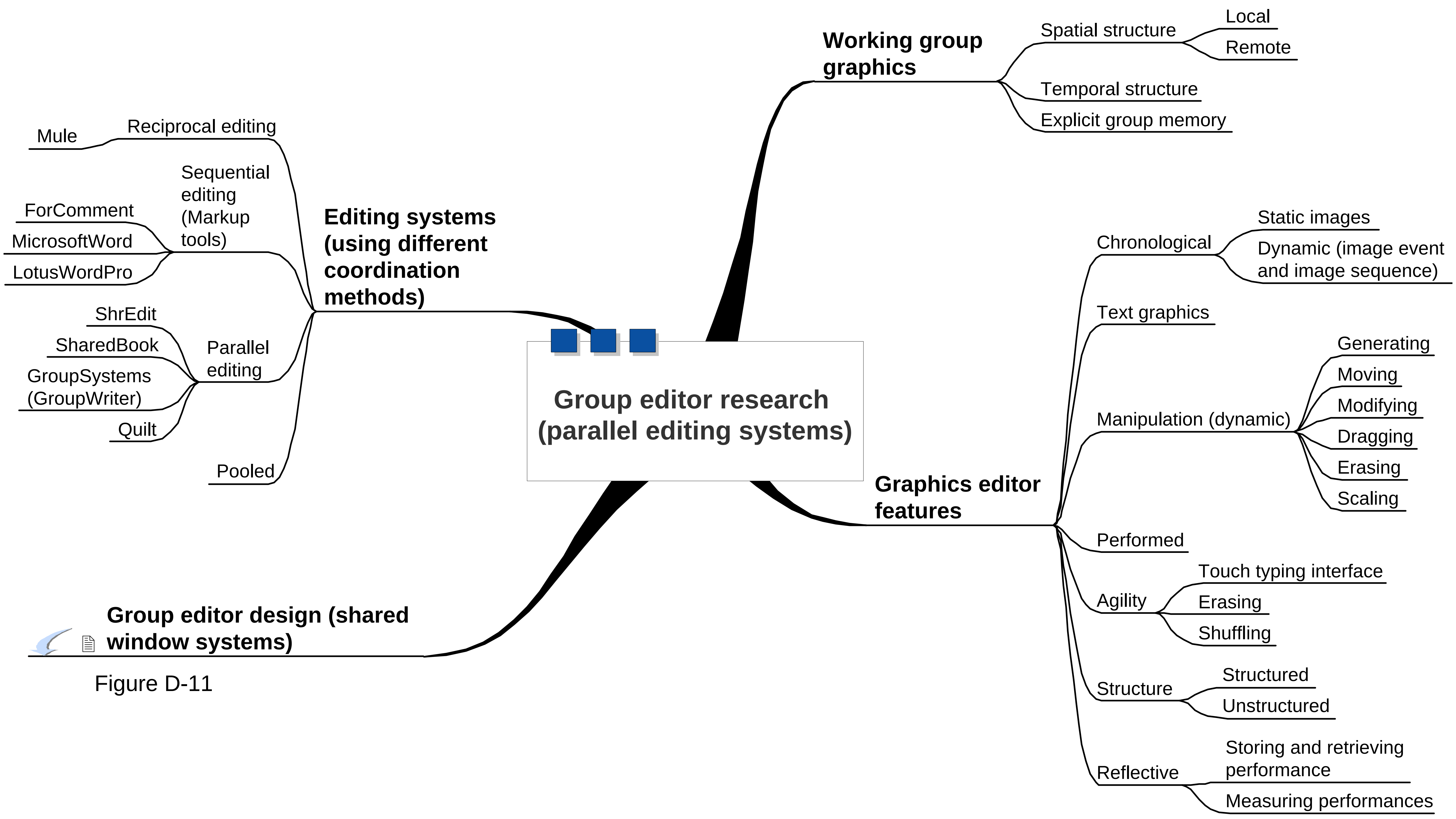
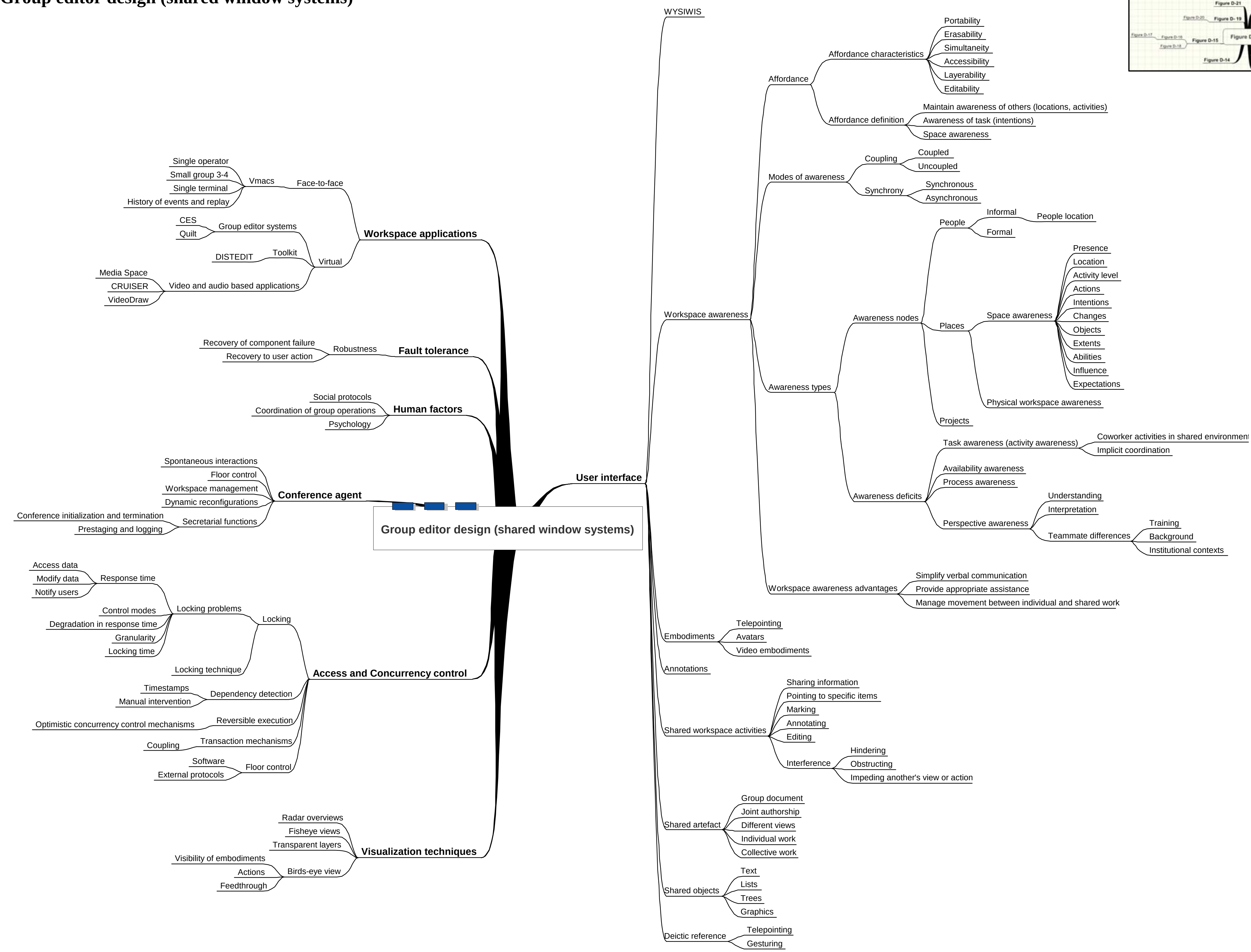


Figure D-11: Group editor design (shared window systems)



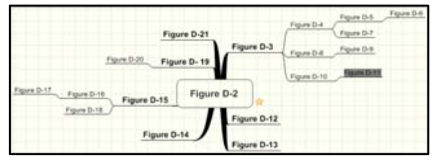
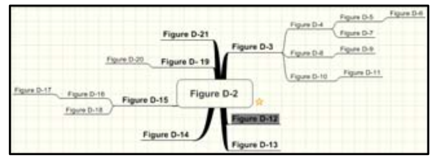


Figure D-12: Process



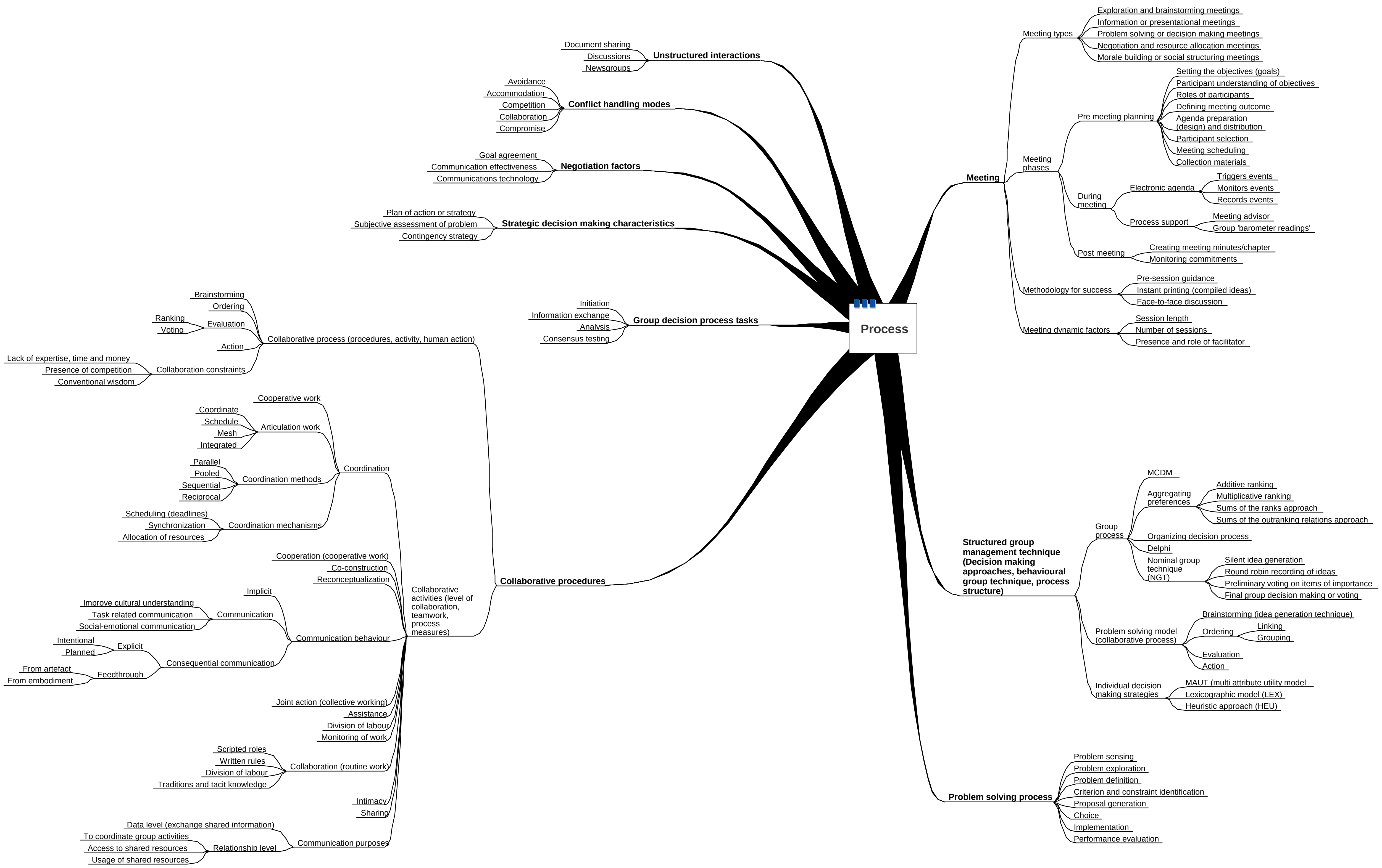
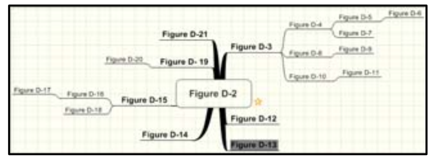


Figure D-13: Task



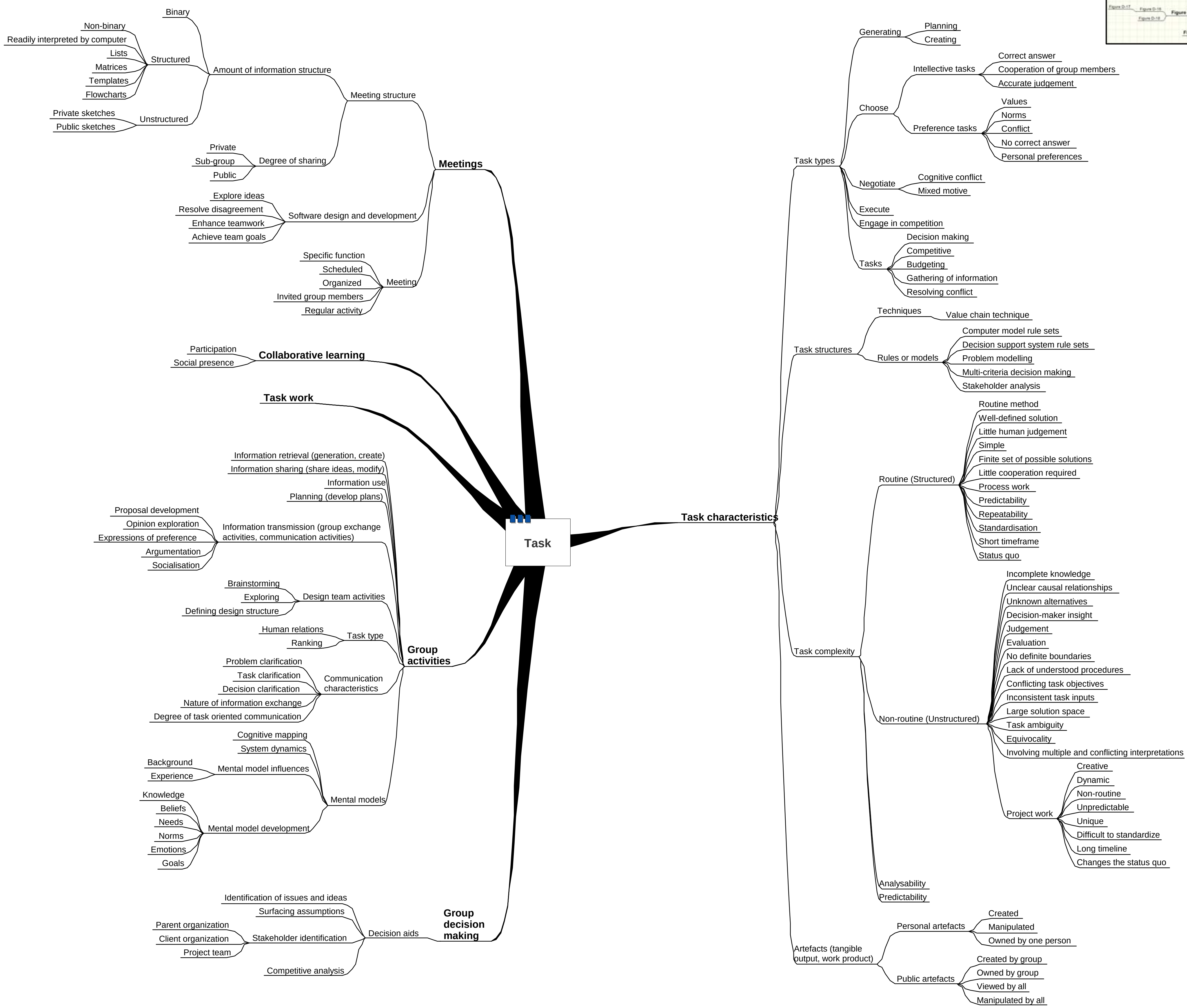


Figure D-14: Activity outcomes (Task outcomes)

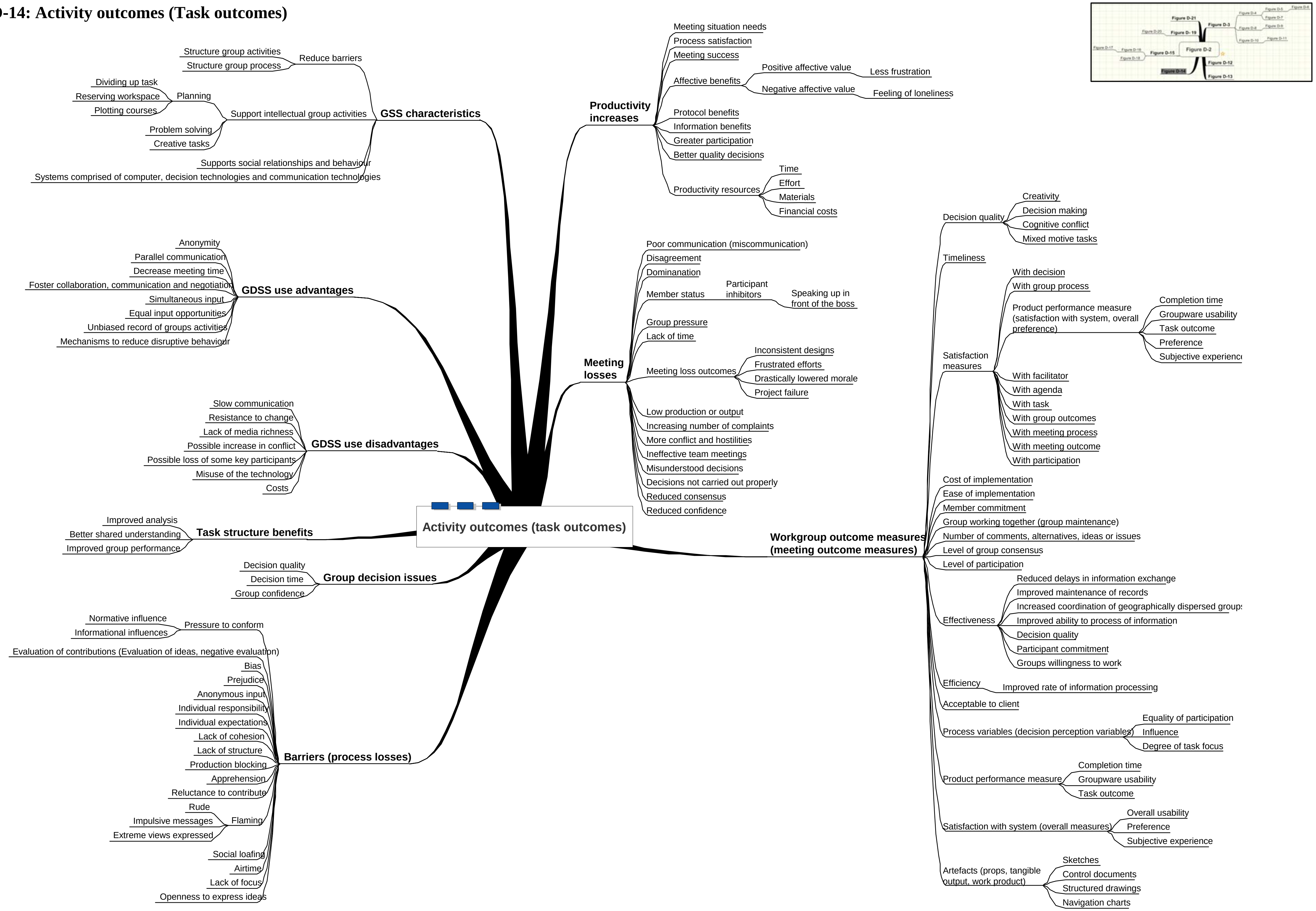
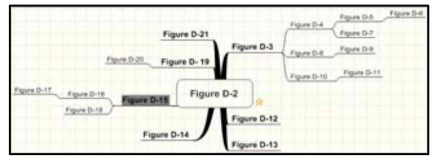


Figure D-15: Group



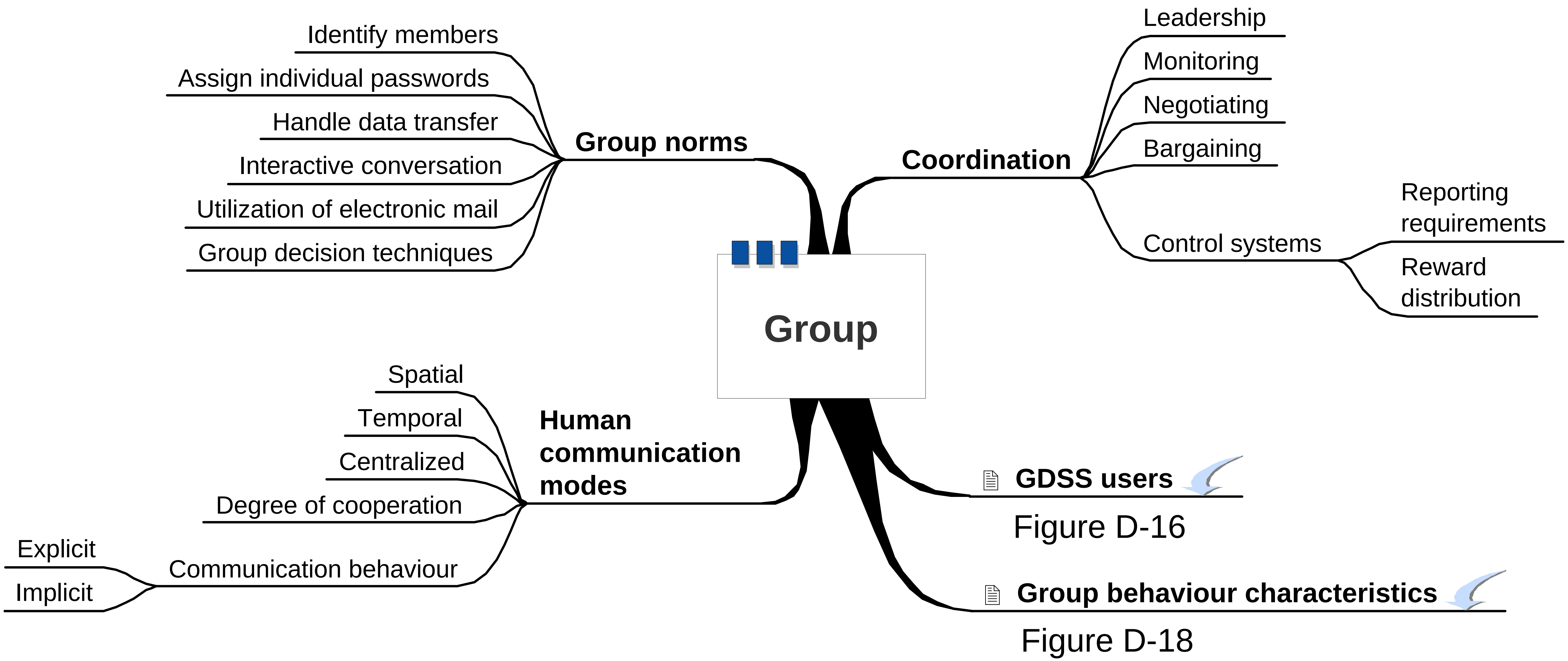


Figure D-16: GDSS users

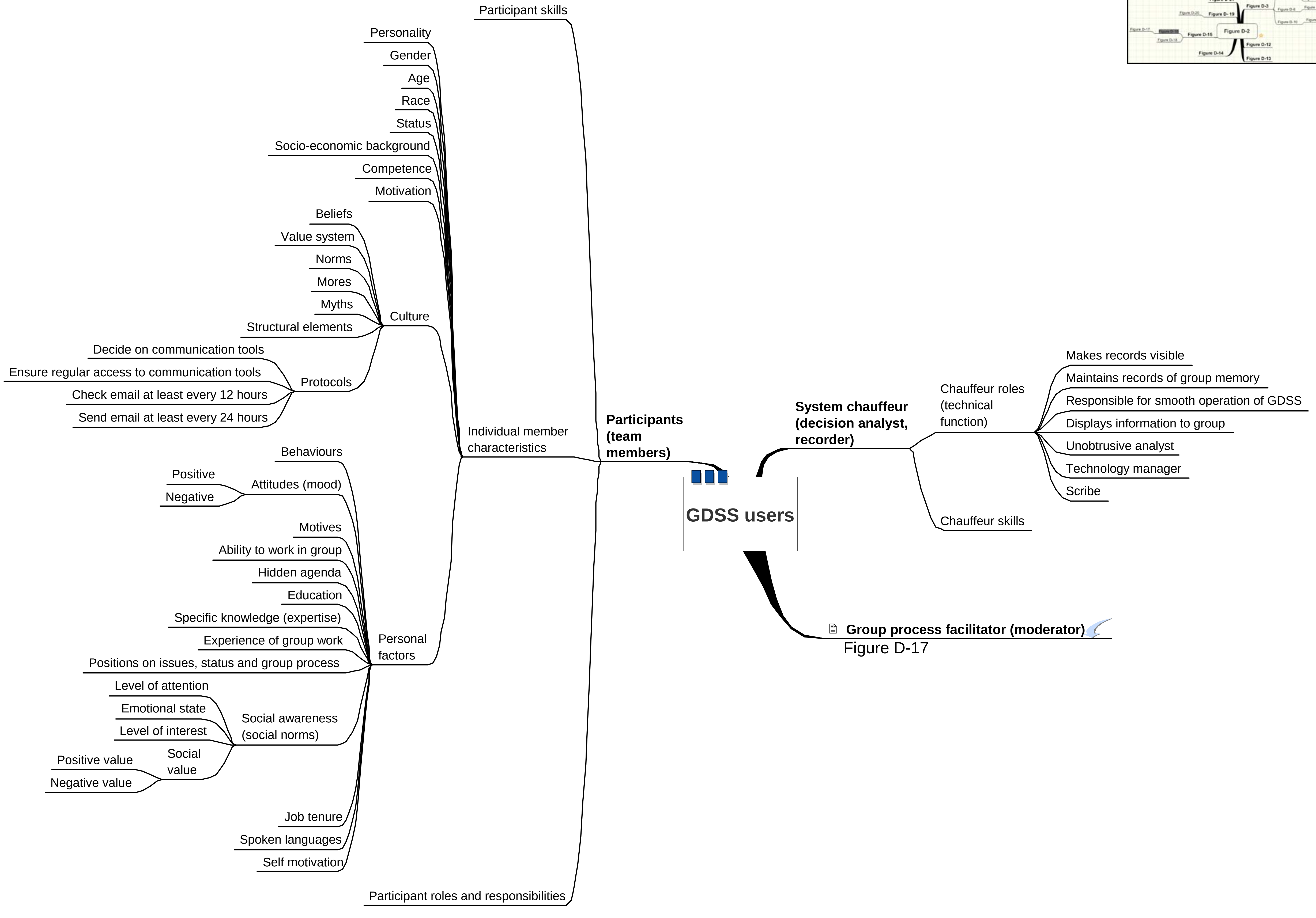
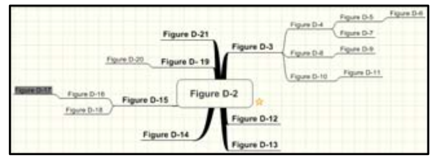


Figure D-17: Group process facilitator (moderator)



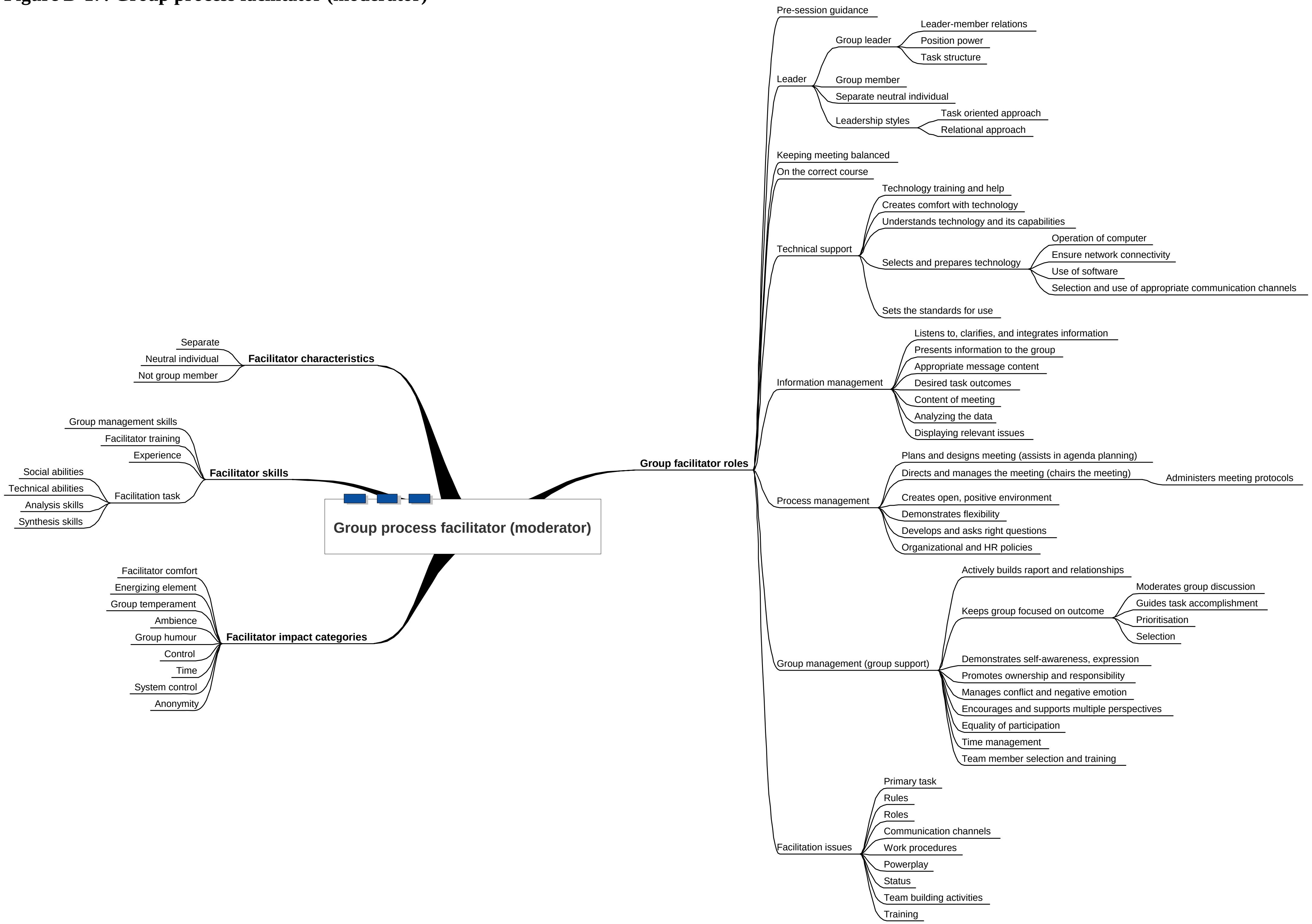
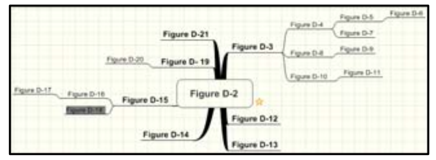


Figure D-18: Group behaviour characteristics



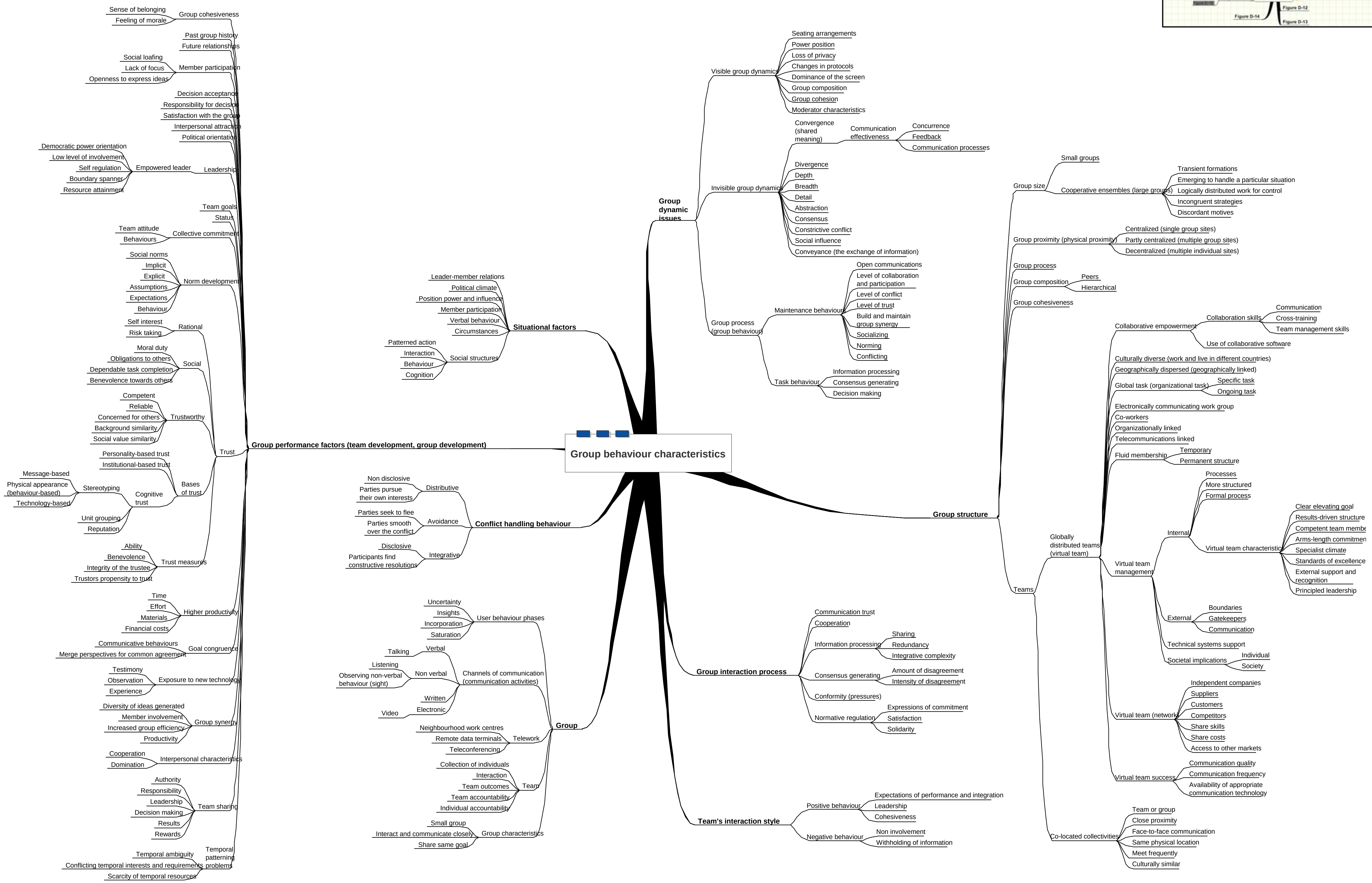


Figure D-19: Groupware environment (locales)

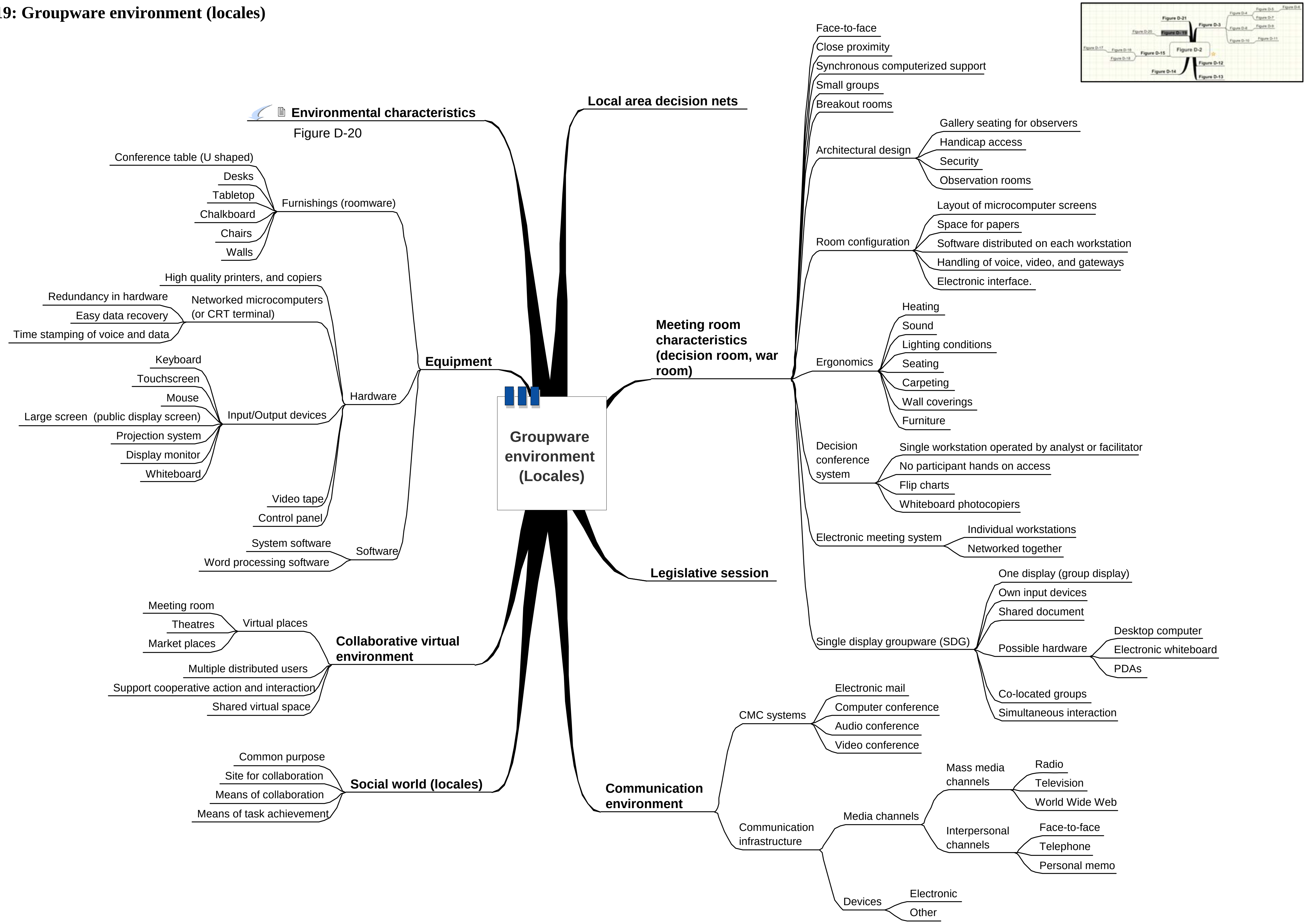


Figure D-20: Environmental characteristics

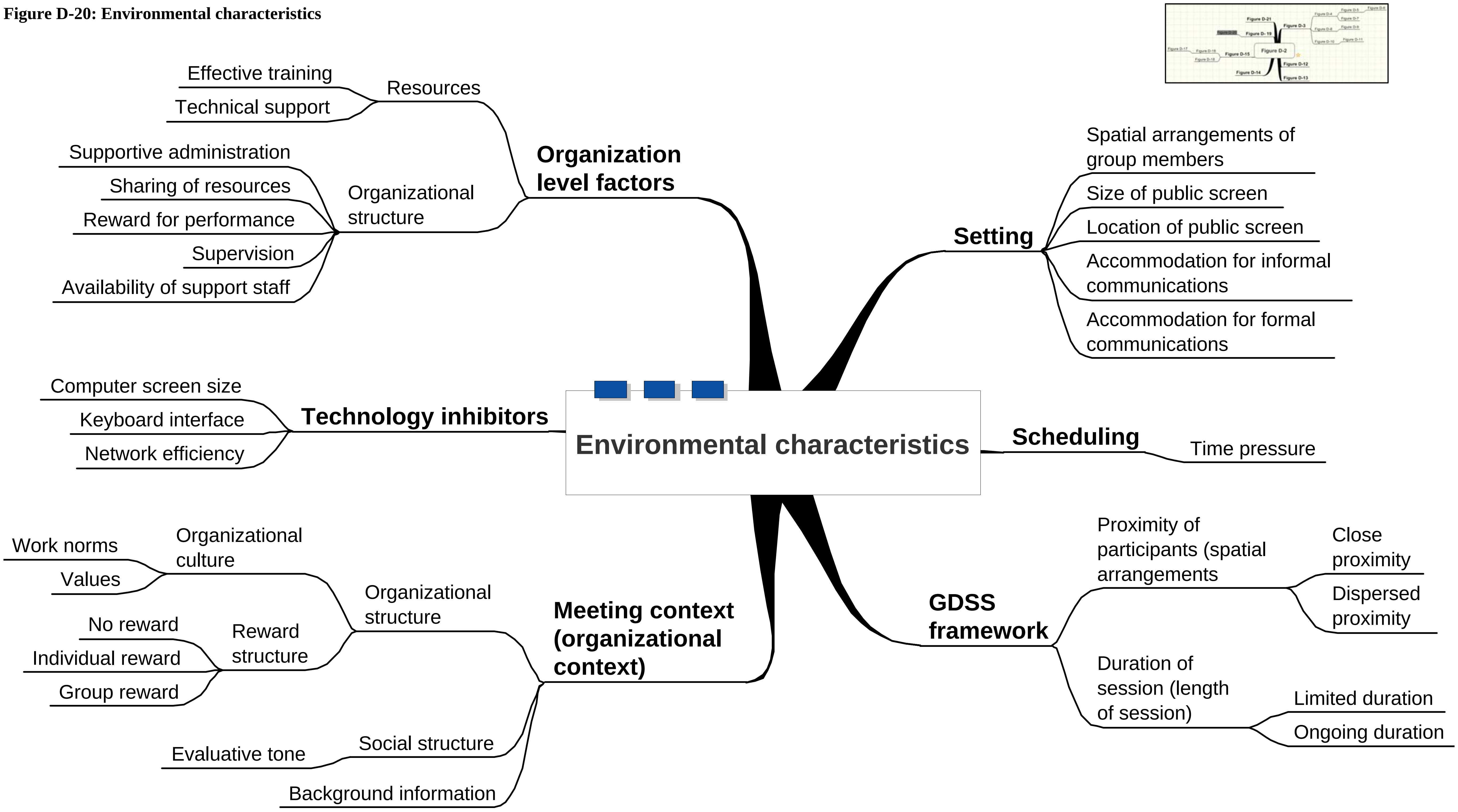
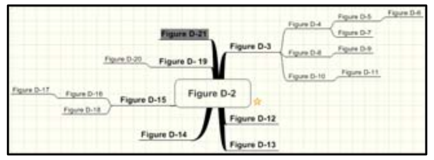
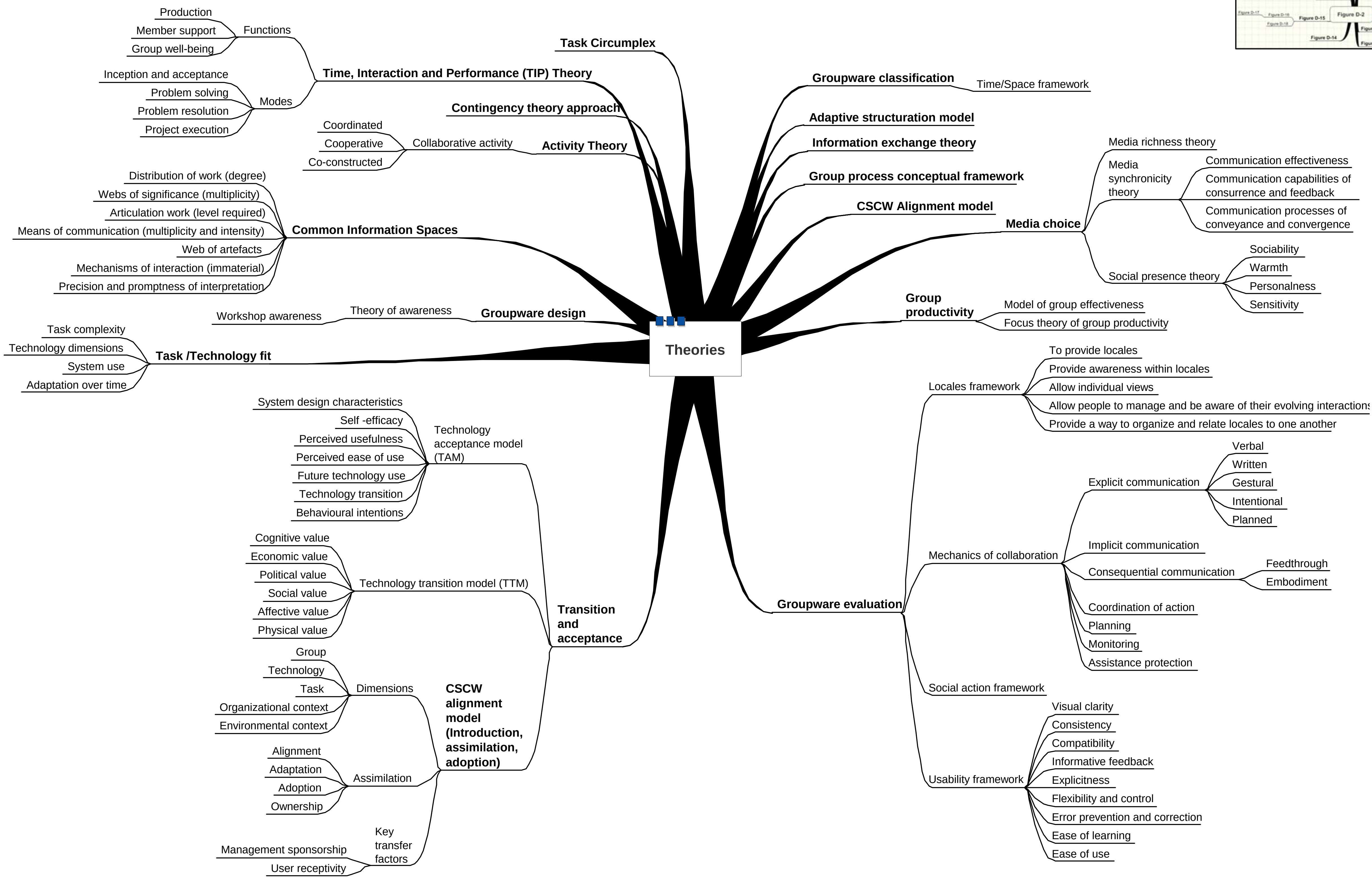


Figure D-21: Theories





Appendix E: CSCW Dictionary

Guidance for the introduction, style and arrangement of entries in this dictionary has been sourced from the Australian National University 1988, Australian National Dictionary: Australian words and their origins, Oxford University Press, Melbourne, Australia.

Introduction

The aim of this dictionary is to provide an historical record of the use of terms used in the CSCW field. The purpose of the dictionary is to show the scope of the field and provide a consistent set of terms and definitions for use in the CSCW field of research.

Some words have been identified as being introduced into the field by specific authors. Approximate dates of when some words were introduced into the field have been specified.

A three step content analysis process was used to identify terms and definitions from 382 published articles from the CSCW research field from 1978 to 2003. The process used to capture the terms and definitions for the dictionary was intended to cover the specialist vocabulary and document the history of words established as being in common use.

A spreadsheet of citations was developed during the content analysis process. The first task of editing the dictionary was to work through the database of citations to identify the use of words likely to be included. A selection was made of the citations which most fully represented a word's life and most definitively and vividly illustrated its use and meaning.

The dictionary consists of approximately 1200 main entries.

The essence of an entry in an historical dictionary is its citations. These help to established the chronology of a word's use, to substantiate the definition or definitions and illustrate the range of circumstances within which a word has been used.

The dictionary was developed as part of a PhD thesis, however the dictionary is intended as a stand alone document.

Explanation of the style and arrangement of entries

The entry: Each entry is designed to present the information in the most illuminating form. Entries range from the simple, one word entries, to the complex, multiple word entries. The element of an entry (not all of which may be required) appear in the following order.

Headword: The headword, the word which is the subject of the entry, appears at its head in bold italics roman. Subordinate items – combinations, collocations, and phrases of which the headword is the main element, as well as derivatives, appear in their place in the entry in bold roman. Words which normally have an initial capital, as proprietary names retain the capital, all other initial letters being in lower case.

Definition: The definition is either discrete, if there is no division, or subdivided according to the division. The definition may include cross-references to words which have main entries or are subordinate items. Definitions worded by me from other author materials are in normal font.

Cross reference: There are two main forms of cross reference: if a word is defined by another in the dictionary or listed within qualification, see … , the synonymy is exact. If the cross-reference is introduced by ‘see also … ’ the synonymy is not exact but the information provided under the word referred to is complimentary or in some other way useful.

Citations: sets of citations provide substantiation for the definition and illustrate the history of the word’s use. Some words are more copiously exemplified than others, this may be a reflection of their amount of use. A citation is preceded by a date (of publication) and the name of the author of an article is given (Full references of sources are provided in the reference list). Every effort has been made to record the earliest use of a word in this research field, and to provide a reasonably spaced sequence of citations to the year 2003. Citations for each entry are in date order from the oldest to the more recent. Citations are given in the source except that, in the interests of economy, ellipses have been used to show the removal of extraneous material. Care has been taken not to distort the authors intent.

Some of the terms used in the articles were not provided with definitions by authors of the 382 articles analysed. These terms have been included with their source and citations, but no definitions have been provided. The search for definitions in other publications was outside the scope of this research.

Proprietary Names

> *This dictionary includes some words which are, or are asserted to be, proprietary names or trade marks. Their inclusion does not imply that they have acquired for legal purposes a non-proprietary or general significance, not is any other judgement implied concerning their legal status. In cases where the editor has some evidence that a word is used as a proprietary name or trade mark this is indicated, but no judgement concerning the legal status of such words is made or implied thereby (ANU 1988).*

List of Acronyms from the CSCW field

AT	Activity Theory
AST	Adaptive Structuration Theory
AE	Alternative Evaluator
BBS	Bulletin Board System
BEACH	Basic environment for Active Collaboration with Hypermedia
BSCW	Basic Support for Cooperative Work
CA	Conversation Analysis
CAD	Computer Aided Design
CBIS	Computer Based Information System
CC	Constructive consensus
CC	Computer Conferencing
CES	Collaborative document Editing System
CIS	Common Information Space
CGT	Collaborative Group Technology
CM.sup 3	Computer Mediated Meeting Management system
CMC	Computer Mediated Communication
CWSS	Collaborative Work Support System
CSCL	Computer Supported Cooperative Learning
CSCW	Computer Supported Cooperative Work
CRT	Cathode Ray Tube
CVE	Collaborative Virtual Environment
DBMS	Database Management System
DGSS	Distributed Group Support System
DVC	Desktop Video Conferencing
DVCS	Desktop Video Conferencing System
EBS	Electronic Brainstorming
EDS	Electronic Discussion Systems
EIES	Electronic Information Exchange System
EMS	Electronic Meeting System
EMSS	Electronic Meeting Support System
EVDT	Electronic voting and discussion technique
ftf	face to face
GDS	Group Decision System
GDSS	Group Decision Support System
GSI	Group Styles Inventory
GSS	Group Support System
GTR	Global Team Rooms
HEU	Heuristic approach
IMGDM	Internet-based Multiattribute Group Decision Making
IM	Instant Messaging
IRC	Internet Relay Chat
LEX	Lexicographic model
MAUT	Multi Attribute Utility Model
MCDM	MultiCriteria Decision Making
MST	Media Synchronicity Theory
MUD	Multi-User Dungeons
NC	Notification Collage
NGT	Nominal Group Technique

NSS	Negotiation Support System
PAVE	Pal Virtual Environment
SDG	Single Display Groupware
SODA	Strategic Options Data Analysis
PDA	Personal Digital Assistant
TAM	Technology Acceptance Model
TFT	Task Force Team
TTM	Technology Transition Model
VC	Virtual Classroom
VR	Virtual reality
VTT	Virtual team trust
WFMS	Workflow Management System
WYSIWIS	What you see is what I see

Terminology and definitions for years 1978-2003

absolute positioning: Absolute positioning is based on proximity **1999** Bergqvist et al. (from Holmquist et al.1998) *absolute positioning is based on proximity, eg. Hummingbird system.*

abstraction: Abstraction is an invisible group dynamic. **1998** Briggs et al. *The invisible group dynamics that may be created are convergence and divergence, depth and breadth, detail and abstraction, consensus and constrictive conflict, to name but a few. Because a team may elect to contribute anonymously, people need not fear retribution from peers or superiors if they contribute unpopular ideas.*

acceptance: Acceptance is included in the concept of uptake of computer systems. Uptake is the sustained use of the technology for real work. Uptake also includes acquisition adoption, implementation, assimulation, routinization, and, course use. **2000** Turner and Turner (4) *Uptake - the sustained use of the technology for real work. …Inconsistent use of terminology: uptake include acquisition, adoption, acceptance, implementation, assimilation, routinization, and, of course use.*

acceptance and transition: Acceptance is the key indicator of success for technology transition. **1998** Briggs et al. *Technology Acceptance Model (TAM) is a causal model of actual system use, the key indicator of success for technology transition. It posits that actual technology use (AU) is directly caused by behavioural intentions (BI), a measure of the strength of one's intentions to perform a specific behavior. Intention is a useful construct because it can be measured well in advance of actual use…Technology Transition Model (TTM), frames acceptance as a multiplicative function of the magnitude and frequency of the perceived net value of a proposed change, moderated by the perceived net value associated with the transition period itself. TTM frames net value as having a number of dimensions, including cognitive, economic, political, social, affective, and physical. It posits that cognitive net value derives from at least three sources: changes in access, technical, and conceptual attention loads.*

access control: Access control is a technical measure. Access control determines who or what can access the information and who can make changes to it. **1986** Greif and Sarin (199), *Control over sharing: Two critical issues in managing shared data for CSCW are access control and synchronization of concurrent actions.* **2001** Baker et al. (9) *Technical measures such as access control, concurrency control, undo, version control, and turn-taking have been implemented.* **2003** Bose *There may need to be access control on the information that determines who, or what, can access the information and who can make changes to it.*

accessibility (1): Accessibility is a system purchase evaluation issue. The typical user must be able to obtain the equipment and the support necessary to use the system without inordinate effort. **1988** Rice and Shook (257) *The influence of accessibility on the use and evaluation of a computer-mediated communication system such as EMS has received increasing … Culnan (1985) suggested four dimensions to the concept of system accessibility: (a) terminal accessibility, (b) information accessibility, (c) system reliability, and (d) ease of learning the control language. This study focuses on the first dimension of accessibility … Accessibility and Appropriateness Affect Outcomes Independently of Usage Individuals' evaluations of the EMS studied here seem related to perceptions about how well the system is able to satisfy certain communication requirements, in addition to the extent to which the respondent used the system.*

accessibility (2): Accessibility is an interactive system characteristic related to learning modes. **1981** Turoff et al. *Learning accessibility: The knowledge and effort needed by users to gain access to a system.*

accessibility (3): Accessibility is a system scalability issue related to reliability and performance. **1986** Fanning and Raphael *Reliability and performance. If the system took more than a couple of seconds to* A*respond to a keystroke, or crashed more than once a week, it would not be acceptable and any other advantages it might have would be moot. Easy accessibility from the normal workplace. The typical user must be able to obtain the equipment and support necessary to use the system from his/her normal workplace without inordinate effort.*

accommodation: Accommodation is an unassertive behavior characterized by a tendency to concur with and conform to the majority position rather than take an opposing minority position. Accommodation behaviors are focused more on maintaining team harmony than on negotiating integrative, optimal solutions. Accommodation involves conceding to others and giving in to teammates' positions. Accommodation is one of five conflict handling modes to describe conflict management in organizational work groups. The other four are: avoidance, competition, collaboration and compromise. **1985a** DeSanctis and Gallupe F*ive conflict-handling modes to describe conflict management in organizational work groups: avoidance, accommodation, competition, collaboration, and compromise.* **2001** Montoya-Weiss et al. A*ccommodation is an unassertive behavior characterized by a tendency to concur with and conform to the majority position rather than take an opposing minority position. Accommodation behaviors are focused more on maintaining team harmony than on negotiating integrative, optimal solutions. Accommodation involves conceding to others and giving in to teammates' positions.*

accommodation behaviour: Accommodation behaviour is characterized by an obliging concern for others. Accommodation behaviours are focused more on maintaining team harmony than on negotiating integrative, optimal solutions. **2001** Montoya-Weiss et al. *Accommodation behaviors are focused more on maintaining team harmony than on negotiating integrative, optimal solutions. Accommodation behavior is characterized by an obliging concern for others.*

acquisition: Acquisition means purchasing the technology. **1986** Applegate et al. (from Gallupe 1986) *Gallupe (1986) presented research design factors that were considered in a study of the influence of a GDSS on decision quality, decision time and group confidence in the decision. He presents a series of research design issues and recommendations for GDSS research. These include the task, subjects, setting, dependent measures and GDSS design and implementation/acquisition.* **2002** Turner and Turner *Acquisition* **-** *purchasing the technology*

action: Action relates to the processes of collaboration where commitments of who does what are made and fulfilled or not. **1986** Johnson et al. (349) *We can characterize the process of collaboration through phases 'invention' (ideas are generated; structuring of roles becomes clearer), 'evaluation' (ideas are assessed; ambiguity is reduced); 'action' (commitments of who does what are made and fulfilled or not). We will consider the experiences of these two quite different project groups in using the Coordinator for each of these activities.*

action learning: Action learning is a group learning and problem-solving process whereby group members work on real issues and problems with an emphasis on self-development and learning by doing. Action learning, a means of development, intellectual, emotional or physical that requires its subjects, through responsible involvement in some real, complex and stressful problem, to achieve intended change to improve their observable behavior henceforth in the problem field. **2001** Yoong and Gallupe *The term action learning was coined by Revans (1982, pp. 626-27) and is defined as 'a means of development, intellectual, emotional or physical that requires its subjects, through responsible involvement in some real, complex and stressful problem, to achieve intended change to improve their observable behavior henceforth in the problem field'. Revans' original concept and equation for learning* **-** *$L = P + Q$ (i.e. learning equals programmed knowledge from the past plus questioning insight)* **-** *have now been extended and applied in information* *systems education (Avison, 1989; Jessup and Egbert, 1995), information management (Finlay and Marples, 1998) and organisational development (Ramirez, 1983; Gregory, 1994). In these contexts, al.is a group learning and problem-solving process whereby group members work on real issues and problems with an emphasis on self-development and learning by doing.*

actions in workspace: Examples of actions in workspace are listing, drawing, and gesturing. **2002** Tuikka (187) (from Tang 1989) *Actions in workspace: listing, drawing, and gesturing.*

active: **1985** DeSanctis and Gallupe *The extent to which group members are active in the group is also affected by the group's initial evaluation of the contributions of various members.*

active and adaptive text: Active and adaptive text is a CMC system factor relating to text processing. Active and adaptive text is the ability of text to incorporate programs or functions that are executed as part of the delivery mechanism to readers. **1981** Turoff et al. *The ability of text to incorporate programs or functions that are executed as part of the delivery mechanism to readers. This includes the ability of text to contain forms or surveys for the reader to respond to and make conditional on various factors or specific responses what the reader actually sees.*

Active Hydra: Active Hydra is an integrated analog audio-video-enabled-camera-display-speaker-microphone unit equipped with physical proximity sensors to control its operation. Active Hydra embodies a video/audio connection to a single remote person. **1998** Greenberg and Gutwin (11) *Active Hydra embodies a video/audio connection to a single remote person.* **2001** Boyle (1) (from Kuzuoka and Greenberg 1999) *Active Hydra [8] an integrated analog audio video-enabled camera-display-speaker-microphone unit equipped with physical proximity sensors to control its operation.*

activity: Activity is a task performed in a specific context. Activities are cooperative processes, where something is worked out together, forming the basic contexts of human action. **1992** Kuuti and Arveno (234) *Activity - b. user of a read-made artifact in a pre-specified way c. user of a read-made artifact in a self-specified way d. creator of a new artifact.* **2002** Sikorski *The task performed in a specific context*. **2002** Tuikka (188) *Activities are cooperative processes, where something is worked out together, forming the basic contexts of human action.*

activity awareness: Activity awareness gives workers indications of what is happening and what has happened recently in collaborative activities. **1999** Hayashi et al. (99) *Activity awareness gives workers indications of what is happening and what has happened recently in collaborative activities.***2000** Jang et al. (28) *Activity awareness represents a lack of awareness about other's activities (what are they doing).*

activity driven design: Activity driven design is a system design strategy that focuses on group activities rather than on group tasks. **1984** Huber (203) *To focus on group activities rather than on group tasks, and to derive the necessary system capabilities from a review of these activities and a consideration of how computing and communication technology might be used to carry them out … A discussion of GDSS design strategies led to the conclusion that an activity-driven design strategy was superior to either a technique-driven or task-driven strategy. (p.203)*

Activity theory (AT): Activity Theory has been proposed as a basis for CSCW research. **2002** Tuikka (187) *Activity Theory (AT) has been proposed as a basis for CSCW research by Kuuti [17]*.

adaptability: Adaptability is an interactive system characteristic that includes control, flexibility, leverage and simplicity, and modifiability. **1981** Turoff et al. *Definitions of system characteristics common to all interactive systems … Adaptability: (1) Control: The ability of users to feel in control of the computer, while making sure they understand what they are doing and where they are in the interaction. (2) Flexibility & Variety: The ability* *of users to tailor the system to their own style of interaction in carrying out tasks. (3) Leverage & Simplicity: The ability of users to execute significant computer operations with a minimum of interface effort (minimization of the number and length of user supplied entries). (4) Modifiability: The ability of users to adapt the system to serve their needs.*

adaptation: **1991** Applegate *Assimilation has been defined as a process of successive alignment between group, task, and technology leading to mutual adaptation and ownership.* **1996** Hiltz et al. (3) *Adaptation or modes of appropriation is an important intervening variable.*

Adaptive Structuration Theory: Adaptive Structuration Theory (AST) is a high-level theory explaining the relationship between technology use and social interaction in creating group outcomes in organizational contexts. AST is based on Structuration Theory developed by Giddens (1979, 1984), which proposes that a complete understanding of social interaction requires incorporating explanations of both the structure of relationships and the dynamics or processes of relationships. The processes both take place in social structures, and shape those structures over time. AST posits that a GSS is a social technology which enables and constrains interaction in the workspace. The technology enables structures such as parallel communication channels and anonymous voting which groups may choose to use or ignore. **1993** Wheeler et al. (508) *Adaptive structuration Theory advanced by Poole and DeSanctis (1989, 1990) argues that a GSS is a social technology which enables and constrains interaction in the workplace. The technology enables structures such as parallel communication channels and anonymous voting which groups may choose to use or ignore.* **2000** Maznevski and Chudoba (476) *Adaptive Structuration Theory (AST) is a high-level theory explaining the relationship between technology use and social interaction in creating group outcomes in organizational contexts. AST is based on structuration theory developed by Giddens (1979, 1984), which proposes that a complete understanding of social interaction requires incorporating explanations of both the structure of relationships and the dynamics or processes of relationships. The processes both take place in social structures, and shape those structures over time (DeSanctis and Poole 1994).*

additive ranking: Additive ranking is a technique for preference aggregation. **1986** Bui and Jarke *The Co-OP group model bank contains four techniques for preference aggregation and some negotiation support modules. The former include additive ranking, multiplicative ranking, the sums-of-the-ranks approach, and the sums- of-the-outranking-relations approach [6]. Unless otherwise specified, the Co-OP group module automatically searches for all aggregation techniques compatible with the MCDM used by any individual decision maker.*

ad-hoc team: Ad-hoc teams are groups brought together for a finite time to tackle a specific project. **2000** Pare and Dube *Ad hoc team: Groups brought together for a finite time to tackle a specific project.*

adoption (1): Adoption means the decision to purchase. Adoption is a process that may or may not lead to continued use. **2002** Turner and Turner (4) *Adoption can mean the decision to purchase, or the routine use of technology by end-users.* **2003** Pollard (172) *Rogers' (1995) defines adoption as a process that may or may not lead to continued use.*

adoption (2): Adoption is the routine use of technology by end-users, but may or may not lead to continued use. **2002** Turner and Turner (4) *Adoption can mean the decision to purchase, or the routine use of technology by end-users.* **2003** Pollard (172) *Rogers' (1995) defines adoption as a process that may or may not lead to continued use. Recently, IT researchers have begun to report on some aspects of these important post adoption issues.*

adoption and diffusion: **2002** Turner and Turner *Uptake - the sustained use of the technology for real work. …Inconsistent use of terminology: uptake include acquisition, adoption, acceptance, implementation, assimilation, routinization, and, of course use.*

AE: see Alternative evaluation tool.

affective benefit: see Affective value.

affective reward: Affective reward is the positive emotional response sometimes associated with goal attainment. **2003** Siao *Affective reward is defined as the positive emotional response sometimes associated with goal attainment.*

affective value: Affective value can be positive or negative. Changing to a new technology may engender positive or negative emotional responses to which the prospective user may attach value. **1988** Kraemer and King (130) *GDSSs appear to bring "affective" benefits in the sense that they enliven meetings and in some cases help encourage a sense of group cohesion.* **1998** Briggs et al. C*hanging to a new technology may engender positive or negative emotional responses to which the prospective user may attach value. For example, the new system might engender less frustration (positive affective value) or more feelings of loneliness (negative affective value).*

affordance: The affordances of physical workspaces allow people to maintain awareness of others' locations, activities, and intentions relative to the task and to the space-awareness that enables them to work together more effectively.Affordances offered by media space systems for perception and interaction. Affordances are properties of the environment that offer actions to appropriate organisms. **1992** Gaver (17) (from Gibson 1797) *Affordances offered by media space systems for perception and interaction. Affordances are properties of the environment that offer actions to appropriate organisms.* **1996** Gutwin and Greenberg (208) *The affordances of physical workspaces allow people to maintain awareness of others' locations, activities, and intentions relative to the task and to the space-awareness that enables them to work together more effectively.*

affordance for communication: Affordances for communication can include text chat, digital voice and video. **1998** Greenberg and Gutwin (1) *systems that afford communication (eg. text chat, digital voice and video).*

affordances for interactive movement: Affordances for interactive movement can have positive or negative impacts Media spaces are often discontinuous, reducing the ability to create communicative gestures and to control conversational access. **1992** Gaver (1) *Affordances for interactive movement - media spaces are often discontinuous, reducing the ability to create communicative gestures and to control conversational access.*

affordances for listening: Affordances for listening can have positive or negative impacts. Audio equipment is usually momophonic, impeding localization and conveying a biased sample of remote audio information. **1992** Gaver *Affordances for listening – Audio equipment is usually momophonic, impeding localization and conveying a biased sample of remote audio information*.

affordances for movement: Affordances for movement such as cameras and microphones are stationary or only move remotely, preventing perceptual exploration. **1992** Gaver *Affordances for movement – cameras and microphones are stationary or only move remotely, preventing perceptual exploration.*

affordances for predictable interaction: Affordances for predictable interaction such as isotropism which is a material that has characteristics that are the same when measured along any axis. **1992** Gaver I*sotropism – a material which has characteristics that are the same when measured along any axis.*

affordances for shared artifacts: Examples of systems that afford sharable artifacts are electronic whiteboards and shared applications. **1998** Greenberg and Gutwin (1) *Systems that afford sharable artifacts (eg Electronic whiteboards, shared applications).*

agenda: Agenda is a process structure that helps to direct the pattern, timing or content of meetings. **1991** Nunamaker et al 1991 *Process structure refers to process techniques or rules that direct the pattern, timing or content of this communication (12), such as an agenda or process methodology such as Nominal Group Technique (NGT).*

agenda planning:Agenda planning is one of four functions executed by the human facilitator of electronic meetings. **2001** Antunes and Ho *According to Nunamaker et al. (1997), the human facilitator executes four functions: (1) provides technical support by initiating and finishing specific software tools; (2) chairs the meeting, maintaining and updating the agenda; (3) assists in agenda planning; and, finally, (4) provides organisational continuity, setting rules and maintaining an organisational repository. One more complex function considered by Schwarz (1994) and Miranda and Bostrom (1999) concerns improving the future group performance, which extends the scope from the specific problem and process at hand towards continued progress review.*

agent: Agents are self-contained, concurrently executing software processes that encapsulate the current state in terms of knowledge, and are able to communicate with other agents through message passing. **1999** Whatley et al. (27) (from Wooldridge and Jennings 1995) *Agents are self-contained, concurrently executing software processes that encapsulate the current state in terms of knowledge, and are able to communicate with other agents through message passing.*

aggregated: Aggregated is a mode of the prioritization process where each member assigns individual weights first, then individual priorities are aggregated using a predetermined computation rule. **1986** Bui and Jarke *Co-OP can perform the prioritization process in three modes: -Pooled: All group members collectively enter a common priority vector. -Sequential: Group members, according to their expertise, assign priority to a subset of criteria. -Aggregated: Each member assigns individual weights first; then individual priorities are aggregated using a predetermined computation rule.*

aggressive group: Aggressive groups are characterized by competition, criticism, interruptions, and overt impatience. **2000** Potter et al. (from Cooke and Szumal 1994). *Aggressive groups are characterized by competition, criticism, interruptions, and overt impatience.*

aggressive interaction style: Aggressive interaction style places greater emphasis on personal achievement needs, with personal ambitions placed above concern for group outcome. Aggressive groups are characterized by competition, criticism, interruptions, and overt impatience. **2000** Potter et al. (from Cooke and Szumal 1994) *Aggressive style places greater emphasis on personal achievement needs, with personal ambitions placed above concern for group outcome. Aggressive groups are characterized by competition, criticism, interruptions, and overt impatience.*

agility: Agility is a text-graphic manipulation feature. These include speed in creation, moving and modifying images **1986** Lakin (264) *Agility and generality must not be achieved at the expense of specializability. After a group has initially sketched an idea in text and graphics, then that same medium should also support refining the sketch according to formal schema. … Agility is measured in text-graphic manipulations per second … Vmacs achieves ability through a touch-typing interface with no waiting for menus. Among key features of this kind of text-graphics manipulation are: agility (speed in creation, moving and modifying images) generality (freedom to create any kind of image at any time and place); structure (definable spatial patterns of text and graphics are often used); and dynamics (manipulation of text-graphic unfolding over time).*

aides: *Aides are a GDSS success factor.* ***1984*** *Huber (203) … major factors in GDSS success are the capabilities of the users and their aides in, managing a decision group and drawing appropriately on the GDSS technology.*

Alternative Evaluation Tool: Alternative evaluation is a prioritization tool. Alternative Evaluator (AE) is a multicriteria decision making tool that uses a similar interactive/chauffeured set of styles. With AE, the group rates each alternative on a 1-10 scale for each criterion. Criteria can be considered equally important, or can be assigned different weights. **1994** Chen and Hsu *Alternative evaluation is a prioritization tool. Alternative Evaluator (AE) is a multicriteria decision making tool that uses a similar* *interactive/chauffeured set of styles. With AE, the group rates each alternative on a 1-10 scale for each criterion. Criteria can be considered equally important, or can be assigned different weights.[Check this reference]*

ambience: Group ambience is a facilitator impact category when using electronic meeting systems. **1992** Lewis and Whiteley *Facilitator impact categories were generated by facilitators. They included: facilitator comfort, the energizing element (is it depleted or enhanced through GDSS); group temperament or ambience, and the use of humour in the group; control.*

analysis: Analysis is a group decision task. Analysis refers to the interpretation of the results of group discussions or decisions. **1986** Bui and Jarke 1986 (94) *there are different tasks in group decision processes that must be supported: -Initiation. How does the group start the collective decision-making process? Should the group elect a person who leads the discussion? -Information exchange. How can a member request or disseminate information? -Analysis. How does the group interpret the results of group discussions or decisions? -Consensus testing. What decision technique(s) should be adopted, for example, democratic vote or weighted majority rule?*

analysis tool: Information analysis tools are GDSS features. Information analysis tools are designed to aid in decision making. These tools quickly and easily organize, model, change, and rank information – that is, they transform data from individual contributions to shared team information. The tools include ways to organize and analyse information, such as by the use of voting and modelling. **1987** DeSanctis and Gallupe *Conceivably, data analysis tools, planning aids and other GDSS features will prevent influential members from encouraging poor choices.* **2001** Dennis and Wixom *… information analysis tools designed to aid in decisionmaking [14]. These tools quickly and easily organize, model, change, and rank information-that is, they transform data from individual contributions to shared team information. These level 2 tools include ways to organize and analyze information, such as by the use of voting and modeling.*

analyzing method: Analyzing methods could be a GDSS group feature. Analyzing methods may include analysing prior group interactions and judgments to eliminate redundant input during brainstorming. **1985a** DeSanctis and Gallupe *Group Features - Numerical and graphical summarization of group members' ideas and votes - Menus which prompt for input of text, data, or votes by group members - Program(s) for specialized group procedures, such as calculation of weights for decision alternatives; anonymous recording of ideas; formal selection of a group leader; progressive rounds of voting toward consensus-building; or elimination of redundant input during brainstorming - Method of analyzing prior group interactions and judgments - Text and data transmission among the group members, between the group members and the facilitator, and between the group members and a central computer processor.*

annotating:Annotating is a shared workspace activity that can be supported by shared screen systems, shared window systems and multiuser editors. **1994** Ishii, Kobayashi and Arit (8) *Shared workspace activities include sharing information, pointing to specific items, marking, annotating, and editing. These activities can be supported by computer-based groupware, including shared screen systems, shared window systems, and multiuser editors.*

annotations: **1996** Greenberg and Roseman *Annotations: Users can enter and edit text at any time, which is displayed on all screens.*

anonymity: Anonymity enables group members to contribute comments without being identified, which may increase the motivation to participate. Anonymity reduces the reluctance to contribute information, because it shields the contributor from group reaction and deindividualizes the interaction. Communicators do not know owners of expressed ideas in group interaction process. **1992** Bostrom and Anson *Communicators do not know owners of expressed ideas in group interaction process.* **1992** McLeod and Liker *Anonymity* *removes social barriers to participatiuon that stem from evaluation apprehension and social status differences. The increased inputs from all group members should also result in increased decision quality.* **1998** Gavish and Gerdes *Types of anonymity: Anonymity can be viewed as a composite of three types of anonymity - environmental, content-based and procedural. Environmental anonymity refers to the extent to which environmental factors affect the anonymity of the communication system. These factors include such elements as: the number of individuals involved in the communication session, the proximity of these individuals, and the level of inter-group familiarity. Content-based anonymity - " the extent to which the source of a specific contribution can be identified through the contribution content. Procedural anonymity dealing with the communication protocols.* **2001** Dennis and Wixom *Anonymity, on the other hand, enables group members to contribute comments without being identified, which may increase the motivation to participate. Without anonymity, individuals, particularly low status participants, may withhold ideas due to negative evaluation apprehension [16, 30] or may feel pressured to conform to the group majority or senior participants' views [24]. Anonymity reduces the reluctance to contribute information, because it shields the contributor from group reaction and deindividualizes the interaction [7].*

anonymity of contributions: Anonymity of contributions is a means to reduce productivity losses in group decision making **1986** Kraemer and King (117) *GDSS's can reduce these losses by allowing anonymity of contribution to the discussions, searching of data bases and doing analyses to answer question,, and displaying individuals' inputs to the public screen for open discussion.*

anonymous communication: Anonymous communication affords that group members are not able to attribute ownership to any ideas. **1992** McLeod and Liker *Anonymous communication means that group members are not able to attribute ownership to any ideas.*

anonymous input: Anonymous input is a technical GDSS feature that assists in removing common barriers to group work and communication.**1986** Kraemer and King *At the simplest level GDSS provide features aimed at removing common barriers to group work and communication, such as unequal consideration of ideas, dominance by individuals, peer pressure, and loss of autonomy. These features include anonymous input of ideas and preferences, and large screens for instantaneous display of ideas, and secret voting and compilation. The level is illustrated by the electronic boardroom or computer-supported conference room.* **1987** DeSanctis and Gallupe *Level 1 GDSSs provide technical features aimed at removing common communication barriers, such as large screens for instantaneous display of ideas, voting solicitation and compilation, anonymous input of ideas and preferences, and electronic message exchange between members.*

anonymous vote recording: Anonymous voting helps reduce bias of dominant individuals in the group. GDSS systems sometimes include the recording of anonymous votes. Voting systems allow for rapid identification of variance in participant attitudes on given issues. **1985a** DeSanctis and Gallupe *Group Features - Numerical and graphical summarization of group members' ideas and votes - Menus which prompt for input of text, data, or votes by group members - Program(s) for specialized group procedures, such as calculation of weights for decision alternatives; anonymous recording of ideas; formal selection of a group leader; progressive rounds of voting toward consensus-building; or elimination of redundant input during brainstorming - Method of analyzing prior group interactions and judgments - Text and data transmission among the group members, between the group members and the facilitator, and between the group members and a central computer processor* **1986** Kraemer and King *Voting systems allow for rapid identification of variance in participant attitudes on given issues. Anonymous voting helps reduce bias of dominant individuals in the group, and results are tabulated rapidly and displayed to a common screen in a summary format. Agreement and disagreement on issues is readily apparent. When confidence measurement is introduced to weight votes of individuals, greater interpretive information is available for assessing the meaning of the votes.* **1995** Aiken et al. *Automated record keeping: A GDSS automatically records comments, votes, and other information shared by a group onto a disk file. This automated log of the discussion supports the development of an organizational memory from meeting to meeting.*

application sharing system: Application sharing systems allow people to work together simultaneously using existing single-user applications. This form of data conferencing is referred to as collaboration transparency because the shared use is transparent to the application and its developers; no application source is modified or inspected to achieve collaborative use. **2000** Begole et al. *allow people to work together simultaneously using existing single-user applications. This form of data conferencing is referred to as collaboration transparency because the shared use is transparent to the application and its developers; no application source is modified or inspected to achieve collaborative use.*

apprehension: Participant apprehension is a process loss during group meetings. Anonymity enables group members to contribute comments in electronic meetings without apprehension which reduces process losses. **2001** Dennis and Wixom *Anonymity, on the other hand, enables group members to contribute comments without being identified, which may increase the motivation to participate. Without anonymity, individuals, particularly low status participants, may withhold ideas due to negative evaluation apprehension [16, 30] or may feel pressured to conform to the group majority or senior participants' views [24].* **2001** Genuchten et al. *Process losses (for example, air time and participant apprehension).*

architectural design: Architectural design is an attribute of a GDSS decision room. **1988** Dennis et al. *One area of possible research that has been neglected to date is a comparison of key attributes of different GDSS Decision Rooms. Decision Rooms differ across several attributes, such as architectural design, room configuration, public display capabilities, and system software.*

Argnoter: Argnoter: a tool for considering and evaluating alternate proposals. **1987** Stefik et al. *Argnoter, a tool for considering and evaluating alternate proposals.*

artefact: Artefacts or artifacts are a tangible output, such as a work product, produced from the execution of an implemented process. **1998** Greenberg and Gutwin (4) *The artefacts in that space act as stage and props for rich person-to-person interaction.* **2002** Sikorski (from ISO 15504) *A tangible output, such as a work product, produced from the execution of an implemented process.*

artifact: see artefact.

articulation work: Articulation work is the work group members do, caused by their interdependency, in order to coordinate, schedule, mesh, integrated, etc., their cooperative work. **1998** Bardram (90) *The conceptualization of cooperative work within the framework of Coordination mechanism [21] makes an analytical distinction between "cooperative work" and "articulation work", the later being the work actors do, caused by their interdependency, in order to coordinate, schedule, mesh, integrated, etc., their cooperative work. Hence, articulation work is an overhead to the cooperative work. However, this view does not incorporate any dynamic understanding of work in the sense that what is cooperative work in one situation might be articulation in another, and vice versa.*

artificial intelligence technique: Artificial intelligence techniques such as distributed problem solving, evidential reasoning, belief maintenance are tools in some GDSS for which the communication manager provides a framework of usage. **1986** Bui and Jarke *There are also different classes of tools for which the communication manager provides a framework of usage. In the simplest case, these may be merely shared databases; even then, there is at least a need for novel transaction concepts, such as those used in design databases [19]. More complex methods include various artificial intelligence techniques (e.g., distributed problem solving, evidential reasoning, belief maintenance), multiple criteria decision methods (MCDM), game theory from operations research, and a large number of behavioral, process- oriented tricks (threats, promises, deadlines, etc.).*

assimilation: Assimilation: a process of successive alignment between group, task, and technology leading to mutual adaptation and ownership. **1991** Applegate *Assimilation has been defined as a process of successive alignment between group, task, and technology leading to mutual adaptation and ownership.*

assistance: Group members provide help to one another when it is needed. Assistance may be opportunistic and informal, where the situation makes it easy for one person to help another, or it may be explicitly requested. **2001** Potts-Steves et al. *Group members provide help to one another when it is needed. Assistance may be opportunistic and informal, where the situation makes it easy for one person to help another, or it may be explicitly requested.*

assumptions: **1988** DeSanctis*Information inputs consist of data (knowledge, ideas, opinions, preferences) or rules (assumptions, procedures) for group action. To the extent that there is perceived information asymmetry between people, individuals invoke networks to send and receive information.* **1998** Knoll and Jarvenpaa *Group norms: Group norms, implicit and explicit, are assumptions or expectations held by members of a group regarding correct and incorrect behavior (12).*

AST: see Adaptive Structuration Theory

asynchronous: Asynchronous is a communication system format. Asynchronous refers to the dimension of time – at different times. **1980** Hiltz et al. *A computerized conference (CC) is a form of communication in which participants type into and read from a computer terminal. The participants may be on line at the same time – termed a 'synchronous' conference, or may interact asynchronously.* **1995** Ocker et al. (2) *Asynchronous refers to the dimension of time - at different times.* **1996** Hiltz et al.*Asynchronously: Groups in which interaction is distributed in time as well as in space.* **1997** Roseman and Greenberg *Asynchronously - work at different times.*

asynchronous collaboration: Asynchronous collaboration means the users are not instantly communicating. Email is a common example of asynchronous collaboration. **1998** Hein et al. (6) *Asynchronous collaboration simply means that the users are not instantly communicating. Rather, each will send a message or reply to a previous message at any particular time. E-mail is a common and very precise example of asynchronous collaboration.*

asynchronous communication: Electronic mail, topic-oriented mailing lists, electronic bulletin boards and computer conferences are all forms of asynchronous communication. In asynchronous communication environments, the conveyance of cues is hindered, feedback is delayed, and interruptions or long pauses in communication often occur. **1987** Stefik et al. *Computer conferencing [16, 17] which emphasizes the use of computers to support asynchronous communication and discussion over a computer network.* **1988** Jarrell and Barrett *Electronic mail, topic-oriented mailing lists, electronic bulletin boards, and computer conferences are all forms of asynchronous communication.* **2001** Montoya-Weiss et al. (from Jarvenpaa et al.1998) *In virtual teams, the dispersed asynchronous communication context renders inoperable many of the usual forms of social control, such as direct supervision, physical proximity, shared experiences, and social trust (Jarvenpaa et al., 1998).* **2001** Montoya-Weiss et al. (from McGrath 1991) *Synchronous interaction is an orderly process wherein verbal and nonverbal cues help regulate the flow of conversation, facilitate turn taking, provide immediate feedback, and convey subtle meanings. In lean, asynchronous communication environments, the conveyance of cues is hindered, feedback is delayed, and interruptions or long pauses in communication often occur.*

asynchronous conferencing tool*:* Asynchronous conferencing tools, such as a bulletin board system (BBS) is a category of Non Real-time conferencing. **1998** Hein et al. (10) *Asynchronous conferencing tools, such as a bulletin board system (BBS) is a category of Non Real-time conferencing.*

asynchronous coupled: Asynchronous-coupled is one of four categories of modes of workspace awareness. The other three are: synchronous-coupled, synchronous-uncoupled, and asynchronous-uncoupled. **1999** Hayashi et al. (from Fuchs et al.1995) *Modes of workspace awareness classified into four categories: synchronous-coupled, asynchronous-coupled, synchronous-uncoupled, and asynchronous-uncoupled.*

asynchronous DGSS: Asynchronous DGSS: allow distributed participants to log into the same meeting but at different times. Participants can log in and catch up with what is going on in the meeting, enter comments if necessary, and log out of the meeting at various times. E-mail, Voice-mail and messaging workflow management systems (such as in Lotus Notes) are some of the supporting technologies. **1998** Tung and Turban *Asynchronous DGSS: allow distributed participants to log into the same meeting but at different times. Participants can log in and catch up with what is going on in the meeting, enter comments if necessary, and log out of the meeting at various times. E-mail, Voice-mail and messaging workflow management systems (such as in Lotus Notes) are some of the supporting technologies.*

asynchronous GDSS: Asynchronous GDSS allows participants to interact at different points of time. GDSS-based meetings enable asynchronous sessions where each participant can 'attend' on a schedule that is most convenient to that individual. **1995** Gavish et al. *Asynchronous GDSS. GDSS-based meetings enable asynchronous sessions where each participant can 'attend' on a schedule that is most convenient to that individual.* **2001** Carneiro … *an asynchronous GDSS can be designed to enable a group of decision makers to offer their contributions to the decision process from different locations at any time, but this study does not deal with asynchronous GDSS.*

asynchronous groupware characteristic: Three asynchronous groupware characteristics can greatly reduce the cognitive and communication limitations present in synchronous contexts: rehearsability, parallelism, and reprocessability. **2001** Schmidt (from Dennis and Valacich 1999) *Third, asynchronous groupware possesses three characteristics that greatly reduce the cognitive and communication limitations present in synchronous contexts: rehearsability, parallelism, and reprocessability.*

asynchronous groupware: Asynchronous groupware includes collaborative writing, World Wide Web, and electronic mail. For these, transmission speed is no longer a problem. Asynchronous groupware, users usually collaborate accessing and modifying shared information without immediate knowledge about the actions of other users. **1997** Hofstede et al. (1) *Asynchronous groupware includes collaborative writing, World Wide Web, and electronic mail. For these, transmission speed is no longer a problem.* **2000** Prequica et al. *Asynchronous groupware, users usually collaborate accessing and modifying shared information without immediate knowledge about the actions of other users.*

asynchronous uncoupled: Asynchronous-uncoupled is one of four categories of modes of workspace awareness. The other three are: synchronous-coupled, synchronous-uncoupled, and asynchronous-coupled.**1999** Hayashi et al. (from Fuchs et al.1995) *Modes of workspace awareness classified into four categories: synchronous-coupled, asynchronous-coupled, synchronous-uncoupled, and asynchronous-uncoupled.*

AT: see Activity theory

atmosphere: Atmosphere is a CMC factor. Atmosphere includes sense of community, evolution, and human help **1981** Turoff et al. *Computer-mediated communication systems: System Factors: A. Atmosphere: Sense of Community: The ability of the system to provide features, such as membership and interest directories, which allow users to form communities of interests as needed. Evolution: The ability of the system to change through feedback from its user community. Human help: The ability of the system to supply human help directly to its users.*

attention: Attention means cognitive effort over time. Human attention resources are limited. Any attention spent on operating a new technology interferes with problem solving and goal attainment. **1998** Briggs et al. *Attention: cognitive effort over time. Human attention resources are limited. Any attention spent on operating a new technology interferes with problem solving and goal attainment.*

attitude: Attitude is a group dynamic issue that impacts team development and use of group support systems. **1995** Er and Ng *Group dynamics aspect has been entirely ignored by GDSS researchers. Issues such as norms, leadership, power, role model, group cohesion, group stability, personal attraction, social and emotional support, motives, attitude, etc., which are well-known in organizational behaviour literature (4), have not been addressed by GDSS researchers.* **1995** Whitman et al. *While these studies have demonstrated that GSS can enhance cohesion, they do not address the effect that team development will have on the GSS experience. In work environments, the development of higher levels of team cohesion and commitment is associated with higher productivity and unidimensionality of team attitudes toward performance (Scott and Townsend, 1994).* 2003 Pollard *This study explores how perceptions, experience, attitudes, communication behavior and environment affect continued and discontinued use of a group support system (GSS) as an organizational innovation*

attractiveness: **2002** Sikorski *Usability: The capability of the software product to be understood, learned, used and attractive to the user, when used under specified conditions. The components of usability, learnability, operability, attractiveness, compliance.*

audio conferencing: Audio conferencing is a form of teleconferencing that allows members to communicate by sound. **1985a** DeSanctis and Gallupe *For dispersed groups, a local area network, telephone lines, satellite, or microwave relay may be required to allow group members to communicate with one another. Electronic mail, computer conferencing, audio and video conferencing might also be integrated into the GDSS environment.* **1988** Egido (from Kraemer 1982) … *and various forms of teleconferencing (audio, video, computer) for intercity travel became the subject of national and international policy discussions, with research peaking during 1972- 76.* **1995** Aiken et al. *Computer-Mediated Conference: A large group dispersed geographically. Several office automation applications such as computer conferencing, audio conferencing, and video conferencing permit geographically-dispersed group members to communicate. Using a Computer-Mediated Conference, there is no need to schedule meetings in advance. Participants send their input to a central database or electronic mailbox, and other participants respond to the input and eventually a decision is made by consensus.*

authority: **2000** Stough et al *Teams share authority, responsibility, leadership, decision making, results, and rewards.*

automated record keeping: Automated record keeping is a GDSS feature. A GDSS automatically records comments, votes, and other information shared by a group onto a disk file. This automated log of the discussion supports the development of an organizational memory from meeting to meeting. **1995** Aiken et al. *Automated record keeping: A GDSS automatically records comments, votes, and other information shared by a group onto a disk file. This automated log of the discussion supports the development of an organizational memory from meeting to meeting.*

automated planning tools: **1986** Kraemer and King *These techniques might include: planning tools such as brainstorming, stakeholder identification and analysis, or organization analysis; modeling tools that support qualitative and quantitative decision analysis such as decision trees, risk analysis, social judgment analysis or multiattribute utility analysis.* **1987** DeSanctis and Gallupe *A Level 2 GDSS might provide automated planning tools, or other aids commonly found in individual decision support systems, for group members to work on and view simultaneously, again using a large common screen.*

automatic message filtering rule: Automatic message filtering rules are a characteristic of some email systems, examples are Information Lens and Eudora**.** Receivers can specify rules to automatically filter and classify messages arriving in their mailbox. **1986** Malone et al. (2). *In addition, the Lens system provides four important optional capabilities: (1) People can use structured message templates to help them compose and read their messages; (2) Receivers can specify rules to automatically filter and classify messages arriving in their mailbox; (3) Senders can include as an addressee of a message, in addition to specific individuals or distribution lists, a special mailbox (currently named "LENS") to indicate that the sender is willing to have this message automatically redistributed to anyone else who might be interested; and (4) Receivers can specify rules that find and show messages addressed to LENS that the receiver would not otherwise have seen.* **1998** Hein et al. (8) (from Eudora website)*Eudora is a post office protocol (POP) client that allows a user to send, receive, and manage e-mail. It features drag-and-drop attachments, spelling checker, voice messaging, customizable toolbbars, multiple e-mail account management, filters, multiple mailboxes, and PGP encryption. It also supports multiple standards, such as rich HTML, Internet Message Access Protocol (IMAP4), Sendmail Transfer Protocol (SMTP), Lightweight Directory Access Protocol (LDAP, and multiple encoding methods (uuencode, MIME, Binhex).*

autonomous collaboration: Autonomous collaboration is a hybrid communication model which includes both synchronous and asynchronous collaboration. **1999** Adams *TimeWarp System (which combines versioning and time-based browsing with asynchronous, coordinated resource sharing) as neither synchronous nor asynchronous collaborations; they call this hybrid model autonomous collaboration.*

autonomous cooperative information systems: Autonomous and heterogeneous co-operative information systems allow data exchange and sharing among several components of co-operative information systems. **2001** Carneiro (from Keim et al.1994) *Autonomous and heterogeneous co-operative information systems allow data exchange and sharing among the several components of co-operative information systems.*

availability awareness: Availability awareness refers to 'when can I reach them'. There is often a lack of awareness about availability of other group members. Lack of awareness causes difficulties with scheduling and coordinating synchronous group meetings. **2000** Jang et al. *Availability awareness - teams floundered without real-time communication, but had difficulties scheduling and coordinating synchronous group meetings. They lacked awareness about each other's availability (when can I reach them).*

avatar: Avatars are embodiments that represent people with stylized pictorial representations of actual bodies. **1998** Greenberg and Roseman (24) *Avatars ie. Graphical automations (which may even include a video face) that can be seen by others.* **1999** Adams (4) *Avatars* **-** *a visual representation such as a graphic or photo of oneself.* **2002** Gutwin and Greenberg (13) *Avatars are embodiments that represent people with stylized pictorial representations of actual bodies.*

avoidance behaviour: Avoidance behaviour is characterized by evasiveness and failure to confront other parties. People demonstrating this behaviour are apathetic toward conflicting points of view and outcomes in general. **1988** Poole et al. *Two additional indices of productive conflict management are based on observation of behavioral processes and group interaction. Studies of conflict have distinguished three general modes of conflict handling behavior: distributive behavior, avoidance behavior, and integrative behavior (Sillars, 1980; Sillars, Perry, Colletti, and Rogers, 1982; Killman and Thomas, 1975)…Parties exhibiting avoidance behavior seek to flee or to smooth over the conflict.* **2001** Montoya-Weiss et al. *We draw on work by Rahim (1983, 1992) and Thomas and Kilmann (1974) that delineates five conflict-handling modes to describe conflict management in organizational work groups: avoidance, accommodation, competition, collaboration, and compromise…Avoidance behaviour is characterized by evasiveness and* *failure to confront other parties. People demonstrating this behaviour are apathetic toward conflicting points of view and outcomes in general.*

awareness: Awareness is the state of knowing or being informed that enables collaborators to interpret others actions and to guide one's own actions. It consists of a combination of people, activity, and contextual awareness. **1992** Dourish and Berlotti *Awareness is an understanding of the activities of others, which provides a context for your own activity.* **1997** Schlichter et al. *Different sub-types of awareness: informal awareness, group-structural awareness, social awareness, and workspace awareness … Awareness is part of the "glue" that allows groups to be more effective than individuals.* **1997** Gutwin and Greenberg *Awareness as informedness, a sense that implies three qualities. First, awareness is knowledge about a dynamic environment, and must be maintained as the environment changes over time. Second, awareness is maintained through perceptual information gathered from the environment.is maintained through perceptual information gathered from the environment. Third, awareness is generally secondary to some other goal; that is, it is generally for something else.* **2000** Jang et al. *Our observations led us to focus on four specific types of awareness deficits suffered by the virtual teams we studied [9]. activity awareness, availability awareness, process awareness, perspective awareness.* **2002** Girgensohn et al. *Awareness is the state of knowing or being informed that enables collaborators to interpret others actions and to guide one's own actions. It consists of a combination of people, activity, and contextual awareness.* **2002** Cadiz et al. *Awareness is an understanding of the activities of others, which provides a context for your own activity.*

awareness deficit: Awareness deficits suffered by the virtual teams: Lack of awareness about other's activities (what are they doing). Lack of awareness availability (when can I reach them). Lack of process awareness (Where are we in the project). Lack of perspective awareness (what are they thinking and why) **2000** Jang et al. (1) *Awareness deficits suffered by the virtual teams: Lack of awareness about other's activities (what are they doing). Lack of awareness availability (when can I reach them). Lack of process awareness (Where are we in the project). Lack of perspective awareness (what are they thinking and why)*

awareness information: Awareness information: presence, location, activity level, actions, intentions, changes, objects, extents, abilities, influence, and expectations. **1997** Gutwin and Greenberg *Awareness information: presence, location, activity level, actions, intentions, changes, objects, extents, abilities, influence, and expectations.* **2002** Cadiz et al. *Awareness information can also be displayed on secondary displays. Sometimes the secondary display can be a specialized display like Georgia Tech's InfoCanvas [15], and sometimes the display can be a normal monitor that extends the user's primary workspace to a second display.*

awareness mode: There are four modes of awareness that can be described by two orthogonal classifications: Coupling: there is the coupled awareness (participants have the same focus of work. Synchrony: participants may either be aware synchronously (knowledge about events that happen currently or asynchronously (knowledge about events in the past). **1997** Schlichter et al. *There are four modes of awareness that can be described by two orthogonal classifications: Coupling: there is the coupled awareness (participants have the same focus of work. Synchrony: participants may either be aware synchronously (knowledge about events that happen currently or asynchronously (knowledge about events in the past).*

Babble: The Babble system was developed by IBM. Babble is a chat-like communication tool in which typed messages are transmitted across a TCP/IP network, stored on a server and displayed to each client. Babble allows its users to engage in synchronous or asynchronous textual conversations, and provides visual feedback. **1999** Bradner et al. *Babble system developed by IBM. Babble is a chat-like communication tool in which typed messages are transmitted across a TCP/IP network, stored on a server and displayed to each client.*

Babble allows its users to engage in synchronous or asynchronous textual conversations, and provides visual feedback.

back-channel communication: **1999** Gutwin and Greenberg *measurable speech process characteristics - backchannel communication, interruptions, overlaps, and turn-taking were effective in examining face-to-face interactions.*

back channel feedback: Back-channel feedback - When people converse, they require evidence that their utterances have been understood. In verbal communication, a common form of this evidence is back-channel feedback. **2002** Gutwin and Greenberg (10) *Back-channel feedback - When people converse, they require evidence that their utterances have been understood. In verbal communication, a common form of this evidence is back-channel feedback.*

background:Background is an individual characteristic of each group member. **1987** Jelassi and Beauclair *While GDSS developers are trying to design systems that will help structure the group process, it is important to acknowledge briefly the characteristics that decision makers bring with them to the decision making environment (10, 27). These include: (1) Individual characteristics of each group member (eg. personality, sex, age, race, status, socio-economic background, competence, and motivation); (2) Group characteristics (eg political orientation, leadership, complexity of the task and circumstances, size of group, and history of its members); and (3) environmental characteristics (eg. setting, scheduling, length of a session, organizational context, and spatial arrangement).* **1989** Pinsonneault and Kraemer *First is the attitude that group members have toward working in groups and working with the other members of the group. Second is the ability of the members to work in a group. Third is the individual motives, or hidden agendas of group members, and fourth is the background of the group members which includes previous experience in working with groups and other factors like education or specific knowledge.*

background information*:* Background information is an electronic meeting context. **1986** Begeman et al. *… the meeting context including the organizational structure, the social structure, and other background information.*

bargaining: **1988** DeSanctis *Coordination is typically accomplished in groups through mechanisms such as leadership, monitoring and control systems (eg. audits, reporting requirements, reward distribution), negotiation, and bargaining.*

barrier removal: **1986** Kraemer and King *At the simplest level GDSS provide features aimed at removing common barriers to group work and communication, such as unequal consideration of ideas, dominance by individuals, peer pressure, and loss of autonomy. These features include anonymous input of ideas and preferences, and large screens for instantaneous display of ideas, and secret voting and compilation. The level is illustrated by the electronic boardroom or computer-supported conference room.*

barriers to GDSS/GSS use: There are three categories of barriers to successful use of GDSS/GSS: technical problems, problems with the computer package and incomplete understanding of the decision-making process or other group activities. A GDSS aims to improve the process of group decision making by removing common communication barriers, providing techniques for structuring decision analysis, systematically directing the pattern, timing or content of discussion. A GSS attempts to reduce barriers to communication by structuring group activities, providing parallel input and anonymity of comments. **1988** Kraemer and King (133) *Barriers to successful use of GDSSs: We identify a number of barriers to successful use of GDSSs. For ease of presentation, we divide these into three categories: technical problems, problems with the GDSS package and incomplete understanding of the decision-making process.* **1989** Ackermann (3) (from DeSanctis and Gallupe 1996) *DeSanctis and Gallupe (1986) suggest 'a GDSS aims to improve the process of group decision making by removing common communication barriers, providing techniques for structuring decision analysis, and systematically directing the pattern, timing* *or content of discussion'.* **1997** Williams and Wilson *GSS: group support systems attempt to reduce barriers to communication that might otherwise be present and in most cases, also attempt to structure group activities and processes in a positive way.* **2001** Bourke (from Dennis and Gallupe 1993) *This parallel input feature, along with the anonymity of the comments, has been found to reduce communication barriers among group members, resulting in increased generation of ideas.*

barriers to communication: There are a number of barriers to communication. Some ways of removing barriers to communication are: simultaneous communication, public screen, and structured group activities. **1992** McLeod and Liker S*imultaneous electronic communication removes the logistic barriers to communication associated with the one-at-a-time speaking norms in ordinary face-to-face communication.* **1996** Sia et al. *Group support systems (GSS) provide groups with a repertoire of decision aids that help to remove communication barriers during meetings … Public screen: … a GSS feature aimed at removing communication barriers during group meetings.* **1997** Williams and Wilson *GSS: group support systems attempt to reduce barriers to communication that might otherwise be present and in most cases, also attempt to structure group activities and processes in a positive way.*

barriers to group decision making*:* Conditions which prevent the free expression of ideas in a group. These include: pressure to conform, evaluation of contributions, bias, prejudice, anonymous inputs, evaluation of ideas, individual responsibility and expectations, lack of cohesion, and lack of structure. **1985a** DeSanctis and Gallupe (p.7) *the major barrier to effective group decision making is any condition which prevents the free expression of ideas in a group … group members may feel a strong pressure to conform, thus stifling the input of non-conforming ideas to the decision process, or certain members may regard other members as more competent or higher in status than they are (Hoffman, 1965) … Newly-formed groups usually lack cohesion and a structure for operating (Klein & Ritti, 1980)*

barriers to group work: There are a number of different types of barriers to group work; social barriers, organizational barriers, technical barriers, and barriers of time and space. Social barrier examples are: unequal consideration of ideas, dominance by individuals, loss of autonomy, peer pressure, and miscommunication. Lack of interaction richness may also be a barrier to group work. **1986** Kraemer and King 1986 *"Losses" of productivity in group decision making occur because: 1. Discussions are dominated by certain individuals. 2. Low-status members defer to high-status members. 3. Group pressures lead to conformity of thought. 4. Miscommunication among members is common. 5. Insufficient time is spent in problem exploration and generation of alternatives.* **1992** McLeod and Liker *Anonymity removes social barriers to participatiuon that stem from evaluation apprehension and social status differences. The increased inputs from all group members should also result in increased decision quality.* **1996** Barua et al. (6) *Interaction richness: the extent to which we can overcome the barriers of space, time and media/document formats in interacting with others. This would include: (1) Ability to talk, see, write and draw in both synchronous and asynchronous manner; (2) access relevant reference information; (3) archiving interactions for future review; (4) debate issues, problems, ideas, articles, etc. in open public forums on a global basis.* **2000** Stough et al. *Computer-based conferencing systems: these allow a workgroup to exchange views, ideas, or information in a discussion to overcome the barriers created by time and space.* **2001** Johnson et al. *Virtual teams: are groups of people who collaborate closely even though they may or may not be separated by space, time, and organizational barriers.*

bases of trust: Three different bases of trust are applicable to virtual teams; personality-based, institutional-based, and cognitive trust. Cognitive trust is further subdivided into three dimensions; stereotyping, unit grouping, and reputation categorization. **2003** Sarker et al. *Drawing on the literature, 3 different bases of trust applicable to virtual teams have been identified: personality-based, institutional-based, and cognitive trust, with cognitive trust* *further subdivided into 3 dimensions: stereotyping, unit grouping, and reputation categorization.*

basic individual decision making strategy: Three basic individual decision making strategies are the multiattribute utility model (MAUT), the lexicographic model (LEX), and a Heuristic approach. **2003** Beroggi *Our theoretical framework of IMGDM will, consequently, distinguish three basic individual decision making strategies, the multiattribute utility model (MAUT) as a compensatory approach, the lexicographic model (LEX) as a non-compensatory approach, and a non-specified heuristic approach (HEU), which does not rely on any analytic concept, allowing decision makers to resort to their own intuition in decision making.*

Basic Support for Cooperative Work (BSCW): Basic Support for Cooperative Work (Prototype) is a simple shared workspace system that runs on top of the Internet. BSCW client is an application program with a shared workspace. It provides basic functionality such as browsing the contents of a workspace, adding and removing documents, examining change histories and so on. **1995** Bentley and Dourish *Basic BSCW Basic Support for Cooperative Work (Prototype) – simple shared workspace system that runs on top of the Internet. BSCW client is an application program with a shared workspace. It provides basic functionality such as browsing the contents of a workspace, adding and removing documents, examining change histories and so on … The system supports collaboration in heterogeneous environments (a different-time different-place situation).* **1999** Hayashi et al. (102) (from Hortstmann and Bentley 1997) *BSCW system which provides shared workspaces entirely in the WWW, supports the asynchronous-coupled mode of workspace awareness.*

Bayou: Bayou is a replicated database system based on opidemic operation-based update propogation. **2000** Prequica et al. *Bayou is a replicated database system based on opidemic operation-based update propogation.*

BBS: see Bulletin Board System

BEACH: BEACH (Basic Environment for Active Collaboration with Hypermedia) is a synchronous groupware framework that provides large spatial visual workspaces and allows for truly synchronous input of several users at a time. It has a hypermedia document structure providing basic interaction objects and bidirectional hyperlinks. **2002** Prante et al. (111) *BEACH (Basic environment for Active Collaboration with Hypermedia) [34] is a synchronous groupware framework that provides large spatial visual workspaces according to the design principles summarized in [2] and allows for truly synchronous input of several users at a time. It has a hypermedia document structure providing, among other, basic interaction objects and bidirectional hyperlinks.*

behaviour (1): Behaviour is an interactive system characteristic that includes humanization; regularity and predictability; and responsiveness. **1981** Turoff et al. *Definitions of system characteristics common to all interactive systems: … C. Behavior Humanization: Treating the user as an intelligent human being rather than as a slave of the computer. Regularity and predictability: The ability of a user to anticipate the actions of the computer and to expect consistent responses to operations and functions. Responsiveness: The ability of the system to respond quickly and meaningfully to user requests to carry out various operations and functions.*

behaviour (2): Behaviour can refer to group behaviour, communicative behaviour or organizational behaviour. Two categories of group behaviour are maintenance behaviour and task behaviour. **1987** DeSanctis and Gallupe (from Hare 1962) *Effects on Perceived Physical Proximity, Interpersonal Attraction, and Group Cohesion: The electronic communication component within a GDSS will influence perceived physical distance among members which, in turn, will affect interpersonal attraction and group cohesion. The degree of physical distance between people is known to exert considerable influence on* *organizational behavior.* **1987** Jelassi and Beauclair. *As we have shown, design strategies can be specific to certain group behaviours (eg. diffusion of responsibility) as well as general to computer-based decision support systems (eg. communication and information sharing, consistency and coherehce).* **1989** Pinsonneault and Kraemer *Five contextual variables appear to be important in the behavioural research on groups: personal factors, situational factors, group structure, technological support, and task characteristics. Personal factors refer to the attitudes, behaviours, and motives of individual group members. Four personal factors have been found to affect group processes in organization behavior.* **1998** Prinz et al. *Communicative behaviours are the means through which group members can influence each other and create standards of behaviour: eg. By observing each other's actions, or by explicit and implicit communication [28]* **2000** Pare and Dube (from Gladstein 1984) *Group processes which refers to two broad categories of group behaviours, namely, maintenance behaviours are required to build and maintain group synergy and momentum (eg. Open communications, level of collaboration and participation, level of conflict, level of trust), while task behaviours are those needed to solve problems that prevent the group's objectives from being achieved (eg. information processing, consensus generating, decision making).* **2003** Huang et al. *Group behaviours such as socializing, norming and conflicting could still be functioning in group interaction processes.*

behavioural group technique: see Structured group management technique.

behavioural intentions: In the Technology Acceptance Model, behavioural intentions are a measure of the strength of one’s intentions to perform a specific behaviour. Intentions is a useful construct because it can be measured well in advance of actual use. **1998** Briggs et al. *Technology Acceptance Model (TAM) is a causal model of actual system use, the key indicator of success for technology transition. It posits that actual technology use (AU) is directly caused by behavioural intentions (BI), a measure of the strength of one's intentions to perform a specific behavior. Intention is a useful construct because it can be measured well in advance of actual use.*

behavioural process-oriented trick: Behavioural process-oriented tricks could include threats, promises and deadlines. These could be different tools for which the communication manager in a GDSS provides a framework of usage. **1986** Bui and Jarke (37) *There are also different classes of tools for which the communication manager provides a framework of usage. In the simplest case, these may be merely shared databases; even then, there is at least a need for novel transaction concepts, such as those used in design databases [19]. More complex methods include various artificial intelligence techniques (e.g., distributed problem solving, evidential reasoning, belief maintenance), multiple criteria decision methods (MCDM), game theory from operations research, and a large number of behavioral, process- oriented tricks (threats, promises, deadlines, etc.).*

***behavioural-driven design**:* Behavioural-driven design is when behavioural issues are taken into account when designing GDSS systems. **1987** Jelassi and Beauclair *This discussion of GDSS design issues is a positive step toward a behaviourally-driven design of group decision support systems. As we have shown, design strategies can be specific to certain group behaviours (eg. diffusion of responsibility) as well as general to computer-based decision support systems (eg. communication and information sharing, consistency and coherehce).*

belief maintenance: **1986** Bui and Jarke *There are also different classes of tools for which the communication manager provides a framework of usage. In the simplest case, these may be merely shared databases; even then, there is at least a need for novel transaction concepts, such as those used in design databases [19]. More complex methods include various artificial intelligence techniques (e.g., distributed problem solving, evidential reasoning, belief maintenance), multiple criteria decision methods (MCDM), game theory from* *operations research, and a large number of behavioral, process- oriented tricks (threats, promises, deadlines, etc.).*

beliefs: Beliefs are a part of culture. Beliefs determine actual behaviour. **1994** Watson et al. *Culture is the beliefs, value system, norms, mores, myths, and structural elements of a given organization, tribe, or society (16). Culture exists at national (12), regional (25), and corporate levels (5).* **1997** Hofstede et al. *Mental Models include knowledge, beliefs, needs, norms, emotions, goals. These models are important, since they determine actual behaviour, and their implicit nature asks for explication, for which several techniques are available (eg. Cognitive mapping, system dynamics).*

benevolence: Benevolence towards others is an important dimension of trust. **1999** Furst et al. *These are two important dimensions of trust: dependable task completion and benevolence towards others (the extent to which others exhibit care and concern for team members and their willingness to assist others beyond what their role may require).*

bias: Biases can be towards individuals in a group or related to the communication channels that are used in group work. **1986** Kraemer and King *Anonymous voting helps reduce bias of dominant individuals in the group, and results are tabulated rapidly and displayed to a common screen in a summary format.* **2001** Pauleen and Yoong *Other important factors in determining facilitator strategies, some of which are alluded to in this paper, include issues concerning team member selection and training, organisational and HR policies, as well as the team's desired task outcomes and biases towards communication channels, particularly in global virtual teams.*

binary information structure: Binary information structures consist of 1s and 0s**.1986** Begeman et al. *Within all of these structures, the types of information that may be presented, manipulated, and captured during a meeting can be categorized according to the amount of its structure (binary, structured, or unstructured), and according to the degree of sharing (private, subgroup, or public) … Structured information is information (typically non-binary) which has regular form and can be readily interpreted by a computer. This might include lists, matrices, templates, and flowcharts.*

birds-eye view: Birds-eye view of the entire workspace in a small secondary window designed to make embodiments, cations and feedthrough visible, regardless of where they occur in the workspace. **2001** Baker et al. (11) *Birds-eye view of the entire workspace in a small secondary window. A properly designed overview makes embodiments, actions and feedthrough visible, regardless of where they occur in the workspace.*

Boardnoter: Boardnoter, closely imitates the functionality of a chalkboard. It is intended for informal meetings that rely heavily on informal freestyle sketching. **1987** Stefik et al. *Boardnoter, closely imitates the functionality of a chalkboard. It is intended for informal meetings that rely heavily on informal freestyle sketching. To draw with Boardnoter, one uses the "chalk" to erase one uses the "eraser" to type one uses the miniature "typewriter", and to point one uses the "pointer". To sketch a square with Boardnoter, one simply "picks up the chalk" and makes four strokes. A subsequent version of Boardnoter will go beyond the chalkboard by adding capabilities for copying, moving, resizing, linking with rubber band lines, grouping, and smoothing (neatening), and for using and scaling selections from a set of predrawn images.*

***brainstorming*:** Brainstorming is a group decision making technique in which participants contribute ideas in a totally open and free format without criticising one another. Brainstorming is used in the initial idea generation phase. It is important to encourage synergy in group interactions and to not interfere with or inhibit the flow of ideas. A meeting tool known as Cognoter could be used for this stage. **1986** Applegate et al. *to get many ideas 'on the table'.* **1986** Foster and Stefik (9) *The goal of the brainstorming stage is to get many ideas 'on the table' for possible inclusion in the presentation. Two many ideas are better than too few - it is easier to prune than to generate. Since the goal is quantity,* *participation by all members of the group must be encouraged and any actions that would inhibit the flow of ideas should be discouraged … Items are not evaluated or deleted in this stage and at first, little attention is paid to details of organization.* **1987** Stefik et al. *since the brainstorming phase involves the initial generation of ideas used in the presentation, it is important to encourage synergy in group interactions and to not interfere with or inhibit the flow of ideas.* **2000** Stough et al. (from Schermerhorn et al. 1994) *Brainstorming is a group decision-making technique in which participants contribute ideas in a totally open and free format without criticising one another.*

Brainstorming Categorizer: Brainstorming Categorizer can be used to quickly and easily take the output of a brainstorming session and allow a group to create categories or buckets of the ideas. The categorizer facilitates learning and consensus as the group discusses the merits and classification of each idea generated in the anonymous brainstorming session. **2003** Lee and Albrecht *Brainstorming Categorizer can be used to quickly and easily take the output of a brainstorming session and allow a group to create categories or buckets of the ideas. The categorizer facilitates learning and consensus as the group discusses the merits and classification of each idea generate in the anonymous brainstorming session.*

brainstorming inhibitor: Some technology factors are brainstorming inhibitors. These technology factors could be computer screen size, keyboard interface, network efficiency. **1986** Applegate et al. *While Electronic Brainstorming does appear to neutralize the group effects that have been suggested as inhibitors of idea generation during group brainstorming and to improve the efficiency of the session by allowing parallel process and automatic recording, specific aspects of the technology that tend to inhibit the idea generation process have been identified. These factors include: (I) the size of the computer screen, (2) the keyboard as an unfamiliar interface metaphor for some executives, and (3) the efficiency of the network in handling multiple, simultaneous file transfers.* **2003** Corbitt and Martz (from Nunamaker et al.1991) *Nunamaker, et al. (1991) posit the main advantages of this technology are: parallel and simultaneous input, e.g. all participants talk at once; opportunities for equal input; a full unbiased record of a group's activities that are recorded by the computer; anonymity, so that some of the traditional participation inhibitors (speaking up in front of the boss) are minimized; and, mechanisms can be encoded into the software that discourage disruptive behavior by individual group members.*

brainstorming meeting: Exploration and brainstorming is a type of meeting. **1986** Begeman et al. *Meeting Types include: 1. Exploration and Brainstorming meetings, 2. Informational or Presentational meetings, 3. Problem Solving or Decision Making meetings, 4. Negotiation or Resource Allocation meetings 5. Morale Building or Social Structuring meetings.* **1987** Cook et al. *There are also a variety of meeting types, distinguished by their main goals or purpose: 1. exploration and brainstorming meetings, 2. information sharing or presentation meetings, 3. problem-solving or decision-making meetings, 4. negotiation or resource allocation meetings, and 5. morale building or social structuring meetings.*

Briefcase: Briefcase provides read-only access to any text files in the meeting memory. **1994** Chen and Hsu *Briefcase provides read-only access to any text files in the meeting memory.*

BSCW: see Basic Support for Cooperative Work.

Bulletin Board System (BBS): Bulletin Boards are a CMC system type, a type of groupware and asynchronous communication. Electronic mail, topic-oriented mailing lists, electronic bulletin boards, and computer conferences are all forms of asynchronous communication or non real-time conferencing. **1988** DeSanctis *People who gather together to watch a formal presentation, for example, are very loosely coupled. Communication here is typically one-way. Electronic conferences or bulletin boards are other examples of loosely coupled groups.* **1988** Jarrell and Barrett *Electronic mail, topic-oriented mailing lists, electronic bulletin boards, and computer conferences are all forms of asynchronous communication.* **1994** Ishii et al. *Familiar groupware examples include email, bulletin boards, group* *schedulers, group decision support systems, workflow systems, collaborative authoring tools, and screen sharing software.* **1995** Aiken et al. *Local Area Decision Network: A small group whose members are dispersed. When a few group members are unable to meet face-to-face and are dispersed in a limited geographical area, a Local Area Decision Network can be used. For example, group members may meet in different offices asynchronously using a computerized bulletin board, or they may meet synchronously using a real-time document editor.* **1996** Roseman *Groupware is software that helps two or more people collaborate. It is a pretty general category that includes applications like email or Usenet bulletin boards. Workflow and document management systems like Lotus Notes are the most commonly known groupware applications today.* **1998** Hein et al. *Asynchronous conferencing tools, such as a bulletin board system (BBS) is a category of Non Real-time conferencing.***2002** Girgensohn et al. *Social interaction spaces: Digital cities [9], community networks [24], portals such as eBay and Slashdot, and older technologies based on electronic bulletin board systems, newsgroups and mailing lists [22, 23] are just some of the examples of social interaction spaces.*

CA: see Conversation Analysis.

calendar management: Examples of calendar management systems are MPCAL and RTCAL. **1986** Malone et al. (102) *Most previous systems for supporting group work can be thought of as belonging to one of two categories. In one category, are forms processing, calendar management, and other systems that contain a great deal of formalized knowledge about the application domains they are intended to support ...* **1986** Greif and Sarin (188) (from Greif 1984) *The example systems we describe in Section 2 are drawn from different application areas-calendar management and document preparation-and span two modes of cooperative work, that of real-time and asynchronous meetings … The two systems that deal with calendar management (MPCAL and RTCAL) both derive from the personal calendar system PCAL.*

callable voting program: Callable voting program is a software planning model for the idea generation and analysis process. **1986** Applegate et al. *Four software planning models are available to assist planners with the idea generation and analysis process. They are: (I) Electronic Brainstorming (group brainstorming version); (2) Electronic Brainstorming (individual brainstorming version); (3) Idea Structuring and Analysis; and (4) a callable voting program for interactive idea prioritization.*

CaptureLab: Capture Lab was designed by Electronic Data Systems. Capture Lab was designed as a hardware sharing approach to support a wide range of meeting requirements. The Capture Lab did not provide software designed for specific tasks (each application could be used for several different tasks), nor did it provide any tools for structuring process. **1990** Halonen et al. *Advantages of Hardware Sharing Four features of the hardware sharing approach are advantageous to face to face meetings, First, unlike many groupware systems that have focused on supporting specific group activities, such as decision making or software design, the Capture Lab is designed to support the wide range of meeting requirements that commonly occur in business. Thus, a great degree of flexibility is required to support the variety of computational requirements (such as word processing, graphics, idea organization, spreadsheets, or Computer Aided Design) that meeting participants might have. The hardware sharing approach enables Capture Lab users to work with any software that runs on the Macintosh. This means users can run their favorite word processing or graphics software, or any number of specialized packages they might need. A second advantage of the hardware sharing approach is that implementation requirements are much fewer than for groupware systems. Because of the potentially wide range of applications meeting participants might need, implementation requirements were an important factor in our decision to adopt the hardware sharing approach---it simply wasn't feasible to build and maintain the large collection of groupware programs that our users would require.* **1992** McLeod and Liker *Capture Lab … was designed by Electronic Data Systems (Mantei 1988, Elwart-Keys_etal1990, Horton_etal1991). The Capture Lab* *does not provide software designed for specific tasks (each application could be used for several different tasks), nor does it provide any tools for structuring process.*

casual interaction: Casual interactions are the spontaneous and one-person initiated meetings that occur over the course of the day. **1998** Greenberg and Gutwin (9) C*asual interaction, the spontaneous and one-person initiated meetings that occur over the course of the day.*

Categorizing Categorizer: Categorizing Categorizer is a system tool. It can be used to create categories or 'buckets' or ideas and to rapidly move the ideas or comments into these categories. **2003** Lee and Albrecht *Categorizing Categorizer can be used to create categories or "buckets" or ideas and to rapidly move the ideas or comments into these categories.*

CBIS: see Computer Based Information System.

CC: see Constructive consensus approach.

centralized decision making: Decision making can be centralized or decentralized. **1986** Stasz and Bikson (320) *Issues in Computer Supported Cooperative Work: Our field study assessed a number of impacts of the organization's transition to a computer- based information system. Here we discuss five: training, dissemination, hierarchical vs. network communications, centralized vs. decentralized decisionmaking, and cooperative work between different technologies and systems.*

CES: See Collaborative document Editing System.

channels of communication: Four channels of communication are verbal, non-verbal, written and electronic. The communication channel promotes more equal participation and influence on outcomes by group members. **1988** Zigurs et al. *Four channels of communication were available: verbal, non-verbal, written, and electronic, with each channel defined according to the skills required to use it, its features, capacity, and impact on the receiver.* **1988** Zigurs et al. (from DeSanctis and Gallupe 1987; Huber 1984a) *A rationale underlying the potential effectiveness of GDSSs has been that the electronic communication channel promotes more equal participation and influence on outcomes by group members.* **1988** Ciborra and Olson *The physical proximity of team members and availability of channels determine the medium: face-to-face, telephone, memo, electronic mail, etc. … The organization acts as a loosely defined hierarchy with heavy emphasis on lateral channels of communication: electronic mail, computer conferencing, etc. facilitate lateral communication and are highly critical to daily operations.* **1988** Dennis et al. *There are three communication channels that need to be effectively integrated, although not every channel will necessarily be provided in every environment. First, participants have access to the electronic communication channel via a computer workstation, which provides individual access to information ... Second, the environment may support verbal communication, either through face- to-face communication of group members in the same room, or via a microphone/speaker voice channel for groups members not in the same room ... Third, provision for video or "sight" communication may also be useful ...*

chat system: Chat systems are a simple text-based chat tool that allows users to type text messages to each other. Chat is poor at managing interruptions, organizing turn-taking, conveying comprehension and resolving floor control conflicts. **1996** Roseman and Greenberg (10) *Chat – a simple text-based chat tool is provided that allows users to type messages to each other when they are in the same room.* **1999** Adams (3) *Chat systems, users converse with one another by typing text.* **2000** Smith et al.*Chat is poor at managing interruptions, organizing turn-taking, conveying comprehension, and resolving floor control conflicts.*

chauffeur: A system chauffeur or chauffeur is a person who serves as the intermediary between the group and the GDSS software. A chauffeur's role is one of an unobtrusive analyst, managing the technology and acting as a scribe during the 'open' sessions. **1984** Huber (198)

… if the group "facilitator" or the system "chauffeur" of a GDSS gets stuck … **1993** Liou and Nunamaker *Chauffeur who serves as the intermediary between the group and the GDSS software.* **2002** Wood and Blyth *Chauffeur's role was essentially one of an unobtrusive analyst, managing the technology and acting as a scribe during the'open' sessions in which the focus group discussed project risks.*

chauffeur driven mode: A facilitation mode. The chauffeur driven mode supports the intervention of a facilitator in order to manipulate the technology but not the decision process. **2001** Antunes and Ho (from Dickson et al 1993) *Others categorized different facilitation modes: the user-driven mode is associated to the absence of a formal meeting facilitator by making the GDSS functionality available to all group members, the chauffer-driven mode supports the intervention of a facilitator in order to manipulate the technology but not the decision process and, finally, the facilitator-driven mode considers that the facilitator influences the group on how to use the technology.*

chauffeur skills: see Chauffeur **1984** Huber (198) *… user skills (ie. Facilitator skills, chauffeur skills, and participants skills) decline if they are not utilized.*

chauffeured approach: Chauffeured approach: groups receive technical assistance through a chauffeur. **2002** DeVreede et al. *Chauffeured approach: groups receive technical assistance through a chauffeur.*

chauffeured style: Chauffeured style, only one person uses the meeting system, either a group member or the meeting leader/facilitator. A workstation is connected to a public display screen, providing an electronic version of the traditional blackboard. The group verbally discusses the issues with the electronic blackboard used as a group memory to record and structure information. **1991** Nunamaker et al.*Chauffeured style, only one person uses the EMS, either a group member or the meeting leader/facilitator. A worksatation is connected to a public display screen, providing an electronic version of the traditional blackboard. The group verbally discusses the issues with the electronic blackboard used as a group memory to record and structure information.*

choice: Choice is a step in the problem-solving process. Intellective choice is the selection of a correct answer among a given set of alternatives. **1984** Huber (200) … a*ny step of the problem-solving process: problem sensing, problem exploration, problem definition, criterion and constraint identification, proposal generation, proposal evaluation, choice, implementation, and performance evaluation.* **1988** Watson et al. *To date, positive effects of GDSS have been observed for idea generation (Applegate, 1986; Lewis, 1982), proglem finding (Gallupe 1985), intellective choice (ie. selection of a correct" answer among a given set of alternatives)(Turoff and Hiltz 1982), and planning tasks (Applegate 1986; Steeb and Johnston 1981).* **1992** McLeod and Liker *OptionFinder is a keypad-based meeting system designed by Option Technologies Inc. The University of Georgia has taken the lead in conducting research on OptionFinder (Watson_etal1991). These researchers characterize it as providing a midlevel of technological support as compared to SAMM and GroupSystems. This system provides each meeting participant with a 10 button keypad for inputting responses stimulus questions designed in a forced choice comparison, or scale format.* **2001** Dennis and Wixom D*ecision quality, was defined by most researchers as the correctness or "goodness" of the group's choice for choice tasks.*

choice shift: the shift from initial individual preferences to group choice. **1998** Tung and Turban (177) (from Kiesler et al. 1984) *Choice shift: the shift from initial individual preferences to group choice.*

CIS: see Common Information Space.

close proximity: Close proximity is when members are co-located. Close proximity is a characteristic of a decision room or 'war room'. The proximity of participants discussed in the GDSS framework **1984** Huber *The proximity of participants discussed in the GDSS framework.* **1987** Jelassi and Beauclair (145) *the face-to-face, close proximity, synchronous*

GDSS type commonly known as "war room" [30] or a "decision room" [6]. The decision room features computerized support in addition to traditional small group interaction. **1999** Furst et al. (250) *Co-located collectivities are those groups or teams whose members are within close proximity of each other and for whom the dominant mode of communication is face-to-face. Members of co-located groups or teams typically work in the same physical location or come together regularly and frequently to meet in the same location.*

closure: Interactive system characteristic related to behaviour. Informing users when an operation has been successfully or unsuccessfully completed. **1981** Turoff et al. *Informing users when an operation has been successfully or unsuccessfully completed.*

CM.sup 3: CM.sup.3 is a group decision support system designed to address the challenges of meetings distributed in time and space. **1995** Gavish et al. *CM.sup.3 is a new group decision support system designed to address the challenges of meetings distributed in time and space … CM.sup.3 (The name was coined by Ron Grohowski, then with IBM, after using the prototype decision support system at Owen Graduate School of Management) is a computer-and telecommunication-based decision support environment designed to facilitate group consensus formation and enhance the group decision-making processes. The [CM.sup.3] project's objective is to apply computing and telecommunication technologies to 'add value' to a group decision process, not simply recreate the group's natural decision process within a computer setting. The CM.sup.3 system is a prototype system.*

CMC: see Computer Mediated Communication.

CMC design issues: see Design issues.

CMC monitoring system: EIES has a monitoring system to collect usage patterns **1978** Turoff and Hiltz *The subjective reactions of users of EIES to this form of communication and to specific features of the system have been reported elsewhere (Hiltz, 1978a, 1978b). In this paper, we wish to present data on usage patterns collected by the EIES monitoring system, and our interpretations of what these data show about adaptation to this form of human communication.*

CMC system: see Computer Mediated Communication System.

coauthoring systems: Co-authoring systems are a class of CSCW systems.The other three classes are messaging systems, conferencing systems, and meeting systems. **1990** Halonen et al. (167) *Further, hardware sharing does not preclude the use of groupware programs. Available groupware designed specifically for synchronous meetings, and even asynchronous groupware (for example, argumentation tools, such as gIBIS [2], or coauthoring tools, such as Quilt [71) can be used in a hardware sharing environment.* **1996** Barua et al. (4) (from Rodden 1991) *Group work: is based on spatial (local or remote) and temporal relationships (asynchronous or synchronous), analogous to geographically scope and real-time ability. He further uses this relationship to separate CSCW systems into four classes, messaging systems, conferencing systems, meeting systems and co-authoring systems.*

co-construction level: At the cooperation and co-construction level, collaboration is directed to a known object (or goal) shared by the actors, but the means are not shared or even known to all the actors. Thus, actors continuously modify actions based on intermediate results, adapting to others' actions and conceptualising their own actions in the process of realising the object. At the co-construction level new motives are created. **1999** Bertelson and Neilson *At the cooperation and co-construction level, collaboration is directed to a known object (or goal) shared by the actors, but the means are not shared or even known to all the actors. Thus, actors continuously modify actions based on intermediate results, adapting to others' actions and conceptualising their own actions in the process of realising the object. At the co-construction level new motives are created.*

cognitive map: Cognitive maps are graphical maps of concepts and their relationships.**1989** Ackermann *What is SODA (is it a GDSS)? SODA is built upon the Cognitive Mapping Technique (based on Kelly, 1955, and originally developed by Eden, Sims and Jones, 1979) which aims to capture the wisdom of a group in a form that is both useful for the group to work on and from which a strategy or portfolio of actions can be generated.* **1997** Hofstede et al. *Mental Models include knowledge, beliefs, needs, norms, emotions, goals. These models are important, since they determine actual behaviour, and their implicit nature asks for explication, for which several techniques are available (eg. Cognitive mapping, system dynamics).* **2002** DeVreede et al. *Cognitive maps: graphical maps of concepts and their relationships.*

cognitive trust: Cognitive trust (that develops from social cues and impressions that an individual receives from the other). Cognitive trust is one of three bases of trust applicable to virtual teams. The other two are personality-based and institutional based trust. Cognitive trust is further subdivided into three dimensions: stereotyping, unit grouping and reputation categorization. **2003** Sarker et al. C*ognitive trust (that develops from social cues and impressions that an individual receives from the other) … Drawing on the literature, 3 different bases of trust applicable to virtual teams have been identified: personality-based, institutional-based, and cognitive trust, with cognitive trust further subdivided into 3 dimensions: stereotyping, unit grouping, and reputation categorization.*

cognitive value: Cognitive value may be positive or negative. Cognitive value has three dimensions; technical, access, and conceptual. **1998** Briggs et al. (157) *Cognitive Value: A proposed system may cause some change in the attention demanded to accomplish a task. We define attention as cognitive effort over time. Human attention resources are limited. Any attention spent on operating a new technology interferes with problem solving and goal attainment. If the proposed system would reduce demands on the attention of the prospective user, this might be perceived as a positive cognitive value. If it would increase demands on attention, this might be perceived as a negative cognitive value. We have identified at least three dimensions of cognitive value: technical, access, and conceptual.*

Cognoter: Cognoter is a Colab tool used to prepare presentations collectively. Its output is an annotated outline of ideas and associated text. **1986** Foster and Stefik *Cognoter divides the organization process into smaller and different kinds of steps. In Cognoter, independent decisions can be made independently, ideas can be generated and simply "put on the table" without concern about their position in relation to other ideas. The steps for organizing ideas are incremental and efficient. Cognoter separates the concerns of idea generation, ordering and evaluation … Cognoter is a Colab tool used to prepare presentations collectively. Its output is an annotated outline of ideas and associated text. … Ideas are represented in Cognoter by short descriptve items that are displayed in a public window. Items are not evaluated or deleted in this stage and, at first, little attention is paid to details of organization.*

Colab: Colab was a face-to-face meeting support system, set up at Xerox PARC, that gave a group several meeting tools. The Colab was designed for small working groups of two to six persons using personal computers connected over a local area network. **1987** Stefik et al. *an experimental meeting room known as the Colab has been set up at Xerox PARC. In the Colab, computers support collaborative processes in face-to-face meetings. The Colab is designed for small working groups of two to six persons using personal computers connected over a local area network.* **1992** Bannon (8) *Xerox PARC CoLab: This project involved building a computerized meeting environment to support small (2 to 6 people) face-to-face meetings. A special room was constructed containing several workstations connected on a local area network. A number of software tools were developed to allow users to jointly work on documents and share the same views on these documents (WYSIWIS - What you See Is What I SEE).* **1998** Greenberg and Roseman (from Stefik et al.1987) *CoLab was a face to face meeting support system that gave a group several meeting tools*

Colab tool: Colab tools that were based on formal models of the meeting process. Two such tools were Cognoter and Argnoter. **1987** Stefik et al. *Other Colab tools are based on much more formal models of the meeting process. Two such tools are Cognoter and Argnoter.*

collaborating: Collaborating: finding common ground for multiparty problems. **1998** Knoll and Jarvenpaa *Collaboration occurs through a purposive relationship, when there is a desire or need to solve a problem, to create, or to discover something within a set of constraints (13, p.36). When collaborating, as much time is spent on understanding what is being done as actually doing it.* **1998** McMahon (1) *Collaborating: finding common ground for multiparty problems.*

collaboration: Collaboration: peoples ability to work together. Collaboration is a process through which parties who see different aspects of a problem can constructively explore their differences and search for solutions that go beyond their own limited vision of what is possible. Three aspects of collaboration are product, process and satisfaction. **1992** O'Dwyer and Giser *Collaboration: people's ability to work together.* **1997** Schlichter et al. *Collaboration requires two or more participants who contribute to a common task. A crucial point for successful collaboration is the manner in which individual work is related to the group as a whole.* **1998** McMahon *Collaboration is a process through which parties who see different aspects of a problem can constructively explore their differences and search for solutions that go beyond their own limited vision of what is possible.* **1998** Knoll and Jarvenpaa (4) *Collaboration occurs through a purposive relationship when there is a desire or need to solve a problem, to create, or to discover something within a set of constraings [13 p.36]. When collaborating, as much time is spent on understanding what is being done as actually doing it.* **1999** Gutwin and Greenberg (248) *Three aspects of collaboration: product, process and satisfaction.* **2000** Boyle and Greenberg (1) *Collaboration may be loosely defined as people working together towards common goals, sharing ideas, and exchanging information.*

collaboration behaviour: Collaboration behavior is characterized by attempts to identify and achieve outcomes that integrate the interests of all parties involved. This behavior emphasizes openness to others' points of view, objective consideration of all information, and shared efforts to solve problems and reach a jointly optimal solution. **2001** Montoya-Weiss et al. *Collaboration behavior is characterized by attempts to identify and achieve outcomes that integrate the interests of all parties involved. This behavior emphasizes openness to others' points of view, objective consideration of all information, and shared efforts to solve problems and reach a jointly optimal solution.*

collaboration constraint: Collaboration constraints are lack of expertise, time, or money; or the presence of competition or conventional wisdom (prejudices of the day). **1998** Knoll and Jarvenpaa (4) *Collaboration constraints are lack of expertise, time, or money; or the presence of competition or conventional wisdom (prejudices of the day).*

collaboration phase*:* Collaboration phases are invention, evaluation and action **1986** Johnson et al. (349). *We can characterize the process of collaboration through phases "invention" (ideas are generated; structuring of roles becomes clearer), "evaluation" (ideas are assessed; ambiguity is reduced); "action" (commitments of who does what are made and fulfilled or not).*

collaboration software: Collaboration software is a combination of traditional forms of communication that are mediated through a computer (verbal represented by audio, letters represented by document sharing, face-to-face represented by video, etc.). **1998** Hein et al.(4) *Collaboration software is a combination of traditional forms of communication that are mediated through a computer (verbal represented by audio, letters represented by document sharing, face-to-face represented by video, etc.).*

collaboration support: Including data management, graphic display, decision documentation, tutoring, decision analysis consultation, group process facilitation, meeting facility, vote tabulation and display **1986** Kraemer and King *There are about three general functions and 1-2 dozen specific functions that are provided in support of decision conferences: a. structured decision analysis decision trees multiattribute utility b. structured group process social judgment analysis delphi technique nominal group technique c. collaboration support data management graphic display decision documentation tutoring decision analysis consultation group process facilitation meeting facility vote tabulation and display.*

collaboration tool: Collaboration tools (or online groupware) are computer-based technologies that allow users who are geographically separated to work in conjunction with one another. **1998** Hein et al. (4) *Colloboration tools: can be explained as computer-based technologies that allow users who are geographically separated to work in conjunction with one another at respectable speeds and with a minimal redundancy of work.* **1998** Hein et al. (7) *collaboration tools or online groupware.*

collaboration transparency system: Collaboration transparency is a form of data conferencing - the shared use is transparent to the application and its developers; no application source is modified or inspected to achieve collaborative use. **2000** Begole et al. *Collaboration transparency - This form of data conferencing is referred to as collaboration transparency because the shared use is transparent to the application and its developers; no application source is modified or inspected to achieve collaborative use. Several collaboration-transparency systems are available free on widely used platforms, allowing even casual computer users to try them out..*

collaborative activity: Levels of collaborative activity identifies a three level hierarchical structure of a collaborative activity [9]: coordinated, cooperative and constrictive collaborative activity. **1998** Bardram (1) *Levels of collaborative activity identifies a three level hierarchical structure of a collaborative activity [9]: coordinated, cooperative and constrictive collaborative activity.*

collaborative authoring: Also referred to as collaborative writing is a process in which authors with differing expertise and responsibilities interact during the intervention and revision of a common document. Collaborative writing systems permit each member of workgroups to create and edit his or her sections of any document type including text, graphics, spreadsheets, and so on. **1997** Schlichter et al. *Collaborative writing: a process in which authors (eg. Editors, graphics experts, users, reviewers) with differing expertise and responsibilities interact during the invention and revision of a common document.(25).* **2000** Stough et al. *Collaborative writing/programming/drawing: this is an activity of creating documents by a group of collaborative workers. Collaborative writing systems permit each member of workgroups to create and edit his or her sections of any document type including text, graphics, spreadsheets, and so on.*

collaborative computing: Collaborative computing utilizes networking, communication, concurrent processing, and windowing environments. **1991** Grudin *Collaborative computing utilizes networking, communication, concurrent processing, and windowing environments.*

collaborative decision making: Collaborative decision making involves group processes, where people work together to accomplish a decision-making task. The process of decision making can be considered to be a collaborative learning process, where participants exchange knowledge about the task domain. **1998** Kwok and Khalifa (309) *Collaborative decision making involves group processes, where people work together to accomplish a decision-making task. The process of decision making can be considered to be a collaborative learning process, where participants exchange knowledge about the task domain.*

Collaborative document Editing System (CES): CES is an interactive multi-user system that was implemented in a distributed workstation environment. **1986** Greif and Sarin *The collaborative document editing system CES was implemented in a distributed workstation environment.* **1989** Ellis and Gibbs *Transaction mechanisms have been used for* *concurrency control in interactive multi-user systems (for example, CES or Quilt), but, these are loosely-coupled systems and have less demanding response time requirements.*

collaborative empowerment: Collaborative empowerment of virtual teams requires two different types of training: traditional collaborative skills such as communication, cross-training and team management skills; and training in how to use a range of collaborative software that will enhance the team's work. **1996** Townsend et al. (125) *Collaborative empowerment of virtual teams requires two different types of training: traditional collaborative skills such as communication, cross-training and team management skills; and training in how to use a range of collaborative software that will enhance the team's work.*

collaborative interpretation: Collaborative interpretation, a process where a group interprets and transforms a diverse set of information fragments into a smaller, coherent set of meaningful descriptions. **2000** Cox and Greenberg (289) *Collaborative interpretation, a process where a group interprets and transforms a diverse set of information fragments into a smaller, coherent set of meaningful descriptions.*

collaborative laboratory: The Colab is a collaborative laboratory. Collaborative laboratories are used for research purposes such as testing new technology and running experiments. **1986** Kraemer and King *The only current illustration of the collaborative laboratory that we are aware of is Colab at Xerox Palo Alto Research Center (Stefik, 1985). It is currently a part of the Colab Project.*

collaborative learning: Collective learning is learning that emphasizes group or cooperative efforts. Collaborative learning generates a greater diversity of ideas, more critical thinking, and more creative responses than when learning occurs individually. **1990** Hiltz *Collaborative learning is defined as learning that emphasizes group or cooperative efforts among faculty and students. It stresses active participation and interaction by both students and instructors. Knowledge is gained through an active dialogue that enables the sharing of ideas and information (see Bouton and Garth, 1983; Whipple, 1987) … The labels given to collaborative or group learning are many; among them are: "cooperative learning, collective learning, study circles, team learning … " (Bouton and Garth, 1983), and ":peer-group learning" or syndicates" (Collier, 1980).* **1998** Jones et al. *Studies have shown that collaborative learning is superior to individualistic learning in terms of better performance, satisfaction with the learning process, and motivation to learn (11). Collaborative learning generates a greater diversity of ideas, more critical thinging, and more creative responses than when learning occurs individually (36).* **1998** Kwok and Khalifa (309) *Collaborative decision making involves group processes, where people work together to accomplish a decision-making task. The process of decision making can be considered to be a collaborative learning process, where participants exchange knowledge about the task domain.*

Collaborative learning theory: Collaborative learning theory, learning occurs through interaction with other individuals. Collaborative learning is superior to individualistic learning in terms of better performance, satisfaction with the learning process, and motivation to learn (11). Collaborative learning generates a greater diversity of ideas, more critical thinking, and more creative responses than when learning occurs individually (36). **1998** Jones et al. (2) *Collaborative learning theory, learning occurs through interaction with other individuals. Studies have shown that collaborative learning is superior to individualistic learning in terms of better performance, satisfaction with the learning process, and motivation to learn (11). Collaborative learning generates a greater diversity of ideas, more critical thinging, and more creative responses than when learning occurs individually (36).*

collaborative software system: Collaborative software systems also referred to as group support systems are specifically designed to create an enhanced environment for brainstorming, focus group work, and group decision making. These systems provide their users with a variety of support tools to poll participants and assemble statistical information relevant to the decision activity. These systems allow users to "turn off" their individual identities during a brainstorming session and interact with relative anonymity, which can be very helpful in certain contexts. **1998** Townsend et al. (from Townsend et al.1995) *Collaborative software systems is designed to empower real time group decision making and other creative activities. These systems, called group support systems (GSS), are specifically designed to create an enhanced environment for brainstorming, focus group work, and group decision making. These systems provide their users with a variety of support tools to poll participants and assemble statistical information relevant to the decision activity. Finally, these systems allow users to "turn off" their individual identities during a brainstorming session and interact with relative anonymity, which can be very helpful in certain contexts.* **1998** Townsend et al. (21) (from Schrage 1995) *Collaborative software systems are the second component of the virtual team technical infrastructure. Effective collaboration requires team members to work both interactively and independently: collaborative software is designed to augment both types of group work activitie and to empower teamwork processes*.

collaborative system: Collaborative systems (also known as collaboratory) provide an open electronic platform for individual or groups with common interests to efficiently exchange, disseminate and create issues, ideas and knowledge. **1996** Barua et al. (2) *Collaboratove system (which we will call a collaboratory) provides an open electronic platform for individual or groups with common interests to efficiently exchange, disseminate and create issues, ideas and knowledge.*

collaborative technology: Collaborative technology (sometimes referred to as groupware applications) can be defined in reference to a more encompassing and powerful goal: the construction of communal ways of seeing, acting and knowing. A collaborative technology is a tool that enables individuals to jointly engaged in active production of shared knowledge. **1992** Rochelle *Collaborative technology can be defined in reference to a more encompassing and powerful goal: the construction of communal ways of seeing, acting and knowing. A collaborative technology is a tool that enables individuals to jointly engaged in active production of shared knowledge.* **1995** Dourish *Collaborative applications coordinate activities which may be distributed in time and or space.* **1998** Rochelle *Collaborative technology is one which allows participants to transform a shared experience that is lacking clear possibilities for action into an experience that can be routinely and meaningfully handled by their community; a collaborative technology is a tool for the mutual production of new practices. Collaborative technology is therefore the basis of a generative community of practice. It allows the community to reconstruct a shared experience continually so as to produce greater meaning and greater potential for successful future action.* **1998** Hein et al. *Collaboration software is a combination of traditional forms of communication that are mediated through a computer (verbal represented by audio, letters represented by document sharing, face-to-face represented by video, etc.).* **2001** Davison and DeVreede *Collaborative technologies, sometimes referred to as "groupware applications" given their deployment to support groups of individuals engaging in collaborative tasks, have developed rapidly in the last few years.*

collaborative virtual environment (CVE): CVE are characterized by the rendering of virtual places (meeting rooms, theatres, marketplaces and so on) which are inhabited by multiple distributed users who are mutually represented to each other in order to support cooperative action and interaction within a shared virtual space. **1998** Pycock et al. *CVEs on the other hand, are characterized by the rendering of virtual places (meeting rooms, theatres, marketplaces and so on) which are inhabited by multiple distributed users who are mutually represented to each other in order to support cooperative action and interaction within a shared virtual space.* **1999** Benford et al. (179) *Inhabited TV combines collaborative virtual environments (CVES) with broadcast TV so that on-line audiences can participate in TV shows within shared virtual worlds.*

collaborative work: Collaborative work allows individuals in distinct physical locations to communicate with each other. **1995** Heath et al. *Collaborative work- Audio-Visual and computing networks which allowed individuals in distinct phyusical locations to communicate with each other both visually and vocally.*

collaborative work support system (CWSS): CWSS is a term used by Bostrom and Anson for systems that provide support for collaborative work. Three approaches for CWSS are generic tools, generic tasks and application specific. **1988** Bostrom and Anson (100) *This section outlines three different but related types of Collaborative Work Support Systems (CWSS). The three approaches are generic tools, generic task and application-specific CWSS.*

collaboratory: Also known as collaborative system provide an open electronic platform for individual or groups with common interest to efficiently exchange, disseminate and create issues, ideas and knowledge. **1996** Barua et al. (2) *Collaboratove system (which we will call a collaboratory) provides an open electronic platform for individual or groups with common interests to efficiently exchange, disseminate and create issues, ideas and knowledge.*

Collaboratus: Collaboratus is a suite of tools that help teams more effectively work together to accomplish a task or goal. **2003** Lee and Albrecht *Collaboratus (the Latin word means to collaborate). A suite of tools that help teams more effectively work together to accomplish a task or goal.*

collective culture: Collective cultures tend to prefer completing tasks together. Collective cultures lean toward high context communication in the majority of social interactions. **2001** Montoya-Weiss et al. *Collectivist cultures tend to prefer completing tasks together. …Collectivist cultures also lean toward high context communication in the majority of social interactions.*

collective learning: see collaborative learning. **1990** Hiltz *The labels given to collaborative or group learning are many; among them are: "cooperative learning, collective learning, study circles, team learning … " (Bouton and Garth, 1983), and ":peer-group learning" or syndicates" (Collier, 1980).*

collective trust: Collective trust is a common belief among group members that individuals will behave in accordance with the commitments, will be honest in the negotiations preceding those commitments, and will refrain from taking undue advantage of another. **1998** Jarvenpaa and Leidner (30) (from Cummings and Bromiley) *Collective trust: is a common belief among a group of individuals that another individual or group (a) makes good-faith efforts to behave in accordance with any commitments. (b) is honest in whatever negotiations preceded such commitments and (c) does not take excessive advantage of another even when the opportunity is available.* **2003** Sarker et al. (from Cummings and Bromiley 1996) *Cummings and Bromiley (1996) view collective trust as the common belief among group members that individuals will behave in accordance with the commitments, will be honest in the negotiations preceding those commitments, and will refrain from taking undue advantage of another.*

co-located: Co-located: individuals who work together in the same physical location and are often culturally similar. Co-location, or physical proximity more generally, is said to reinforce social similarity, shared values, and expectations, and to increase the immediacy of threats from failing to meet commitments. **1998** Jarvenpaa and Leidner (from Latane et al. 1995) *Co-location, or physical proximity more generally, is said to reinforce social similarity, shared values, and expectations, and to increase the immediacy of threats from failing to meet commitments.* **2001** McDonough et al. *Co-located teams are located in close physical proximity. While these teams may be comprised of culturally diverse members, there have been few studies that have focused on this possibility.*

co-located collectivity: Co-located collectivities are those groups or teams whose members are within close proximity of each other and for whom the dominant mode of communication is face-to-face. Members of co-located groups or teams typically work in the same physical location or come together regularly and frequently to meet in the same location. **1999** Furst et al. (250) *Co-located collectivities are those groups or teams whose members are within close proximity of each other and for whom the dominant mode of communication is face-to-face. Members of co-located groups or teams typically work in the same physical location or come together regularly and frequently to meet in the same location.*

commercial GSS products: Commercial GSS products include GroupSystems, Lotus Notes, Microsoft's Exchange, Netscape's Collabra Share, Novell's Groupwise. **2003** Siao *A number of commercial GSS products (eg. GroupSystems.com products, Lotus Notes, Microsoft's Exchange, Netscape's Collabra Share, Novell's Groupwise) have also emerged.*

commitment*:* Commitment is defined as the participant's intent to support the decision made by the group **2003** Corbitt and Martz *Commitment is defined as the participant's intent to support the decisions made by the group.*

common ground: Common ground is the shared understanding among collaborators that permits interactions to proceed smoothly and the shared context for the social interaction. **2002** Girgensohn et al. (140) *Common ground is the shared understanding among collaborators that permits interactions to proceed smoothly and the shared context for the social interaction.*

common information space (CIS): Parameters of common information spaces: 7 parameters: (i) the degree of distribution of work; (ii) the multiplicity and intensity of webs of significance; (iii) the level of required articulation work; (iv) multiplicity and intensity of means of communication; (v) the web of artifacts; (vi) immaterial mechanisms of interaction; (vii) the need for precision and promptness of interpretation. **2002** Bossen (176) *Parameters of common information spaces: 7 parameters: (i) the degree of distribution of work; (ii) the multiplicity and intensity of webs of significance; (iii) the level of required articulation work; (iv) multiplicity and intensity of means of communication; (v) the web of artifacts; (vi) immaterial mechanisms of interaction; (vii) the need for precision and promptness of interpretation.*

Commune: Commune is a drawing editor. Its main difference from GroupSketch is that people used a stylus to write directly on top of the horizontally oriented monitor. GroupSketch required people to draw awkwardly with a mouse. **1998** Greenberg and Gutwin (5) *Commune: its main difference from GroupSketch is that people used a stylus to write directly on top of the horizontally-oriented monitor while ours required people to draw (awkwardly) with a mouse.*

Communication: Communication is the sharing of information Communication is the primary way in which collaborative activities are accomplished by humans in a social setting, whether focused on coordination, cooperation, or co-construction and re-conceptualization. Communication can be sorted into three types; improving cultural understanding, task related communication, and social emotional communication. **1980** Hiltz et al. *…participants communicate by talking, listening and observing non-verbal behaviour….* **1992** O'Dwyer and Giser *Communication: the sharing of information.* **1997** Schlichter et al. *Communication serves two main needs: (1) on the data level to exchange shared information, eg. The exchange of group documents or group membership information, and (2) on the relationship level to coordinate the group activities as well as the access to and the usage of shared resources.* **1998** Riva and Galimberti *Communication as the passage of information from one person to another is becoming obsolete.This model usually called the parcel-post model (Shannon and Weaver 1949), is now being radically challenged, partly because of some of the peculiar features of electronic environments, so as the asymmetry between message sender and message receiver.* **1998** Bardram *Communication is the primary way in which collaborative activities are accomplished by humans in a social* *setting, whether focused on coordination, cooperation, or co-construction and re-conceptualization.* **2000** Robey et al. (58) *We sorted communication into three types: a) improving cultural understanding. b) task related communication, c) social-emotional communication.* **2000** Potter et al. *Communication: involves the exchange of information between two or more team members in the appropriate manner. It also serves to clarify, verify, and acknowledge messages. Communication is central to teamwork because it links together other components such as monitoring of performance and feedback.*

communication activity: A communication activity is when participants communicate by talking, listening and observing non-verbal behavior, and where there is no lag between the sending and receipt of communication signals. **1980** Hiltz et al. (75)? (from DeSanctis and Gallupe 1987) **1998** Bardram *Communication is the primary way in which collaborative activities are accomplished by humans in a social setting, whether focused on coordination, cooperation, or co-construction and re-conceptualization.*

communication capability: A CMC system factor that includes communication richness, special purpose communication structures, indirect communication channels, document distribution, and voting. Communication capabilities can also relate to capabilities of the Internet. Media Synchronicity Theory proposes that communication effectiveness results from matching the communication capabilities of concurrence and feedback to the communication processes of conveyance and convergence. **1981** Turoff et al. *Communications Capabilities Communication richness: The richness of the communication options offered such as conferences, messages and document access, and the variety of communication features associated with the options, such as confirmations of deliveries, notifications of access, use of pen names, status reports of readership, footnote and commenting or voting features. Special purpose communication structures: The ability of the system to supply or be adapted to supply special-purpose communication structures for activities such as facilitating, providing protection from information overload by filtering, allowing participation by very large groups through rules of order, incorporating systems such as personalized calendars which allow direct or indirect communications among the users. Indirect communication channels: The ability to set up indirect communication linkages among individuals and groups, such as informing a group of authors what the readers are looking for and not finding in key word searches. Document distribution: The features which allow the distribution of documents to interested parties. Voting: Provision of voting scales which may be associated with items for responses by others, with feedback to participants.* **1996** Barua et al. *Internet applications such as Newsgroups and Internet Relay Chat (IRC) provide the asynchronous and synchronous communication capabilities respectively, they do not support multimedia or hypertext linking capabilities like the web.***1998** Cockburn and Greenberg (777) *Commercial vendors are rapidly developing applications that exploit the real-time communication capabilities of the Internet and examples include Intel's "Proshare" - Netscape"s "CoolTalk", and Microsoft"s "NetMeeting".***2002** Baker *MST proposes that communication effectiveness results from matching the communication capabilities of concurrence and feedback to the communication processes of conveyance (the exchange of information) and convergence (the development of a shared meaning about information)*

communication channel: Communication channels that are electronic could include email, chat (such as ICQ), web-based groupware products (such as Blackboard). Two other types of communication channel are mass media channels such as radio, television and newspapers, and interpersonal channels such as face-to-face, telephone, and personal memos. **2003** Davison et al. (525) *The developers and consultants communicated with each other through a mix of email, chat technologies such as ICQ, and a purposely provided web-based groupware product – Blackboard – hosted on a server at the City University of Hong Kong. They were essentially free to use any and every technology to facilitate their communication.* **2003** Pollard *Communication channels. Two types of communication channels have been influential in diffusing technology - mass media channels, defined by*

Rogers (1995) as: all those means of transmitting messages that involve a mass medium, such as radio, television, newspapers, and so on, which enable a source of one or a few individuals to reach an audience of many. and interpersonal channels, defined as: "face-to-face; telephone; personal memo".

communication characteristic: Communication characteristics refer to the clarification efforts made by team members in trying to understand the problem to be solved, the task to be performed and the decision to be made, as well as the nature of the information exchange between team members and the degree of task-oriented communication between team members. **2000** Pare and Dube *Communication characteristics refer to the clarification efforts made by team members in trying to understand the problem to be solved, the task to be performed and the decision to be made, as well as the nature of the information exchange between team members and the degree of task-oriented communication between team members.*

communication development: Five key communication developments identified to improve electronic group communication are: increased speed of communication, dramatic reduction in communication costs, increased communication bandwidth, vastly expanded connectivity, integration of communication with computing technologies. **2003** Pauleen (from Fulk and DeSanctis 1995) *Transitional ICT-Supported Teams Fulk and DeSanctis (1995) discussed five key developments that have led to the possibilities of richer, more complex communication in organizations: increased speed of communication, dramatic reduction in communication costs, increased communication bandwidth, vastly expanded connectivity, and integration of communication with computing technologies. These developments have made the use of transitional ICT-supported teams not only possible, but also prevalent in today's organizations.*

communication equipment: This can include local area network, telephone lines, satellite, microwave relay. **1985a** DeSanctis and Gallupe *For dispersed groups, a local area network, telephone lines, satellite, or microwave relay may be required to allow group members to communicate with one another. Electronic mail, computer conferencing, audio and video conferencing might also be integrated into the GDSS environment.*

communication manager: A fourth component of GDSS needed for distributed GDSS. It has three roles, coordinator role, detective role and inventor role. **1986** Bui and Jarke (83) *The careful design of a communication manager as a fourth DSS component, in addition to dialogue manager, data manager, and model manager, is, therefore, a crucial prerequisite of a distributed GDSS.*

*co**mmunication manager role**:* There are at least three specific ommunication manager roles: coordinator role, detective role and inventor role. **1986** Bui and Jarke *One can identify at least three specific roles: (1) Coordinator role. The communication manager should coordinate the ini- tial situation analysis and problem definition ... Walton [52] suggests that by installing a communication medium that follows some norms of fairness (e.g., equality of participation, preserving autonomy), information exchange will be more abundant and accurate. (2) Detective role. Problem analysis could be distorted by an individual's attempt to spy on others' activities or by the influence of some members who try to take over an individual's responsibility ... (3) Inventor role. The inventor role is an extension of the coordinator role.*

communication manager tool: There are different classes of tools for which the communication manager provides a framework of usage: shared databases, artificial intelligence techniques, multiple criteria decision methods, game theory, and a large number of behavioural process-oriented tricks. **1986** Bui and Jarke *There are also different classes of tools for which the communication manager provides a framework of usage. In the simplest case, these may be merely shared databases; even then, there is at least a need for novel transaction concepts, such as those used in design databases [19]. More complex methods include various artificial intelligence techniques (e.g., distributed problem solving, evidential reasoning,* *belief maintenance), multiple criteria decision methods (MCDM), game theory from operations research, and a large number of behavioral, process- oriented tricks (threats, promises, deadlines, etc.).*

***communication medium**:* Communication mediums (modes) are face to face or computer conferencing **1980** Hiltz et al. *How does this form of communication change the process and outcome of group discussions, as compared to the "normal" face to face (FtF) medium of group discussion, where participants communicate by talking, listening and observing non-verbal behavior, and where there is no lag between the sending and receipt of communication signals?* **1988** Ciborra and Olson. *The communication structure described above is not necessarily electronic. The physical proximity of team members and availability of channels determine the medium: face-to-face, telephone, memo, electronic mail, etc.* **1988** Egido *Teleconferencing systems and services, are the main set of technologies developed thus far to support group work. Within this set of technologies, videoconferencing is often thought of as a new, futuristic communication mode that lies between the telephone call and the face-to- face meeting*. **1986** Fanning and Raphael *Until computer teleconferencing systems can encompass several modes of human communication-- e.g. text, voice, sketched diagrams, and photographs.* **1986** Bui and Jarke *Walton [52] suggests that by installing a communication medium that follows some norms of fairness (e.g., equality of participation, preserving autonomy), information exchange will be more abundant and accurate.* **1994** Galagher and Kraut (112) *Social presence is the extent to which a communication medium elicits the same psychological experience as unmediated, face-to-face communication … Media that provide social presence do so because they permit interactivity and expressiveness … According to Contingency theory, tasks involving high levels of uncertainty and equivocality require a communication medium that permits interactive, expressive communication.* **1995** Ocker et al. *Mode of communication consists of distributed asynchronous computer conferencing and traditional FtF communication.* **1996** Hiltz et al. *A specific GSS is a particular combination of communication mode, tools and structuring of process (via a facilitator or procedural instructions/agenda).*

communication mode: Refer to communication medium.

communication purpose: The purpose of communication is to serve two main needs: at the data level to exchange shared information and at the relationship level to coordinate the group activities and access shared resources. **1997** Schlichter et al. *Communication serves two main needs: (1) on the data level to exchange shared information, eg. The exchange of group documents or group membership information, and (2) on the relationship level to coordinate the group activities as well as the access to and the usage of shared resources.*

communication representation tool: Communication representation tools could include topic structures in computer conferences or embedded links between documents. **1986** Malone et al. (102) *… systems that provide some very general representation tools (such as topic structures in computer conferences or embedded links between documents) and very little other formal knowledge about their domains*" *Such as electronic mail, computer conferencing and hypertext systems*

***communication richness**:* A CMC system factor relating to communication capabilities. "The richness of the communication options offered such as conferences, messages and document access, and the variety of communication features associated with the options, such as confirmations of deliveries, notifications of access, use of pen names, status reports of readership, footnote and commenting or voting features" **1981** Turoff et al.(92-93) *The richness of the communication options offered such as conferences, messages and document access, and the variety of communication features associated with the options, such as confirmations of deliveries, notifications of access, use of pen names, status reports of readership, footnote and commenting or voting features.*

communication software: Communication software is specifically aimed at supporting the collaborative aspects of group work and includes tools for both local and long distance text, data, voice, and video transmission among local and distant group members, between group members and the facilitator, and between group members and the central processor. **1988** Kraemer and King *Communication software is specifically aimed at supporting the collaborative aspects of group work and includes tools for both local and long distance text, data, voice, and video transmission (eg. Electronic chalkboard, electronic voting, networking, electronic mail, computer conferencing) among local and distant group members, between group members and the facilitator, and between group members and the central processor.*

communication structure: Communication structures are system factors of computer-mediated communication systems relating to communications capabilities. **1981** Turoff et al. *Communications Capabilities Communication richness: The richness of the communication options offered such as conferences, messages and document access, and the variety of communication features associated with the options, such as confirmations of deliveries, notifications of access, use of pen names, status reports of readership, footnote and commenting or voting features. Special purpose communication structures: The ability of the system to supply or be adapted to supply special-purpose communication structures for activities such as facilitating, providing protection from information overload by filtering, allowing participation by very large groups through rules of order, incorporating systems such as personalized calendars which allow direct or indirect communications among the users. Indirect communication channels: The ability to set up indirect communication linkages among individuals and groups, such as informing a group of authors what the readers are looking for and not finding in key word searches. Document distribution: The features which allow the distribution of documents to interested parties. Voting: Provision of voting scales which may be associated with items for responses by others, with feedback to participants.*

communication system: Communication systems are systems that afford verbal, written and/or graphic interaction between people**. 1998** Greenberg and Gutwin *Systems that afford communication (eg. Text chat, digital voice and video).*

communicative behaviour: Communicative behaviours are the means through which group members can influence each other and create standards of behaviour. **1998** Prinz et al. *Communicative behaviours are the means through which group members can influence each other and create standards of behaviour: eg. By observing each other's actions, or by explicit and implicit communication [28].*

communicative protocol: Communicative protocols include telephones, DVCS, electronic mail, and Internet/intranets.**1998** Townsend et al. *Communicative protocols (eg. telephones, DVCS, electronic mail, and Internet/intranets).*

communities of practice*:* Participants in a community of practice learn work practices that satisfy their local needs, and they often ignore or neglect formally prescribed p0ractices that are seen as less relevant to performance. **2000** Robey et al. (from Orr 1996) *Participants in a community of practice learn work practices that satisfy their local needs, and they often ignore or neglect formally prescribed practices that are seen as less relevant to performance.*

competition behaviour: Competition behaviour is characterized by each party's pursuing his or her own interest without regard to others. This behaviour involves concealment of information, competitivemess, and negative attitudes toward alternative solutions. **2001** Montoya-Weiss et al. *Competition behaviour is characterized by each party's pursuing his or her own interest without regard to others. This behaviour involves concealment of information, competitivemess, and negative attitudes toward alternative solutions. Competitive interactions typically involve the use of power and domination as one party tries to force its views on the other.*

***completion time**:* Completion time is a basic measure of product performance. It assumes that there is a relationship between the activities of collaboration and the speed at which a group can perform the task. **1999** Gutwin and Greenberg (256) *Completion time is a basic measure of product performance. It assumes that there is a relationship between the activities of collaboration and the speed at which a group can perform the task.*

***comprehension**:* Comprehension is an interactive system characteristic related to learning modes. **1981** Turoff et al. (91) *The ability of users to understand as a whole what the system is capable of accomplishing, before having to learn how to do it.*

compromise behaviour: Compromise behaviour is characterized by intermediate concern for self and others. The parties acknowledge differences in preferences and then work toward settling on some middle ground. **2001** Montoya-Weiss et al. *Compromise behaviour is characterized by intermediate concern for self and others. The parties acknowledge differences in preferences and then work toward settling on some middle ground.*

computer-based conferencing system: Computer based conferencing systems allow a workgroup to exchange views, ideas, or information in a discussion to overcome the barriers created by time and space. **2000** Stough et al. *Computer based conferencing systems: these allow a workgroup to exchange views, ideas, or information in a discussion to overcome the barriers created by time and space. Many types of computer-based conferencing systems exist today including computer conferencing (e-mail meeting), desktop conferencing, teleconferencing, video conferencing, and multimedia conferencing.*

computer based information system (CBIS): Computer based information systems are used to support intelligent collaborative work. **2000** Stough et al. (from Jessup and Valacich 1993) *GSS is defined as a CBIS used to support intellectual collaborative work. …Workgroup database management system: Information storage and retrieval are one of the fundamental operations of CBIS.* **2003** Corbitt and Martz (from Jessup and Valacich 1993, p.5) *Jessup and Valacich's (1993, p. 5). definition of CGT, "computer based information systems used to support intelligent collaborative work," captures the main theme of this category.*

computer-based system: One form of computer-based system to support collaborative work is most often called a Group Support System, or GSS. Other terms include ‘Group Decision Support Systems’ (GDSS) and ‘Electronic Meeting Systems’. **1996** Hiltz et al. (1) *One form of computer based system to support collaborative work (“groupware” Johnson-Lenz, 1982; Ellis et al.1991) is most often called a Group Support System, or GSS. Other terms include “Group Decision Support Systems” (GDSS): (DeSanctis and Gallupe 1987) and “Electronic Meeting Systems” (Nunamaker et al. 1991).*

computer conferencing: Computer conferencing (also known as remote conferencing, or desk-top conferencing) is a technology which allows small groups to form and communicate through inexpensive and technically simple electronic mediation. Computer conferencing is asynchronous, which means that ‘meetings’ take place over an extended time period, usually around some prearranged topic. **1980** Hiltz et al. *How does this form of communication change the process and outcome of group discussions, as compared to the "normal" face to face (FtF) medium of group discussion, where participants communicate by talking, listening and observing non-verbal behavior, and where there is no lag between the sending and receipt of communication signals? … The chief independent variable of interest is the impact of computerized conferencing on a communications mode upon the process and outcome of group decision making, as compared to face-to-face discussions. Two different types of tasks were chosen, and group size was set at five persons.* **1985a** DeSanctis and Gallupe, *For dispersed groups, a local area network, telephone lines, satellite, or microwave relay may be required to allow group members to communicate with one another. Electronic mail, computer conferencing, audio and video conferencing might also be integrated into the GDSS environment.* **1987** Stefik et al. *Computer conferencing [16, 17] which emphasizes the use of computers to support asynchronous communication and discussion over a computer network … Remote conferencing that rely mostly on* *computers rather than video: known as computer conferencing, these systems include electronic mail, editors, voting mechanisms, shared files, and archiving, but do not provide structure for the conferences based on any models of group problem-solving processes.* **1988** Kraemer and King *Computer conferencing is asynchronous, which means that "meetings" take place over an extended time period, usually around some prearranged topic. The conference chair usually initiates the meeting with an introductory statement and questions about the topic, which is then broadcast to all participants. The participants in turn join the meeting at their convenience, but within the prescribed "meeting time" (usually a week or two), read the chair's message and any responses from other participants, and then broadcast their own messages. Participants may respond to any and all messages and may join or exit the meeting at any time. When the appointed time to end the meeting comes or when message traffic drops off, the chair exercises the prerogative of summarizing the meeting and ending it.* **1989** Feenberg *Computer conferencing is a technology which, for the first time, allows small groups to form and communicate through inexpensive and technically simple electronic mediation.* **1992** Galegher and Kraut *ICoSy: a program that supports both electronic mail and computer conferences … Technologies such as electronic mail and computer conferencing are generally rates as 'lean' media, lacking the potential to support intricate communication about complex topics.*

computer mediated communication (CMC): Also known as computer mediated conferencing. Computer mediated communication systems allow geographically dispersed group members to communicate asynchronously. Several office automation applications such as computer conferencing, audio conferencing, and video conferencing support geographical communication. Using a Computer-Mediated Conference, there is no need to schedule meetings in advance. Participants send their input to a central database or electronic mailbox, and other participants respond to the input and eventually a decision is made by consensus. Computer mediated communication (CMC) tools such as conferencing, email, and discussion forums, support the communication needs for the task roles of group projects. **1980** Hiltz et al. The c*hief independent variable of interest is the impact of computerized conferencing on a communications mode upon the process and outcome of group decision making, as compared to face-to-face discussions.* **1995** Aiken et al. *Computer-Mediated Conference: A large group dispersed geographically. Several office automation applications such as computer conferencing, audio conferencing, and video conferencing permit geographically-dispersed group members to communicate. Using a Computer-Mediated Conference, there is no need to schedule meetings in advance. Participants send their input to a central database or electronic mailbox, and other participants respond to the input and eventually a decision is made by consensus.* **1996** Hiltz et al. (from Turoff 1991) *DGSS use asynchronous computer mediated communication to support anytime/anywhere group discussions and decision making … EIES is a CMC enhanced with GDSS tools, that provides the foundation that allows continued evolution and the incorporation of additional functionality.*

computer mediated communication tool: Computer mediated communication tools such as conferencing, email and discussion forums, support the communication needs for the task role of group projects. **1999** Whatley et al. *Computer mediated communication (CMC) tools such as conferencing, email, and discussion forums, support the communication needs for the task roles of group projects.*

computer mediated communication system factor: CMC system factors include atmosphere, communications capabilities, text processing, and specialized support software **1981** Turoff et al. *Computer mediated communication systems: System factors: A. Atmosphere Sense of community: The ability of the system to provide features, such as membership and interest directories, which allow users to form communities of interests as needed. Evolution: The ability of the system to change through feedback from its user community. Human help: The ability of the system to supply human help directly to its users. Communications Capabilities Communication richness: The richness of the communication options offered* *such as conferences, messages and document access, and the variety of communication features associated with the options, such as confirmations of deliveries, notifications of access, use of pen names, status reports of readership, footnote and commenting or voting features. Special purpose communication structures: The ability of the system to supply or be adapted to supply special-purpose communication structures for activities such as facilitating, providing protection from information overload by filtering, allowing participation by very large groups through rules of order, incorporating systems such as personalized calendars which allow direct or indirect communications among the users. Indirect communication channels: The ability to set up indirect communication linkages among individuals and groups, such as informing a group of authors what the readers are looking for and not finding in key word searches. Document distribution: The features which allow the distribution of documents to interested parties. Voting: Provision of voting scales which may be associated with items for responses by others, with feedback to participants. C. Text Processing Text editing: The direct modification of text during the composition process. Text formatting: The ability to have the computer set up formats for text such as paragraphing, tables, spacing, margins, etc. Document formatting: The ability to format a document by paging and incorporating such things as headings. Text mobility: The ability to move text around the system, such as from a message into a personal notebook. Text retrieval and linkages: The relationships, indexes and linkages set up to relate items of text to one another, and to the possibilities of dealing with non-linear type documents such as in "hypertext". Virtual text referencing: The ability to reference and incorporate existing text items in new text items in a virtual manner. Active and adaptive text: The ability of text to incorporate programs or functions that are executed as part of the delivery mechanism to readers. This includes the ability of text to contain forms or surveys for the reader to respond to and make conditional on various factors or specific responses what the reader actually sees. D. Specialized Support Software Integrated data structures: The ability of the users to communicate data in other than free text and the ability of the computer to recognize data items and who has authored them. It is usually assumed that such structures maintain the identity of the creators or suppliers of the data and allow authorship control over the segments of the data structures the user is responsible for. An example of this might be a budget planning system. User simulations: The ability of a system to develop tailored programs to simulate aspects of users' communication behavior, and thereby augment their communication capabilities by acting as an intermediary. A simple example would be a background task to carry out a search while the user is off line. Priveleges and protection: The ability of the system to preserve the access privilege structure provided by the author of material and to deal with read, write, edit and utilize access both on the part of the sender and receiver. In some instances it is necessary to allow a function triggered by a user to access material for utilization that was supplied by another user. However, the user making use of this material would not necessarily have raeding privileges for that material. An example is being able to ask of someone else's calendar if they can meet on a certain date and time. This is "utilize" access and is different from the more standard forms of access usually provided on interactive systems. The ability of the user to understand the forms of access and to make use of them as well as to be able to track their use by others on his or her material is a further aspect of this factor. Market structures: Software designed to facilitate payments based on the provision and use of information. For example, the ability of a user to advertise price information and to collect revenues for its use.*

Computer-mediated meeting management: see CM.sup.3.

computer supported cooperative learning (CSCL): CSCL is the study of the use of collaborative technology in education. **1995a** Kochmann (1) *CSCL for the more focused study of the use of collaborative technology in education.*

computer supported cooperative work (CSCW): CSCW is a generic term which combines the understanding of the way people work in groups with the enabling technologies of computer networking and associated hardware, software and techniques. Computer supported cooperative work is defined as work by multiple active subjects sharing a common object, supported by information technology. **1986** Greif and Sarin *An identifiable research field focused on the role of the computer in group work.* **1992** Kuuti and Arvenon (234) *Computer supported cooperative work is defined as work by multiple active subjects sharing a common object, supported by information technology.* **1992** Bannon (from Suchman 1989) *CSCW - The design of computer-based technologies with explicit concern for the socially organized practices of their intended users.* **1994** Ishii et al. *CSCW is an identifiable interdisciplinary research field focused on the role of computer and communication technology to support group work. CSCW examines how people work together in groups and how groupware technologies can support collaboration..* **1995** Pfeifer (1) *CSCW is an acronym that stands for Computer Supported Cooperative Work. It is the scientific discipline that motivates and validates groupware design. Put another way, it is a science that involves describing how to develop groupware applications. CSCW is also concerned with the study and theory of how people work together, and how groupware affects group behaviour.* **1997** Schlichter et al. (from Wilson 36) *CSCW is a generic term which combines the understanding of the way people work in groups with the enabling technologies of computer networking and associated hardware, software and techniques.*

computer teleconferencing system: Teleconferencing is a mode of communication that can include text, voice, sketched diagrams and photographs. **1986** Fanning and Raphael *Until computer teleconferencing systems can encompass several modes of human communication-- e.g. text, voice, sketched diagrams, and photographs,* **1988** Kraemer and King *Group network: The group network has its roots in computer teleconferencing but is also a response to its limitations … The teleconferencing facility is a GDSS designed primarily to facilitate meetings between groups at two or more locations. All of the conference rooms designed for teleconferencing have been designed to facilitate audio or video teleconferencing rather than computer teleconferencing, since the latter does not require a conference room. Computers seldom play a directy role in these teleconferencing facilities since most of the concern is with trying to mimic face-to-face meetings.* **2000** Stough et al. *Computer-based conferencing systems: these allow a workgroup to exchange views, ideas, or information in a discussion to overcome the barriers created by time and space. Many types of computer-based conferencing systems exist today including computer conferencing (e-mail meeting), desktop conferencing, teleconferencing, video conferencing, and multimedia conferencing.*

computerized conferencing: also see computer-based conferencing system. Computerized conferencing is a mode or medium of communication. **1980** Hiltz et al. *The factors were mode of communication (face-to-face vs. computerized conference) and problem type (human relations vs. a more "scientific" ranking problem with a correct answer) … The chief independent variable of interest is the impact of computerized conferencing on a communications mode upon the process and outcome of group decision making, as compared to face-to-face discussions. Two different types of tasks were chosen, and group size was set at five persons … A variable of secondary Interest is problem type. Much experimental literature indicates that the nature of the problem has a great deal to do with group performance. One type of problem that we used is the human relations case as developed by Bales. These are medium complex, unsettled problems that have no specific "correct" answer. The second type was a "scientific" ranking problem (requiring no specific expertise), which has a single correct solution plus measurable degrees of how nearly correct a group's answer may be.* **1996** Barua et al. (from Rodden 1991) *Group work: is based on spatial (local or remote) and temporal relationships (asynchronous or synchronous), analogous to geographically scope and real-time ability. He further uses this relationship to separate CSCW systems into four classes, messaging systems, conferencing systems, meeting systems and co-authoring systems*

computerized conferencing system:see computerized conferencing and computer-based conferencing system

computerized conferencing variable: Computerized conferencing variables could be task type (or problem type) and group size. **1980** Hiltz et al … *computerized conferencing … Two different types of task were chosen, and group size … problem type … One type of problem … is human relations case … The second type was a 'scientific' ranking problem.*

computerized support: Computerized support is a characteristic of a 'decision room'. Computerized support in a decision room could be a synchronous GDSS. **1987** Jelassi and Beauclair (145) *the face-to-face, close proximity, synchronous GDSS type commonly known as "war room" [30] or a "decision room" [6]. The decision room features computerized support in addition to traditional small group interaction.*

computing/communication capability: A means to reduce productivity losses in group decision making **1981** Turoff et al. *Communications Capabilities Communication richness: The richness of the communication options offered such as conferences, messages and document access, and the variety of communication features associated with the options, such as confirmations of deliveries, notifications of access, use of pen names, status reports of readership, footnote and commenting or voting features. Special purpose communication structures: The ability of the system to supply or be adapted to supply special-purpose communication structures for activities such as facilitating, providing protection from information overload by filtering, allowing participation by very large groups through rules of order, incorporating systems such as personalized calendars which allow direct or indirect communications among the users. Indirect communication channels: The ability to set up indirect communication linkages among individuals and groups, such as informing a group of authors what the readers are looking for and not finding in key word searches. Document distribution: The features which allow the distribution of documents to interested parties. Voting: Provision of voting scales which may be associated with items for responses by others, with feedback to participants.***1996** Barua et al. *Internet applications such as Newsgroups and Internet Relay Chat (IRC) provide the asynchronous and synchronous communication capabilities respectively, they do not support multimedia or hypertext linking capabilities like the web.* **1998** Cockburn and Greenberg *Commercial vendors are rapidly developing applications that exploit the real-time communication capabilities of the Internet and examples include Intel's "Proshare" - Netscape"s "CoolTalk", and Microsoft"s "NetMeeting". (p.777)* **2002** Baker *MST proposes that communication effectiveness results from matching the communication capabilities of concurrence and feedback to the communication processes of conveyance (the exchange of information) and convergence (the development of a shared meaning about information).*

concensus reaching approach: Consensus reaching approaches include voting principles and game analytic methods. A most important measure of consensus reaching among decision makers' preference rankings is a rank correlation measure. **2003** Beroggi (from Beroggi 1999) *Different approaches to consensus reaching in group decision making exist, including voting principles and game analytic methods. A most important measure of consensus reaching among decision makers' preference rankings is a rank correlation measure.*

concurrency control: Concurrency control is a technical measure. One solution to concurrency control is to lock data before it is modified. **1986** Greif and Sarin *Control over sharing: Two critical issues in managing shared data for CSCW are access control and synchronization of concurrent actions … Some specific features for access control and concurrency control are not yet fully addressed in any existing systems or applications. Our experiments with role definitions in MPCAL offer just a few of the kinds of fine control of access that will be required by end users of CSCW applications.* **1989** Ellis and Gibbs, *Some of these challenges [Elli88b] reside in the areas of group interfaces, access control, social protocols, and coordination of group operations ... Concurrency control also has novel* *aspects within groupware as we will demonstrate in this paper … WYSIWIS interfaces have two implications on concurrency control. First response times are important - the time taken to access data, modify data, or notify users of changes must be as short as possible. Secondly, if the concurrency control scheme entails the use of modes where actions of one user are not immediately seen by the others, then the effect of these modes on the group's dynamics must be considered and only allowed if they are not disruptive … Locking. One solution to concurrency control is simply to lock data before it is modified. For instance, in an editor such as GROVE, outline items could be locked whenever a user places their cursor over an item. …For groupware systems there are a number of problems. First there is the complication of distributed concurrency control algorithms based on transaction processing and the subsequent cost to response time … Dependency-detection. One recent proposal for concurrency control in groupware systems is the dependency-detection model [Stef87]. Dependency detection is based on the use of timestamps to detect conflicting operations; conflicts are re- solved by manual intervention … Reversible Execution. This is another recent proposal for concurrency control in groupware systems. With reversible execution [Sari85], operations are executed immediately but information is kept so that they may be undone later if necessary. Many optimistic concurrency control mechanisms fall within this category [Bern87].* **2001** Baker et al. *Technical measures such as access control, concurrency control, undo, version control, and turn-taking have been implemented.*

concurrency of transmission: Concurrency of transmission is a problem that is sometimes found in the asynchronous meetings when messages that are sent to each participant are received in a different order than sent. **1986** Greif and Sarin *Control over sharing: Two critical issues in managing shared data for CSCW are access control and synchronization of concurrent actions.* **1998** Tung and Turban *Concurrency of transmission - problem is sometimes found in the asynchronous meetings when messages that are sent to each participant are received in a different order than sent.*

concurrent feedback: Concurrent feedback plays an important role in communicating that the receiver has understood the message. **2001** Dennis and Wixom *Concurrent feedback plays an important role in communicating that the receiver has understood the message [29].*

conference agent: The conference agent is responsible for: floor control, workspace management, dynamic reconfiguration and secretarial functions. **1990** Lauwers and Lantz *The conference agent is also responsible for: floor control: Processing user input with respect to whether or not that user is currently authorized to generate input for a particular application or application ... workspace management: Determines the manner in which shared windows are "grouped" within the shared workspace, including window layout; …dynamic reconfiguration: Handling latecomers and the departure of participants prior to termination of the conference ... secretarial functions: These include conference initialization and termination, pre- staging, and logging. Architecturally, one can think of these functions as being provided by a conference secretary module.*

conference architecture: Conference architecture classified incoming and archived messages and distributes tasks among groups or individual conferences. Here the metaphoric identification of conference architecture with interior design is most clearly relevant since each conference on the network is a bit like a room in a building. **1989** Feedberg *Conference architecture classified incoming and archived messages and distributes tasks among groups or individual conferences. Here the metaphoric identification of conference architecture with interior design is most clearly relevant since each conference on the network is a bit like a room in a building.*

conference facilitator: (also known as a chauffeur) Conference facilitator’s role was that of a technical assistant, helping groups with equipment problems and answering questions of a technical nature **1995** Ocker et al. *Conference facilitator’s role was that of a technical assistant, helping groups with equipment problems and answering questions of a technical nature*

conference facility: A conference facility is a single room with a conference table and supporting equipment. **1988** Kraemer and King *At a minimum, the conference facility is a single room with a conference table and supporting equipment.*

conference table: A conference table is usually included in a GDSS meeting room. **1984** Huber (195) *A typical GDSS consists of a meeting room with a conference table. Each seating position has a small CRT terminal. Input at these terminals is by keyboard, touchscreen, mouse, or some combination of these devices.*

conference type:There are seven basic conference types: discussions, project management, seminars, information exchange, data collection, composition and simulation games. **1988** Whitescarver et al. *Various collections of structure parameters and roles have been collected into seven basic conference types designed to serve different communication objectives. These are: Discussions: The simplest conference type, discussions allows a straightforward two- level (root comments and replies) structure. Project Management: This conference structure incorporates activities specifically designed to track individual tasks and the assignments to those tasks. Seminars: A set of activities specifically designed to allow an instructor to create a "Virtual Classroom", replacing the traditional classroom in a remote learning situation. The instructor is able, for example, to give and track assignments. A unique example is a series of discussion questions which constitute a reply situation such that no member of the conference can see the replies already made to a comment until he himself has replied. Information Exchange: Oriented to support the exchange of unpredictable information when the group of people is large. Data Collection: This structure allows a group to collaboratively develop a shared data base or to collectively validate the inputs for a data base. It may also include analysis activities to operate on the data provided by conference members. An example is the gathering of budget data from diverse projects into a single organized budget for planning or analysis purposes. Composition: Structure for the collaborative composition of a document. A set of root comments form the outline of the document; the document owner can individually tailor who is allowed to write or edit selected portions of the outline. Associated tracking, via notifications, indicates document modifications. Simulation games: A special structure being developed to allow the set-up of event-oriented role-playing games; it allows the owner to fill in the material governing the particular role-playing game.*

conferencing: Conferencing is a functional component of a CMC system **1988** Kraemer and King *Computer conferencing is asynchronous, which means that "meetings" take place over an extended time period, usually around some prearranged topic.* **1989** Feenberg *Computer conferencing is a technology which, for the first time, allows small groups to form and communicate through inexpensive and technically simple electronic mediation (sic).* **1999** Whatley et al. *Computer mediated communication (CMC) tools such as conferencing, email, and discussion forums, support the communication needs for the task roles of group projects.* **2001** Burke *Video conferencing is an attractive delivery method in distance-learning courses because it can transmit both video and audio images in real time (i.e., synchronous) and delayed time (i.e., asynchronous). As a result, video conferencing replicates the traditional classroom more closely than other types of technology.*

conferencing system: see computer-based conferencing system and computer mediated conferencing systems. Conferencing systems are a class of CSCW systems. The other three classes are messaging systems, meeting systems, and coauthoring systems. **1996** Barua et al. (from Rodden 1991) *Group work: is based on spatial (local or remote) and temporal relationships (asynchronous or synchronous), analogous to geographically scope and real-time ability. He further uses this relationship to separate CSCW systems into four classes, messaging systems, conferencing systems, meeting systems and co-authoring systems.* **1998** Hein et al. (from Coleman 1997) *Electronic meeting system is a category of real-time conferencing systems (local and remote) as well as collaborative presentation systems.***1999** Adams *Desktop conferencing systems support more lightweight interactions, and feature text and/or audio (and occasionally video) for communication, mechanisms for awareness,* *and shared tools (eg. Whiteboards and text editors) for creating and manipulating artifacts.* **2000** Ishaya and Macauley *Desktop video conferencing (DVC) - This uses a synchronous - remote form of communication. It is a medium where audio, video and data are transmitted, allowing collaborative working through shared applications.*

conflict handling mode: Five conflict handling modes are used to describe conflict management in organizational work groups: avoidance, accommodation, competition, collaboration, and compromise. **2001** Montoya-Weiss et al. *We draw on work by Rahim (1983, 1992) and Thomas and Kilman (1974) that delineates five conflict handling modes to describe conflict management in organizational work groups: avoidance, accommodation, competition, collaboration, and compromise.*

conformity: Group pressure may lead to conformity of thought in teams. Normative and information influences contribute to conformity in teams. **1986** Kraemer and King (from Huber 1982a) *Huber (1982a) provides the following succinct assessment of the issue: I. Effective group decision making requires: 1. Meeting the need of the situation. 2. Ensuring that members are satisfied with the process. 3. Enabling members to meet and work successfully in the future. II. "Losses" of productivity in group decision making occur because: 1. Discussions are dominated by certain individuals. 2. Low-status members defer to high-status members. 3. Group pressures lead to conformity of thought. 4. Miscommunication among members is common. 5. Insufficient time is spent in problem exploration and generation of alternatives.* **1987** DeSanctis and Gallupe *The key effect of structured approaches appears to be increasing member participation (White et al.1980), focusing the problem, avoiding conformity pressures, and keeping the group on track (Gallupe 1985).* **2000** Pare and Dube *Group interaction processes, namely communication trust, cooperation, information processing (sharing, redundancy, integrative complexity), consensus generating (amount and intensity of disagreement), conformity pressures) and normative regulation (expressions of commitment, satisfaction and solidarity). In turn these group processes form an important basis for the shaping of project outcomes***.** **2001** Schmidt (from Deutsch and Gerard 1955) *Normative and informational influences contribute to conformity in teams.*

congruency: Goal congruency is the degree to which the vested interests of individual team members are compatible with the group goal. **1997** Nunamaker et al. *Goal congruence - the degree to which the vested interests of individual team members are compatible with the group goal.*

congruency of groupware: Congruency of groupware involves two processes, First, the group must develop appropriate communicative behaviours, and secondly, group members must merge different perspectives to reach common agreements about cooperation. **1998** Prinz et al. *We refer to achieving congruency of groupware use as involving two processes: first, the group must develop appropriate communicative behaviours, and secondly, group members must merge different perspectives to reach common agreements about cooperation*

consensus and negotiation/choice models:Consensus and negotiation/choice models are a general class of planning and problem-solving models implemented in GDSS systems **1986** Applegate et al. *Four general classes of planning and problem-solving models are implemented in the system: (I) information gathering/idea generation models, (2) information/idea synthesis models, (3) quantitative analysis models and (4) consensus and negotiation/choice models.* **1991** Nunamaker et al. *Group Matrix is a consensus-building tool that enables participants to dynamically enter and change numeric (or text) ratings in a two-dimensional matrix. Typically groups initially enter ratings with an alternative style. These ratings are then discussed and revised using a supported style.* **1995** Gavish er al. *CM.sup.3 (The name was coined by Ron Grohowski, then with IBM, after using the prototype decision support system at Owen Graduate School of Management) is a computer-and telecommunication-based decision support environment designed to facilitate group consensus formation and enhance the group decision-making processes. The*

[CM.sup.3] project's objective is to apply computing and telecommunication technologies to 'add value' to a group decision process, not simply recreate the group's natural decision process within a computer setting. The CM.sup.3] system is a prototype system. **2003** Lee and Albrecht *GroupVoter is a collaborative tool that helps a group to determine their level of consensus on particular topics. The tool has four different voting methods, including - Yes/No and True/False - Top 'n' favourites - 'n' Point Scales - Likert Scales.*

consensus formation: Concensus formation: an entire group considers a problem on a basis of reason and discussion. each member expresses a view and a decision is made to which all can commit themselves at least in part. **1997** Salisbury et al. (226) *Consensus formation: an entire group considers a problem on a basis of reason and discussion. Each member expresses a view and a decision is made to which all can commit themselves at least in part.*

consensus generating: Consensus generating is a group interaction process that includes amount and intensity of disagreement. **2000** Pare and Dube *Group interaction processes, namely communication trust, cooperation, information processing (sharing, redundancy, integrative complexity), consensus generating (amount and intensity of disagreement), conformity pressures, and normative regulation (expressions of commitment, satisfaction and solidarity). In turn these group processes form an important basis for the shaping of project outcomes.*

consensus testing: Consensus testing is a group decision task **1986** Bui and Jarke *There are different tasks in group decision processes that must be supported: -Initiation. How does the group start the collective decision-making process? Should the group elect a person who leads the discussion? -Information exchange. How can a member request or disseminate information? -Analysis. How does the group interpret the results of group discussions or decisions? -Consensus testing. What decision technique(s) should be adopted, for example, democratic vote or weighted majority rule?*

consequential communication: Consequential communication and explicit communication are two types of information given off by artifacts as they are manipulated by others (also called feedthrough), and information given off by the characteristic actions of a person’s embodiment in the workspace. **2000** Gutwin and Greenberg *Explicit communication and consequential communication (two types) information given off by artifacts as they are manipulated by others (also called feedthrough, Dix et al.1993), and information given off by the characteristic actions of a person’s embodiment in the workspace.*

constructive consensus approach (CC): Constructive consensus approach follows the basic method developed by several researchers **1996** Hiltz et al. *The constructive consensus approach (CC) follows the basic method developed by several researchers (Hall 1971) Hiltz_etal1991; Nemiroff_etal1976; Schweiger_etal 1986).*

constructive interaction style: Constructive interaction style is characterized by a balanced concern for personal and group outcomes, cooperation, creativity, free exchange of information, and respect for other’s perspectives. The constructive style enables group members to fulfil both needs for personal achievement as well as needs for affiliation. **2000** Potter et al. (from Cooke and Szumal 1994) *Constructive interaction style is characterized by a balanced concern for personal and group outcomes, cooperation, creativity, free exchange of information, and respect for other’s perspectives. The constructive style enables group members to fulfil both needs for personal achievement as well as needs for affiliation.*

Constructivist Theory: Constructive theory, individuals learn best when they discover things by themselves rather than when they are told the facts. **1998** Jones et al. (2) *Constructivist theory, individuals learn best when they discover things by themselves rather than when they are told the facts. (20)*

consultative model: Consultative model is an organizational model in which specific tasks are subcontracted to outside experts. **2000** Pare and Dube (from Gorton and Motwani 1996)

Organizational models that can influence virtual team structure. The models in question are cooperative (all members share overall project management responsibilities), delegation models (a supervisor assumes overall management but delegates specific responsibilities) and consultative models (specific tasks are sub-contracted to outside experts).

Contact Point: Contact Point is a web based application that helps a business manage its relationship with its customers (workflow system). **2000** Mamykina and Wolf *Contact Point is a web based application that helps a business manage its relationship with its customers (workflow system).*

content based anonymity: Content based anonymity – the extent to which the source of a specific contribution can be identified through the contribution content **1998** Gavish and Gerdes (306) *Content based anonymity – the extent to which the source of a specific contribution can be identified through the contribution content*

content facilitation: Content facilitation focuses on the content of the meeting, analysing the data, and displaying relevant issues. With content facilitation the facilitator gives more information or direction than the impartial information or direction provided with process facilitation. Content facilitation attempts to improve task performance directly by offering insights, interpretations, or opinions about the task and various decision alternatives available to the group. **2001** Dennis and Wixom *Facilitation has two key dimensions: process facilitation and content facilitation [4, 35]. Process facilitation attempts to help the group in structuring the process by which it uses the available GSS tools. Content facilitation attempts to improve task performance directly by offering insights, interpretations,or opinions about the task and various decision alternatives available to the group.* **2002** DeVreede et al. (129) *Content facilitation focuses on the content of the meeting, analysing the data, and displaying relevant issues. With content facilitation the facilitator gives more information or direction than the impartial information or direction provided with process facilitation (Griffith et al.1998).*

context characteristic: Context characteristics include organizational culture, time pressure, evaluative tone (eg. Critical or supportive), reward structure (eg. Non versus individual versus group) **1991** Nunamaker et al. *Context characteristics include organizational culture, time pressure, evaluative tone (eg. Critical or supportive), reward structure (eg. Non versus individual versus group) etc.*

contextual factor: Contextual factors include such contingencies as the goals of the group task, degree of uncertainty, group structure (relationships and rules for action), group size, and time pressure. **1988** DeSanctis *Contextual factors include such contingencies as the goals of the group task, degree of uncertainty, group structure (relationships and rules for action), group size, and time pressure.*

contextuality: Contextuality is the amount of additional information required to make decisions versus the straight facts. **2001** Montoya-Weiss et al. *Contextuality is the amount of additional information required to make decisions versus the straight facts.*

contingency: Types of contingencies: communication condition (face-to-face or dispersed – we extend this to include synchronous vs asynchronous); group size and task type. **1996** Hiltz et al. (3) *Types of contingencies: communication condition (face-to-face or dispersed – we extend this to include synchronous vs asynchronous); group size and task type.*

contingency model: Contingency model hypothesizes that process and outcomes depend upon the interaction of four sets of characteristics: context, group, task and EMS. **1991** Nunamaker et al. *Contingency model which hypothesizes that process and outcomes depend upon the interaction of four sets of characteristics: context, group, task and EMS.*

Contingency Theory: According to contingency theory, tasks involving high levels of uncertainty and equivocality require a communication medium that permits interactive, expressive communication. Contingency theory proposes that using computer-mediated communication to accomplish complex collaborative work will be difficult, especially for tasks that require interactive, expressive communication. **1992** Galagher and Kraut *According to contingency theory, tasks involving high levels of uncertainty and equivocality require a communication medium that permits interactive, expressive communication.* **1994** Galegher and Kraut (110) *Contingency theory proposes that using computer-mediated communication to accomplish complex collaborative work will be difficult, especially for tasks that require interactive, expressive communication.*

continued use: Continued use issue relating to group support systems can include perceptions, experience, attitudes, communication behaviour and environment. **2003** Pollard *This study explores how perceptions, experience, attitudes, communication behaviour and environment affect continued and discontinued use of a group support system (GSS) as an organizational innovation.*

control (1): Control is a group mechanism to assist coordination. A facilitator may feel that they lose some of the control of the meeting to the technology. **1988** DeSanctis *Coordination is typically accomplished in groups through mechanisms such as leadership, monitoring and control systems (eg. audits, reporting requirements, reward distribution), negotiation, and bargaining.* **1992** Lewis and Whiteley *Several prominent impact categories were generated by facilitators (see Table 3). They included: facilitator comfort (a feeling of being at ease with the process) and the energizing element (is it depleted or enhanced through GDSS?); group temperament or ambience, and the use of humor in the group; control (does the facilitator lose any of it to the technology?).*

control (2)*:* Control is an interactive system characteristic related to adaptability. Also refer access control, concurrency control and floor control.. **1986** Greif and Sarin (199) *Control over sharing: Two critical issues in managing shared data for CSCW are access control and synchronization of concurrent actions.* **1989** Ellis and Gibbs *Some of these challenges [Elli88b] reside in the areas of group interfaces, access control, social protocols, and coordination of group operations ... Concurrency control also has novel aspects within groupware as we will demonstrate in this paper.*

control (3)*:* Control can relate to the ability of the users to control the computer. **1981** Turoff et al. (91) *The ability of users to feel in control of the computer, while making sure they understand what they are doing and where they are in the interaction*

control over sharing*.* see control (2)

control terminal: A control terminal is one piece of hardware that is used in a decision conference room. **1986** Kraemer and King *The hardware for the decision conference consists of a medium-sized conference room furnished with a large-screen video projector, a computer, video terminals, hand-held terminals for voting or other input by the participants, and a control terminal for presenting participant inputs in graphic form and for accessing other sources of information (e.g., databases, general reference materials, results of previous conferences).*

convergence: Convergence, the development of a shared meaning about information. **2002** Baker (81) *MST proposes that communication effectiveness results from matching the communication capabilities of concurrence and feedback to the communication processes of conveyance (the exchange of information) and convergence (the development of a shared meaning about information).*

Conversation Analysis (CA): Conversation analysis is the sociological study of the structures of ordinary face-to-face and spoken interaction. **2000** Smith et al. *Conversation analysis (CA) - the sociological study of the structures of ordinary face-to-face and spoken interaction.*

conveyance: Conveyance is the exchange of information. This is considered in Media Synchronicity Theory (MST). **2002** Baker *MST proposes that communication effectiveness results from matching the communication capabilities of concurrence and feedback to the* *communication processes of conveyance (the exchange of information) and convergence (the development of a shared meaning about information).*

Co-OP: Co-OP is a GDSS that can perform the prioritisation process in three modes; pooled, sequential and aggregated. The Co-OP group module automatically searches for all aggregation techniques compatible with the MCDM used by any individual decision maker. **1986** Bui and Jarke (92) *Co-OP can perform the prioritization process in three modes: -Pooled: All group members collectively enter a common priority vector. -Sequential: Group members, according to their expertise, assign priority to a subset of criteria. -Aggregated: Each member assigns individual weights first; then individual priorities are aggregated using a predetermined computation rule. …The Co-OP group model bank contains four techniques for preference aggregation and some negotiation support modules. The former include additive ranking, multiplicative ranking, the sums-of-the-ranks approach, and the sums- of-the-outranking-relations approach [6]. Unless otherwise specified, the Co-OP group module automatically searches for all aggregation techniques compatible with the MCDM used by any individual decision maker.*

cooperation: Cooperation or collaboration are used to refer to a set of participants working together to produce a product or service. Cooperation and co-construction levels, collaboration is directed to a known object (or goal) shared by the actors, but the means are not shared or even known to all the actors. thus, actors continuously modify actions based on intermediate results, adapting to others' actions based on intermediate results, adapting to others' actions and conceptualising their own actions in the process of realising the object. **1997** Schlichter et al. (362) *Cooperation or collaboration are used to refer to a set of participants working together to produce a product or service.* **1999** Bertelson and Neilson (282) *Cooperation and co-construction levels, collaboration is directed to a known object (or goal) shared by the actors, but the means are not shared or even known to all the actors. thus, actors continuously modify actions based on intermediate results, adapting to others' actions based on intermediate results, adapting to others' actions and conceptualising their own actions in the process of realising the object..*

cooperative ensemble: The term cooperative ensembles can be used instead of the term 'large groups'. They are transient formations, emerging to handle a particular situation after which they are dissolved. Their work is distributed logically, in terms of control, and involve incongruent strategies and discordant motives. **1996** Dennis et al. (6) *Schmidt and Bannon (1991) finds "cooperative ensembles" instead of the word "groups", are either large, or are embeddedwithin larger ensembles. They are also often transient formations, emerging to handle a particular situation after which they are dissolved again, and their work is distributed logically, in terms of control, and involve incongruent strategies and discordant motives.*

cooperative learning:see Collaborative learning **1990** Hiltz *The labels given to collaborative or group learning are many; among them are: "cooperative learning, collective learning, study circles, team learning …" (Bouton and Garth, 1983), and ":peer-group learning" or syndicates" (Collier, 1980).*

cooperative model: Cooperative model is an organizational model in which all members share overall project management responsibilities. **2000** Pare and Dube (from Gorton and Motwani 1996) *Organizational models that can influence virtual team structure. The models in question are cooperative (all members share overall project management responsibilities), delegation models (a supervisor assumes overall management but delegates specific responsibilities) and consultative models (specific tasks are sub-contracted to outside experts).*

cooperative process: Activities are cooperative processes, where something is worked out together, forming the basic contexts of human action. **2002** Tuikka (188) *Activities are cooperative processes, where something is worked out together, forming the basic contexts of human action.*

cooperative work: Cooperative work involves the ongoing and seamless transition between individual and collaborative tasks, where personnel are simultaneously participating in multiple, interrelated activities. **1995** Heath et al. (89) *Cooperative work involves the ongoing and seamless transition between individual and collaborative tasks, where personnel are simultaneously participating in multiple, interrelated activities.*

coordination: Coordination is the set of tasks and processes by which groups of actors carrying out activities manage interdependencies, in order for them to perform effectively as a group. The importance of coordination can be seen in the need to bring the efforts of all co-workers together in order to produce a product or service. Examples of the need for coordination in collaborative work is the need to ensure the completion of all work, the lack of redundant work (eg. avoid conflicting actions) and the timely completion of the work. Coordination is typically accomplished in groups through mechanisms such as leadership, monitoring and control systems (eg. audits, reporting requirements, reward distribution), negotiation, and bargaining. **1988** DeSanctis *Coordination is typically accomplished in groups through mechanisms such as leadership, monitoring and control systems (eg. audits, reporting requirements, reward distribution), negotiation, and bargaining.* **1995** Ocker et al. *Coordination is the set of tasks and processes by which groups of actors carrying out activities manage interdependencies, in order for them to perform effectively as a group.* **1997** Schlichter et al. *The importance of coordination can be seen in the need to bring the efforts of all co-workers together in order to produce a product or service. Examples of the need for coordination in collaborative work is the need to ensure the completion of all work, the lack of redundant work (eg. avoid conflicting actions) and the timely completion of the work.* **1998** Bardram *The conceptualization of cooperative work within the framework of Coordination mechanism [21] makes an analytical distinction between "cooperative work" and "articulation work", the later being the work actors do, caused by their interdependency, in order to coordinate, schedule, mesh, integrated, etc., their cooperative work. Hence, articulation work is an overhead to the cooperative work. However, this view does not incorporate any dynamic understanding of work in the sense that what is cooperative work in one situation might be articulation in another, and vice versa.* **1998** Tung and Turban (from Turoff and Hiltz 1993) *Organizational group activities divided into four coordination methods that groups use. They are parallel, where individuals approached the problem independently; pooled, same as parallel except a standard is utilized to formulate a group result such as group vote; sequential, where all group members undertake the problem-solving phases in a sequential manner and, reciprocal, where changes made in one part of the problem can force other group members to reconsider other parts of the problem, such as in a case where consistency relations are imposed.* **1999** Bertelson and Neilson *Levels of collaboration: coordination, co-operation and co-construction.* **2001** Montoya-Weiss et al. (from McGrath 1991) *Teams typically use a variety of coordination mechanisms to manage temporal problems; these include scheduling (deadlines), synchronization (aligning the pace of effort among members), and allocation of resources (specifying the time to be spent on specific tasks).*

coordination activity: The communications component of a GDSS coordinates various activities such as initialization, consensus, search, negotiation, and mediation. **1986** Bui and Jarke *Second, the communications component coordinates various activities (i.e., initialization, consensus search, negotiation, and mediation).*

coordination function: Coordination functions are specified on the basis of permanent organisationalrules with the help of process definition tools. **1995** Sauter et al. *Coordination functions are specified on the basis of permanent organisationalrules with the help of process definition tools.*

coordination level: Coordination level, collaboration is an integral part of routine work; the participants act according to scripted roles, defined by explicit written rules, the division of labour, traditions and tacit knowledge. **1999** Bertelson and Neilson (282) *Coordination level, collaboration is an integral part of routine work; the participants act according to* *scripted roles, defined by explicit written rules, the division of labour, traditions and tacit knowledge.*

coordination mechanisms: Coordination mechanisms can include scheduling, synchronization, and allocation of resources **1998** Bardram (90) *The conceptualization of cooperative work within the framework of Coordination mechanism [21] makes an analytical distinction between "cooperative work" and "articulation work". the latter being the work actors do, caused by their interdependency, in order to coordinate, schedule, mesh, integrated, etc., their cooperative work. Hence, articulation work is an overhead to the cooperative work. However, this view does not incorporate any dynamic understanding of work in the sense that what is cooperative work in one situation might be articulation in another, and vice versa.* **2001** Montoya-Weiss et al. (from McGrath 1991) *Coordination mechanisms include scheduling (deadlines), synchronization (aligning the pace of effort among members), and allocation of resources (specifying the time to be spent on specific tasks).*

coordination of action: Coordination of action is one of the seven activities that are covered by the mechanics of collaboration. **2001** Potts-Steves et al. (3) *There are seven activities that are covered by the mechanics of collaboration, explicit communication, implicit communication, coordination of action, planning, monitoring, assistance, protection.*

coordinator role: A role of the 'communication manager' in GDSS. Coordinates the initial situation analysis and problem definition. **1986** Bui and Jarke (95) *One can identify at least three specific roles: (1) Coordinator role. The communication manager should coordinate the initial situation analysis and problem definition ... Walton [52] suggests that by installing a communication medium that follows some norms of fairness (e.g., equality of participation, preserving autonomy), information exchange will be more abundant and accurate. (2) Detective role. Problem analysis could be distorted by an individual's attempt to spy on others' activities or by the influence of some members who try to take over an individual's responsibility ... (3) Inventor role. The inventor role is an extension of the coordinator role.*

COPE: COPE, the group decision support software which has been developed initially by the University of Bath and currently by the University of Strathclyde. **1989** Ackermann (from Eden and Ackermann 1988) *COPE the group decision support software which has been developed initially by the University of Bath and currently by the University of Strathclyde, is then introduced. This software is aimed to aid the process by creating a model (or database) of all the data generated by the group and then allow various analyses to be carried out.*

***cost benefit model**:* Cost benefit models are a decision analytic technique for resource allocation. Decision analytic techniques are sometimes included in decision conference software. **1988** Kraemer and King (123) *The software of the decision conference is usually some form of decision analytic technique: decision trees and influence trees; multiattribute expected utility models for single-stage decisions; hierarchical evaluation structures for multiattribute utility analysis; Pareto algorithms for two-party negotiations; cost-benefit models for resource allocation; and spread- sheet models. Software for graphics and vote tally and display also are part of the decision conference facility.*

coupling: Awareness can be coupled or uncoupled. Coupled awareness is when the participants have the same focus of work. Uncoupled awareness is when the information is independent of the user's current focus of work. **1997** Schlichter et al. *There is the coupled awareness (participants have the same focus of work, eg. They work on the same shared artifact and are aware of each other) and uncoupled awareness (" information independent of the user's current focus of work"*

***create**:* The development and modification of information **1984** Huber (200*) Personal entry terminals and appropriate software will enable the group, and each participant in the group, to create and modify the group's information displays. "What if" and other analytic* *software will enable the group to use information, even ad hoc information entries brought forth during the meeting, as input to interrogations made and responded to in real time.* **1996** Barua et al. *Collaborative system (which we will call a collaboratory) provides an open electronic platform for individual or groups with common interests to efficiently exchange, disseminate and create issues, ideas and knowledge.* **1999** Greenberg et al. *Personal artifacts are things created, manipulated, and owned by one and only one person … Public artifacts differ, as they are created by cooperating group members, are considered owned by the group rather than any individual member, and can be viewed and manipulated by all. (p.1-2)*

criterion and constraint identification: Fourth step in the problem solving process. **1984** Huber (200) *any step of the problem-solving process: problem sensing, problem exploration, problem definition, criterion and constraint identification, proposal generation, proposal evaluation, choice, implementation, and performance evaluation.*

Critical Mass Theory: Critical mass theory predicts that the utility of a communications medium to its users will rise with the number of people using the system, particularly when users are important in some way to each other. **2002** Turner and Turner (4) (from Markus 1987). *Critical mass theory predicts that the utility of a communications medium to its users will rise with the number of people using the system, particularly when users are important in some way to each other.*

CRT terminal: Cathode Ray Tube terminal. Collaborative system technology **1984** Huber (195) *A typical GDSS consists of a meeting room with a conference table. Each seating position has a small CRT terminal. Input at these terminals is by keyboard, touchscreen, mouse, or some combination of these devices.*

Cruiser: Cruiser is a virtual shared workspace system, also known as a media space system. **1990** Ishii *There have been two types of approaches proposed to realize real-time shared workspaces for distributed groups. (1) Multi-user software such as shared-window-systems lLant86, Suzu86, LauwS)OA, Lauw90B, Ahuj90] and special purpose applications [Fost86, Elli90] running on networked workstations. (2) Video and audio communication-based virtual shared work spaces, such as Media Space lStu188, Har190], CRUISER [Root88], VideoDraw [Tang90].* ***1998*** *Greenberg and Gutwin (11). Users of the Cruiser media space would often open a full bandwidth video connection to the empty office of a collaborator, solely to 'ambush' its occupant, ie. To see when they returned (Fish, Kraut, Root and Rice 1992).*

cryptography: Cryptography deals with the encryption mechanisms needed to securely transmit a message. **1998** Gavish and Gerdes (301) *Cryptography deals with the encryption mechanisms needed to securely transmit a message.*

CSCL: see Computer Supported Cooperative Learning

CSCW: see Computer Supported Cooperative Work.

CSCW alignment model: CSCW alignment process along two dimensions. The first analyses alignment among group, technology and task. The second dimension defines CSCW alignment in terms of structure, process, and outcome, which corresponds roughly to Leonard-Barton's infrastructure technical and value alignments. **1991** Applegate *CSCW alignment process along two dimensions. The first analyses alignment among group, technology and task. The second dimension defines CSCW alignment in terms of structure, process, and outcome, which corresponds roughly to Leonard-Barton's infrastructure technical and value alignments.*

CSCW application: see CSCW systems. **1986** Greif and Sarin *Our experiments with role definitions in MPCAL offer just a few of the kinds of fine control of access that will be required by end users of CSCW applications … The two systems that deal with calendar management (MPCAL and RTCAL) both derive from the personal calendar system PCAL*

(Greif 1984) **1992** Kuuti and Arvenon *This approach corresponds closely to the recent theoretical attempts to define CSCW applications by means of a common object, content, issue, etc. (Applegate et al. 1991, Bannon & Schmidt 1991, Hartfield & Graves 1991, Kuuti 1991).* **2003** Greasley *A CSCW application is appropriate to support the activities of the team members by issuing reminders to staff to perform tasks and recording the tasks and events that have occurred for reference by other team members.*

CSCW system: CSCW systems can be separated into four classes, messaging systems, conferencing systems, meeting systems and co-authoring systems. **1996** Barua et al. (Rodden (16)). *Group work: is based on spatial (local or remote) and temporal relationships (asynchronous or synchronous), analogous to geographically scope and real-time ability. He further uses this relationship to separate CSCW systems into four classes, messaging systems, conferencing systems, meeting systems and co-authoring systems.* **2003** Greasley *A CSCW application is appropriate to support the activities of the team members by issuing reminders to staff to perform tasks and recording the tasks and events that have occurred for reference by other team members.*

culturally diverse:Culturally diverse means that team members have different cultural backgrounds and often speak different languages. **1998** Jarvenpaa and Leidner *Global virtual teams: was defined by three dimensions: (1) no common past or future, (2) culturally diverse and geographically dispersed, and (3) electronically communicating.* **2001** McDonough et al. (110) *Global teams are both geographically dispersed and culturally diverse (13, 19). Their members are physically dispersed across multiple countries, representing different nationalities, have different cultural backgrounds and speak different languages.*

culture: Culture is the beliefs, value system, norms, mores, myths, and structural elements of a given organization, tribe, or society. Culture exists at national, regional, and corporate levels. **1994** Watson, et al. (46) *Culture is the beliefs, value system, norms, mores, myths, and structural elements of a given organization, tribe, or society (Nath 1988). Culture exists at national (Hofstede 1980), regional (Weiss 1988), and corporate levels (Deal & Kenedy 1982).* **2000** Maznevski and Chudoba (from Maznevski et al. 1997) *Culture is the set of deep level values associated with societal effectiveness, shared by an identifiable group of people.* **2000** Pare and Dube (from Duart and Snyder 1999) *Culture of a society in terms of work norms and values (eg. Priority of work in individual life, working hours).* **2003** Pauleen *They were an indigenous cultural group with their own beliefs, values and protocols (Hall, 1976; Hofstede, 1980)*

cursor war: Cursor wars where people would fight for who was controlling the cursor and text insert spot. **1998** Greenburg and Gutwin *Cursor wars where people would fight for who was controlling the cursor and text insert spot.*

Cu-SeeMe: CU-SeeMe enables videoconferencing with another site located anywhere in the world. By using "reflector" software, multiple parties at different locations can participate in a CU-SeeMe conference, each from their own desk-top conputer. **2000** Ishaya and Macauley (149) *CU-SeeMe enables videoconferencing with another site located anywhere in the world. By using "reflector" software, multiple parties at different locations can participate in a CU-SeeMe conference, each from their own desk-top conputer.*

customizability and support: A system purchase evaluation issue and system scalability issue. The availability to tailor the system to the unique needs of the purchaser and to address any further problems that may arise **1986** Fanning and Raphael (294). *System scalability. ... Ease of use. Users with an unimaginable variety of backgrounds and prejudices all become instant critics of how a system should have been designed, the first time a confusing command is encountered. Customizability and support. Whether obtained from a vendor or developed in house, the expertise would have to be available to tailor the system to the unique needs of our company and then to address further problems that would undoubtedly arise in the future; we cannot consider depending on any operational tool without such* *assurance. Reliability and performance. If the system took more than a couple of seconds to respond to a keystroke, or crashed more than once a week, it would not be acceptable and any other advantages it might have would be moot. Easy accessibility from the normal workplace. The typical user must be able to obtain the equipment and support necessary to use the system from his/her normal workplace without inordinate effort.*

CVE: see Collaborative Virtual Environment.

CWSS: see Collaborative Work Support System.

Cyberspace: Cyberspace are virtual environments that comprise another arena for social interaction and cooperative work. Cyberspace: the mind turned inside out. **1999** Bowers and Martin (from Gibson 1979) *Gibson (1979) once defined cyberspace as "the mind turned inside out". Virtual environments comprise another arena for social interaction and cooperative work alongside others.*

DACIA: DACIA is a framework for building adaptive distributed applications in a modular fashion. **2000** Litiu and Prakash *DACIA is a framework for building adaptive distributed applications in a modular fashion.*

data: Data is knowledge, ideas, opinions or preferences. **1988** DeSanctis *Information inputs consist of data (knowledge, ideas, opinions, preferences) or rules (assumptions, procedures) for group action. To the extent that there is perceived information asymmetry between people, individuals invoke networks to send and receive information.*

data analysis tool: Data analysis tools are features that are sometimes included in highly integrated GDSS systems. **1987** DeSanctis and Gallupe *Conceivably, data analysis tools, planning aids and other GDSS features will prevent influential members from encouraging poor choices.* **1988** Kraemer and King *GDSS can refer to simple systems for voting and display of data or to highly integrated systems that incorporate voting, modeling, data analysis, decision analysis, and data display.*

data management: Data management is a collaboration support function usually included in a GDSS and DSS. **1987** Jelassi and Beauclair (from Sprague and Carlson 1982). *One of three basic functions of DSS and GDSS.* **1988** Kraemer and King (126) *The kinds of software typically provided in an information center include packaged programs for data management, report generation, data retrieval and query, text-handling, statistical analysis, and mathematical and simulation modeling.* **1988** DeSanctis *Example group level phenomena of interest to iS researchers include: information exchange and filtering in groups, IT support of group work, data management for support of group knowledge, or the effects of IT use on meeting success.* **2000** Prequica et al. *Prospero toolkit presents a model for data management based on the synchronization of divergent streams of activity.*

data manager: The Data manager is a component of GDSS **1986** Bui and Jarke *The careful design of a communication manager as a fourth DSS component, in addition to dialogue manager, data manager, and model manager, is, therefore, a crucial prerequisite of a distributed GDSS.*

data transmission: Data transmission is a group feature allowing communication among group members, between the group members and the facilitator, and between the group members and a central computer processor. **1985a** DeSanctis and Gallupe *Group Features: - Numerical and graphical summarization of group members' ideas and votes - Menus which prompt for input of text, data, or votes by group members - Program(s) for specialized group procedures, such as calculation of weights for decision alternatives; anonymous recording of ideas; formal selection of a group leader; progressive rounds of voting toward concensus-building; or elimination of redundant input during brainstorming - Method of analysing prior group interactions and judgments - Text and data transmission among the group members, between the group members and the facilitator, and between the group* *members and a central computer processor - The GDSS software may be designed to support a specific decision or a class of decisions.*

database: The software components of GDSS usually include a database, a model base, specialized application programs and an easy-to-use, flexible user interface. Groupware products may provide features such as email, document databases, scripting languages and agents, to automate workflows. **1985a** DeSanctis and Gallupe *The software components of the GDSS include a database, a model base, specialized application program(s) to be used by the group, and an easy-to- use, flexible user inter-face … Some highly specific GDSS systems may not require a database; for example, those that merely collect, organize, and communicate members' opinions about a problem. However, most sophisticated systems will include databases, along with model bases, very high-level languages for program writing, and interfaces with standard managerial-level software (graphics, statistical/OR packages, spreadsheets, etc.). The GDSS software may or may not interface with individual DSS software.* **1995** Er and Ng *GDSS is an interactive computer-based information system which combines the capabilities of communication technologies, database technologies, computer technologies, and decision technologies to support the identification, analysis, formulation, evaluation, and solution of semi-structured or unstructured problems by a group in an user-friendly computing environment.* **1999** Atkinson and Lam *Groupware products such as Notes provide features to automate (or semi automate) workflows. These features include email, document databases, scripting languages, and agents.*

database management: Database management systems handle queries from participants, create subschemas as necessary for each participant, control access to public, or corporate databases. **1985a** DeSanctis and Gallupe *Basic Features - Text and data file creation, modification, and storage for group members - Word processing for text editing and formatting - Learning facilities for naive GDSS users - On-line *'help" facilities - Worksheets, spreadsheets, decision trees, and other means of graphically displaying numbers and text - State-of-the-art database management which can handle queries from all participants, create subschemas as necessary for each participant, control access to public, or corporate, databases, etc.*

decentralized decision making: Decentralized decision making means that the decision is made by the group when they are dispersed across several sites. **1986** Stasz and Bikson *Issues in computer-supported cooperative work. Our field study assessed a number of impacts of the organization's transition to a computer- based information system. Here we discuss five: training, dissemination, hierarchical vs. network communications, centralized vs. decentralized decision making, and cooperative work between different technologies and systems.*

decentralized system: Decentralized systems have participants dispersed across several sites. **1995** Gavish et al. *Decentralized GDSS (participants dispersed across several sites). …Group proximity: meetings can be centralized, partly centralized, or decentralized.* **1998** Boutellier et al. (from Petrofic 1992, p.20) *Groupware is the IT-based support for decentralized project meetings and is thus the group equivalent of bilateral e-mail communication. Every participant possesses a workstation via which he or she can communicate with the other participants in a computer network. Groupware provides comprehensive methods of supporting dispersed R&D teams by means of special group-oriented, computer-based methods, as electronic brainstorming, the common drawing up of agendas, various coordination methods or automatic protocol generation.*

decision aid: The public screen of a decision conference facility is used to display group decision aid tools. Sometimes facilitators assist the group to access both qualitative and quantitative decision aids. Decision aid tools can include spreadsheets, graphs and charts. **1986** Applegate et al. *Planning session facilitators assist the group in their planning activities providing access to a workbench of quantitative and qualitative decision aids for identification of issues and ideas, surfacing assumptions, stakeholder identification,* *competitive analysis and other enterprise and situation analysis activities.* **1987** DeSanctis and Gallupe *The public screen is used to display ideas, show analyses of group preferences and votes, and display decision aid tools (spreadsheets, graphs, charts, etc.).* **1988** Kraemer and King *The decision conference facility is discussed in the literature under the labels of group decision support system, decision analysis, and group decision aid.* **1996** Sia et al. *Group support systems (GSS) provide groups with a repertoire of decision aids that help to remove communication barriers during meetings.*

decision analysis technique: see decision analytic techniques

decision analyst: A decision analyst explains the various decision analytic tools available and works with participants in modelling their decision problems. **1988** Kraemer and King (123) *the participants usually are assisted by decision analysts who explain the various decision analytic tools available and work with the participants in modelling their decision problem*

decision analytic technique: Decision analytic techniques are sometimes included in software of the decision conference. These techniques could include "decision trees, influence trees, multiattribute expected utility modes for single stage decisions, utility and probability assessment, hierarchical evaluation structures for multiattribute utility analysis, multiattribute weighting analysis, Pareto algorithms for two party negotiations; cost benefit models for resource allocation; and spread sheet models. **1986** Kraemer and King (123) *The software of the decision conference is usually some form of decision analytic technique: decision trees and influence trees; multiattribute expected utility models for single-stage decisions; hierarchical evaluation structures for multiattribute utility analysis; Pareto algorithms for two-party negotiations; cost-benefit models for resource allocation; and spread- sheet models. Software for graphics and vote tally and display also are part of the decision conference facility.* **1988** Kraemer and King *Decision modeling software is specifically aimed at supporting group decision making and includes modeling languages (eg. SIMSCRIPT, DYNAMO), decision structuring techniques such as stakeholder analysis, brainstorming, nominal group technique, and Delphi technique, and specialized software for decision analysis techniques such as utility and probability assessment, multi attribute utility analysis, and multiattribute weighting analysis [Adelman 1984]. …The decision conference facility is discussed in the literature under the labels of group decision support system, decision analysis, and group decision aid … Technical problems: GDSSs depend on one or more of a number of technologies: computer processing and storage, graphics displays, database management systems, statistical processors, decision analysis and modeling programs, communication, and distributed input devices. At the current stage of technical development, there are several shortcomings in these technologies that affect GDSS use.*

decision characteristic: Decision characteristics refer to the ways in which decisions are made by groups. This includes the depth of the analysis, the degree of participation of the team members, the degree of consensus reached in making a decision, and the time it takes to reach a decision. **2000** Pare and Dube (from Kraemer and Pinsonneault 1990) *In the context of virtual teams, decision characteristics refer to the ways in which decisions are made by such groups. This includes the depth of the analysis, the degree of participation of the team members, the degree of consensus reached in making a decision, and the time it takes to reach a decision.*

decision conference component: These are hardware, software and people (participants) **1988** Kraemer and King *The hardware for the decision conference consists of a medium-sized conference room furnished with a large-screen video projector, a computer, video terminals, hand-held terminals for voting or other input by the participants, and a control terminal for presenting participant inputs in graphic form and for accessing other sources of information (e.g., databases, general reference materials, results of previous conferences) … The software of the decision conference is usually some form of decision analytic technique: decision trees and influence trees; multiattribute expected utility models* *for single-stage decisions; hierarchical evaluation structures for multiattribute utility analysis; Pareto algorithms for two-party negotiations; cost-benefit models for resource allocation; and spread- sheet models. Software for graphics and vote tally and display also are part of the decision conference facility … The participants in the decision conference are the actual people in the organization who are involved in making a decision. In addition, the participants usually are assisted by decision analysts who explain the various decision analytic tools available and work with the participants in modeling their decision problem. The participants also might be assisted by one or more group process facilitators-people trained in the behavioral dynamics of group meetings and in facilitating self-awareness of the group about its processes.*

decision conference facility: Decision conference facility is discussed in the literature under the labels of group decision support system, decision analysis and group decision aids. **1988** Kraemer and King *The decision conference facility is discussed in the literature under the labels of group decision support system, decision analysis, and group decision aid. What distinguishes the decision conference from the other GDSSs is its explicit focus on improving decision making by groups and its emphasis on the use of structured decision processes, mainly involving computer models but increasingly involving group process models as wel.l*

decision conference hardware: Conference room, video projector, large screen, computer, video terminals, hand-held terminal, control terminal **1988** Kraemer and King *The hardware for the decision conference consists of a medium-sized conference room furnished with a large-screen video projector, a computer, video terminals, hand-held terminals for voting or other input by the participants, and a control terminal for presenting participant inputs in graphic form and for accessing other sources of information (e.g., databases, general reference materials, results of previous conferences).*

decision conferencing: Decision conference sometimes called group decision systems (GDS). **1998** Pervan *Group Decision Systems (GDS), sometimes called Decision Conferencing, where computer support is provided by a single workstation operated by a member of the facilitation team [41].*

decision documentation: A collaboration support function usually included in a GDSS (decision conference system) **1988** Kraemer and King (126) *Several general observations can be made based on information about these systems. 1. There are about three general functions and 1-2 dozen specific functions that are provided in support of decision conferences: a. structured decision analysis decision trees multiattribute utility b. structured group process social judgment analysis delphi technique nominal group technique c. collaboration support data management graphic display decision documentation tutoring decision analysis consultation group process facilitation meeting facility vote tabulation and display.*

decision group: Groups engaged in decision-related tasks. A decision group may or may not have the authority to make the final decision. **1984** Huber (196) By d*ecision groups we mean groups engaged in decision-related tasks, eg., creating a short list of alternatives for a decision maker. A decision group may or may not have the authority to make the final decision.*

decision group management: Decision group management is a major factor in GDSS success. **1984** Huber (196) *By decision groups we mean groups engaged in decision related tasks, eg., creating a short list of alternatives for a decision maker. A decision group may or may not have the authority to make the final decision.* **1984** Huber (203) … *It was also noted that major factors in GDSS success are the capabilities of the users and their aides in, managing a decision group and drawing appropriately on the GDSS technology. This fact supported the belief that vendor support may be critical to GDSS success in the great majority of applications.*

decision making: Strategic decision making is a process carried out by a team of people, with three characteristics: (1) on the basis of existing objectives, a plan of action, or strategy, is generated, (2) the information available about the problem situation is imperfect or incomplete, so that assessment is necessarily subjective, and (3) the strategy includes options for action to take when unexpected contingencies occur. **1997** Hofstede et al. (from Noorderhaven 1995). *A process carried out by a team of people, with three characteristics: (1) on the basis of existing objectives, a plan of action, or strategy, is generated, (2) the information available about the problem situation is imperfect or incomplete, so that assessment is necessarily subjective, and (3) the strategy includes options for action to take when unexpected contingencies occur.*

decision making approach: Decision making approaches could include ordinary group process, nominal group technique (NGT), preference ranking, voting principles and game analytic methods. **1985a** DeSanctis and Gallupe *A variety of decision making approaches could be used, such as ordinary group process or Nominal Group Technique, but essentially the process would involve using the GDSS to show the decision makers the current situation in terms of markets and finances, etc. and to facilitate the generation and evaluation of ideas.* **2003** Beroggi (from Beroggi 1999) *Different approaches to consensus reaching in group decision making exist, including voting principles and game analytic methods (Beroggi 1999, Chapter 9). A most important measure of consensus reaching among decision makers' preference rankings is a rank correlation measure.*

decision model: Decision model can include four generic modules: creative confrontation, poling of experts/participation, systematic structuring, and implementing and controlling. **2001** Antunes and Ho (12) **(**from Hwang and Lin 1987) *Decision model defines four generic modules: creative confrontation, poling of experts/participation, systematic structuring, and implementing and controlling..*

decision modelling software: Decision modelling software is specifically aimed at supporting group decision making and includes modelling languages, decision structuring techniques such as stakeholder analysis, brainstorming, nominal group technique, and Delphi technique, and specialized software for decision analysis techniques such as utility and probability assessment, multi attribute utility analysis and multiattribute weighting analysis. **1987** DeSanctis and Gallupe *Modeling tools to support analysis that ordinarily are performed in a qualitative fashion, such as social judgment formation, risk analysis, or multiattribute utility methods can be introduced to the group via a Level 2 GDSS.* **1988** Kraemer and King (118-119) (from Adelman 1984). *Decision modeling software is specifically aimed at supporting group decision making and includes modeling languages (eg. SIMSCRIPT, DYNAMO), decision structuring techniques such as stakeholder analysis, brainstorming, nominal group technique, and Delphi technique, and specialized software for decision analysis techniques such as utility and probability assessment, multi attribute utility analysis, and multiattribute weighting analysis.* **2001** Ackermann and Eden *Group Decision Support Systems focus on providing a group with modelling support (Ackermann 1997) …Thus, a GDSS is usually built around a particular theoretical and methodological approach to decision modelling, problem solving and the management of complexity (DeSanctis and Gallupe 1987; Dickson et al. 1992; Phillips 1987; Quinn et al. 1985).*

decision process: Decision process is a bundle of tasks that include gathering, interpreting and exchanging information, creating and identifying alternative scenarios, choosing among alternatives, and implementing and monitoring the choice. **2001** Antunes and Ho (from Guzzo and Salas 1995) *The group decision process may be broadly defined as a bundle of tasks that include gathering, interpreting and exchanging information; creating and identifying alternative scenarios; choosing among alternatives; and implementing and monitoring a choice.*

decision quality: Decision quality is an effectiveness measure and is a dimension of meeting outcomes. Decision quality is the correctness or ‘goodness’ of the group’s choice for choice tasks. **1986** Applegate et al. (from Gallupe 1986) *Gallupe (1986) presented research design factors that were considered in a study of the influence of a GDSS on decision quality, decision time and group confidence in the decision.* **1987** DeSanctis and Gallupe, *Outcomes of meetings may be measured on many dimensions, including decision quality and timeliness, satisfaction with the decision, cost or ease of implementation, member commitment to implementation, or the group's willingness to work together in the future.* **1996** Hiltz et al.(4) *Effectiveness measures (eg. Number of different ideas generated or decision quality).* **2001** Dennis and Wixom D*ecision quality, was defined by most researchers as the correctness or "goodness" of the group's choice for choice tasks.* **2001** Carneiro (from DeSanctis and Gallupe 1987) *The effectiveness of the group's decision making process may be evaluated in terms of decision quality, participant commitment to implementation, and the group's willingness to work together in the future.* **2003** Ngwenya and Keim *Time to decision and decision quality were surrogate measures of group information sharing effectiveness.*

decision related meeting: Decision related meetings are where people possessing different facts, expertise, and points of view, share and use information in order to select their individual or collective courses of action. **1984** Huber *meetings where people possessing diferent facts, expertise, and points of view share and use information in order to select their individual or collective courses of action.*

decision room: This is a GDSS technology category that has close proximity of participants and limited duration of the decision making session. Decision room supports a small group ranging in size from three to approximately 24 people who need to meet face-to-face. The decision room features computerized support in addition to traditional small group interaction. **1986** Applegate et al. (from Kraemer and King 1984; DeSanctis and Gallupe 1985) *Systems that fall under the classification of a GDSS include: (I) Decision Conferences (or Decision Rooms), (2) Teleconferencing, (3) Local Ongoing Decision Networks, (4) Remote Ongoing Decision Networks, and (5) Information Centers.* **1987** DeSanctis and Gallupe *The organization sets up a room (much like a boadroom) with special facilities, such as a horseshoe-shaped table facing a large screen, with a display monitor and data input device available for each participant. Group member communications may be transmitted verbally or via electronic messaging.* **1987** Jelassi and Beauclair *the face-to-face, close proximity, synchronous GDSS type commonly known as "war room" [30] or a "decision room" [6]. The decision room features computerized support in addition to traditional small group interaction.* **1995** Aiken et al. *Decision Room: A small group in a face-to-face meeting. A decision room supports a small group ranging in size from three to approximately 24 people who need to meet face-to-face. Some decision rooms (such as the SAMM system at the University of Minnesota) can support a group no larger than 10 people while others (such as the facilities at the University of Arizona or IBM) can support larger groups.* **1997** Williams and Wilson *Decision room – same time, same place technologies.*

decision satisfaction: A dimension of meeting outcomes. **2001** Dennis and Wixom *Performance has been defined in different ways by different researchers [e.g., 45, 51]. We follow the approach of Drazin and Van de Ven [17], Benbasat and Lim [2], and Dennis and Kinney [10], who defined performance in terms of three major factors: (1) effectiveness as defined by decision quality or number of ideas generated, (2) efficiency as defined by the time to complete the task, and (3) participants' satisfaction with the process or outcomes.*

decision structuring technique: also called ‘structured group process’ and ‘behavioural group technique’ Decision structuring techniques are often used in decision modeling software and include such techniques as stakeholder analysis, brainstorming, nominal group technique, and Delphi technique. **1988** Kraemer and King (from Adelman 1984). *Decision structuring techniques such as stakeholder analysis, brainstorming, nominal group technique, and Delphi technique.*

decision time: Decision time or task completion time is a task performance factor. **1986** Applegate et al. (from Gallupe 1986) *Gallupe (1986) presented research design factors that were considered in a study of the influence of a GDSS on decision quality, decision time and group confidence in the decision. He presents a series of research design issues and recommendations for GDSS research. These include the task, subjects, setting, dependent measures and GDSS design and implementation/acquisition.* **2003** Greasley *WFMS include the following types of function, which can be simulated: (1) a workflow queue of activities or tasks which need to be performed to achieve a business process often prioritised in a set order according to the business rules; (2) scheduling - assignment of tasks between a group of people, the workflow queue being queried to issue reminders to staff to perform tasks; (3) a routeing system for tasks and messages between team members; and (4) task performance metrics for managers - e.g. task completion time.*

decision tree model: Decision tree is a group task model often referred to as a decision analytic technique. **1986** Applegate et al. *In addition, prior to this research, the focus of existing systems was primarily to provide support for a small number of specific group tasks (e.g., structuring or decision alternatives using decision tree models, analysis of group preferences using multi-attribute utility models and group consensus and negotiation models). Support for the idea generation phase of the problem-solving process was discussed by Huber (1984) but was not implemented in the existing systems.* **1995** Er and Ng *A group decision support system is defined as an interactive computer-based information system which combines the capabilities of communication technologies (LAN, WAN, telecommunication), database technologies (relational, hierarchical and network models), computer technologies (maingrame computer, minicomputer, microcomputer, personal computer, VLSI system, supercomputer), and decision technologies (linear programming, integer programming, multi-objective linear programming, sequential optimisation, dynamic compromise programming, AHP, Electre, Multi-attribute utility theory, Q-analysis, risk analysis, simulation, forecasting, statistical analysis, decision tree, etc.) to support the identification, analysis formulation, evaluation and solution of semi-structured or unstructured problems by a group.*

decision tree: A decision tree is a decision analytic technique that is sometimes included as software in a decision conference. **1984** Huber (196) *For example, one system provides the capability for a group to construct and employ a decision tree, and that is about all it does. Another provides the capability for a group to identify and analyse the multi-attribute utility functions of its members. Yet another provides the capability for a group to obtain its members' strengths of feeling about the importance of different organizational goals and the performance of organizational units with regard to these goals and to use the resulting values in an organizational analysis algorithm.* **1986** Kraemer and King (123) *The software of the decision conference is usually some form of decision analytic technique: decision trees and influence trees; multiattribute expected utility models for single-stage decisions; hierarchical evaluation structures for multiattribute utility analysis; Pareto algorithms for two-party negotiations; cost-benefit models for resource allocation; and spread- sheet models. Software for graphics and vote tally and display also are part of the decision conference facility.*

degree of sharing: This can be private, subgroup or public. Types of information can be categorized according to the amount of its structure and according to the degree of sharing. **1986** Begeman et al. *For example, the interaction method of meeting [DOYL85] suggests that there should be a facilitator, who is a leader charged with keeping the meeting balanced and on a correct course, and a recorder who maintains, and makes publicly visible, the group memory. Other options may imply that, rather than restricting access to the group memory and the public display, equal access for all might be preferred. Within all of these structures, the types of information that may be presented, manipulated, and captured during a meeting can be categorized according to the amount of its structure* *(binary, structured, or unstructured), and according to the degree of sharing (private, subgroup, or public).*

Deictic reference: Deictic references. The practice of pointing or gesturing to indicate a noun used in conversation is called deictic reference, and is ubiquitous in shared workspaces. **2002** Gutwin and Greenberg *The practice of pointing or gesturing to indicate a noun used in conversation is called deictic reference, and is ubiquitous in shared workspaces.*

delay phenomenon: Delay phenomenon in video-based communication includes a lower frequency of backchannels, speaker feedback, and interruptions, as well as an increase in formal hand-overs. **1999** Ruhleder and Jordan *Delay phenomenon in video-based communication includes a lower frequency of backchannels, speaker feedback, and interruptions, as well as an increase in formal hand-overs.*

delegation model: Delegation model is an organizational model in which a supervisor assumes overall management but delegates specific responsibilities. **2000** Pare and Dube (from Gorton and Motwani 1996) *Organizational models that can influence virtual team structure. The models in question are cooperative (all members share overall project management responsibilities), delegation models (a supervisor assumes overall management but delegates specific responsibilities) and consultative models (specific tasks are sub-contracted to outside experts).*

Delphi Technique: A structured group process (also referred to as behavioural group technique, consensus-seeking technique, decision structuring technique, group problem solving technique, or structured group management technique) sometimes included as a general function of a GDSS (decision conference system). **1984** Huber (195) *One such approach has been the use of structured group management techniques such as the Nominal Group Technique and the Delphi technique [Delbecq, Van de Van and Gustafson, 1975, Van Grundy 1981].* **1986** Kraemer and King *Several general observations can be made based on information about these systems. 1. There are about three general functions and 1-2 dozen specific functions that are provided in support of decision conferences: a. structured decision analysis decision trees multiattribute utility b. structured group process social judgment analysis delphi technique nominal group technique c. collaboration support data management graphic display decision documentation tutoring decision analysis consultation group process facilitation meeting facility vote tabulation and display.* **1986** Bui and Jarke *Behavioral group techniques, such as the Delphi method and the Nominal Group Technique, can be used more efficiently with electronic support [20, 51]* **1987** Stefik et al. *The Delphi method (22) and the Nominal Group method (20), for example, are techniques for structuring group problem solving that have been used with and without computer support.* **1987** DeSanctis and Gallupe *Automated Delphi or other consensus-seeking techniques might be incorporated in Level 2 systems.* **2003** Ngwenya and Keim *Solutions have ranged from manual group process structuring techniques such as the Delphi method (Dalkey 1969) and the Nominal group technique (NGT) (Delbecq, Van de Ven, and Gustafson 1975) to contemporary group support systems GSS) (DeSanctis and Gallupe 1987).*

design issue: Design issues can include system capabilities, system delivery modes and system design strategies. **1984** Huber (195) *The paper focuses on three major issues in the design of these systems: 1) System capabilities, 2) System delivery modes, and 3) system design strategies, and discusses the relationship of these issues to system use and survival.* **1987** Jelassi and Beauclair *This discussion of GDSS design issues is a positive step toward a behaviourally-driven design of group decision support systems. As we have shown, design strategies can be specific to certain group behaviours (eg. diffusion of responsibility) as well as general to computer-based decision support systems (eg. communication and information sharing, consistency and coherehce).* **1988** Dennis et al. *Workstation Design: Workstation design issues include layout of microcomputer- screen, space for papers/other work, software distributed on each workstation hard disk, and local area net (LAN)* *handling of voice, video, and gateways. Providing an electronic interface for each group member encourages all group members to participate and enhances the efficiency of that participation.*

design strategy: see System design strategy

desirable effects of GSS**:** Desirable effects of GSS are greater participation, and better quality decisions. Undesirable effects are reduced consensus and confidence. **2003** Lester et al. *GSS has demonstrated both desirable effects (greater participation, better quality decisions) and undesirable effects (reduced consensus and confidence) in previous research (Fjermestad and Hiltz, 1999; Benbasat and Lim, 1993).*

desktop computer: Desktop computers are a basic hardware component of any groupware system. **1985a** DeSanctis and Gallupe *The basic components of any GDSS include hardware, software, people, and procedures. Hardware Regardless of the specific decision situation, the group as a whole, or each member, must be able to access a computer processor and display information. The minimal hardware equirements of the system include: an input/output device, a processor, a communication line between the I/O device and the processor, and either a common viewing screen or individual monitors for use in displaying information to the group. More sophisticated systems may contain I/O terminals or desktop computers for each group member, several central processors, long-distance communications equipment, and several large viewing screens.* **2002** Prante et al. *Single display groupware [28] focuses on the use of one display and several input devices connected to it to overcome the fact that current input-device hardware (as, eg. Touch screen) allows for only one user interacting at a time - even though there are drivers announced which will enable, eg. interactive whiteboards, to handle two input streams at a time. Typical setups are a standard desktop computer or an electronic whiteboard displaying the shared document and several PDAs connected to the display-computer via serial cables [18, 6] or via infrared connections. This allows for simultaneous input into the same document through several input streams supported at a time.*

desktop video conferencing (DVC): Desktop video conferencing (DVC) uses a synchronous remote form of communication. It is a medium where audio, video and data are transmitted, allowing collaborative working through shared applications. DVCs are the core systems around which the rest of virtual team technologies are built. **1998** Townsend et al. (21) *Desktop videoconferencing Systems (DVCS) are the core system around which the rest of virtual team technologies are built. Although virtual teams would be possible with simple email systems and telephones, DVCS recreates the face-to-face interactions of conventional teams, making possible more complex levels of communication among team members.* **2000** Ishaya and Macauley *Desktop video conferencing (DVC) – This uses a synchronous - remote form of communication. It is a medium where audio, video and data are transmitted, allowing collaborative working through shared applications.*

detective role : A role of a communication manager in a distributed GDSS **1986** Bui and Jarke *One can identify at least three specific roles: (1) Coordinator role. The communication manager should coordinate the initial situation analysis and problem definition. ... Walton [52] suggests that by installing a communication medium that follows some norms of fairness (e.g., equality of participation, preserving autonomy), information exchange will be more abundant and accurate. (2) Detective role. Problem analysis could be distorted by an individual's attempt to spy on others' activities or by the influence of some members who try to take over an individual's responsibility ... (3) Inventor role. The inventor role is an extension of the coordinator role.*

determinants of trust: Determinants of trust are measures of ability, benevolence, the integrity of the trustee as perceived by the trustor, and the trustor’s propensity to trust. **2003** Sarker et al. *This instrument focuses primarily on measuring the ability, benevolence, and integrity of the trustee as perceived by the trustor, and the trustor’s propensity to trust, all of which are seen as determinants of overall trust.*

development approach: There are three development approaches to groupware systems, generic tools approach, generic task approach and application-specific approach. **1988** Bostrom and Anson (100) *This section outlines three different but related types of Collaborative Work Support Systems (CWSS). The three approaches are generic tools, generic task and application-specific CWSS … CWSS developers who take a Generic Tools approach focus on tools that support specific group activities or group behavioral techniques such as brainstorming, structuring Ideas or voting … Generic Task CWSS In a meeting, the focus is usually on higher level processing tasks - planning, decision-making, etc. - that utilize the information processing tasks … The application-specific CWSS is developed to tackle a specific application within an organization. These systems often involve integrating generic CWSS tools or task support … with specialized software that supports the specific application.*

DGSS: *see* Distributed group support systems.

dialogue: A dialogue is a sustained collective inquiry into everyday experience that people typically take for granted. **2000** Tan et al. (from Shein 1993) *A dialogue is a sustained collective inquiry into everyday experience that people typically take for granted.*

dialogue management: One of three basic functions of DSS and GDSS **1987** Jelassi and Beauclair (from Sprague and Carlson 1982) *GDSS are designed to provide tools for decision-making by supporting the three basic DSS functions, of data, model, and dialogue management.*

dialogue manager: Dialogue manager is a component or function of a GDSS. **1986** Bui and Jarke *The careful design of a communication manager as a fourth DSS component, in addition to dialogue manager, data manager, and model manager, is, therefore, a crucial prerequisite of a distributed GDSS.* **1987** Jelassi and Beauclair (from Sprague and Carlson 1982) *GDSS are designed to provide tools for decision-making by supporting the three basic DSS functions, of data, model, and dialogue management.*

dialogue outcome: Two types of dialogue outcomes, shared ground rules of a team and shared team conventions and norms. **2003** Huang et al. *In general, two types of dialogue outcomes can be generated. The first type can be termed as shared ground rules of a team (or tangible shared team meanings), which may include the four basic team elements discussed in the introduction--the team structure (e.g., leadership and role differentiation), team identity (e.g., team goals), team interdependence (e.g., team coordination), and team history (e.g., the frequency of team meeting). The second type is a kind of shared team conventions and norms (or intangible shared team meanings), which may guide team interactions consciously (e.g., respecting differences in team interactions), and most of the time, maybe unconsciously (e.g., a team norm may exist in some cultures where ideas given by senior people will be automatically and unconsciously considered with higher weights in team interactions).*

Dialogue theory: Dialogue Theory: Dialogue theory offers suggestions on how team mental models can be developed. A dialogue is a sustained collective inquiry into everyday experience that people typically take for granted (Shein 1993). Its objective is to create a setting where people are more aware of the context surrounding their experience and more conscious of the thought processes that give rise to the experience. **2000** Tan et al. *Dialogue Theory: Dialogue theory offers suggestions on how team mental models can be developed. A dialogue is a sustained collective inquiry into everyday experience that people typically take for granted (Shein 1993). Its objective is to create a setting where people are more aware of the context surrounding their experience and more conscious of the thought processes that give rise to the experience.*

Diffusion of Innovation Theory: Diffusion of innovation theory defines diffusion as the process by which (1) an innovation is (2) communicated through certain channels (3) over time among (4) the members of a social system. **2002** Van Slyke et al. (from Mahajan et al

1990) *Diffusion of innovation theory is concerned with how the use of an innovation spreads throughout a social system.* **2003** Pollard (173) *The case study method was used to investigate the largely unexplored process of GSS adoption and diffusion in terms of human factors, internal organizational context, external organizational environment and GSS management activities … For these reasons, Rogers' (1995) individual diffusion model appears to be an appropriate framework for this study. In addition, Rogers' five-stage model facilitates exploration of post adoption behavior and factors that lead to continued and discontinued use in different stages of the adoption process, i.e., (1) awareness, (2) attitude formation, (3) decision to adopt/reject, (4) first use, and (5) continued use/discontinuance … Diffusion of innovation theory Rogers' (1995) defines diffusion as "the process by which (1) an innovation is (2) communicated through certain channels (3) over time among (4) the members of a social system".*

diffusion of responsibility*:* A group behaviour issue. Also known as social loafing. Diffusion of responsibility results when group members fail to take responsibility for their own actions **1987** Jelassi and Beauclair (147) *Diffusion of responsibility : also known as social loafing, results when group members fail to take responsibility for their own actions.* **2003** Siao (from Pinsonneault and Heppel) *This assumption was cautioned, however, by Pinsonneault and Heppel (31), who researched the various aspects of anonymity. They discovered that there were five main components to anonymity: (1) identification - ideas and/or comments cannot be associated to individuals; (2) diffused responsibility -responsibility is diffused to all members of a group, not given to one particular person; (3) proximity - how close people sit to one another affects the degree to which they feel that the exchange is anonymous; (4) knowledge of other group members - if people know each other well, they feel that their statements may be recognized; and (5) confidence in the system itself- if users are not confident in the system then it is unlikely that they will be confident that their exchange is anonymous.*

directory*:* The basic concept of a directory is a way of identifying, storing and retrieving resources within the organization or resources that are related to the organization. **2003** Bose *The basic concept of a directory is a way of identifying, storing and retrieving resources within the organization or resources that are related to the organization.*

disagreement: Disagreement in a team is a productivity loss. **1986** Begeman et al. *Poor communication and disagreement at meetings can result in inconsistent designs, frustrated efforts, drastically lowered morale, and ultimately to project failure. We have a set of creative ideas which, we hypothesize, can use automated technology to positively impact face-to-face design meetings.* **1987** Cook et al. *Meetings constitute an important part of the software design and development environment. They are used to explore ideas, resolve disagreements, and enhance teamwork to achieve team goals.* **2000** Pare and Dube *Group interaction processes, namely communication trust, cooperation, information processing (sharing, redundancy, integrative complexity), consensus generating (amount and intensity of disagreement), conformity pressures) and normative regulation (expressions of commitment, satisfaction and solidarity). In turn these group processes form an important basis for the shaping of project outcomes.*

discussion rule: Discussion rules define the duration of the discussion, and the number of interventions a group member can perform during the discussion. **2001** Carneiro *Discussion rules define the duration of the discussion, and the number of interventions a group member can perform during the discussion.*

dispersed proximity: The proximity of participants discussed in the GDSS framework. Other terms for dispersed are distributed, decentralised or geographically separated. **1987** DeSanctis and Gallupe *Three environmental contingencies are identified as cirical to GDSS design: group size, member proximity, and the task confronting the group.* **1991** Nunamaker et al. G*roup member proximity: groups may be distributed with respect to both space and* *time.* **1995** Gavish et al. (723) *Group proximity: meetings can be centralized, partly centralized, or decentralized.*

dissemination: Dissemination can be an impact of the transition to a CBIS. The dissemination of ideas. **1986** Stasz and Bikson (320) *Issues in Computer-Supported cooperative work Our field study assessed a number of impacts of the organization's transition to a computer-based information system. Here we discuss five: training, dissemination, hierarchical vs. network communications, centralized vs. decentralized decisionmaking, and cooperative work between different technologies and systems.* **2003** Bose (from Davison and Briggs 2000) *Electronic presentation facilities Presentation capabilities can aid group members in idea creation and dissemination as well as provide a professional appearance to customers, business partners and people within the organization.*

DistEdit: DistEdit is a toolkit for the development of multi-user collaboration editors. **1990** Knitster and Prakash *The requirements of the D&Edit toolkit are quite simple: Multiple-user collaboration: editors built using the DistEdit toolkit should allow users to collaboratively edit text files without being in physical proximity. Reasonable performance: communications protocols used within DistEdit should give a consistent view of files to all users with reasonably low delay so that group editing is not an inconvenience. Compatibility with multiple, existing editors: it should be possible to use different editors in a single group session. People usually have their own favorite editors and it would be desirable not to force them to use a different editor when participating in a group session. Fault-tolerance: the group session should continue to run smoothly despite machine crashes and people leaving or joining the group. Hiding of communication protocols: adapting an editor to group editing using DistEdit should not require knowledge of distributed systems issues, such as communication protocols.*

distributed: Distributed can have three dimensions: temporal, spatial and technological. In other words it can refer to different times, different places or to a distributed system on different servers. **1991** Nunamaker et al. G*roup member proximity: groups may be distributed with respect to both space and time.* **1995** Ocker et al. *Distributed refers to the dimension of space - at different places.* **1996** Hiltz et al. *Distributed has dimensions: temporal, spatial and technological … Distributed: The system used is itself distributed that is, there can be more than one "server" in different places which are linked, and the user interaction may occur on a "user agent" located on the individual PC.* **2001** McDonough et al. (111) *The terms distributed and virtual have sometimes been used interchangeably (32). Both refer to the notion that the team's members are geographically dispersed, but unlike global teams, they are comprised of team members who are culturally similar (42).*

distributed group support system (DGSS): DGSS are created by the combination of the characteristics of computer-mediated communication systems and group decision support systems, to support the full range of tasks involved in projects. Thus, not only decision making but also the planning, budgeting, gathering of information, and resolving conflicts are supported. **1996** Hiltz et al. (p1) *Distributed group support systems use asynchronous computer-mediated communication to support anytime, anywhere group discussions and decision making … DGSS embed GDSS type tools and procedures within a computer-mediated communication (CMC) system to support collaborative work among dispersed groups of people.* **1998** Tung and Turban *DGSS is a technology that can help groups to overcome some of the difficulties associated with being in different places and sometimes in different time zones … The technologies developed for supporting face-to-face groups, such as GDSS, could be the base for what Microsoft calls 'distributed workgroup computing systems, also known as distributed group support systems (DGSS or D-GSS) … Synchronous DGSSs: Synchronous DGSSs allow distributed participants to interact with one another in a 'real time' mode, ie. They interact with one another at the same time. The participants are distributed across multiple sites linked by various communication technologies. Some of the supporting technologies are screen sharing, whiteboard, audio-conferencing, and various types of video-conferencing. These technologies can be carried* *on the Intranet, Internet, corporate or public networks, or VANs … Asynchronous DGSS: allow distributed participants to log into the same meeting but at different times. Participants can log in and catch up with what is going on in the meeting, enter comments if necessary, and log out of the meeting at various times. E-mail, Voice-mail and messaging workflow management systems (such as in Lotus Notes) are some of the supporting technologies.***1998** Tung and Turban (from Turoff et al.[36]) … *DGSS are created by the combination of the characteristics of computer-mediated communication systems and group decision support systems, to support the full range of tasks involved in projects. Thus, not only decision making but also the planning, budgeting, gathering of information, and resolving conflicts are supported.*

distributed workgroup computing system*:* Distributed workgroup computing systems, also known as distributed group support systems are technologies developed for supporting distributed groups. **1998** Tung and Turban (175) *The technologies developed for supporting face-to-face groups, such as GDSS, could be the base for what Microsoft calls 'distributed workgroup computing systems, also known as distributed group support systems (DGSS or D-GSS)*

document distribution*:* Document distribution is a CMC factor relating to communication capabilities. The features which allow the distribution of documents to interested parties. **1981** Turoff et al. (92-93). *Communications Capabilities Communication richness: The richness of the communication options offered such as conferences, messages and document access, and the variety of communication features associated with the options, such as confirmations of deliveries, notifications of access, use of pen names, status reports of readership, footnote and commenting or voting features. Special purpose communication structures: The ability of the system to supply or be adapted to supply special-purpose communication structures for activities such as facilitating, providing protection from information overload by filtering, allowing participation by very large groups through rules of order, incorporating systems such as personalized calendars which allow direct or indirect communications among the users. Indirect communication channels: The ability to set up indirect communication linkages among individuals and groups, such as informing a group of authors what the readers are looking for and not finding in key word searches. Document distribution: The features which allow the distribution of documents to interested parties. Voting: Provision of voting scales which may be associated with items for responses by others, with feedback to participants.*

document formatting*:* Document formatting is a CMC factor relating to text processing. Document formatting is the ability to format a document by paging and incorporating such things as headings. **1981** Turoff et al. (92-93). *Text Processing ‘Text editing: The direct modification of text during the composition process. Text formatting: The ability to have the computer set up formats for text such as paragraphing, tables, spacing, margins, etc. Document formating: The ability to format a document by paging and incorporating such things as headings. Text mobility: The ability to move text around the system, such as from a message into a personal notebook. Text Retrieval and linkages: The relationships, indexes and linkages set up to relate items of text to one another, and to the possibilities of dealing with non-linear type documents such as in "hypertext". Virtual text referencing: The ability to reference and incorporate existing text items in new text items in a virtual manner. Active and adaptive text: The ability of text to incorporate programs or functions that are executed as part of the delivery mechanism to readers. This includes the ability of text to contain forms or surveys for the reader to respond to and make conditional on various factors or specific responses what the reader actually sees.*

dominance by individual: Dominance by individuals is a productivity loss in group decision making and a barrier to group work **1986** Kraemer and King (17) *How might GDSS's help increase productivity of decision meetings? Huber (1982a) provides the following succinct assessment of the issue: I. Effective group decision making requires: 1. Meeting the need of the situation. 2. Ensuring that members are satisfied with the process. 3. Enabling members* *to meet and work successfully in the future. II. "Losses" of productivity in group decision making occur because: 1. Discussions are dominated by certain individuals. 2. Low-status members defer to high-status members. 3. Group pressures lead to conformity of thought. 4. Miscommunication among members is common. 5. Insufficient time is spent in problem exploration and generation of alternatives. III … At the simplest level GDSS provide features aimed at removing common barriers to group work and communication, such as unequal consideration of ideas, dominance by individuals, peer pressure, and loss of autonomy. These features include anonymous input of ideas and preferences, and large screens for instantaneous display of ideas, and secret voting and compilation. The level is illustrated by the electronic boardroom or computer-supported conference room.* **1987** DeSanctis and Gallupe *Effects on Power and Influence: The usual political dynamics of the group will change once technology is introduced to the process. To the extent that GDSS technology encourages equality of participation and discourages dominance by an individual member or subgroup, perceived member power and influence should become more distributed and decision quality should improve. The loss of social cues due to electronic communication can be expected to encourage open input of creative ideas, discovery of optimal solutions, and selection of an alternative based on its merits rather than on compromise (Boje and Muminghan 1982; Rutter and Robinson 1981).* **2000** Pare and Dube *Interpersonal characteristics include the degree of cooperation in the virtual team and the degree to which certain team members dominate the group processes.* **2001** Montoya-Weiss et al. *Competition behavior is characterized by each party's pursuing his or her own interest without regard for others. This behavior involves concealment of information, competitiveness, and negative attitudes toward alternative solutions. Competitive interactions typically involve the use of power and domination as one party tries to force its views on the other.*

domination of discussion: see dominance by individuals

dragging: Dragging is a manipulation feature in graphics editors. This feature is now in most Windows software. **1986** Lakin *Manipulations include dragging, erasing and scaling.*

drastically lowered morale: Drastically lowered morale is a meeting loss outcome **1986** Begeman et al. *Poor communication and disagreement at meetings can result in inconsistent designs, frustrated efforts, drastically lowered morale, and ultimately to project failure. We have a set of creative ideas which, we hypothesize, can use automated technology to positively impact face-to-face design meetings.*

duration: Duration is the total amount of time spend on a system. Duration or connect time can be a system usage measure. **1988** Rice and Shook *Usage An important concept in the study of information systems in general is usage. We focus on two dimensions, the form and the source, of usage measures here (these are discussed in greater detail in [55]). The form of usage data may include, among other types of usage, duration (or the total amount of time spent on a system), and frequency (or the number of accesses or entries to a system). With respect to computer systems, these forms of usage are typically called connect time and log-ons, respectively.***2002** Morris et al. *System usage is commonly operationalized in four ways in the literature: frequency of use, duration of use, variety of applications used, and variety of tasks performed.*

duration of decision making session: Duration of decision making sessions can be limited and ongoing. **1987** Jelassi and Beauclair (from DeSanctis and Gallupe 1985) *DeSanctis and Gallupe (1985) categorize GDSS technology into four separate areas: decision room, local decision network, linked decision rooms, and remote decision networks. They distinguish between the four models in terms of proximity of participants and duration of the decision making session.*

during meeting phase*:* see In-meeting phase

DVC: see Desktop video conferencing

dynamic*:* Dynamic is a text-graphics manipulation feature. Manipulation of text-graphics unfolding over time **1986** Lukin (264) *Dynamics (measuring things that change over time).*

Dynamo*:* Dynamo is a modelling language that is sometimes used in decision modelling software. **1988** Kraemer and King (118-119) (from Adelman 1984) *Decision modeling software is specifically aimed at supporting group decision making and includes modeling languages (eg. SIMSCRIPT, DYNAMO), decision structuring techniques such as stakeholder analysis, brainstorming, nominal group technique, and Delphi technique, and specialized software for decision analysis techniques such as utility and probability assessment, multi attribute utility analysis, and multiattribute weighting analysis.*

ease of use: Ease of use is a dimension of usability. Ease of use: the user interface and system functionality must be such that virtually anyone can employ the technology. Ease of use is a system purchase evaluation issue. **1986** Fanning and Raphael (294) *System scalability ... Ease of use. Users with an unimaginable variety of backgrounds and prejudices all become instant critics of how a system should have been designed, the first time a confusing command is encountered.* **1997** Nunamaker *Ease of use: the user interface and system functionality must be such that virtually anyone can employ the technology* **2003** Siao (from Guillemette [16]) *The usability of a system is a multidimensional construct (13). Guillemette (16) listed nine dimensions of usability: ease of learning, ease of use, task orientation, self-description, predictability, fault tolerance, flexibility, user control, and friendliness.***2003** Siao *This paper reports the evaluation of an existing GSS. Our usability framework consists of nine dimensions: visual clarity, consistency, compatibility, informative feedback, explicitness, flexibility and control, error prevention and correction, ease of learning, and ease of use.*

easy accessibility: A system purchase evaluation issue Easy accessibility: the typical user must be able to obtain the equipment and support necessary to use the system from his/her normal workplace without inordinate effort. **1986** Fanning and Raphael (294) *Reliability and performance. If the system took more than a couple of seconds to respond to a keystroke, or crashed more than once a week, it would not be acceptable and any other advantages it might have would be moot. Easy accessibility from the normal workplace. The typical user must be able to obtain the equipment and support necessary to use the system from his/her normal workplace without inordinate effort.*

economic value: Economic value may be positive or negative. **1998-9** Briggs et al. *Changing to a new technology may cause changes in the economic status of the individual or the organization. For example, the new system might lead to more efficiency and thus higher profits (positive economic value), or it might cause a prospective user to lose a job (negative economic value).*

effective communication: Effective communication (during the requirements definition process) is associated with improved productivity and higher quality systems. **1996** Hiltz et al. *Effective communication (during the requirements definition process) is associated with improved productivity and higher quality systems (Curtis 1988)*

effective functioning teams: There are eight properties of effectively functioning teams: a clear and elevating goal, a results-driven structure, competent team members, unified commitment, a collaborative climate, standards of excellence, external support and recognition, and principled leadership. **2003** Huang et al. (from Larson and LaFasto 1989). *Larson and LaFasto (1989) identify eight properties of effectively functioning teams: a clear and elevating goal, a results-driven structure, competent team members, unified commitment, a collaborative climate, standards of excellence, external support and recognition, and principled leadership.*

effective group process: Hackman's model of work group effectiveness is defined in terms of output acceptable to the client, group maintenance and growth, and member satisfaction. Effective group process is influenced by organization context, group design and group synergy **1991** Applegate (20) *A widely used model developed by Hackman [41] defines work group effectiveness in terms of output acceptable to the client, group maintenance and growth, and member satisfaction. These outcome measures are facilitated by knowledge and skill brought to bear on the task, and appropriateness of the task performance strategies implemented by the group. The influence of these process effectiveness criteria on outcome effectiveness criteria is mediated by the presence of sufficient material resources required to accomplish the task. Organisation context, group design, and group synergy influence the development of effective group processes. Goodman and collegues [37] and Gladstein [35], although agreeing with Hackman on the key determinants for work group effectiveness, suggest developing research models in finer detail.*

effectiveness (1): Effectiveness is the accuracy and completeness with which users achieve specified goals. **1987** DeSanctis and Gallupe *The effectiveness of the group's decision making process may be evaluated in terms of decision quality, participant commitment to implementation, and the group's willingness to work together in the future*. **1989** Ackermann (3) (from Keen 1978) *Effectiveness involves identifying what should be done and ensuring that the chosen criterion is the relevant one.* **2002** Sikorski (from ISO 9241-11) *Effectiveness: The accuracy and completeness with which users achieve specified goals.*

effectiveness (2): Effectiveness is the capability of the software product to enable users to achieve specified goals with the accuracy and completeness in a specified context of use. Effectiveness is a set of attributes that bar on the relationship between the level of performance of the software and the amount of resources used, under stated conditions. **2002** Sikorski (from ISO 9126:1995) *A set of attributes that bar on the relationship between the level of performance of the software and the amount of resources used, under stated conditions.* **2002** Sikorski (ISO/IEC 9126-1) *Effectiveness: The capability of the software product to enable users to achieve specified goals with the accuracy and completeness in a specified context of use.*

effectiveness measures: Effectiveness measures (eg. number of different ideas generated or decision quality). **1996** Hiltz et al. (4) *Effective measures (eg. number of different ideas generated or decision quality).*

efficiency (1): Efficiency means the resources expended in relation to the accuracy and completeness with which users achieve goals. Efficiency is doing a specified job well. **1989** Ackermann (3) (from Keen 1978). *Efficiency is doing a specified job well.* **1995** Gavish et al. (from Smith and Vanecek 1990) *Effects on meeting efficiency: Continuity, spontaneity, immediacy of feedback and the dynamics of debate are all affected when participants are not simultaneously present in the meeting (Smith and Vanecek, 1990).* **2001** Dennis and Wixom *Efficiency, was defined in most cases, as the time to reach decisions. …Performance has been defined in different ways by different researchers [e.g., 45, 51]. We follow the approach of Drazin and Van de Ven [17], Benbasat and Lim [2], and Dennis and Kinney [10], who defined performance in terms of three major factors: (1) effectiveness as defined by decision quality or number of ideas generated, (2) efficiency as defined by the time to complete the task, and (3) participants' satisfaction with the process or outcomes.* **2002** Sikorski (from ISO 9241-11) *Efficiency: The resources expended in relation to the accuracy and completeness with which users achieve goals.*

efficiency (2): Efficiency means the capability of the software product to provide appropriate performance, relative to the amount of resources used, under stated conditions. **2002** Sikorski (from ISO 9126-1 (draft)) *Efficiency: The capability of the software product to provide appropriate performance, relative to the amount of resources used, under stated conditions.*

efficiency and effectivensss characteristics: Efficiency and effectiveness contribute to an organization's reduction of costs, professional appearance, reputation, and fostering of teamwork in its employees. **2003** Bose *GSS are a major IT component in many medium to large-sized organizations that have evolved and leveraged their computing technologies. As* *organizations grow in size and complexity it becomes more important to operate efficiently and as effectively as possible. These two characteristics contribute to an organization's reduction of costs, professional appearance, reputation, and fostering of teamwork in its employees.*

efficiency and effectiveness improvement capability: Capabilities of GSS that improve efficiency and effectiveness characteristics are group decision-making, communication, collaboration, knowledge sharing and distribution, idea generation or brainstorming and distance learning. **2003** Bose (from Stough et al. 2000) *GSS offer many capabilities to improve these characteristics, such as, group decision-making, communication, collaboration, knowledge sharing and distribution, idea generation or brainstorming, and distance learning.*

efficiency measure: Efficiency measures such as calendar time to decision. **1996** Hiltz et al. *Efficiency measures (eg. Calendar time to decision).* **1999** Gutwin and Greenberg (256) *Verbal efficiency - is a more direct measure of communiction. Each of the tasks requires that participants convey a certain amoun of information, but the number of words that a group uses to convey that information can vary. Therefore, the number of words spoken (on the subject of site location, for example) indicates how efficiently participants are communicating that information.*

EIES: See Electronic information exchange system.

Electronic Information Exchange System (EIES): EIES is a computerized conferencing system intended to allow both the facilitation of scientific and technical communications and experimentation and research into human information-communications cognitive processes. To meet the first objective EIES offers functional components of messaging, conferencing, notebooks and bulletins for its users" **1978** Turoff and Hiltz (659) *The subjective reactions of users of EIES to this form of communication and to specific features of the system have been reported elsewhere (Hiltz, 1978a, 1978b). In this paper, we wish to present data on usage patterns collected by the EIES monitoring system, and our interpretations of what these data show about adaptation to this form of human communication.* **1988** Whitescarver et al. U*ser functionality: Computer-Mediated Communications systems being developed at NJIT (EIES II and TEIES) reflect the hypothesis that the next generation of these systems need to be designed for everyday use. It is assumed that messaging and computer-based conferencing will serve as the principal communications medium in an organization.(p.262)* **1990** Hiltz *EIES is a computerized conferencing system intended to allow both the facilitation of scientific and technical communications and experimentation and research into human information-communications cognitive processes. To meet the first objective EIES offers functional components of messaging, conferencing, notebooks and bulletins for its users.* **1996** Hiltz et al. *EIES is a CMC enhanced with GDSS tools, that provides the foundation that allows continued evolution and the incorporation of additional functionality (Turoff 1991).*

electronic (callable) voting program: Callable voting program for interactive idea prioritization is a software planning model. **1986** Applegate et al. *Four software planning models are available to assist planners with the idea generation and analysis process. They are: (I) Electronic Brainstorming (group brainstorming version); (2) Electronic Brainstorming (individual brainstorming version); (3) Idea Structuring and Analysis; and (4) a callable voting program for interactive idea prioritization.* **1986** Kraemer and King *Voting systems allow for rapid identification of variance in participant attitudes on given issues. Anonymous voting helps reduce bias of dominant individuals in the group, and results are tabulated rapidly and displayed to a common screen in a summary format. Agreement and disagreement on issues is readily apparent. When confidence measurement is introduced to weight votes of individuals, greater interpretive information is available for assessing the meaning of the votes.* **1988** Dennis et al. *Examples of tools in the PLEXSYS toolkit include: ? Session director – guides the facilitator or group leader in selection of the tools to be used* *in a session and generates an agenda. Default times and output reports are listed and may be modified at the group's discretion. - Electronic brainstorming – supports idea generation, allowing group members to simultaneously and anonymously share comments on a specific question - Issue analyser – helps group members identify and consolidate key focus items resulting from idea generation. Support is also provided for integrating external information to support identified focus items - Voting – provides a variety of prioritising methods including Likert scales, rank ordering, and multiple choice. All group members cast private ballots. Accumulated results are displayed. - Topic commenter – supports idea solicitation and provision of additional detail in conjunction with a list of topics. Each topic may have subtopics. Participants enter, exchange, and review information on self-selected topics ? Policy formation – supports the group in developing a policy statement or mission through iteration and group consensus - Organizational infrastructure – provides support for capturing characteristics of organizational data sets, information systems, and structure to provide a foundation for impact analysis. - Stakeholder identification and assumption surfacing – is used to systematically evaluate the implications of a proposed policy or plan. Stakeholder assumptions are identified, scaled, and graphically analysed. - Alternative evaluator – provides multicriteria decision-making support. Alternatives can be examined under flexibly weighted criteria to evaluate decision scenarios and tradeoffs.***1990** Halonen et al. *Many Group Decision Support Systems (GDSSs), such as SAMM [4], provide voting and ranking tools that can be used to explore a group's consensus on issues.* **2001** Ackermann and Eden *GSSs in contrast focus on providing electronic brainstorming and electronic voting (Nunamaker et al. 1988) - features that are often also critical to the success of a GDSS.*

electronic brainstorming: This is a software planning model and idea generation technique. Electronic brainstorming can be a group or individual activity **1986** Applegate et al. (18) *Four software planning models are available to assist planners with the idea generation and analysis process. They are: (I) Electronic Brainstorming (group brainstorming version); (2) Electronic Brainstorming (individual brainstorming version); (3) Idea Structuring and Analysis; and (4) a callable voting program for interactive idea prioritization … While Electronic Brainstorming does appear to neutralize the group effects that have been suggested as inhibitors of idea generation during group brainstorming and to improve the efficiency of the session by allowing parallel process and automatic recording, specific aspects of the technology that tend to inhibit the idea generation process have been identified. These factors include: (I) the size of the computer screen, (2) the keyboard as an unfamiliar interface metaphor for some executives, and (3) the efficiency of the network in handling multiple, simultaneous file transfers.* **1988** Dennis et al. *Examples of tools in the PLEXSYS toolkit include: ? Session director – guides the facilitator or group leader in selection of the tools to be used in a session and generates an agenda. Default times and output reports are listed and may be modified at the group's discretion. ? Electronic brainstorming – supports idea generation, allowing group members to simultaneously and anonymously share comments on a specific question ? Issue analyser – helps group members identify and consolidate key focus items resulting from idea generation. Support is also provided for integrating external information to support identified focus items.* **2001** Ackermann and Eden *GSSs in contrast focus on providing electronic brainstorming and electronic voting (Nunamaker et al. 1988) - features that are often also critical to the success of a GDSS.*

Electronic Classroom: The Electronic Classroom allows the dissemination of instructional methods and procedures. It is an effective alternative to face-to-face instruction. Also see virtual classroom. **1988** Whitescarver (261) *Education (The Electronic Classroom): Electronic Classrooms- using tailorable features within CSCW networks is an effective alternative to face- to-face instruction [9]. This process is also applicable to dissemination of instructional methods and procedures.*

electronic conferencing:

electronic mail: Other terms are email, and e-mail. Electronic mail is a groupware application. Having the ability to send messages electronically to people connected, either via a local area network or wide area network around the world. Electronic mail lacks interactivity, temporal and spatial proximity of communicating individuals, and the ability to convey multiple cues. E-mail is, therefore a 'lean' medium in comparison to GSS. **1985a** DeSanctis and Gallupe *For dispersed groups, a local area network, telephone lines, satellite, or microwave relay may be required to allow group members to communicate with one another. Electronic mail, computer conferencing, audio and video conferencing might also be integrated into the GDSS environment.***1988** Kraemer and King *Communication software is specifically aimed at supporting the collaborative aspects of group work and includes tools for both local and long distance text, data, voice, and video transmission (eg. Electronic chalkboard, electronic voting, networking, electronic mail, computer conferencing) among local and distant group members, between group members and the facilitator, and between group members and the central processor.* **1992** Bannon (10) (from Bannon 1986). *Electronic mail: to some people, electronic mail is seen as the clearest example of a groupware application that has made a significant impact in the work place. Having the ability to send messages electronically to people connected either via a local area network or a wide area network around the world has undoubtedly given new opportunities for forms of remote collaboration undreamt of in the past.* **1997** Hofstede et al. (1) *Asynchronous groupware includes collaborative writing, World Wide Web, and electronic mail. For these, transmission speed is no longer a problem.* **1998** Hein et al. *Asynchronous collaboration simply means that the users are not instantly communicating. Rather, each will send a message or reply to a previous message at any particular time. E-mail is a common and very precise example of asynchronous collaboration.* **1998** Townsend et al. (26) *Communicative protocols (eg. Telephones, DVCS, electronic mail, and Internet/Intranets).* **1998** Dennis et al. *E-mail and, by extension, listservs enable individuals to send electronic messages to others or to entire groups of other users. Communication is sequential and generally unstructured.* **1999** Shirani et al. E*lectronic mail lacks interactivity, temporal and spatial proximity of communicating individuals, and the ability to convey multiple cues. E-mail is, therefore a 'lean' medium in comparison to GSS.* **2000** Stough et al. *Electronic mail (e-mail): This is the most pervasive and successful form of person-to-person groupware. Anyone who has an e-mail address can send electronic mail to anyone with an e-mail address on any computer in the world connected to a computer network. E-mail capability has also become an essential element in many commercial groupware products.*

electronic meeting system (EMS): Electronic meeting systems is an umbrella term to include GDSS, and GSS. Electronic meeting system is a category of real-time conferencing systems (local and remote) as well as collaborative presentation systems. Electronic meeting systems are a combination of GSS and CSCW. **1988** Dennis et al. *A combination of GSS and CSCW. …EMS are more than group decision support systems: they support more tasks than just decision making; they focus on communication. They move beyond the GDSS decision room, where groups must meet at the same time in the same place, to meetings that can be conducted across time and space … There are three parts to the EMS concept: group process and outcomes, methods, and environment (Figure 2).* **1988** Bostrom and Anson *Attributes of the CWSS supported meeting environment can contribute to design team effectiveness in a number ways (see Table 2). 1) Anonymity can help overcome inhibftions of users and/or analysts to participate. Thus the CWSS supports an interactive design strategy, facilitating with higher user and analyst influence which Henderson (1987) found to positively impact team perfor- mance. 2) Simultaneity can improve the efficiency of generating ideas or judgments and processing information during design team meet- ings. With improved efficiency, more individuals can be actively involved. It can also prevent individuals from dominating the group interaction so that more points of view can be expressed. 3) Process structuring techniques are supported which can im- prove group creativity and facilitate agenda control of meetings. Given the diversity of information* *contained in the LSD, it is impor- tant that the team devote sufficient attention to each area and not wander ranomly from topic to topic. 4) Electronic recording and display of information generated during a meeting provides a complete record of what took place. Original and subsequent versions of ideas are stored so that information loss is minimized. In its electronic form, the information may be used as input to other special purpose software, such as CASE tools, (and vice versa), for further manipulation after the meeting. 5) Improved processing capacity* **1990** Greenberg and Chang *Consider the Capture Lab, a computer-supported meeting room whose construction emphasised the need for careful design of all aspects of the room (Mantei, 1988; EDS, 1988).***1991** Nunamaker et al. *Electronic Meeting System has emerged which strives to make group meetings more productive by applying information technology. EMS technology is designed to directly impact and change the behavior of groups to improve group effectiveness, efficiency, and satisfaction.* **1992** McLeod and Liker *Electronic meeting systems feature: Any EMS is a bundle of tools and characteristics, and for the most part research has not unbundled these characteristics (Jarvenpaa_etal1988, Easton_etal1990 for exceptions). A particular EMS may offer both low structure and high structure tools. For example, Nunamaker et al.1991 describe GroupSystem's Electronic Brainstorming tool as providing low task structure, while the Topic Commenter tool provides high task structure. In our characterization of particular EMS as high or low structure we consider the net effects of the system intended by its designers … Low and High structure EMS - the preponderance of influence that technology and groups exert on each other. High structure EMS attempts to directly influence group structure and processes through explicit rules and procedures embedded in the software. Low structure EMS do not explicitly build in rules or procedures that govern group interaction. Low structure EMS are hypothesized to increase task focus through the use of shared flexible software tools and shared views of joint work.* **1996** Hiltz et al. *One form of computer based system to support collaborative work ("groupware;" Johnson-Lenz, 1982; Ellis et al.1991) is most often called a Group Support System, or GSS. Other terms include "Group Decision Support Systems" (GDSS): (DeSanctis & Gallupe, 1987) and "Electronic Meeting Systems" (Nunamaker et al, 1991).* **1998** Hein et al. (from Coleman 1997) *Electronic meeting system is a category of real-time conferencing systems (local and remote) as well as collaborative presentation systems.* **1998** Pervan (11) *GSS factors: Two dimensions of the GSS environment were considered. First, the type of GSS support may be (a) Electronic Meeting Systems (EMS) where participants have individual computer-based support all networked together, (b) Group Decision Systems (GDSs), sometimes called Decision Conferencing, where computer support is provided by a single workstation operated by a member of the facilitation team [41], or (c) Negotiation Support Systems (NSS), which are computer-based systems for the support of parties involved in a negotiation process. Second, the time/place combination may be face-to-face (the 'decision room') , asynchronous but in different places eg. Teleconferencing and videoconferencing), ansynchronous but in the same place (Local decision network), or asynchronous and dispersed (remote decision making).* **2000** Stough et al. (from Dennis et al. 1988) *Electronic meeting system: an umbrella term to include GDSS, GSS, CSCW. EMS Concept* **2003** Corbitt and Martz (from DeSanctis and Gallupe 1985) *GDSS: Originating in 1985 under the label Group Decision Support Systems (GDSS) (DeSanctis and Gallupe, 1985), this category of groupware is known under several aliases including Group Support Systems (GSSs), Collaborative Group Technology (CGT), Electronic Meeting Systems (EMS) and Computer-Mediated Communication.*

electronic message system: Electronic messaging system is one of four classes of CSCW systems. The other three classes are conferencing systems, meeting systems and co-authoring systems. **1983** Murrel *There is evidence that computer message systems affect equality of participation, group structure and consensus.* **1996** Barua et al. (4) (from Rodden 1991) *Group work: is based on spatial (local or remote) and temporal relationships (asynchronous or synchronous), analogous to geographically scope and real-*

time ability. He further uses this relationship to separate CSCW systems into four classes, messaging systems, conferencing systems, meeting systems and co-authoring systems.

electronically supported meeting: see Electronic meeting system.

email: is CSCW technology . See electronic mail.

embedded link: Hypertext systems provide some very general representational tools such as topic structures in computer conferences or embedded links between documents. **1986** Malone et al. (102) *Most previous systems for supporting group work can be thought of as belonging to one of two categories. In one category, are forms processing, calendar management, and other systems that contain a great deal of formalized knowledge about the application domains they are intended to support (e.g., Greif, 1982 Ellis & Bernal, 1982; Fox et al, 1983; Sluizer & Cashman, 1985). In the other category are electronic mail, computer conferencing, and hypertext systems that provide some very general representational tools (such as topic structures in computer conferences or embedded links between documents) and very little other formal knowledge about their domains (e.g. Engelbart & English, 1968; Hiltz & Turoff, 1978 Trigg, Suchman, & Halasz, 1986).*

emergence: Emergence where the participants' shared understanding develops gradually as they interact with each other and the source material. Emergence is a characteristic of the process by which the group interprets and transforms these initial raw fragments into the rich final descriptions. **2000** Cox and Greenberg (189) *Emergence, where the participants' shared understanding develops gradually as they interact with each other and the source material.***2000** Cox and Greenberg (290) *Emergence is a characteristic of the process by which the group interprets and transforms these initial raw fragments into the rich final descriptions. Moran Chiu and van Melle [15] characterize emergence as the observation that: ideas do not arise well formed. At least there are expressions of fragments of thoughts. Once there is some rough material to work with, interpretations gradually begin to emerge as they are discussed [15, p.46] … Edmonds, Moran, and Do [6] elaborate: Emergence happens usually after a long period of evolution in a design process. It is sometimes a background process, a change of attitude or getting information about a new aspect of attitude for perception and interpolation or shifting context and paradigm. It sometimes involves revisiting old ideas and seeing the breakthrough, to see new possibilities emerge. (p.2)*

empowered leader: Empowered leader: a leader with a democratic power orientation and a low level of involvement who exhibits behaviours such as presenting a living model of self-regulation, acting as a boundary spanner, ad assisting team members in obtaining resources. **1998** Oakley (from Stewart and Manz 1995) *Empowered leader: a leader with a democratic power orientation and a low level of involvement who exhibits behaviors wuch as presenting a living model of self-regulation, acting as a boundary spanner, and assisting team members in obtaining resources.*

EMS: see Electronic Meeting Systems.

EMSS: Electronic meeting support system (EMSS). see Electronic meeting system (EMS). **1991** Applegate *EMSS is a technology used to support group communication, information sharing, and process during face-to-face (same time/same place) meetings.*

energizing element: A category that impacts facilitator meetings **1992** Lewis and Whiteley. *Facilitator impact categories were generated by facilitators. They included: facilitator comfort, the energizing element (is it depleted or enhanced through GDSS); group temperament or ambience, and the use of humour in the group; control.*

environment: Environment includes software and hardware that sets the context for interaction. Hardware can include specially designed furnishings and architectural spaces that are considered integral to correct utilization of a given software application. **1992** Gaver (17) *Affordances offered by media space systems for perception and interaction. Affordances are* *properties of the environment that offer actions to appropriate organisms (Gibson, J.J. 1979).* **1996** Kurser *Environment includes software and hardware that sets the context for interaction. Hardware can include specially designed furnishings and architectural spaces that are considered integral to correct utilization of a given software application.* **1998** Jarvenpaa and Leidner (from DeSanctis and Poole 1987) *Global implies culturally diverse and glovally spanning members that can think and act in concert with the diversity of the global environment.* **1999** Bowers and Martin (19) *Cyberspace: Virtual environments*

environmental anonymity: Environmental anonymity refers to the extent to which environmental factors affect the anonymity of the communication system. These factors include such elements as: the number of individuals involved in the communication session, the proximity of these individuals, and the level of inter-group familiarity. **1998** Gavish and Gerdes *Environmental anonymity refers to the extent to which environmental factors affect the anonymity of the communication system. These factors include such elements as: the number of individuals involved in the communication session, the proximity of these individuals, and the level of inter-group familiarity.*

environmental characteristic: Also referred to as context characteristics. Environmental characteristics include setting (to include ergenomics), scheduling, length of session, organizational context (organizational culture, time pressure, evaluative tone, reward structures) and spatial arrangements. **1986** Applegate et al. (17) *A large U-shaped table is equipped with networked microcomputers that are recessed into the table to facilitate interaction among participants. A microcomputer attached to a large screen projection system is also on the network which permits display of work done at individual workstations or of aggregated information from the total group. Break-out rooms are equipped with microcomputers that are networked to the microcomputers at the main conference table.* **1987** Jelassi and Beauclair (147) *While GDSS developers are trying to design systems that will help structure the group process, it is important to acknowledge briefly the characteristics that decision makers bring with them to the decision making environment (10, 27). These include: (1) Individual characteristics of each group member (eg. personality, sex, age, race, status, socio-economic background, competence, and motivation); (2) Group characteristics (eg political orientation, leadership, complexity of the task and circumstances, size of group, and history of its members); and (3) environmental characteristics (eg. setting, scheduling, length of a session, organizational context, and spatial arrangement).* **1988** Dennis et al. *As a category, group process and outcomes encompasses several different constructs. These include the characteristics of the group itself the characteristics of the task on which the group is working, the organizational context in which system use takes place, the process through which the group utilizes the system, and the outcomes resulting from system use … Ergonomics: Ergonomics issues include characteristics of the room, such as heat, sound, lighting conditions, and seating, where the group decision making takes place. Ignoring the impact of the setting may destroy the very nature of the fragile environment in which successful group decision making is facilitated. Aesthetics that provide a measure of executive appeal in terms of comfort and familiarity allow decision makers to better focus on issues at hand. Carpeting, wall coverings, and furniture appropriate to organizational conference rooms provide a setting where decision makers can comfortably relate to complex organizational questions.* **1991** Nunamaker et al. *Context characteristics include organizational culture, time pressure, evaluative tone (eg. Critical or supportive), reward structure (eg. Non versus individual versus group) etc.*

environmental contingency: Three environmental contingencies have been identified as critical to GDSS design: group size, member proximity or communication condition, and the task confronting the group. **1987** DeSanctis and Gallupe *Three environmental contingencies are identified as critical to GDSS design: group size, member proximity, and the task confronting the group.* **1991** Nunamaker et al. *Contingency model which hypothesizes that process and outcomes depend upon the interaction of four sets of characteristics: context,* *group, task and EMS.* **1992** Galegher and Kraut *According to Contingency theory, tasks involving high levels of uncertainty and equivocality require a communication medium that permits interactive, expressive communication.* **1994** Galegher and Kraut *The essence of contingency theory is its claim about the importance of the task/technology fit.* **1996** Hiltz et al. *Types of contingencies: communication condition (face to face or dispersed - we extend this to include synchronous vs asynchronous); group size and task type.*

environmental decision room characteristic: These include a large U shaped conference table, networked micro computers, large screen projection system and break-out rooms **1986** Applegate et al. *A large U-shaped table is equipped with networked microcomputers that are recessed into the table to facilitate interaction among participants. A microcomputer attached to a large screen projection system is also on the network which permits display of work done at individual workstations or of aggregated information from the total group. Break-out rooms are equipped with microcomputers that are networked to the microcomputers at the main conference table.* **1986** Bui and Jarke *For example, decision room GDSSs using personal terminals and a public screen have been shown to make certain types of decision meetings more effective [14, 16, 17].* **1987** DeSanctis and Gallupe *The organization sets up a room (much like a boadroom) with special facilities, such as a horseshoe-shaped table facing a large screen, with a display monitor and data input device available for each participant. Group member communications may be transmitted verbally or via electronic messaging.* **2001** Carneiro *The typical GDSS for face-to-face meetings are decision rooms where the group members use workstations to interact at the same time and in the same place (Turban, 1995; Lewis, 1987).*

erasing: Erasing is a manipulation feature of graphics editors. Graphics editor manipulation includes: generating, moving, modifying and erasing text-graphic objects. **1986** Lakin *Manipulation includes generating, moving, modifying and erasing text-graphic objects.*

evaluation: Evaluation is a phase of the collaboration process. Evaluation is when ideas are assessed, and ambiguity is reduced. The other two phases are invention and action. **1986** Johnson et al.(349) *Coordinator in stages of collaboration I . Overview We can characterize the process of collaboration through phases "invention" (ideas are generated; structuring of roles becomes clearer), "evaluation" (ideas are assessed; ambiguity is reduced); "action" (commitments of who does what are made and fulfilled or not). We will consider the experiences of these two quite different project groups in using the Coordinator for each of these activities.*

evaluation of contribution: Evaluation of contributions or evaluation of ideas, is a step in the problem-solving process. The evaluation of contributions can be a barrier to group work as it may inhibit group contributions from low status participants (This is referred to as negative evaluation apprehension, or unequal consideration of ideas). **1984** Huber (200) *…any step of the problem-solving process: problem sensing, problem exploration, problem definition, criterion and constraint identification, proposal generation, proposal evaluation, choice, implementation, and performance evaluation.* **1985a** DeSanctis and Gallupe *A variety of decision making approaches could be used, such as ordinary group process or Nominal Group Technique, but essentially the process would involve using the GDSS to show the decision makers the current situation in terms of markets and finances, etc. and to facilitate the generation and evaluation of ideas.* **1987** DeSanctis and Gallupe *In the case of CHOOSING tasks, where alteranatives are known and in need of evaluation by group members, the objectives of GDSS technology should be to aid in the selection of either the correct solution (in intellective tasks) or the socially preferred solution (for preference tasks).* **1990** Connolly et al. *On the negative side, working in a group might inhibit a contributor who anticipated embarrassment, hostile evaluation, conformity pressures or other punishments for proposing an unusual idea (Collaros and Anderson, 1969).* **2001** Dennis and Wixom *Parallelism is the ability of group members to simultaneously enter information. No participant needs to wait for others to finish before contributing information. The need to wait to speak (termed production blocking) has been identified as* *a major cause of poor performance in verbally interacting groups [16, 30]. Parallelism mitigates production blocking resulting in process gains [20, 46]. Anonymity, on the other hand, enables group members to contribute comments without being identified, which may increase the motivation to participate. Without anonymity, individuals, particularly low status participants, may withhold ideas due to negative evaluation apprehension [16, 30] or may feel pressured to conform to the group majority or senior participants' views [24]. Anonymity reduces the reluctance to contribute information, because it shields the contributor from group reaction and deindividualizes the interaction [7].*

***evaluation stage*:** This is a stage of organizing ideas which could be undertaken using a meeting tool known as Cognoter. **1986** Foster and Stefik (12) *In the evaluation stage the final form of the presentation is determined. In this stage the participants prepare the complete organization of the paper or talk. Participants should review the overall structure, reorganizing the ideas as needed, filling in missing details, and putting aside peripheral and irrelevant ideas. Critical analysis, deletion, and outline generation are best considered after brainstorming and ordering are mainly complete.*

evolution: A CMC factor relating to atmosphere. Evolution is the ability of the system to change through feedback from its user community. **1981** Turoff et al. (92-93). *Computer mediated communication systems: System factors: A. Atmosphere Sense of community: The ability of the system to provide features, such as membership and interest directories, which allow users to form communities of interests as needed. Evolution: The ability of the system to change through feedback from its user community.*

explicit communication: Explicit communication is communication that is intentional and planned. **2001** Potts-Steves et al. *Explicit communication – group members must be able to provide each other with information. Verbal, written, and gestural communication are cornerstones of collaboration.* **2002** Pinelle et al*. Explicit communication is communication that is intentional and planned.*

explicit group memory: Explicit group memory means that the display provides a lingering representation of the task state **1986** Lakin (256) (from Ball and Gilkey 1972) *The display provides a lingering representation of the task state.*

explicitness: Explicitness is a usability dimension. **2003** Siao (from Ravden and Johnson [32]) *Ravden and Johnson (32) proposed another version of nine dimensions for usability. They are visual clarity, consistency, compatibility, informative feedback, explicitness, appropriate functionality, flexibility and control, error prevention and correction, and user guidance and support.*

exploration and brainstorming meeting: Exploration and brainstorming meeting is a meeting type. The meeting types are distinguished by their main goals or purpose. The other types of meetings are information sharing or presentation meetings, problem solving or decision making meetings, negotiation or resources allocation meetings, and morale building or social structuring meetings. **1986** Begeman et al. *Meeting Types include: 1. Exploration and Brainstorming meetings, 2. Informational or Presentational meetings, 3. Problem Solving or Decision Making meetings, 4. Negotiation or Resource Allocation meetings 5. Morale Building or Social Structuring meetings.* **1987** Cook et al. *There are also a variety of meeting types, distinguished by their main goals or purpose: 1. exploration and brainstorming meetings, 2. information sharing or presentation meetings, 3. problem-solving or decision-making meetings, 4. negotiation or resource allocation meetings, and 5. morale building or social structuring meetings.*

exposure: Exposure to new technology. There are three kinds of exposure: testimony, observation and experience. **1998/9** Briggs et al. *People develop their attitudes toward a new technology based on their exposure to it. We identified three kinds of exposure: testimony, observation, and experience. Testimony may be as informal as a conversation at a water cooler or as formal as a refereed academic article. Observation may range from a* *glimse of a video clip to several days of watching over people's shoulders as they use the technology. Experience may range from a few minutes of hands-on playing to days of intensive use for mission-critical applications.*

face to face: A communication medium or mode. See face to face communication.

face to face communication: Face to face communication is a 'mode' or 'medium' of communication. Normal face to face (FtF) medium of group discussion is where participants communicate by talking, listening and observing non-verbal behavior, and where there is no lag between the sending and receipt of communication signals. Face to face is a characteristic of a decision room. **1980** Hiltz et al. (75) *How does this form of communication change the process and outcome of group discussions, as compared to the "normal" face to face (FtF) medium of group discussion, where participants communicate by talking, listening and observing non-verbal behavior, and where there is no lag between the sending and receipt of communication signals? … The experiments thus had a 2 x 2 factorial design (see figure one). The factors were mode of communication (face-to-face vs. computerized conference) and problem type (human relations vs. a more "scientific" ranking problem with a correct answer). These factors constituted the "independent variables." Each problem-mode condition included a total of eight groups.* **1988** Ciborra and Olson *The communication structure described above is not necessarily electronic. The physical proximity of team members and availability of channels determine the medium: face-to-face, telephone, memo, electronic mail, etc.* **1990** Greenberg and Chang *General computer support for four styles of real- time interactions are distinguished and surveyed: 1) face to face meetings; 2) remote conferencing; 3) casual real time interaction; and 4) multi-user applications. Each topic is introduced, motivations discussed, and the key technical systems and related research described.* **1996** Hiltz et al. *Modes of communication (asynchronous computer-mediated communication (CMC) vs. face-to-face).* **1999** Furst et al. *Co-located collectivities are those groups or teams whose members are within close proximity of each other and for whom the dominant mode of communication is face-to-face. Members of co-located groups or teams typically work in the same physical location or come together regularly and frequently to meet in the same location.* **2003** Pauleen (from Ngwenyama and Lee 1997) *Rich channels, such as face-to-face and video conferencing, enable rapid feedback, the use of varied social cues and personalization of use, helping to resolve equivocality.* **2003** Pollard *Communication channels. Two types of communication channels have been influential in diffusing technology - mass media channels, defined by Rogers (1995) as: all those means of transmitting messages that involve a mass medium, such as radio, television, newspapers, and so on, which enable a source of one or a few individuals to reach an audience of many. and interpersonal channels, defined as: "face-to-face; telephone; personal memo". In his review of innovation diffusion,*

facilitation: Facilitation is a dynamic process that involves: managing relationships between people, tasks and technology, structuring tasks, and contributing to the effective accomplishment of meeting outcomes. Facilitation is a combination of technical and social abilities. Facilitation has two key dimensions: process facilitation and content facilitation. **2001** Antunes and Ho *The second role regards facilitation as a combination of technical and social abilities … The final facilitation role concerns group development … Miranda and Bostrom (1999) also defined a framework were facilitation is divided between process and content facilitation.* **2001** Dennis and Wixom *Facilitation has two key dimensions: process facilitation and content facilitation [4, 35]. Process facilitation attempts to help the group in structuring the process by which it uses the available GSS tools. Content facilitation attempts to improve task performance directly by offering insights, interpretations, or opinions about the task and various decision alternatives available to the group.* **2003** Hostager (75) *Most researchers agree that facilitation is a dynamic process that involves: 1) managing relationships between people, tasks and technology, 2) structuring tasks, and 3) contributing to the effective accomplishment of meeting outcomes.*

facilitation mode: There are three facilitation modes: the user driven mode, the chauffeur-driven mode, and the facilitator-driven mode. **2001** Antunes and Ho (from Dickson et al. 1993) *Others (Dickson et al. 1993) categorized different facilitation modes: the user-driven mode is associated to the absence of a formal meeting facilitator by making the GDSS functionality available to all group members, the chauffer-driven mode supports the intervention of a facilitator in order to manipulate the technology but not the decision process and, finally, the facilitator-driven mode considers that the facilitator influences the group on how to use the technology.*

facilitation role: Facilitation is a combination of technical and social abilities. Facilitation role: A dynamic process that involves managing relationships between people, tasks and technology, as well as structuring tasks and contributing to the effective accomplishment of the meeting's outcome. The facilitation role also concerns group development. GSS Facilitation is a complex role involving myriad tasks and responsibilities. Two forms of facilitation roles in a GSS context are: (1) technical facilitation operating the GSS technology in a smooth, seamless and adept manner, to ensure the task is completed in an efficient and technically proficient manner, and (2) group process facilitation-supporting and guiding the unfolding group interaction in a manner that draws upon the human resources at hand, maximizing positive group dynamics and channelling conflict in constructive ways. **2001** Antunes and Ho *The second role regards facilitation as a combination of technical and social abilities … The final facilitation role concerns group development.* **2002** DeVreede et al. (from Clawson et al. 1993) *Facilitation role has been defined as a dynamic process that involves managing relationships between people, tasks and technology, as well as structuring tasks and contributing to the effective accomplishment of the meeting's outcome*. **2003** Hostager (from Griffith et al.1998) *GSS Facilitation is a complex role involving myriad tasks and responsibilities. Griffith, Fuller and Northcraft (1998) identified two forms of facilitation roles in a GSS context: (1) technical facilitation operating the GSS technology in a smooth, seamless and adept manner, to ensure the task is completed in an efficient and technically proficient manner, and (2) group process facilitation-supporting and guiding the unfolding group interaction in a manner that draws upon the human resources at hand, maximizing positive group dynamics and channelling conflict in constructive ways.*

facilitation task: Facilitation task, encompasses social and technical abilities, analysis and synthesis skills, and making use of planning and flexibility, which opens multiple opportunities for computational support. **2001** Antunes and Ho *Facilitation is a complex task, encompasses social and technical abilities, analysis and synthesis skills, and making use of planning and flexibility, which opens multiple opportunities for computational support.***2001** Antunes and Ho (from Clawson et al. 1995) *Several authors rely on a timing dimension where facilitation is divided in pre-meeting, meeting and post-meeting stages (Bostrom et al. 1993; Clawson et al. 1995).*

facilitator: Facilitator or leader: One who is leader charged with keeping the meeting balanced and on a correct course, and a recorder who maintains and makes publicly visible, the group memory .The person who chairs an electronic meeting. This person may be the group leader, another group member, or a separate, neutral individual who is not a group member. The facilitator is the person performing the non-technical functions. The facilitator provides an open environment for discussion and combats social-loafing through encouraging those naturally less outspoken members to contribute through structured or unstructured means, and ensures the focus of the group is maintained on the issue at hand. **1984** Huber (198) *…if the group "facilitator" or the system "chauffeur" of a GDSS gets stuck…* **1986** Begeman et al. (5) *For example, the interaction method of meeting [DOYL85] suggests that there should be a facilitator, who is a leader charged with keeping the meeting balanced and on a correct course, and a recorder who maintains, and makes publicly visible, the group memory. Other options may imply that, rather than restricting access to the group memory and the public display, equal access for all might be preferred. Within all of these* *structures, the types of information that may be presented, manipulated, and captured during a meeting can be categorized according to the amount of its structure (binary, structured, or unstructured), and according to the degree of sharing (private, subgroup, or public).* **1992** Lewis and Whiteley. *Whilst there is no dearth of advice and information on professional facilitator roles, styles, and models (1, 3, 22), the usual assumption in the organizational development and management literature is that "humanware" rather "groupware" will be the modus operandi. If advantage is to be taken of the opportunity for partnership with GDSS in a synergistic relationship, then the current role of the process consultant or facilitator needs to be investigated, informed, and adjusted as new research findings become available.* **1997** Nunamaker et al. *Facilitator or leader: The person who chairs an electronic meeting. This person may be the group leader, another group member, or a separate, neutral individual who is not a group member.* **1996** Gavish et al. *Facilitator. The support functions may be broadly divided into technical and non-technical. The technical functions include the operation of computers, ensuring network connectivity, and the use of the GDSS software. The non-technical functions include moderating group discussion, administering the meeting protocols, and guiding the group members toward accomplishment of the task. Typically, the person performing these non-technical functions is called the facilitator.* **2001** Antunes and Ho (from Clawson and Bostrom 1993) *Clawson and Bostrom (1993) and Clawson et al. (1993) assessed the roles of the human facilitator and provided empirical evidence that planning the meeting is one of the most critical roles.* **2001** Pauleen and Yoong (from Kimbal 2000) *The role of the team facilitator is to move the team towards its objectives by encouraging collaboration. This is done through a sustained process of relationship building, idea generation, prioritisation and selection.* **2003** Wood and Blyth *The facilitator, where possible, provides an open environment for discussion and combats social-loafing through encouraging those naturally less outspoken members to contribute through structured or unstructured means, and ensures the focus of the group is maintained on the issue at hand.*

facilitator characteristic: Facilitator characteristics include demographics, training and experience. **2003** Lester et al. (from Niederman and Volkema 1999) *Niederman and Volkema (1999) investigated the impact of facilitator characteristics (i.e., demographics, training, and experience) on GSS usage and management In this study we used the same trained, experienced facilitator to lead all groups, but we manipulated the facilitator's style.*

facilitator comfort: Facilitator comfort means a feeling of being at ease with the process. Facilitator comfort is one of the impact categories identified by facilitators. The other impact categories were: energizing element, group temperament, ambience, group humour, control, time, system control, and anonymity. **1992** Lewis and Whiteley *Several prominent impact categories were generated by facilitators (see Table 3). They included: facilitator comfort (a feeling of being at ease with the process) and the energizing element (is it depleted or enhanced through GDSS?); group temperament or ambience, and the use of humor in the group; control (does the facilitator lose any of it to the technology?). Additionally, time, or the response to having it controlled by a system caused enough comment to warrant further investigation. One of the central features of MeetingWare is the ability to preserve anonymity of ideas as individuals privately "talk" to the keyboard instead of upfronting before a group of colleagues.*

facilitator function: Facilitator function could also refer to facilitation roles. Facilitator functions include providing technical support by initiating and finishing specific software tools, chairs the meeting, maintaining and updating the agenda, assists in agenda planning, and finally, providing organisational continuity, setting rules and maintaining an organisational repository.**2001** Antunes and Ho (57) (from Nunamaker et al. 1997) *According to Nunamaker et al.(1997) the human facilitatorexecutes four functions: (1) provides technical support by initiating and finishing specific software tools; (2) chairs the meeting, maintaining and updating the agenda; (3) assists in agenda planning, and finally,* *(4) provides organisational continuity, setting rules and maintaining an organisational repository.*

facilitator model: Facilitator models are the procedures that facilitators follow. **1992** Lewis and Whiteley *Whilst there is no dearth of advice and information on professional facilitator roles, styles, and models (1, 3, 22), the usual assumption in the organizational development and management literature is that "humanware" rather "groupware" will be the modus operandi. If advantage is to be taken of the opportunity for partnership with GDSS in a synergistic relationship, then the current role of the process consultant or facilitator needs to be investigated, informed, and adjusted as new research findings become available.*

facilitator role: see facilitation role

facilitator skills: Facilitator skills decline if they are not utilized. **1984** Huber (198) *The first follows from the previous idea; because user skills (ie. Facilitator skills, chauffeur skills, and participants skills) decline if they are not utilized,*

facilitator strategy:Facilitator strategies will include the selection and use of appropriate communication channels, appropriate message content, level of relationship between the facilitator and the team members, team member selection and training, organisational and HR policies, team's desired task outcomes and biases towards communication channels. **2001** Pauleen and Yoong *Facilitator strategies will include the selection and use of appropriate communication channels and appropriate message content. The level of relationship between the facilitator and team members necessary to accomplish the team's task is one of the key determining factors in creating a facilitator's strategy. Other important factors in determining facilitator strategies, some of which are alluded to in this paper, include issues concerning team member selection and training, organisational and HR policies, as well as the team's desired task outcomes and biases towards communication channels, particularly in global virtual teams.*

facilitator style**:** Facilitator style, the extent to which the facilitator's behaviours are representative of a leader who places a priority on managing the relationship present within a group setting or of a leader who concentrates on the task at hand. Facilitator style could be task-oriented or relationship-oriented. **1992** Lewis and Whiteley *Whilst there is no dearth of advice and information on professional facilitator roles, styles, and models (1, 3, 22), the usual assumption in the organizational development and management literature is that "humanware" rather "groupware" will be the modus operandi. If advantage is to be taken of the opportunity for partnership with GDSS in a synergistic relationship, then the current role of the process consultant or facilitator needs to be investigated, informed, and adjusted as new research findings become available.* **2003** Lester et al. *By facilitator style, we are referring to the extent to which the facilitator's behaviors are representative of a leader who places a priority on managing the relationships present within a group setting or of a leader who concentrates on the task at hand. This study investigates the effects of facilitator style (task-oriented vs. relationship- oriented) and participant mood (positive and negative affect) on multiple measures of Group Support Systems (GSS) satisfaction and effectiveness … This research suggests that a relationship-oriented facilitator style is positively related to five (of six) GSS satisfaction measures--satisfaction with facilitator, agenda, software, task, and process. Positive participant mood at the outset of a GSS meeting is positively related to four measures of satisfaction--satisfaction with facilitator, task, process, and outcome. Surprisingly, negative mood did not adversely affect participant satisfaction as was expected.*

flaming: Flaming behaviour – rude, impulsive messages and expressions of extreme views. Flaming is a group loss issue. **1988** Dennis et al. *In general, the results of such experiments suggest that groups using computer conferencing (or LADN), in comparison to conventional face-to-face groups (FTF), generate decisions of equal quality, are less likely to reach consensus, take longer to reach a group decision, are more likely to participate equally, and are more likely to engage in non-task behavior such as "flaming" although*

Turoff and Hiltz (1982) found face-to-face groups more likely to engage in tension release behavior … Three of the five studies that looked at time to decision found that GDSS users took longer to reach a decision. The other two studies found no differences. The four studies that measured satisfaction with outcomes also had mixed results: two found higher levels of satisfaction, one found lower levels, and one found no differences. The two studies investigating consensus produced inconsistent findings as well: one found no effect and the other found consensus less likely among GDSS groups. And finally, the only study out of these 10 that investigated "flaming" found that there were no differences between GDSS and non-GDSS groups in the number of uninhibited comments they produced **2002** Handel and Herbsleb *Flaming behaviour – rude, impulsive messages and expressions of extreme views.*

flexibility (1): Flexibility is a usability dimension. **2003** Siao (from Guillemette in Carey 1991) *The usability of a system is a multidimensional construct (13). Guillemette (16) listed nine dimensions of usability: ease of learning, ease of use, task orientation, self-description, predictability, fault tolerance, flexibility, user control, and friendliness. … Ravden and Johnson (32) proposed another version of nine dimensions for usability. They are visual clarity, consistency, compatibility, informative feedback, explicitness, appropriate functionality, flexibility and control, error prevention and correction, and user guidance and support.*

flexibility (2): Flexibility is a facilitation skill. **2001** Antunes and Ho *Facilitation is a complex task, encompassing social and technical abilities, analysis and synthesis skills, and making use of planning and flexibility, which opens multiple opportunities for computational support.*

flexibility and variety: Interactive system characteristic related to adaptability. **1981** Turoff et al. (91) *The ability of users to tailor the system to their own style of interaction in carrying out tasks.* **2003** Siao (from Guillemette in Carey 1991) *The usability of a system is a multidimensional construct (13). Guillemette (16) listed nine dimensions of usability: ease of learning, ease of use, task orientation, self-description, predictability, fault tolerance, flexibility, user control, and friendliness.* **2003** Siao (from Ravden and Johnson 1989) *Ravden and Johnson (32) proposed another version of nine dimensions for usability. They are visual clarity, consistency, compatibility, informative feedback, explicitness, appropriate functionality, flexibility and control, error prevention and correction, and user guidance and support.*

flexible: Flexible is used as a required characteristic of a user interface. **1985a** DeSanctis and Gallupe *Software The software components of the GDSS include a database, a model base, specialized application program(s) to be used by the group, and an easy-to-use, flexible user interface.* **2001** Carneiro *… an easy-to-use, flexible interface - allows presenting the relationships and the data in a simple format that is understandable for the participants making the decisions*

floor control: Floor control sometimes referred to as access control. **1986** Greif and Sarin (199) *Control over sharing: Two critical issues in managing shared data for CSCW are access control and synchronization of concurrent actions.* **1989** Ellis and Gibbs *Single Active Participant. Some real-time computer-conferencing systems are intended for situations where only one participant at a time "has the floor" [Lant86]. Access to the floor may be controlled by software or through an external protocol (for example, verbal agreement by the participants).* **1990** Lauwers and Lantz *The conference agent is also responsible for: 0 floor control: Processing user input with respect to whether or not that user is currently authorized to generate input for a particular application or applications ... l workspace management: Determines the manner in which shared windows are "grouped" within the shared workspace, including window layout ... l dynamic reconfiguration: Handling latecomers and the departure of participants prior to termination of the conference ... l secretarial functions: These include conference initialization and termination, pre- staging,* *and logging. Architecturally, one can think of these functions as be- ing provided by a conference secretary module … Floor control is an extremely contentious area of debate, with policies ranging from permitting only one person at a time to control the entire shared workspace, to running "open floor" with anyone generating input at any time to any window. These policies can be characterized along three dimensions: 1. the number of floors-one for the entire conference, one per shared application, or one per window; 2. the number of people who can "hold" a floor at the same time; and 3. how the floor is passed (or handed off) between floor holders. This includes the potential use of auxiliary communication channels, specifically audio.* **2001** Baker et al. (9) *To assist with social protocols, technical measures such as access control, concurrency control, undo, version control, and turn-taking have been implemented.*

focus theory of group productivity: (Briggs et al.1998)

forgiveness and recovery: Interactive system characteristic related to error control. Forgiveness and recovery is the ability of the system not to penalize users unnecessarily for mistakes and to provide mechanisms to easily recover from errors. **1981** Turoff et al. (91) *Error Control Forgiveness and recovery: The ability of the system not to penalize users unnecessarily for mistakes and to provide mechanisms to easily recover from errors. Protection: Protection of the system from damage by a user interaction. Security: Ability to protect the users' data from errors inintentionally or intentionally generated. Reliability: The ability of the system to function without error or loss of data. Also, the frequency and length of instances of the system being unavailable during scheduled operation. Closure: Informing users when an operation has been successfully or unsuccessfully completed.*

formalized knowledge system: Formalized knowledge systems are a category of group systems. These systems contain a great deal of formalized knowledge about the application domains they are intended to support, such as forms processing and calendar management **1986** Malone et al. (102) *Most previous systems for supporting group work can be thought of as belonging to one of two categories. In one category, are forms processing, calendar management, and other systems that contain a great deal of formalized knowledge about the application domains they are intended to support (e.g., Greif, 1982 Ellis & Bernal, 1982; Fox et al, 1983; Sluizer & Cashman, 1985). In the other category are electronic mail, computer conferencing, and hypertext systems that provide some very general representational tools (such as topic structures in computer conferences or embedded links between documents) and very little other formal knowledge about their domains (e.g. Engelbart & English, 1968; Hiltz & Turoff, 1978 Trigg, Suchman, & Halasz, 1986).*

forms of communication*:* Talking, listening and observing non-verbal behaviour. **1980** Hiltz et al. *How does this form of communication change the process and outcome of group discussions, as compared to the "normal" face to face (FtF) medium of group discussion, where participants communicate by talking, listening and observing non-verbal behavior, and where there is no lag between the sending and receipt of communication signals?* **1998** Hein et al. (4) *Collaboration software is a combination of traditional forms of communication that are mediated through a computer (verbal represented by audio, letters represented by document sharing, face-to-face represented by video, etc.).*

forms processing: Forms processing is supported in a formalized knowledge system. **1986** Malone et al. (102) *Most previous systems for supporting group work can be thought of as belonging to one of two categories. In one category, are forms processing, calendar management, and other systems that contain a great deal of formalized knowledge about the application domains they are intended to support (e.g., Greif, 1982 Ellis & Bernal, 1982; Fox et al, 1983; Sluizer & Cashman, 1985).*

frame: Frames are a knowledge representation technique sometimes used in models. **1986** Applegate et al. *The output from all four classes of models serve as input to a knowledge base that provides a mechanism for representing and storing the planning knowledge using* *a variety of knowledge representation techniques (including frames, semantic inheritance networks and production rules).*

frustrated effort: Frustrated efforts are a negative design meeting issue. Other negative issues are inconsistent designs, drastically lowered morale, and project failure.**1986** Begeman et al. *Poor communication and disagreement at meetings can result in inconsistent designs, frustrated efforts, drastically lowered morale, and ultimately to project failure.*

GDS: see Group Decision System

GDSS: See Group Decision Support System

GDSS alias: GDSS has several aliases, or alternative names. These systems are also known as group support systems (GSS), Collaborative group technology (CGT), electronic meeting systems (EMS), and Computer-Mediated Communication (CMC) **1985a** DeSanctis and Gallupe. **2003** Corbitt and Martz (from DeSanctis and Gallupe 1985) *Originating in 1985 under the label Group Decision Support Systems (GDSS) (DeSanctis and Gallupe, 1985), this category of groupware is known under several aliases including Group Support Systems (GSSs), Collaborative Group Technology (CGT), Electronic Meeting Systems (EMS) and Computer-Mediated Communication.*

GDSS analyzing method: Analysing method is a GDSS group feature that provides a method of analysing prior interactions and judgments. **1985a** DeSanctis and Gallupe *Group Features - Numerical and graphical summarization of group members' ideas and votes - Menus which prompt for input of text, data, or votes by group members - Program(s) for specialized group procedures, such as calculation of weights for decision alternatives; anonymous recording of ideas; formal selection of a group leader; progressive rounds of voting toward consensus-building; or elimination of redundant input during brainstorming - Method of analyzing prior group interactions and judgments - Text and data transmission among the group members, between the group members and the facilitator, and between the group members and a central computer processor*

GDSS architecture: GDSS architecture refers to the structure of a GDSS in terms of the tools it uses and the methods by which it accomplishes tasks. This architecture defines an environment for the implementation of the model and reflects the evolutions that information systems have acquired. GDSS architecture integrates the following features, a database, a model base, group functioning procedures, and an easy-to-use flexible interface. **2001** Carneiro *The GDSS architecture refers to the structure of a GDSS in terms of the tools it uses and the methods by which it accomplishes tasks. This architecture defines an environment for the implementation of the model and reflects the evolutions that information systems have acquired … The architecture of this GDSS integrates the following features: a database – it contains a set of data obtained from a case study which is being analysed in order to select a strategic direction; a model base that consists of specialised application programs to be used by the group; group functioning procedure (GFP) – it is a set of rules allowing the definition and control of a decision makers' group meeting plan; and an easy-to-use, flexible interface – allows presenting the relationships and the data in a simple format that is understandable for the participants making the decisions.*

GDSS benefit: GDSS systems can provide three kinds of benefits, affective benefits, protocol benefits and information benefits. **1986** Kraemer and King *We find that GDSS systems can provide three kinds of benefits: affective benefits in which participants' attitudes towards cooperation and decision effectiveness are increased by use of GDSS technologies; protocol benefits, in which the important tasks of focusing on key issues and assessing differences of opinion among participants are facilitated; and information benefits in which GDSS technologies either provide more useful information or facilitate the application of available factual information to evaluation of the assumptions of group members … Affective benefits: GDSSs appear to bring "affective" benefits in the sense that they enliven* *meetings and in some cases help encourage a sense of group cohesion* **1989** Pinsonneault and Kraemer *On the other hand, GDSS are found to increase consensus reaching, increase confidence in the decision by the group members, increase the satisfaction of group members with the process, and increase the satisfaction of the group members with the decision.*

GDSS component: GDSS components include hardware, software, people, procedures and language. GDSS components incorporate idea generation, idea structuring and analysis models. **1984** Huber (195) *A GDSS consists of a set of software, hardware, and language components and procedures*. **1985a** DeSanctis and Gallupe (3) **…** *the basic components of any GDSS include hardware, software, people and procedures*. **1986** Applegate et al. *A major component of the GDSS is the incorporation of idea generation, idea structuring and analysis models*.

GDSS decision making approach: Group decision making approaches could include ordinary group process or Nominal Group Technique. **1985a** DeSanctis and Gallupe (6) **…** *the process would involve using the GDSS to show the decision makers the current situation in terms of markets and finances, etc. and to facilitate the generation and evaluation of ideas…These include ordinary group process or Nominal Group Technique.*

GDSS delivery mode: Three GDSS delivery modes are suggested. The GDSS could be permanently installed at the user's or customer's site. The vendor could rent the system on an on-call basis, or the vendor site installation where the software, hardware, staff, and so forth are provided for a fee. **1984** Huber *There are at least three modes in which GDSS can be made available to users … for the GDSS to be permanently installed at the user's or customer's site … Another delivery mode is for the vendor to rent the system on an on-call basis … The third delivery mode is as a vendor-site installation where the software, hardware, staff, and so forth are all provided for a fee, ... (p199) … It was also noted that major factors in GDSS success are the capabilities of the users and their aides in, managing a decision group and drawing appropriately on the GDSS technology. This fact supported the belief that vendor support may be critical to GDSS success in the great majority of applications. (p.203)*

GDSS design issue: Three major issues in GDSS design, system capabilities, system delivery modes and system design strategies. **1984** Huber (195) *The paper focuses on three major issues in the design of these systems: 1) System capabilities, 2) System delivery modes, and 3) system design strategies, and discusses the relationship of these issues to system use and survival.* **1987** Jelassi and Beauclair *This discussion of GDSS design issues is a positive step toward a behaviourally-driven design of group decision support systems. As we have shown, design strategies can be specific to certain group behaviours (eg. diffusion of responsibility) as well as general to computer-based decision support systems (eg. communication and information sharing, consistency and coherence) … GDSS Design Issues: In this section, an attempt is made to answer the behavioural questions raised above. Related GDSS design issues are addressed from a technical perspective. Our goals are twofold: through GDSS interventions, (1) reduce the negative impact, and (2) enhance the positive effect that diffusion of responsibility, problems of coordination, pressures toward consensus, and deindividuation have on group decision making.*

GDSS element: GDSS elements should include task characteristics, access pattern, GDSS components, their roles and functions. **2001** Carneiro *GDSS design should explicitly consider a common set of elements simultaneously, including task characteristics, access pattern, GDSS components, their roles and functions.*

GDSS environment*:* The GDSS environment might include electronic mail, computer conferencing, and/or audio and video conferencing. **1985a** DeSanctis and Gallupe *Electronic mail, computer conferencing, audio and video conferencing might also be integrated into the GDSS environment*.

GDSS facilitator role: See facilitator and facilitation. Facilitator is a leader charged with keeping the meeting balanced and on a correct course, and a recorder who maintains, and makes publicly visible, the group memory **1986** Begeman et al. (5) [*Facilitator] is a leader charged with keeping the meeting balanced and on a correct course, and a recorder who maintains, and makes publicly visible, the group memory.*

GDSS feature: Anonymous input of ideas and preferences, large screen for instantaneous display, secret voting and compilation **1986** Kraemer and King *At the simplest level GDSS provide features aimed at removing common barriers to group work and communication, such as unequal consideration of ideas, dominance by individuals, peer pressure, and loss of autonomy. These features include anonymous input of ideas and preferences, and large screens for instantaneous display of ideas, and secret voting and compilation. The level is illustrated by the electronic boardroom or computer-supported conference room.* **1987** DeSanctis and Gallupe *Conceivably, data analysis tools, planning aids and other GDSS features will prevent influential members from encouraging poor choices.*

GDSS function: GDSS basic functions include data management, model management and dialogue management **1985a** DeSanctis and Gallupe *The software components of the GDSS include a database, a model base, specialized application program(s) to be used by the group, and an easy-to-use, flexible user interface.* **1986** Bui and Jarke *The careful design of a communication manager as a fourth DSS component, in addition to dialogue manager, data manager, and model manager, is, therefore, a crucial prerequisite of a distributed GDSS.* **1987** Jelassi and Beauclair (from Sprague and Carlson 1982).

GDSS group feature: Group features required of a GDSS may include numerical and graphical summarization of group members' ideas and votes, menus which prompt for input of text, data, or votes by group members, program(s) for specialized group procedures, method of analyzing prior group interactions and judgments, and text and data transmission. **1985a** DeSanctis and Gallupe (5); … - *Numerical and graphical summarization of group members' ideas and votes - Menus which prompt for input of text, data, or votes by group members - Program(s) for specialized group procedures … - Method of analyzing prior group interactions and judgments - Text and data transmission …*

GDSS hardware: GDSS hardware is a basic component of GDSS. Hardware includes input/output device (terminals or desktop computers), processor(s), communication equipment, common viewing screen(s), and individual monitors **1984** Huber (195) *As will be seen a GDSS consists of a set of software, hardware, and language components and procedures that support a group of people engaged in a decision-related meeting.* **1985a** DeSanctis and Gallupe *The basic components of any GDSS include hardware, software, people, and procedures. Hardware Regardless of the specific decision situation, the group as a whole, or each member, must be able to access a computer processor and display information. The minimal hardware equirements of the system include: an input/output device, a processor, a communication line between the I/O device and the processor, and either a common viewing screen or individual monitors for use in displaying information to the group. More sophisticated systems may contain I/O terminals or desktop computers for each group member, several central processors, long-distance communications equipment, and several large viewing screens.*

GDSS human factor: GDSS human factors include spatial arrangement of group members, size and location of public screens, accommodation for 'informal' as well as 'formal' communication between group members. **1985a** DeSanctis and Gallupe (8) W*hat human factor considerations are critical in the design of GDSS (eg. spatial arrangement of group members, size and location of public screens, accommodation for "informal" as well as "formal" communication between group members)?*

GDSS language component: GDSS language are a basic component of GDSS. **1984** Huber (195) *As will be seen a GDSS consists of a set of software, hardware, and language components and procedures that support a group of people engaged in a decision-related* *meeting. (p.195)* **1985a** DeSanctis and Gallupe *The technology of GDSS: A pictorial representative of a typical GDSS is shown in Figure 1. In this generalized model, a group of decision makers has access to a data base, a model base, and GDSS applications software during the course of a decision-related meeting. There is at least one computer processor, one input output device, and one viewing screen. A "group facilitator" coordinates the group's use of the technology, and there is a flexible, friendly user-interface language available for use by the facilitator or each group member.*

GDSS level: GDSS systems can be considered as belonging to a three level hierarchy in terms of support. Level 1 GDSSs provide technical features aimed at removing common communication barriers, such as large screens, voting solicitation and compilation, anonymous input of ideas and preferences, and electronic message exchange between members. Level 2 GDSS might provide automated planning tools, or other aids commonly found in individual decision support systems. Modelling tools such as social judgement formation, risk analysis or multiattribute utility methods may be included in Level 2 systems. Level 2 GDSS may also have group structuring techniques such as Nominal Group Technique and Delphi. Level 3 GDSS may have machine-induced group communication patterns and could include expert advice. **1986** Kraemer and King *At the simplest level GDSS provide features aimed at removing common barriers to group work and communication, such as unequal consideration of ideas, dominance by individuals, peer pressure, and loss of autonomy. These features include anonymous input of ideas and preferences, and large screens for instantaneous display of ideas, and secret voting and compilation. The level is illustrated by the electronic boardroom or computer-supported conference room.* **1987** DeSanctis and Gallupe *Level 1 GDSSs provide technical features aimed at removing common communication barriers, such as large screens for instantaneous display of ideas, voting solicitation and compilation, anonymous input of ideas and preferences, and electronic message exchange between members … A Level 2 GDSS might provide automated planning tools, or other aids commonly found in individual decision support systems, for group members to work on and view simultaneously, again using a large common screen. Modeling tools to support analysis that ordinarily are performed in a qualitative fashion, such as social judgment formation, risk analysis, or multiattribute utility methods can be introduced to the group via a Level 2 GDSS (see Table 2). In addition, group structuring techniques such as those developed in the organization development literature can be efficiently administered to groups within Level 2 technology. Turoff and Hiltz (1982) have experimented with automating the Delphi method and the Nominal Group Technique, and Huber (1982) has discussed the possibility of automating similar group structuring methods that can be cumbersome and ineffective when administered manually … Level 3 GDSS are characterized by machine-induced group communication patterns and can include expert advice in the selecting and arranging of rules to be applied during a meeting (see Table 3).. proposed a model based on a three-level hierarchy ranging from low to high structure. In this model, Level 1 systems provide tools that simply remove barriers to communication and participation, Level 2 systems add structured decision modelling, and Level 3 systems induce specific group communication patterns. [tool structure].* **2001** Dennis and Wixom *Other tools, such as GroupSystems.Com, provide these same level 1 capabilities, but also include level 2 tools, information analysis tools designed to aid in decisionmaking [14]. These tools quickly and easily organize, model, change, and rank information-that is, they transform data from individual contributions to shared team information. These level 2 tools include ways to organize and analyze information, such as by the use of voting and modeling.*

GDSS meeting room: A typical GDSS meeting room consists of a conference table, a computer terminal for each participant, input devices such as keyboard, touchscreen, mouse or a combination of these. **1984** Huber (195) *A typical GDSS consists of a meeting room with a conference table. Each seating position has a small CRT terminal. Input at these terminals is by keyboard, touchscreen, mouse, or some combination of these devices.* **1990** Greenberg and Chang *Consider the Capture Lab, a computer-supported meeting room whose* *construction emphasised the need for careful design of all aspects of the room (Mantei, 1988; EDS, 1988).* **1999** Bergqvist et al.*A typical meeting (Jay 1993) takes place in a meeting room. It fulfils a specific function, it is scheduled and organised according to an agenda, it is usually attended to by an invited group of people, and it often takes place regularly. Formal meetings are usually understood as officially convened, with fixed membership and agendas.*

GDSS Menu: Menus are GDSS group features which prompt for input of text, data, or votes by group members. **1985a** DeSanctis and Gallupe *Group Features: - Numerical and graphical summarization of group members' ideas and votes - Menus which prompt for input of text, data, or votes by group members*

GDSS People: People are a basic component of GDSS. The people component includes a group facilitator and the group members. **1985a** DeSanctis and Gallupe (8) *The basic components of any GDSS include hardware, software, people, and procedures. … The "people" component of the GDSS includes the group members and a "group facilitator" who is responsible for the smooth operation of the GDSS technology when it is in use. The facilitator's role is a flexible one. He or she may be present at all group meetings and serve as the group's "chauffeur" operating the GDSS hardware and software and displaying requested information to the group as needed.*

GDSS procedure programs for group: These include: calculation of weights for decision alternatives; anonymous recording of ideas; formal selection of a group leader; progressive rounds of voting toward consensus-building; or elimination of redundant input during brainstorming **1985a** DeSanctis and Gallupe (5) *… calculation of weights for decision alternatives; anonymous recording of ideas; formal selection of a group leader; progressive rounds of voting toward consensus-building; or elimination of redundant input during brainstorming*

GDSS Procedure: GDSS procedures are a basic component of GDSS. **1984** Huber (195) A *GDSS consists of a set of software, hardware, and language components and procedures that support a group of people engaged in a decision-related meeting.* **1988** Poole et al. *GDSS procedures make processes and roles in conflict management clearer.*

GDSS software component: GDSS software is a basic component of GDSS. The software components of the GDSS include a database, a model base, specialized application program(s) to be used by the group, and an easy-to- use, flexible user inter-face. **1985a** DeSanctis and Gallupe (5) *The software components of the GDSS include a database, a model base, specialized application program(s) to be used by the group, and an easy-to-use, flexible user inter-face.*

GDSS success factor: Major factors in GDSS success are the capabilities of the users and their aides in, managing a decision group and drawing appropriately on the GDSS technology. **1984** Huber (203) … m*ajor factors in GDSS success are the capabilities of the users and their aides in, managing a decision group and drawing appropriately on the GDSS technology.* **1986** Kraemer and King *Barriers to successful use of GDSS systems: We identify a number of barriers to successful use of GDSS systems. For ease of presentation, we divide these into three categories: technical problems; incomplete understanding of the decisionmaking process; and problems with the GDSS "package." Technical Problems GDSS systems depend on a number of technologies: computer processing and storage, graphics displays, data base management systems, statistical processors, decision analysis and modeling programs, communications, and distributed input devices.* **2001** Ackermann and Eden *GSSs in contrast focus on providing electronic brainstorming and electronic voting (Nunamaker et al. 1988) - features that are often also critical to the success of a GDSS.*

GDSS technology category: GDSS technology can be separated into different categories based on a time/space framework. There are four categories in terms of proximity of participants and duration of the decision making session., which include, decision room, local decision network, linked decision rooms, and remote decision networks. Another way to categorize the systems is by considering the amount of formalized knowledge about the application domains. In one category there are forms processing, calendar management and other systems that contain a great deal of formalized knowledge. In the other category are electronic mail, computer conferencing and hypertext systems that provide some very general representational tools and very little other formal knowledge about the domain. **1987** Jelassi and Beauclair (from DeSanctis and Gallupe 1985) *There are four categories in terms of proximity of participants and duration of the decision making session. These include, decision room, local decision network, linked decision rooms, and remote decision networks.* **1986** Malone et al. (102) *Most previous systems for supporting group work can be thought of as belonging to one of two categories. In one category, are forms processing, calendar management, and other systems that contain a great deal of formalized knowledge about the application domains they are intended to support (e.g., Greif, 1982 Ellis & Bernal, 1982; Fox et al, 1983; Sluizer & Cashman, 1985). In the other category are electronic mail, computer conferencing, and hypertext systems that provide some very general representational tools (such as topic structures in computer conferences or embedded links between documents) and very little other formal knowledge about their domains (e.g. Engelbart & English, 1968; Hiltz & Turoff, 1978 Trigg, Suchman, & Halasz, 1986).* **2003** Bose (from Turban and Aronson 2001) *Turban and Aronson (2001) illustrate different categories of GSS based on a time/space framework. The time component describes the time when interactions between group members occur, and the place component describes the location of the group members during interactions. This framework depicts four distinct categories of GSS: 1 same time and same place; 2 same time and different place; 3 different time and same place; and 4 different time and different place.*

GDSS technology: Group support technology can be categorized into four separate areas: decision room, local decision network, linked decision rooms, and remote decision networks. There may be shortcomings in the technologies that affect GDSS use. Group support technology provides an electronic context for communication, brainstorming, problem solving, negotiation, and decision making. **1984** Huber (203) *It was also noted that major factors in GDSS success are the capabilities of the users and their aides in, managing a decision group and drawing appropriately on the GDSS technology. This fact supported the belief that vendor support may be critical to GDSS success in the great majority of applications.* **1987** Jelassi and Beauclair *DeSanctis and Gallupe (1985) categorize GDSS technology into four separate areas: decision room, local decision network, linked decision rooms, and remote decision networks. They distinguish between the four models in terms of proximity of participants and duration of the decision making session.* **1988** Kraemer and King *Technical problems: GDSSs depend on one or more of a number of technologies: computer processing and storage, graphics displays, database management systems, statistical processors, decision analysis and modeling programs, communication, and distributed input devices. At the current stage of technical development, there are several shortcomings in these technologies that affect GDSS use.* **1997** Williams and Wilson (from Dennis et al.1988) *Group support systems (GSS are social, information technology based environments that support intellectual group activities either within or across geographical and temporal boundaries, where (12, 1) information technology environments encompass communication, computing, and decision support technologies, and include, but are not limited to, distributed facilities, computer hardware and software, audio and video technology, procedures, methodologies, facilitation, and applicable group data, and intellectual group activities include, but are not limited to planning, idea generation, problem solving, decision making, issue discussion, negotiation, conflict resolution, and creative or collaborative group activities such as document preparation and sharing.* **1998** Tung and Turban (177) *Synchronous DGSSs: Synchronous DGSSs allow distributed participants to interact with one another in a 'real time' mode, ie. They interact with one* *another at the same time. The participants are distributed across multiple sites linked by various communication technologies. Some of the supporting technologies are screen sharing, whiteboard, audio-conferencing, and various types of video-conferencing. These technologies can be carried on the Intranet, Internet, corporate or public networks, or VANs.* **2003** Hostager *GSS technology provides an electronic context for communication, brainstorming, problem solving, negotiation, and decision making.*

GDSS user skills: see Participant skills, Chauffeur skills and Facilitator skills. GDSS user skills decline if they are not utilized. **1984** Huber (198) *Frequency of use is an important determinant of user skill in either case … The first follows from the previous idea; because user skills (ie. Facilitator skills, chauffeur skills, and participants skills) decline if they are not utilized.*

general design strategy: These include communication and information sharing, consistency, and coherence. **1984** Huber (195) *The paper focuses on three major issues in the design of these systems: 1) System capabilities, 2) System delivery modes, and 3) system design strategies, and discusses the relationship of these issues to system use and survival … A discussion of GDSS design strategies led to the conclusion that an activity-driven design strategy was superior to either a technique-driven or task-driven strategy. (p.203)* **1987** Jelassi and Beauclair (151) *This discussion of GDSS design issues is a positive step toward a behaviourally-driven design of group decision support systems. As we have shown, design strategies can be specific to certain group behaviours (eg. diffusion of responsibility) as well as general to computer-based decision support systems (eg. communication and information sharing, consistency and coherehce).*

general representational tool: General representational tools can include topic structures in computer conferences or embedded links between documents. **1986** Malone et al. *Most previous systems for supporting group work can be thought of as belonging to one of two categories. In one category, are forms processing, calendar management, and other systems that contain a great deal of formalized knowledge about the application domains they are intended to support (e.g., Greif, 1982 Ellis & Bernal, 1982; Fox et al, 1983; Sluizer & Cashman, 1985). In the other category are electronic mail, computer conferencing, and hypertext systems that provide some very general representational tools (such as topic structures in computer conferences or embedded links between documents) and very little other formal knowledge about their domains (e.g. Engelbart & English, 1968; Hiltz & Turoff, 1978 Trigg, Suchman, & Halasz, 1986).*

generality: Generality is a text-graphic manipulation feature. Freedom to create any kind of image at any time and place. **1986** Lakin (264) *Agility and generality must not be achieved at the expense of specializability. After a group has initially sketched an idea in text and graphics, then that same medium should also support refining the sketch according to formal scheme … Agility is measured in text-graphic manipulations per second … Vmacs achieves ability through a touch-typing interface with no waiting for menus. Among key features of this kind of text-graphics manipulation are: agility (speed in creation, moving and modifying images) generality (freedom to create any kind of image at any time and place); structure (definable spatial patterns of text and graphics are often used); and dynamics (manipulation of text-graphic unfolding over time).*

geographical scope: Geographical scope refers to the spatial dimension of a GSS or collaborative system, ie. the ability of a system to cover a certain geographical area. **1996** Barua et al. (4) *Geographical scope refers to the spatial dimension of a GSS or collaborative system, ie. the ability of a system to cover a certain geographical area.*

geographically dispersed: Geographically dispersed is meant as any users not directly sharing physical workspace where the collaborative work is to be completed. Other terms used are distributed and virtual teams. **1998** Hein et al.(7) G*eographically dispersed is meant as any users not directly sharing physical workspace where the collaborative work is to be completed.* **2001** McDough et al.(111) *The terms distributed and virtual have sometimes* *been used interchangeably (32). Both refer to the notion that the team's members are geographically dispersed, but unlike global teams, they are comprised of team members who are culturally similar (42).*

global: Global implies culturally diverse and globally spanning members that can think and act in concert with the diversity of the global environment. **1998** Jarvenpaa and Leidner *Global implies culturally diverse and globally spanning members that can think and act in concert with the diversity of the global environment.*

global task: Global task is a task undertaken by global virtual teams. **2000** Begole et al. *Global virtual team as culturally diverse and geographically dispersed. Global in their task*

global virtual team: Global virtual teams are groups that (a) are identified by their organization(s) and members as a team; (b) are responsible for making and/or implementing decisions important to the organisations global strategy, (c) use technology supported communication substantially more than face-to-face communication, and (d) work and live in different countries. **1998** Jarvenpaa and Leidner *Global virtual team to be a temporary, culturally diverse, geographically dispersed, electronically communicating work group ... Temporary in the definition describes teams where members may have never worked together again as a group.* **2000** Maznevski and Chudoba *Global virtual teams are groups that (a) are identified by their organization(s) and members as a team; (b) are responsible for making and/or implementing decisions important to the organisations global strategy, (c) use technology supported communication substantially more than face-to-face communication, and (d) work and live in different countries.*

globally distributed team: see global virtual team.

graphics display: A collaboration support function usually included in a GDSS (decision conference system). Graphics display can also be a barrier to the use of GDSS. **1986** Kraemer and King *Barriers to successful use of GDSS systems: We identify a number of barriers to successful use of GDSS systems. For ease of presentation, we divide these into three categories: technical problems; incomplete understanding of the decisionmaking process; and problems with the GDSS "package." Technical Problems GDSS systems depend on a number of technologies: computer processing and storage, graphics displays, data base management systems, statistical processors, decision analysis and modeling programs, communications, and distributed input devices.*

graphics editor: Graphics editors are designed to provide computer supported graphics features. **1986** Lakin *The vmacs graphics editor is a computer medium designed to provide general purpose graphics editor features.*

graphics editor features: Graphics editor features include sorting, text-graphics, manipulation (dynamics), agility, structure and generality. **1986** Lakin (264) *Agility and generality must not be achieved at the expense of specializability. After a group has initially sketched an idea in text and graphics, then that same medium should also support refining the sketch according to formal schema. … Agility is measured in text-graphic manipulations per second … Vmacs achieves agility through a touch-typing interface with no waiting for menus. Among key features of this kind of text-graphics manipulation are: agility (speed in creation, moving and modifying images) generality (freedom to create any kind of image at any time and place); structure (definable spatial patterns of text and graphics are often used); and dynamics (manipulation of text-graphic unfolding over time).* **1990** Knister and Prakash *Requirements of the DistEdit toolkit: The requirements of the DistEdit toolkit are quite simple: Multiple-user collaboration: editors built using the DistEdit toolkit should allow users to collaboratively edit text files without being in physical proximity. Reasonable performance: communications protocols used within DistEdit should give a consistent view of files to all users with reasonably low delay so that group editing is not an inconvenience. Compatibility with multiple, existing editors: it should be possible to use different editors in a single group session. People usually have their own favorite editors and it would be* *desirable not to force them to use a different editor when participating in a group session. Fault-tolerance: the group session should continue to run smoothly despite machine crashes and people leaving or joining the group. Hiding of communication protocols: adapting an editor to group editing using DistEdit should not require knowledge of distributed systems issues, such as communication protocols.* **1998** Greenberg and Gutwin *Shared drawing editors, where people could draw something on their display, and where other distant people could see the drawing.*

graphics software: Some graphics software include: Vmacs, Teledesign, DistEdit, TOPES, and PAVE. **1992** Shu *Teledesign - Teledesign was built from scratch specifically designed to support multiple users, although it can also be used by a single designer as needed… Teledesign supports real-time physically dispersed as well as face-to-face meetings of several people using a replicated architecture. In a replicated architecture, a local copy of the application, the graphics editor in this case, runs at each node of the conference.* **1992** Shu *TOPES, which is an interactive graphics teleconferencing system used for the planning of building construction.* **1999** Adams *PAVE is a 2-dimensional graphical MOO, structured as a collection of rooms connected by virtual doorways. A room in PAVE consists of a set of background graphics, in front of which users appear as customizable avatars that can carry props (graphical objects). Rooms and users can each contain event-driven scripts activated by movement to a spot in a room, in response to utterances, in response to arrivals and departures, or through other events. Scripts can play sound effects, add props to a room, execute painting commands, and drive a user's web browser to a particular URL.*

group: A group is a collection of two or more persons who perform some activity together and who are aware of their relationship to one another. A group may be participants in a group meeting. **1986** Bui and Jarke *Defining the Group Norm. The group has to identify its members and assign individual passwords. It also has to agree upon the way it handles data transfers, interactive conversation, utilization of electronic mail, and group decision techniques. For example, the group can request automatic selection and computation of appropriate decision techniques.* **1988** DeSanctis (1) *A group is a collection of two or more persons who perform some activity together and who are aware of their relationship to one another. The shared activity of the group may be looseley coupled, as in the sending and receiving of electronic messages, or tightly integrated, as in the mutual production of a computer program or systems design.* **1996** Kurser (from Shaw 1976) *Group: Two or more persons who are interacting with one another in such a manner that each person influences and is influenced by each other person (Shaw, M.E. 1976, Group dynamics: The spychology of small group behaviour (p.11).* **1996** Dennis et al. *Groups are not always small, participants come and go, their goals are neither shared nor existing, their tasks can be ambigouous, and decision making may occur in a distributed fashion (Lyytinen etal1994; Bannon 1994).* **1998** Bardram *Group: a relatively small ensemble of people, who interact and communicate closely and who share the same goal.* **1999** Furst et al. (250) *Group: collections of individuals whose contributions to a product or a process are additive and can be collated and presented by a group mamager as a result of group effort.*

group activity: Three basic activities which occur in any group are information retrieval, information sharing, and information use There are four categories to group activities: exploration and idea generation, idea organization, prioritizing, and exploration. The shared activity may be loosely coupled or tightly integrated. Organizational group activities divide into four coordination methods: parallel, pooled, sequential, and reciprocal. **1984** Huber *The basic activities which occur in any group … are information retrieval, information sharing, and information use.* **1988** DeSanctis *The shared activity of the group may be looseley coupled, as in the sending and receiving of electronic messages, or tightly integrated, as in the mutual production of a computer program or systems design.* **1991** Nunamaker et al. *Group activities (42): Four categories: exploration and idea generation, involves the development and exploration of issues relevant to the task. Idea organization, involves the synthesizing structiring and organizing of ideas into specific alternatives which may follow* *the generation of ideas; if a group has previously discussed an issues, a meeting may begin with idea organization without idea generation. Prioritising support the individual members in evaluating alternatives. Exploration: Formal methodologies to support policy development and evaluation, such as stakeholder analysis. Idea generation, idea synthesis, prioritizing and exploration of important issues.* **1998** Tung and Turban *Organizational group activities divided into four coordination methods that groups use. They are parallel, where individuals approached the problem independently; pooled, same as parallel except a standard is utilized to formulate a group result such as group vote; sequential, where all group members undertake the problem-solving phases in a sequential manner and, reciprocal, where changes made in one part of the problem can force other group members to reconsider other parts of the problem, such as in a case where consistency relations are imposed.*

group awareness: Group awareness where co-workers are aware of each other's past, current and possibly future activities within a shared environment. **1997** Schlichter et al. *Group awareness: an understanding of the activities of others, which provides a context for your own activity … Group awareness where co-workers are aware of each other's past, current and possibly future activities within a shared environment. The awareness information needed can be exchanged by direct communication or by indirect communication with the help of the system (computer-mediated communication). This whole process is called implicit coordination … Social protocols need a high degree of group awareness in order to be effective.*

group behaviour context factor: Context factors are depth of analysis, degree of participation of the team members, the degree of consensus reached in making a decision, and the time it takes to reach a decision. **2000** Pare and Dube (from Pinsonneault and Kraemer 1989) *In the context of virtual teams, decision characteristics refer to the ways in which decisions are made by such groups. This includees the depth of the analysis, the degree of participation of the team members, the degree of consensus reached in making a decision, and the time it takes to reach a decision.*

group behaviour: Group behaviours such as socializing, norming and conflicting could still be functioning in group interaction processes. **1991** Applegate (31) *Shein (86) defines group norms as the set of assumptions or expectations held by the members of the group or organisation concerning appropriate and inappropriate behaviour. Although group norms are seldom recorded or otherwise explicitly articulated, it has been found that most group members can state implicity norms if questioned. ... Group norms exert powerful control over group behaviour. Schein suggests that shared group norms originate out of a combination of the past experience of individual group members and the shared experience of the group, particularly around the handling of critical incidents. The degree to which group members share the same norms provides a measure of group cohesion. (p.31)* **2000** Pare and Dube (from Gladstein 1984) *Group processes which refers to two broad categories of group behaviours, namely, maintenance behaviours are required to build and maintain group synergy and momentum (eg. Open communications, level of collaboration and participation, level of conflict, level of trust), while task behaviours are those needed to solve problems that prevent the group's objectives from being achieved (eg. information processing, consensus generating, decision making).* **2003** Huang *Group behaviours such as socializing, norming and conflicting could still be functioning in group interaction processes.*

group brainstorming: see brainstorming

group buy-in: GSS has an impact on group buyin. Other issues impacted by GSS are meeting efficiency, labor costs and affective rewards. **2003** Siao *GSS researchers put in a great deal of effort in analyzing the impact that GSS has had on meeting efficiency, group buyin, labor costs, and affective rewards.*

group characteristic: Group characteristics can be identified as either individual member characteristics or characteristics of the group. Individual member characteristics can include skills and expertise job tenure, spoken language(s), self-motivation, and ability to work in groups, commitment, trust, and openness to express ideas. Characteristics of the group can include: group size, group proximity, group composition, (peer and hierarchical), group cohesiveness, political orientation, leadership, complexity of task, and circumstances, history of its members. **1987** Jelassi and Beauclair (147) *While GDSS developers are trying to design systems that will help structure the group process, it is important to acknowledge briefly the characteristics that decision makers bring with them to the decision making environment (10, 27). These include: (1) Individual characteristics of each group member (eg. personality, sex, age, race, status, socio-economic background, competence, and motivation); (2) Group characteristics (eg political orientation, leadership, complexity of the task and circumstances, size of group, and history of its members); and (3) environmental characteristics (eg. setting, scheduling, length of a session, organizational context, and spatial arrangement).* **1988** Dennis et al. *As a category, group process and outcomes encompasses several different constructs. These include the characteristics of the group itself the characteristics of the task on which the group is working, the organizational context in which system use takes place, the process through which the group utilizes the system, and the outcomes resulting from system use …The characteristics of the individual participants, group cohesiveness and motivation, past group history and future relationships have also been shown as important in studies of meetings, so they should be considered in the study of EMS.* **1991** Nunamaker et al.*Group characteristics that can affect processes and outcomes include (but not limited to) group size, group proximity, group composition (peers or hierarchical), group cohesiveness.* **2000** Pare and Dube *Group characteristics (team member characteristics) such as skills and expertise job tenure, spoken language(s), self-motivation, and ability to work in groups, have been connected to group processes and outcomes.* **2003** Corbitt and Martz *Using a case-based research methodology, the data set was collected over a series of 41 meetings and organized around group characteristics such as commitment, trust, openness to express ideas, etc.*

group cohesiveness: Group cohesiveness is an individual participant characteristic. Sometimes refered to as a group characteristic. **1987** DeSanctis and Gallupe *Group cohesiveness may be irrelevant if decision quality is the primary objective of the group; however, the variable becomes extremely important if strong morale, long term cooperation and conformity to group norms are critical to the organization (Festinger 1968; Hollander 1964; Shaw 1976).* **1988** Dennis et al. (593) *The characteristics of the individual participants, group cohesiveness and motivation, past group history and future relationships have also been shown as important in studies of meetings, so they should be considered in the study of EMS.* **1991** Nunamaker et al. *Group characteristics that can affect processes and outcomes include (but not limited to) group size, group proximity, group composition (peers or hierarchical), group cohesiveness, etc.* **1997** Salisbury et al. (from Bollen and Hoyle 1991) *Perceived cohesiveness - emcompasses an individuals sense of belonging to a particular group and his or her feelings of morale associated with membership in the group. Perceived cohesiveness reflects an individual's appraisal of their relationship to the group. Such a perception by individuals relative to their group could be linked to group formation, maintenance, or even productivity in some situations.*

group communication component: Group communication components can be formal or informal. Human components is focused on coordination, cooperation or co-construction and re-conceptualization. **1985a** DeSanctis and Gallupe (8) *What human factors considerations are critical in the design of GDSS (eg. spatial arrangement of group members, size and location of public screens, accommodation for "informal" as well as "formal" communication between group members)?* **1986** Fanning and Raphael *Until computer teleconferencing systems can encompass several modes of human communication-- e.g. text, voice, sketched diagrams, and photographs,* **1998** Bardram *Communication is the primary way in which collaborative activities are accomplished by* *humans in a social setting, whether focused on coordination, cooperation, or co-construction and re-conceptualization.*

group conference: Group conference is a CMC system capability **1981** Hiltz and Turoff *Among the capabilities which long term, regular users found valuable are group conferences, notebooks for text composition, and self-defined commands.*

group confidence: Group confidence in the decision is a factor when considering the influence of a GDSS. When using a GDSS or GSS, some research has shown an increase in group confidence, while other research has shown a decrease in group confidence in the decision. **1986** Applegate et al. (from Gallupe 1986) *Gallupe (1986) presented research design factors that were considered in a study of the influence of a GDSS on decision quality, decision time and group confidence in the decision.* **1988** Dennis et al. *Finally, there are many outcomes of a group meeting that may be measured. These include the decision/outcome quality, participant satisfaction with the outcomes and the process, participant confidence in the outcomes, process time required, level of group consensus, number of comments during the meeting, and the number ofalternatives or issues considered.* **1989** Pinsonneault and Kraemer *On the other hand, GDSS are found to increase consensus reaching, increase confidence in the decision by the group members, increase the satisfaction of group members with the process, and increase the satisfaction of the group members with the decision.* **2003** Lester et al. *GSS has demonstrated both desirable effects (greater participation, better quality decisions) and undesirable effects (reduced consensus and confidence) in previous research (Fjermestad and Hiltz, 1999; Benbasat and Lim, 1993).*

group consensus: Group consensus pressure is often cited as contributing to the condition known as ‘groupthink’. In groupthink the group loses sight of itself as a part of its environment and fails to take into account disconfirming or outside information. There is pressure from within the group to gain consensus and restrict opinions that are not in agreement with the group’s. This is one potential negative effect of group work. **1987** Jelassi and Beauclair *Pressure toward group consensus is often cited as contributing to the condition known as "groupthink" – the group loses sight of itself as a part of its environment and fails to take into account disconfirming or outside information (14). There is also pressure from within the group to gain consensus and restrict opinions that are not in agreement with the group's. This is a situation that we want to avoid since it may lead to risky decisions. The group may fail to generate numerous alternatives, and may suffer from an overall lack of creativity. What can we provide through computerized support that would help groups reduce unwarranted pressure toward group consensus and possible "groupthink"?* **1988** Watson et al. *This investigation has identified some intended and unintended effects of using a decision support system for groups. As intended, the presence of a suggested structure for the group meeting improved the degree of post-meeting consensus. Also, in contrast to the baseline and manual system group meetings, users of the GDSS reported more input into the group's solution and were less likely to perceive that there was a leader in the group. The relationship between pre-meeting and post- meeting consensus was similar in GDSS and manual groups, but post-meeting consensus was not significantly higher in the GDSS groups than in the baseline or manual groups. Although the structure provided in the GDSS and manual conditions reduced the variance across groups on their equality of influence, use of the GDSS did not result in more equal influence of group members on the final solution.*

group consensus and negotiation model: see also Group task model and Planning and problem solving model. Group consensus and negotiation model could be referred to as group task models or planning and problem solving models that may be implemented in GDSS systems for making choices. It appears to neutralize the group effects of inhibitors of idea generation and improve efficiency of the sessions. **1986** Applegate et al. *Four general classes of planning and problem-solving models are implemented in the system: (I) information gathering/idea generation models, (2) information/idea synthesis models, (3) quantitative* *analysis models and (4) consensus and negotiation/choice models.* **1987** DeSanctis and Gallupe *Automated Delphi or other consensus-seeking techniques might be incorporated in Level 2 systems.* **1988** Kraemer and King *Decision modeling software is specifically aimed at supporting group decision making and includes modeling languages (eg. SIMSCRIPT, DYNAMO), decision structuring techniques such as stakeholder analysis, brainstorming, nominal group technique, and Delphi technique, and specialized software for decision analysis techniques such as utility and probability assessment, multi attribute utility analysis, and multiattribute weighting analysis [Adelman 1984].*

group creation: Group creation is supported by text editors **1992** Shu *Text editors that support group creation and modification of documents and software code (Kaiser_etal1987, Leland etal 1988, Galegher&Kraut 1990, Neuwirth_etal1990).*

group decision making: Group decision making and the use of GDSS increase productivity in decision meetings. Effective group decision making requires, meeting the needs of the situation, ensuring that members are satisfied with the process and enabling members to meet and work successfully in the future. **1985** DeSanctis and Gallupe *The major barrier to effective group decision making is any condition which prevents the free expression of ideas in a group (Janis, 1972; Kolasa 1975; Van de Ven & Delbecq 1974). A number of events may lead to this problem. For example, group members may feel a strong pressure to conform, thus stifling the input of non-conforming ideas to the decision process, or certain members may regard other members as more competent or higher in status than they are (Hoffman, 1965). The extent to which group members are active in the group is also affected by the group's initial evaluation of the contributions of various members. People whose ideas are initially accepted by the group are likely to increase their participation, while those whose suggestions are rejected may withdraw from the discussion (Oakes et al 1960; Pepinsky et al 1958).* **1986** Kraemer and King *How might GDSS's help increase productivity of decision meetings? Huber (1982a) provides the following succinct assessment of the issue: I. Effective group decision making requires: 1. Meeting the need of the situation. 2. Ensuring that members are satisfied with the process. 3. Enabling members to meet and work successfully in the future. II. "Losses" of productivity in group decision making occur because: 1. Discussions are dominated by certain individuals. 2. Low-status members defer to high-status members. 3. Group pressures lead to conformity of thought. 4. Miscommunication among members is common. 5. Insufficient time is spent in problem exploration and generation of alternatives.* **1989** Ackermann (from DeSanctis and Gallupe 1986) *DeSanctis and Gallupe (1986) suggest "a GDSS aims to improve the process of group decision making by removing common communication barriers, providing techniques for structuring decision analysis, and systematically directing the pattern, timing or content of discussion".* **1998** Townsend et al.(from Townsend et al.1995) *Collaborative software systems is designed to empower real time group decision making and other creative activities. These systems, called group support systems (GSS), are specifically designed to create an enhanced environment for brainstorming, focus group work, and group decision making.* **2003** Beroggi (from Beroggi 1999) *Different approaches to consensus reaching in group decision making exist, including voting principles and game analytic methods (Beroggi 1999, Chapter 9). A most important measure of consensus reaching among decision makers' preference rankings is a rank correlation measure.*

group decision process: Group decision process may be broadly defined as a bundle of tasks that include gathering, interpreting and exchange information, creating and identifying alternative scenarios, choosing among alternatives and implementing and monitoring a choice. **1986** Bui and Jarke *There are different tasks in group decision processes that must be supported: -Initiation. How does the group start the collective decision-making process? Should the group elect a person who leads the discussion? -Information exchange. How can a member request or disseminate information? -Analysis. How does the group interpret the results of group discussions or decisions? -Consensus testing. What decision technique(s) should be adopted, for example, democratic vote or weighted majority rule?* **1995** Gavish and Gerdes *The [CM.sup.3] project's objective is to apply computing and telecommunication technologies to 'add value' to a group decision process, not simply recreate the group's natural decision process within a computer setting.* **2001** Antunes and Ho *The group decision process may be broadly defined as a bundle of tasks that include gathering, interpreting and exchanging information; creating and identifying alternative scenarios; choosing among alternatives; and implementing and monitoring a choice (Guzzo and Salas 1995).*

Group Decision Support System (GDSS): Group Decision Support Systems consist of a set of software, hardware, and language components and procedures that support a group of people engaged in a decision-related meeting. Group Decision Support Systems focus on providing a group with modelling support. Thus a GDSS is usually built around a particular theoretical and methodological approach to decision modelling, problem solving and the management of complexioty. **1984** Huber *GDSS consists of a set of software, hardware, and language components and procedures that support a group of people engaged in a decision-related meeting.* **1985a** DeSanctis and Gallupe *… an interactive computer-based system that facilitates the solution of unstructured problems by a set of decision makers working together as a group.* **1987** Jelassi and Beauclair (from Sprague and Carlson 1982) *GDSS is an interactive, computer-based information system which is used to enhance structured, semi- and unstructured group decision making tasks in organizations. Like individual DSS (IDSS), GDSS are designed to provide tools for decision making by supporting the three basic DSS functions of data, model and dialogue management.* **1995** Er and Ng 1995 *GDSS is an interactive computer-based information system which combines technologies, database technologies, computer technologies, and decision technologies to support the identification, analysis, formulation, evaluation, and solution of semi-structured or unstructured problems by a group in a user friendly computing environment.* **1996** Hiltz et al. (589) (from DeSanctis and Gallupe 1987) *GDSS as combining communication, computer, and decision technologies to support problem formulation and solution in group meetings.* **1997** Hofstede et al. *GDSS refers to a diverse set of methods and information technology to support groups in handling complex problems or tasks.* **2001** Ackermann and Eden *Group Decision Support Systems focus on providing a group with modelling support (Ackermann 1997) … Thus, a GDSS is usually built around a particular theoretical and methodological approach to decision modelling, problem solving and the management of complexity (DeSanctis and Gallupe 1987; Dickson et al.1992; Phillips 1987; Quinn et al.1985).*

group decision systems (GDS): Group decision systems (GDS) are sometimes called decision conferencing, where computer support is provided by a single workstation operated by a member of the facilitation team. **1998** Pervan *Group decision systems (GDS), sometimes called decision conferencing, where computer support is provided by a single workstation operated by a member of the facilitation team.*

group decision task: Examples of group decision tasks are initiation, information exchange, analysis and consensus testing. Other tasks include gathering, interpreting and exchanging information. **1986** Bui and Jarke (94) *There are different tasks in group decision processes that must be supported: -Initiation. How does the group start the collective decision-making process? Should the group elect a person who leads the discussion? -Information exchange. How can a member request or disseminate information? -Analysis. How does the group interpret the results of group discussions or decisions? -Consensus testing. What decision technique(s) should be adopted, for example, democratic vote or weighted majority rule?* **2001** Antunes and Ho *The group decision process may be broadly defined as a bundle of tasks that include gathering, interpreting and exchanging information; creating and identifying alternative scenarios; choosing among alternatives; and implementing and monitoring a choice (Guzzo and Salas 1995).*

group development: During the course of a group’s development group members slowly merge their different attitudes, behaviours and social norms, gradually moving towards a congruency in the group. Sequential group development models posit unitary development sequences or patterns which groups pass through during the course of their life cycles. Non-sequential models focus on underlying factors that cause shifts in group development. **1998** Prinz et al. *During the course of a group's development, group members slowly merge their different attitudes, behaviours and social norms, gradually moving towards a congruency in the group [14].* **1998** Prinz et al. (from Weick) *Weick [27, p.46] describes group development as organising a collective structure which exists "when behaviours of two or more persons become interstructured".* **2003** Huang et al. *Sequential group development models posit unitary development sequences or patterns which groups pass through during the course of their life cycles. Non- sequential models focus on underlying factors that cause shifts in group development.*

group discussion: Asynchronous communication can change the process and outcomes of group discussion. **1980** Hiltz et al. *How does this form of communication change the process and outcome of group discussions, as compared to the "normal" face to face (FtF) medium of group discussion, where participants communicate by talking, listening and observing non-verbal behavior, and where there is no lag between the sending and receipt of communication signals?*

group dynamic: Group dynamics that can impact focus group outcomes include the composition of the group, levels of group cohesion, the role of social influence, and moderator characteristics. Group dynamics aspect had been entirely ignored by GDSS researchers. Issues such as norms, leadership, power, role model, group cohesion, group stability, personal attraction, social and emotional support, motives, attitude, etc. which are well-known in organizational behaviour literature [4], had not been addressed by GDSS researchers **1995** Er and Ng. *Group dynamics aspect has been entirely ignored by GDSS researchers. Issues such as norms, leadership, power, role model, group cohesion, group stability, personal attraction, social and emotional support, motives, attitude, etc. which are well-known in organizational behaviour literature [4], have not been addressed by GDSS researchers.* **2002** Wood and Blyth *Group dynamics that can impact focus group outcomes include the composition of the group, levels of group cohesion, the role of social influence, and moderator characteristics*

group editor research: see Graphics editor and Text editor

group exchange activity: Group exchange activities such as proposal development, opinion exploration, expressions of preference, argumentation, and socialization. **1987** DeSanctis and Gallupe *We propose that GDSS researchers begin systems design by aiming to support group exchange activities (proposal development, opinion exploration, expressions of preference, argumentation, socialization, etc.), and be less concerned about the precise sequencing of these activities.* **1986** Bui and Jarke T*here are different tasks in group decision processes that must be supported: -Initiation. How does the group start the collective decision-making process? Should the group elect a person who leads the discussion? -Information exchange. How can a member request or disseminate information? -Analysis. How does the group interpret the results of group discussions or decisions? -Consensus testing. What decision technique(s) should be adopted, for example, democratic vote or weighted majority rule?* **1988** DeSanctis *Meaning of exchange include decision phases, conflict management methods, negotiation processes, working relationships, power and influence patterns, task structuring methods, leadership and other processes that reflect the interpretations and social meaning of group exchange.* **1998** Aiken et al. *A GDSS today can be defined as a computer-based system that supports groups of people engaged in a common task and that provides an interface to a shared environment. Most GDSSs are designed to help groups become more productive by supporting the exchange of ideas, opinions, and preferences within the group.* **2003** Pollard *The essential quality of GSS is to provide computer- mediated communication and support for information exchange in meetings.*

group facilitation: see Group facilitator. Group facilitation is a process in which a person who is acceptable to all members of the group, substantively neutral, and has no decision-making authority intervenes to help a group improve the way it identifies and solves problems and makes decisions, in order to increase the group's effectiveness **2001** Sawyer et al. (from Schwarz 1994) *According to Schwarz (1994), group facilitation is a process in which a person who is acceptable to all members of the group, substantively neutral, and who has no decision-making authority intervenes to help a group improve the way it identifies and solves problems and makes decisions, in order to increase the group's effectiveness.*

group facilitator: The group facilitator is responsible for keeping the meeting balanced and on a correct course. The facilitator should also record the proceedings and make publicly visible the group's memory. The facilitator should also be responsible for the smooth operation of the technology and coordinate the group's use of the technology. **1984** Huber (198) *… if the group "facilitator" or the system "chauffeur" of a GDSS gets stuck…* **1985a** DeSanctis and Gallupe *The "people" component of the GDSS includes the group members and a "group facilitator" who is responsible for the smooth operation of the GDSS technology when it is in use. The facilitator's role is a flexible one. He or she may be present at all group meetings and serve as the group's "chauffeur" operating the GDSS hardware and software and displaying requested information to the group as needed … A "group facilitator" coordinates the group's use of the technology, and there is a flexible, friendly user-interface language available for use by the facilitator or each group member.* **1986** Applegate et al. *Planning session facilitators assist the group in their planning activities providing access to a workbench of quantitative and qualitative decision aids for identification of issues and ideas, surfacing assumptions, stakeholder identification, competitive analysis and other enterprise and situation analysis activities.***1986** Begeman et al. *For example, the interaction method of meeting [DOYL85] suggests that there should be a facilitator, who is a leader charged with keeping the meeting balanced and on a correct course, and a recorder who maintains, and makes publicly visible, the group memory. Other options may imply that, rather than restricting access to the group memory and the public display, equal access for all might be preferred. Within all of these structures, the types of information that may be presented, manipulated, and captured during a meeting can be categorized according to the amount of its structure (binary, structured, or unstructured), and according to the degree of sharing (private, subgroup, or public).*

group ground rule (protocol): Group ground rules are tangible shared team meanings relating to team structure, team identity, team interdependence and team history. Ground rules can also relate to shared team conventions and norms which are intangible shared meanings. Shared expectations may be related to communication quality and frequency. **2003** Huang *In general, two types of dialogue outcomes can be generated. The first type can be termed as shared ground rules of a team (or tangible shared team meanings), which may include the four basic team elements discussed in the introduction--the team structure (e.g., leadership and role differentiation), team identity (e.g., team goals), team interdependence (e.g., team coordination), and team history (e.g., the frequency of team meeting). The second type is a kind of shared team conventions and norms (or intangible shared team meanings), which may guide team interactions consciously (e.g., respecting differences in team interactions), and most of the time, maybe unconsciously (e.g., a team norm may exist in some cultures where ideas given by senior people will be automatically and unconsciously considered with higher weights in team interactions).* **2003** Davison et al. (531) *When goal agreement has been achieved, teams can focus on their mutual expectations with regard to communication quality, frequency, etc. It is suggested that teams ground these expectations in a set of protocols that govern all their interactions, i.e. the establishment of group ground rules or protocols. Sample protocols could include: decide on which communication tools you intend to use (e.g., email, Blackboard, etc.) and ensure that you have regular access to these communication tools; check email at least every 12 hours; send email at least every 24 hours; identify days when communication may* *not be possible (e.g., weekends, public holidays); be cognizant of time zone differences between team members, as well as variations such as daylight savings schemes.*

group humour: Group humour is a category that impacts facilitator activities during electronic meetings **1992** Lewis and Whiteley. *Several prominent impact categories were generated by facilitators (see Table 3). They included: facilitator comfort (a feeling of being at ease with the process) and the energizing element (is it depleted or enhanced through GDSS?); group temperament or ambience, and the use of humor in the group; control (does the facilitator lose any of it to the technology?). Additionally, time, or the response to having it controlled by a system caused enough comment to warrant further investigation. One of the central features of MeetingWare is the ability to preserve anonymity of ideas as individuals privately "talk" to the keyboard instead of upfronting before a group of colleagues.*

group interaction processes: Group interaction processes include communication trust, cooperation, information processing, consensus generating, conformity pressures and normative regulation. **2000** Pare and Dube *Group interaction processes, namely communication trust, cooperation, information processing (sharing, redundancy, integrative complexity), consensus generating (amount and intensity of disagreement), conformity pressures, and normative regulation (expressions of commitment, satisfaction and solidarity). In turn these group processes form an important basis for the shaping of project outcomes.*

group leader: Group leaders often have more power than other group members. The power of the group leader can impact the democratic decision process. **1985a** DeSanctis and Gallupe *Program(s) for specialized group procedures, such as calculation of weights for decision alternatives; anonymous recording of ideas; formal selection of a group leader; progressive rounds of voting toward concensus-building; or elimination of redundant input during brainstorming.* **1986** Bui and Jarke (84) *Centralization of control distinguishes democratic decision processes from those in which there is a group leader or mediator with more power than other group members; in the extreme case the group leader could make the decision alone with just advice from other members (e.g., research staff).* **1992** Nunamaker et al. *Facilitator: the person who chairs the meeting is the leader/Facilitator. This person may be the group leader, another group member or, more commonly, a separate, neutral, individual who is not a group member.* **1994** Liou and Nunamaker *The facilitator during knowledge acquisition sessions could be a group leader, guiding the group to achieve objectives of particular sessions, a chauffeur, who serves as the intermediary between the group and the GDSS software, and/or an assistant in the use of computer technology.* **1997** Nunamaker et al. *Facilitator or leader: The person who chairs an electronic meeting. This person may be the group leader, another group member, or a separate, neutral individual who is not a group member*

group learning: see Collaborative learning. **1990** Hiltz *The labels given to collaborative or group learning are many; among them are: "cooperative learning, collective learning, study circules, team learning…" (Bouton and Garth, 1983), and ":peer-group learning" or syndicates")Collier, 1980).*

group level factor: Group level factors include group composition variables (eg. training and technical support) and organizational structure (eg. reward for performance and supervision). **2000** Pare and Dube *Group level factors include group composition variables (eg. training and technical support) and organizational structure (eg. reward for performance and supervision).*

group member: see Group

group member characteristic: see Group characteristic.

group member status: Group member status is a group characteristic that can impact group effectiveness. **1985a** DeSanctis and Gallupe *the major barrier to effective group decision* *makins is any condition which prevents the free expression of ideas in a group (Janis, 1972; Kolasa 1975; Van de Ven & Delbecq 1974). A number of events may lead to this problem. For example, group members may feel a strong pressure to conform, thus stifling the input of non-conforming ideas to the decision process, or certain members may regard other members as more competent or higher in status than they are (Hoffman, 1965).* **1986** Kraemer and King *How might GDSS's help increase productivity of decision meetings? Huber (1982a) provides the following succinct assessment of the issue: I. Effective group decision making requires: 1. Meeting the need of the situation. 2. Ensuring that members are satisfied with the process. 3. Enabling members to meet and work successfully in the future. II. "Losses" of productivity in group decision making occur because: 1. Discussions are dominated by certain individuals. 2. Low-status members defer to high-status members. 3. Group pressures lead to conformity of thought. 4. Miscommunication among members is common. 5. Insufficient time is spent in problem exploration and generation of alternatives. III.*

group memory: Group memory is a process support function of a GDSS. Group memory is documented evidence from past meetings and other group activities. **1986** Begeman et al. *For example, the interaction method of meeting [DOYL85] suggests that there should be a facilitator, who is a leader charged with keeping the meeting balanced and on a correct course, and a recorder who maintains, and makes publicly visible, the group memory.* **1990** Bullen *The need represented in our interviews, (i.e., comments on the value of message linking), is one which should be carefully investigated by both designers and installers of groupware. People use message linking to: w manage communications and documents b keep records b develop "group memory."* **1991** Nunamaker et al. *Process support functions (ie. Parallel communication, group memory, anonymity).* **1998** Tung and Turban *Group memory: Groups need to have an access to the documentation (group memory) of the past meetings that is dynamic over space and time.* **2000** Stough et al. *When the memory stores the text data collected from a group activity, it is often called group memory.*

group norm: Group norms, whether implicit or explicit, are assumptions or expectations held by members of a group regarding correct and incorrect behaviour. **1986** Bui and Jarke (89) *Defining the Group Norm. The group has to identify its members and assign individual passwords. It also has to agree upon the way it handles data transfers, interactive conversation, utilization of electronic mail, and group decision techniques. For example, the group can request automatic selection and computation of appropriate decision techniques.* **1991** Applegate (31) *Shein (86) defines group norms as the set of assumptions or expectations held by the members of the group or organisation concerning appropriate and inappropriate behaviour. Although group norms are seldom recorded or otherwise explicitly articulated, it has been found that most group members can state implicity norms if questioned. ... Group norms exert powerful control over group behaviour. Schein suggests that shared group norms originate out of a combination of the past experience of individual group members and the shared experience of the group, particularly around the handling of critical incidents. The degree to which group members share the same norms provides a measure of group cohesion.* **1995** Er and Ng *Group dynamics aspect has been entirely ignored by GDSS researchers. Issues such as norms, leadership, power, role model, group cohesion, group stability, personal attraction, social and emotional support, motives, attitude, etc., which are well-known in organizational behaviour literature (4), have not bee addresssed by GDSS researchers*. **1998** Knoll and Jarvenpaa *Group norms, whether implicit or explicit, are assumptions or expectations held by members of a group regarding correct and incorrect behaviour …Collaboration occurs within a "purposive relationship" (13). For such existence of a purposive, psychological relationship, the presence of group norms and group cohesion is important (2).* **1998** Prinz et al. *During the course of a group's development, group members slowly merge their different attitudes, behaviours and social norms, gradually moving towards a congruency in the group [14] ... The process of electronic group formation operates in a similar way, with some important differences. The electronic interaction of group members often occurs while members are remote. We refer* *to achieving congruency with groupware use as involving two processes: first, the group must develop appropriate communicative behaviours, and secondly, group members must merge different perspectives to reach common agreements about cooperation*

group oriented social variable: Trust and commitment are two group-oriented social variables. **2003** Corbitt and Martz *We propose that trust and commitment may be 'positive emotional responses' which manifest in groups over time due to the process itself and not just with achieving a goal. The key issue presented is that group or team process includes both task work and social work. Trust and commitment may be two group-oriented social variables impacted by groupware.*

group performance: Group performance variables are decision quality, decision efficiency, and interpersonal behavior . Group performance can be improved through information sharing, task quality, conflict resolution, individual member satisfaction. **1980** Hiltz et al. *Much experimental literature indicates that the nature of the problem has a great deal to do with group performance.* **1988** Dennis et al. *The exact type of task is very important to group performance (Poole et al.1985), so any study of performance must clearly define the nature of the task performed.* **1988** DeSanctis *Researchers' measures of group behavior tend to rely heavily on comparison with "average" groups or "expert" groups, or the judgments of the researcher; objective measures of communication efficiency, decision quality, performance, etc., in the group setting are rarely available (Davis & Kerr, 1986).* **1992** McLeod and Liker *The small group literature has repeatedly found that when left to their own devices, task-oriented groups often evolve structures that are suboptimal and sometimes even dysfunctional to task accomplishment (Hackman and Kaplan 1974, Hall and Watson 1970, Steiner 1972). A number of studies have shown that providing specific rules and resources for task interaction (ie. attempting to influence group structures), can lead to improved group performance along a number of dimensions, such as information shaving (Stasser et al, 1989), task quality (Delbecq et al, 1975), conflict resolution (Hall and Watson 1970) and individual member satisfaction (Delbecq et al.1975, Green and Taber, 1980). Having a task-appropriate structure facilitates information exchange (Stasser et al, 1989, Thomspon and Tuden 1964) and ensures that all group members have opportunities to participate (Green and Taber 1976). High structure EMS provide specific structuring techniques – the rules and resources to govern interaction – to help groups overcome the process losses (Steiner 1972) resulting from the suboptimal structures they typically develop on their own.* **1995** Whitman et al. *Few studies directly distinguish and examine the dynamics of groups as teams (as opposed to randomly associated groups of individuals) with regard to the commonly examined group performance variables of decision quality, decision efficiency, and interpersonal behavior, nor the decision perception variables of individual satisfaction, procedural justice and equity of the decision process.* **1996** Hiltz et al. *Performance outcome (quality and creativity).* **2000** Potter et al. (from Watson and Michaelsen 1988) *Team's interaction style can affect performance. They identified positive and negative behaviors as components of group interaction style. Three groups of behaviors (expectations of performance and integration, leadership, and cohesiveness) contributed to team performance on an intellective task while one group of negative behaviors (eg. noninvolvement, withholding of information) detracted.* **2001** Dennis and Wixom *We follow the approach of Drazin and Van de Ven [17], Benbasat and Lim [2], and Dennis and Kinney [10], who defined performance in terms of three major factors: (1) effectiveness as defined by decision quality or number of ideas generated, (2) efficiency as defined by the time to complete the task, and (3) participants' satisfaction with the process or outcomes.*

group pressure: Group pressure is a productivity loss in group decision making. Group pressure can lead to conformity of thought **1985a** DeSanctis and Gallupe *the major barrier to effective group decision makins is any condition which prevents the free expression of ideas in a group (Janis, 1972; Kolasa 1975; Van de Ven & Delbecq 1974). A number of events may lead to this problem. For example, group members may feel a strong pressure to* *conform, thus stifling the input of non-conforming ideas to the decision process, or certain members may regard other members as more competent or higher in status than they are (Hoffman, 1965). The extent to which group members are active in the group is also affected by the group's initial evaluation of the contributions of various members. People whose ideas are initially accepted by the group are likely to increase their participation, while those whose suggestions are rejected may withdraw from the discussion (Oakes et al.1960; Pepinsky et al.1958).* **1986** Bui and Jarke *Without anonymity, individuals, particularly low status participants, may withhold ideas due to negative evaluation apprehension [16, 30] or may feel pressured to conform to the group majority or senior participants' views.* **1987** DeSanctis and Gallupe *The key effect of structured approaches appears to be increasing member participation (White et al.1980), focusing the problem, avoiding conformity pressures, and keeping the group on track (Gallupe 1985).* **1987** Jelassi and Beauclair *Pressure toward group consensus is often cited as contributing to the condition known as "groupthink" – the group loses sight of itself as a part of its environment and fails to take into account disconfirming or outside information (14). There is also pressure from within the group to gain consensus and restrict opinions that are not in agreement with the group's. This is a situation that we want to avoid since it may lead to risky decisions. The group may fail to generate numerous alternatives, and may suffer from an overall lack of creativity. What can we provide through computerized support that would help groups reduce unwarranted pressure toward group consensus and possible "groupthink"?* **2000** Pare and Dube *Group interaction processes, namely communication trust, cooperation, information processing (sharing, redundancy, integrative complexity), consensus generating (amount and intensity of disagreement), conformity pressures) and normative regulation (expressions of commitment, satisfaction and solidarity). In turn these group processes form an important basis for the shaping of project outcomes*

group process: Group processes refers to two broad categories of group behaviour, namely, maintenance behaviour and task behaviours. Group processes include the generation of alternative ideas, sharing of ideas, communication, planning, negotiation, problem solving, consensus building, and decision-making. **1985a** DeSanctis and Gallupe *A variety of decision making approaches could be used, such as ordinary group process or Nominal Group Technique, but essentially the process would involve using the GDSS to show the decision makers the current situation in terms of markets and finances, etc. and to facilitate the generation and evaluation of ideas.***1988** Dennis et al.(596) *The nature of the group process, such as the presence or absence of a formal or informal group leader, the use of anonymity, the number of meeting sessions, the degree of structure in the group process, equality of participation, level of conflict, and the level of non-task ("uninhibited") behaviour.* **2000** Pare and Dube (from Gladstein) *Group processes which refers to two broad categories of group behaviours, namely, maintenance behaviours are required to build and maintain group synergy and momentum (eg. Open communications, level of collaboration and participation, level of conflict, level of trust) while task behaviours are those needed to solve problems that prevent the group's objectives from being achieved (eg information processing, consensus generating, decision making)*. **2001** Burke *GSS have been acknowledged as supporting group processes, such as the generation of alternative ideas, sharing of ideas, communication, planning, negotiation, problem solving, consensus building, and decision making, in both face-to-face and dispersed business meeting environments.*

group process facilitation: Group process facilitation is a collaboration support function usually included in the design of a GDSS (decision conference system) **1988** Kraemer and King (126) *A collaboration support function usually included in a GDSS (decision conference system).*

group process facilitation: Group process facilitation is one of two forms of facilitation roles in a GSS context performed by the facilitator. Group process facilitation refers to supporting and guiding the group interaction in a manner that draws upon the human resources at hand, maximizing positive group dynamics and channelling conflict in constructive ways. See group facilitation. **2002** DeVreede et al. (129) *Group process facilitation. By this we mean facilitation that interacts with participants and their interactions regarding stated and emergent tasks toward creating meeting outcomes. Since this is in the GSS setting, orchestrating communications and moving toward results are mediated by interaction with supporting technology.* **2003** Hostager (from Griffith et al.1998) *GSS facilitation is a complex role involving myriad tasks and responsibilities. Griffith, Fuller, and Northcraft (1998) identified two forms of facilitation roles in a GSS context: (1) technical facilitationoperating the GSS technology in a smooth, seamless and adept manner, to ensure the task is completed in an efficient and technically proficient manner; and (2) group process facilitation-supporting and guiding the unfolding group interaction in a manner that draws upon the human resources at hand, maximizing positive group dynamics and channeling conflict in constructive ways.*

group process facilitator: People trained in the behavioural dynamics of group meetings, and in facilitating self awareness of the group about its process. See group facilitator. **1988** Kraemer and King (123) *People trained in the behavioural dynamics of group meetings, and in facilitating self awareness of the group about its process.*

group process structuring technique: see Behavioural group technique. Group process structuring techniques such as Delphi method and the Nominal group technique (NGT). **2003** Ngwenya and Keim *Solutions have ranged from manual group process structuring techniques such as the Delphi method (Dalkey 1969) and the Nominal group technique (NGT) (Delbecq, Van de Ven, and Gustafson 1975) to contemporary group support systems (GSS) (DeSanctis and Gallupe 1987).*

group property: Group properties include its development stage, size, composition, coherence, and goal congruence. Other properties are patterned relationships, the task situation and the broader environment in which the group works. Properties of group member could include evaluative tone, team member competence, unified commitment, a collaborative climate, standards of excellence, external support and recognition, and principled leadership. **1990** Connolly et al. *A general conceptual framework for studying group process is given by McGrath 1984, p.13). This framework treats the group interaction process as the consequence of the properties of the group's members, their patterned relationships, the task situation and the broader environment in which they are working. Each of these four elements is, in turn, influenced by the interaction process. We would locate evaluative tone as one potentially important property of the group's members and anonymity as a potentially critical aspect of the patterning of their relationships.***1997** Hofstede et al. *Group properties include its development stage, size, composition, coherence, and goal congruence.* **2003** Huang et al. (from Larson and LaFasto 1989) *Larson and LaFasto (1989) identify eight properties of effectively functioning teams: a clear and elevating goal, a results-driven structure, competent team members, unified commitment, a collaborative climate, standards of excellence, external support and recognition, and principled leadership.*

group protocol: Group protocols are ground rules that govern their interactions. Ground rules could include: decide on which communication tools to use, ensure that you have regular access to communication tools; check email at least every 12 hours; send email at least every 24 hours; identify days when communication may not be possible; and be cognizant of time zone differences between team members. **2003** Davison et al. (531) *When goal agreement has been achieved, teams can focus on their mutual expectations with regard to communication quality, frequency, etc. It is suggested that teams ground these expectations in a set of protocols that govern all their interactions, i.e. the establishment of group ground rules or protocols. Sample protocols could include: decide on which communication tools you intend to use (eg. Email, Blackboard, etc.) and ensure that you have regular access to these communication tools; check email at least every 12 hours; send email at least every 24 hours; identify days when communication may not be possible (eg. Weekends, public* *holidays); and be cognizant of time zone differences between team members, as well as variations such as daylight savings schemes.*

group proximity: Group proximity is a group characteristic. The three types of group proximity are multiple individual sites, a single group site, and multiple group sites. Meetings can be centralized, partly centralized or decentralized. **1987** DeSanctis and Gallupe *Three environmental contingencies are identified as cirical to GDSS design: group size, member proximity, and the task confronting the group.* **1988** Dennis et al. (593**)** *the characteristics of the group, such as group size and group proximity (whether in one room or distributed in several remote locations), and past experience with the problem area, such as group process and tools, must be considered.* **1991** Nunamaker et al. *Group characteristics that can affect processes and outcomes include (but not limited to) group size, group proximity, group composition (peers or hierarchical), group cohesiveness, etc.* **1995** Gavish et al. *Group proximity: meetings can be centralized, partly centralized, or decentralized.* **2003** Siao *The three types of group proximity are multiple individual sites, a single group site, and multiple group sites.*

group size: Group size is a group characteristic. Existing taxonomies consider groups with up to 9 participants as small and groups with 10-30 participants as large. **1987** Jelassi and Beauclair *It is also important to consider the situational variables that a group brings to the decision making environment (eg. task complexity, group size, and political climate) when designing tools for group use (Jelassi 1985).* **1987** DeSanctis and Gallupe *Three environmental contingencies are identified as critical to GDSS design: group size, member proximity, and the task confronting the group.* **1988** Dennis et al. (593) *First, the characteristics of the group, such as group size and group proximity (whether in one room or distributed in several remote locations), and past experience with the problem area, such as group process and tools, must be considered.* **1991** Nunamaker et al. *Group characteristics that can affect processes and outcomes include (but not limited to) group size, group proximity, group composition (peers or hierarchical), group cohesiveness, etc.* **1995** Gavish et al. *Group size: existing taxonomies consider groups with up to 9 participants as small and groups with 10-30 participants as large.* **1996** Hiltz et al. *Types of contingencies: communication condition (face to face or dispersed - we extend this to include synchronous vs asynchronous); group size and task type.*

group structural awareness: Group structural awareness involves knowledge about such things as people's roles and responsibilities, their positions on an issue, their status, and group processes. **1997** Schlichter et al. (from Greenberg (18)) *Different sub-types of awareness: informal awareness, group-structural awareness, social awareness, and workspace awareness … Group structural awareness involves knowledge about such things as people's roles and responsibilities, their positions on an issue, their status, and group processes.*

group structure: Group structure is an emergent pattern created in the process of action and interaction. Groups of peers, or members in some management hierarchy can influence individual interaction and group activity. **1995** Gavish et al. *Group structure and composition: group structure ie. Groups of peers, or members in some management hierarchy) can influence individual interaction and group activity.*

group support system (GSS): GSS is a computer-based information technology which provides a set of structured meeting process tools. GSS are an integrated combination of computer, communication and decision support technologies designed to support group work. GSS are typically characterized by groupware, which allows users to interact with each other in a variety of ways, ranging from shared database access to functionality. **1994** Watson et al. *Group support system is an integrated combination of computer, communication, and decision support technologies designed to support group work (7).* **1996** Barua et al. *GSS are typically characterized by groupware, which allows users to interact with each other in a variety of ways, ranging from shared database access to functionality.* **1996** Hiltz et al. *A specific GSS is a particular combination of communication mode, tools and structuring of* *process (via a facilitator or procedural instructions/agenda) ... The term 'group support system' has come to be used as more general and inclusive than GDSS which is often used to imply decision room, same time settings. GSS can apply to many stages and types of group work, not just 'decision making' and to computer support for groups that are working asynchronously through wide area networks as well as at the same time.* **1997** Williams and Wilson *Group support systems attempt to reduce barriers to communication that might otherwise be present and in most cases, also attempt to structure group activities and processes in a positive way. Second, … group technologies support many different types of intellectual group activities (planning, problem solving, creative tasks, etc.). Third, group support systems are social technologies, and as such, the study of these technologies is complicated by the nature of social relationships and behaviours. Fourth, these systems are comprised of a combination of computer, decision, and communication technologies, but the mix of these technologies varies substantially from system to system. GSS remain difficult to define concisely. Several common characteristics of group support technologies can be identified.* **1997** Nunamaker *A group support system (GSS) is a set of techniques, software and technology designed to focus and enhance the communication, deliberations and decision making of groups …* **1998-9** Briggs et al.*GSS is a suite of network-based software tools to support coordinated and concerted team efforts toward a goal.* **2000** Davison and Briggs *Group support systems is a suite of software tools for focusing and structuring group deliberation, while reducing the cognitive costs of communication and information access among teams making a joint cognitive effort toward a goal [13]. GSS participants simultaneously type their contributions into a network of computers. The software immediately makes all contributions available to the other participants. If the team feels it appropriate, the GSS allows for anonymous input. A GSS may have tools for collaborative idea generation and organization, electronic polling, simultaneous document authoring, and multicriteria decision-making, among others. Each tool creates a different kind of group dynamic.* **2001** Ackermann and Eden *GSS in contrast focus on providing electronic brainstorming and electronic voting (Nunamaker et al. 1988) – features that are often also critical to the success of a GDSS.* **2001** Genuchten et al. *GSS**,** a form of groupware.* **2002** Wood and Blyth *GSS is a computer-based information technology which provides a set of structured meeting process tools.*

group synergy: Group synergy factors reflect the ways in which group members interact to maximize important group outcomes, such as the diversity of ideas generated, member involvement, and increased group efficiency and productivity. **1999** Furst et al. *Group synergy factors reflect the ways in which group members interact to maximize important group outcomes, such as the diversity of ideas generated (Nemeth 1993), member involvement (Lawler 1986), and increased group efficiency and productivity (Hammer and Champy 1993).*

group task model: Group task models include decision tree models, multi attribute utility models, and group consensus and negotiation models **1986** Applegate et al. …*the focus of existing systems was primarily to provide support for a small number of specific group tasks (e.g., structuring or decision alternatives using decision tree models, analysis of group preferences using multi-attribute utility models and group consensus and negotiation.* **1997** Schlichter et al. *Explicit coordination is chosen because the coordination is handled by actions explicitly initiated for coordinating the task. The initiator can be a software component that reacts upon a given task model by initiating some coordination actions. In the real world, this leads to the class of workflow systems, where the standard procedure is described by a model of the task.*

group task: Group tasks may include information retrieval (or generation), information sharing, or information use. Group tasks that are facilitated with computer support could involve list generation, rank ordering, voting, selecting and organizing. **1984** Huber (200) W*hatever tasks a group may engage in, its members will be found to be carrying out one or more of the following activites: information retrieval (or generation), Information sharing, or* *information use.* **1986** Applegate et al … *the focus of existing systems was primarily to provide support for a small number of specific group tasks (e.g., structuring or decision alternatives using decision tree models, analysis of group preferences using multi-attribute utility models and group consensus and negotiation models). Support for the idea generation phase of the problem-solving process was discussed by Huber (1984) but was not implemented in the existing systems.* **1988** Whitescarver et al. *Simple group tasks involve list generation, rank ordering, voting, selecting and organizing. These tasks can be facilitated with software tools. Structured communications further supports group tasks by providing automated support for the social processes and human roles in the group process.* **1988** Egido *Much systematic research has also been conducted to compare the effects of different communication media on various tasks such as problem solving, decision making, and information transmission (for reviews see Williams, 1977, Chapanis, 1980, and Short, Williams, and Christie, 1976).* **2003** Siao *The modules of most GSS reflect the categories of a crude typology of tasks - idea generation, proposal evaluation, alternative selection, and consensus seeking (25, 41). This typology closely resembles the Group Task Circumplex (24), which proposes that all group tasks can be categorized into four types: to generate, to choose, to resolve, and to execute (15, 42). There are three common dimensions that can be integrated into a taxonomy of GSS environments (Figure 1). They are time dispersion, group proximity, and group size (30).*

group temperament: also see Ambience. The temperament of the group can impact the facilitator activities. **1992** Lewis and Whiteley. *Several prominent impact categories were generated by facilitators (see Table 3). They included: facilitator comfort (a feeling of being at ease with the process) and the energizing element (is it depleted or enhanced through GDSS?); group temperament or ambience, and the use of humor in the group; control (does the facilitator lose any of it to the technology?). Additionally, time, or the response to having it controlled by a system caused enough comment to warrant further investigation. One of the central features of MeetingWare is the ability to preserve anonymity of ideas as individuals privately "talk" to the keyboard instead of upfronting before a group of colleagues.*

group work: Group work is based on spatial (local or remote) and temporal relationships (asynchronous or synchronous). **1996** Barua et al. (4) (from Rodden (16)). *Group work: is based on spatial (local or remote) and temporal relationships (asynchronous or synchronous), analogous to geographically scope and real-time ability. He further uses this relationship to separate CSCW systems into four classes, messaging systems, conferencing systems, meeting systems and co-authoring systems.*

GroupSystems: GroupSystems is a commercial GDSS product from Ventana. GroupSystems was a spinoff from the work of Jay Nunamaker and colleagues of the University of Arizona. The system consists of a number of different tools, such as Idea Organizer, Issue Analyzer, Policy Formation, Questionnaire, Stakeholder Identification, Topic Commenter, Vote Selection, Alternative Evaluation, Group Matrix, Group Outliner, Group Writer, and Electronic Brainstorming. **1992** Bannon (12) *Ventana GroupSystems: This commercial product is a spinoff from the work of Jay Nunamaker and colleagues of the University of Arizona. The system consists of a number of different tools that are intended to assist in aspects of the group decision-making process. There is support for brainstorming activity, for ranking alternative choices and voting on them, for preserving anonymity, etc. Focus has been on the support of co-located realtime teams, but the technology can be adapted for use in remote situations or for non-realtime use.* **1995** Aiken et al. *The most widely-used commercial GDSS products (GroupSystems from Ventana, TeamFocus from IBM, and VisionQuest from Collaborative Technologies).* **1998** Hein et al.(9) (from GroupSystems Website) *GroupSystems is a typical electronic meeting systems application. It is a suite of team-based decision software tools that shorten the cycle time for strategic planning, product development, problem solving, and other business processes. Built on a standards-based architecture, GroupSystems integrates with existing enterprise environments at the* *desktop and in meeting rooms. GroupSystem's team performance tools enhance conferencing data sharing to provide results. GroupSystems helps teams work together and collaborate: in meetings, between offices, across the country, or even around the world. Simultaneous input leverages the team's time and creates insightful comments without fear of reprisals. Instant documentation automatically records every idea for distribution and future work. Process support facilitates forward movement in a team process.* **2003** Lee and Albrecht *The Windows version of GroupWriter is incorporated into GroupSystems, a collaborative group support system.*

groupware: Groupware is a term that is commonly used, but lacks a commonly accepted definition. In general, it is a set of hardware and software designed to help groups work together. Groupware enables groups to edit, move, delete, and structure information so that it is presented in a hierarchy or map that is easy to analyse and can evolve as new information is added. Groupware is a generic term for network-based software designed to facilitate group activities such as discussions, debates, joint papers, or team projects. Familiar groupware examples include email, bulletin boards, group schedulers, group decision support systems, workflow systems, collaborative authoring tools and screen sharing software. Groupware can be electronic communication tools, electronic conferencing tools and collaborative work management tools. **1988** Grudin *Evaluation of groupware "in the field" is remarkably complex due to the number of people to observe at each site, the wide variability that may be found in group composition, and the range of environmental factors that play a role in determining acceptance, such as user training, management buy-in, and vendor follow-through (e.g., Lucas, 1976; Gaffney, 1985; White, 1985; Ehrlich, 1987b).* **1989** Ellis and Gibbs *Some of these challenges [Elli88b] reside in the areas of group interfaces, access control, social protocols, and coordination of group operation ... Concurrency control also has novel aspects within groupware as we will demonstrate in this paper.* **1994** Ishii et al. *Groupware is a label for computer-based systems explicitly designed to support groups of people working together. Familiar groupware examples include email, bulletin boards, group schedulers, group decision support systems, workflow systems, collaborative authoring tools, and screen sharing software.* **1994** Chen and Hsu *Groupware, defined as "computer-based systems that support groups of people engaged in a common task (or goal) and that provide an interface to a shared environment" (16), is designed to enhance human communication, collaboration, and coordination.* **1996** Dennis et al. *Groupware is a term that is commonly used, but lacks a commonly accepted definition. In general, it is a set of hardware and software designed to help groups work together. Groupware enables groups to edit, move, delete, and structure information so that it is presented in a hierarchy or map that is easy to analyse and can evolve as new information is added.***1996** Roseman *Groupware systems provide a means for several users to work together, even though they may be separated by distance. Groupware is software that helps two or more people collaborate. It is a pretty general category that includes applications like email or Usenet bulletin boards. Workflow and document management systems like Lotus Notes are the most commonly known groupware applications today.* **1996** Hiltz et al. *One form of computer based system to support collaborative work ("groupware;" Johnson-Lenz, 1982; Ellis et al.1991) is most often called a Group Support System, or GSS. Other terms include "Group Decision Support Systems" (GDSS): (DeSanctis & Gallupe, 1987) and "Electronic Meeting Systems" (Nunamaker et al, 1991).* **1996** Kurser *Origin of the term Groupware: Peter and Trudy Johnson0Lenz coined the term 'groupware' in 1978, they defined it as a whole system of intentional group processes plus supporting software.* **1996** Ciborra (2) *The word groupware defines a socio-technical system as it connects two distinct elements, a socio-organisational one: the "team", a collective way of working, collaboration, the intimacy of staying together and sharing; and a technical one: the ware, hinting at the domain of tools and equipment..* **1997** Roseman and Greenberg *Groupware actually refers to any technology that lets people work together. So things like email and usenet news are also rudimentary groupware technologies. The difference is that email and Usenet don't allow* *people to work together at the same time or 'synchronously', but instead support different time or 'asynchronous' work. Another distinction between types of groupware is whether the system supports people working in the same place (such as a team meeting room) or at a distance, such as different sites on the internet.* **1999** Greenlaw 1999. *Groupware is a generic term for network-based software designed to facilitate group activities such as discussions, debates, joint papers, or team projects.* **2000** O'Brien *Groupware can be electronic communication tools, electronic conferencing tools and collaborative work management tools.* **2001** Pauleen and Yoong (from O'Hara Devereaux and Johansen 1994) *groupware, an umbrella term used to describe "electronic technology and group processes that support teams and organisations as they work together".* **2002** VanSlyke et al. (from Johansen 1988) *Groupware technologies are typically categorized along two primary dimensions, time and place. Groupware is technology designed to facilitate the work of groups. This technology may be used to communicate, cooperate, coordinate, solve problems, compete, or negotiate. While traditional technologies such as the telephone qualify as groupware, the term is ordinarily used to refer to a specific class of technologies relying on modern computer networks, such as email, newsgroups, videophones, or chat.*

groupware challenge: Some of the challenges of groupware resided in the areas of group interfaces, access control, social protocols, and coordination of group operations. **1989** Ellis and Gibbs *Some of these challenges [Elli88b] reside in the areas of group interfaces, access control, social protocols, and coordination of group operations.*

groupware implementation: Groupware implementation is simultaneously a social and technical intervention. **1990** Bullen *Groupware implementation is simultaneously a social and technical intervention.*

groupware product: Groupware products include Lotus Notes, ICICLE, gIBIS, QUILT and SAMM. **1990** Brothers *ICICLE's groupware involves a number of forms of structured communication among the inspectors present at the code inspection meeting, Each communications mode is intended to relieve a different form of secretarial burden from the inspectors.* **1990** Halonen et al. *Many Group Decision Support Systems (GDSSs), such as SAMM [4], provide voting and ranking tools that can be used to explore a group's consensus on issues. Although much of this can be done with traditional software tools, a key element of many of these groupware systems is the ability for users to act anonymously. Further, hardware sharing does not preclude the use of groupware programs. Available groupware designed specifically for synchronous meetings, and even asynchronous groupware (for example, argumentation tools, such as gIBIS [2], or coauthoring tools, such as Quilt [71) can be used in a hardware sharing environment.* **1999** Atkinson and Lam *Groupware products such as Notes provide features to automate (or semi automate) workflows. These features include email, document databases, scripting languages, and agents. Agents allow actions to be triggered by events. For example, when a participant has completed information in a document an email with a link to the document is automatically forwarded to the next appropriate participant informing them that work is pending and allowing easy access for their processing. Customised views of the document database may allow a supervisor to track the status of the workflow to know the percentage of cases in each state, from start to completion, and by participant.*

groupware usability: Groupware usability is the extent to which a groupware system allows teamwork to occur – effectively, efficiently, and satisfactorily – for a particular group and a particular group activity. **1999** Gutwin and Greenberg *Groupware usability: Usability in a single user environment is effective, efficient, and pleasant to use, given a certain set of users and tasks (eg. Neilsen 1993, and Shackel 1990. Real-time groupware systems are subject to these criteria as well, but now two kinds of activity must be considered: taskwork and teamwork.* **2002** Pinelle et al. *Groupware usability: the extent to which a groupware system allows teamwork to occur – effectively, efficiently and satisfactorily – for a particular group and a particular group activity.*

GSS: see Group support systems

GSS adoption and diffusion: GSS adoption and diffusion is explored in terms of human factors, internal organizational context, external organizational environment and GSS management activities. **2003** Pollard *The case study method was used to investigate the largely unexplored process of GSS adoption and diffusion in terms of human factors, internal organizational context, external organizational environment and GSS management activities.*

GSS advantage: GSS advantages include parallel and simultaneous input, and anonymity. **2003** Corbitt and Martz (from Nunamaker et al.1991) *Nunamaker et al. (1991) posit the main advantages of this technology are: parallel and simultaneous input, e.g. all participants talk at once; opportunities for equal input; a full unbiased record of a group's activities that are recorded by the computer; anonymity, so that some of the traditional participation inhibitors (speaking up in front of the boss) are minimized; and, mechanisms can be encoded into the software that discourage disruptive behavior by individual group members.*

GSS characteristic: The major characteristics of electronic Group Support Systems are anonymity, mediation, interactivity, and text-based communication means, which pose an alternative to traditional face-to-face communication settings. **2003** Beroggi *The major characteristics of electronic Group Support Systems are anonymity, mediation, interactivity, and text-based communication means, which pose an alternative to traditional face-to-face communication settings.*

GSS factor: GSS factors include the type of GSS support, and the time/place combination. **1998** Pervan *GSS factors: Two dimensions of the GSS environment were considered. First, the type of GSS support may be (a) Electronic Meeting Systems (EMS) where participants have individual computer-based support all networked together, (b) Group Decision Systems (GDSs), sometimes called Decision Conferencing, where computer support is provided by a single workstation operated by a member of the facilitation team [41], or (c) Negotiation Support Systems (NSS), which are computer-based systems for the support of parties involved in a negotiation process. Second, the time/place combination may be face-to-face (the 'decision room') , asynchronous but in different places eg. Teleconferencing and videoconferencing), ansynchronous but in the same place (Local decision network), or asynchronous and dispersed (remote decision making).(11).*

GSS feature advantages: Some advantages of GSS features can include a reduction in communication barriers among group members, and an increase in generation of ideas. **2001** Burke (from Caouette and O'connor 1998) *This parallel input feature, along with the anonymity of the comments, has been found to reduce communication barriers among group members, resulting in increased generation of ideas (Caouette and O'connor, 1998; Dennis and Gallupe, 1993).*

GSS feature: Two major GSS features are parallel input and anonymity. **2001** Burke *Although most GSS are text-based communication tools, researchers have found that the sophisticated features of GSS (eg. Parallel input, anonymity) have positive effects on collaborative work.*

GSS learning environment: GSS learning environments include face-to-face and distant. GSS learning environment is a GSS research variable. **2001** Burke *This study is an examination of how GSS learning environments face-to-face vs. distant) and task difficulty level (simple vs. difficult) influenced participation levels and social presence among accounting students working collaboratively on an accounting task*

GSS product: see Commercial GSS product.

GSS typology of tasks: GSS typology of tasks can include idea generation, proposal evaluation, alternative selection and consensus seeking. This typology closely resembles the Group

Task Circumplex, which proposes that all group tasks can be categorized into four types: to generate, to choose, to resolve, and to execute. **2003** Siao *The modules of most GSS reflect the categories of a crude typology of tasks – idea generation, proposal evaluation, alternative selection, and consensus seeking. This typology closely resembles the Group Task Circumplex, which proposes that all group tasks can be categorized into four types: to generate, to choose, to resolve, and to execute (McGrath 1984).*

guidance and self documentation*:* Interactive system characteristic related to learning modes. **1981** Turoff et al. (91) *The ability of the system to provide guidance or training to the user as and when required.*

hand gestures: Hand gestures play an important role in any work surface activity. We use them to enact ideas, to signal turn-taking, to focus attention of the group, and to reference objects on the work surface. **1996** Greenberg and Roseman *Hand gestures play an important role in any work surface activity, and presentations are no exception. We use them to enact ideas, to signal turn-taking, to focus attention of the group, and to reference objects on the work surface.*

handheld terminal: Handheld terminals such as personal digital assistants are able to store and retrieve personally relevant information. **1999** Greenberg et al. (1) *Handheld CSCW [4] as information appliances rather than as general purpose computers, where each device affords quite different personal and public acts … Personal digital assistants or PDAs, where people carry small handheld devices to store and retrieve personally relevant information.*

hardware: Hardware is a major component of GDSS. The minimal hardware requirements of these systems include an input/output device, a processor, a communication line, and either a viewing screen or an individual monitor for the display of information. **1984** Huber (195) *As will be seen a GDSS consists of a set of software, hardware, and language components and procedures that support a group of people engaged in a decision-related meeting.* **1985a** DeSanctis and Gallupe *The minimal hardware requirements of the system include: an input/output device, a processor, a communication line between the I/) device and the processor, and either a common viewing screen or individual monitors for use in displaying information to the group. More sophisticated systems may contain I/O terminals or desktop computers for each group member, several central processors, long distance communications equipment, and several large viewing screens.*

Heuristic approach (HEU): Heuristic approach is an individual decision making strategy. A non-specific heuristic approach (HEU) does not rely on any analytic concept, allowing decision makers to resort to their own intuition in decision making. **2003** Beroggi *Our theoretical framework of IMGDM will, consequently, distinguish three basic individual decision making strategies, the multiattribute utility model (MAUT) as a compensatory approach, the lexicographic model (LEX) as a non-compensatory approach, and a non-specified heuristic approach (HEU), which does not rely on any analytic concept, allowing decision makers to resort to their own intuition in decision making.*

hierarchical communication: Hierarchical communication can impact an organizations transition to a computer-based information system. **1986** Stasz and Bikson (320) *Issues in computer-supported cooperative work: Our field study assessed a number of impacts of the organization's transition to a computer-based information system. Here we discuss five: training, dissemination, hierarchical vs. network communications, centralized vs. decentralized decisionmaking, and cooperative work between different technologies and systems.*

hierarchical evaluation structure*:* Hierarchical evaluation structure is a decision analytic technique for multi attribute utility analysis. **1988** Kraemer and King (123) *The software of the decision conference is usually some form of decision analytic technique: decision trees and influence trees; multiattribute expected utility models for single-stage decisions;*

hierarchical evaluation structures for multiattribute utility analysis; Pareto algorithms for two-party negotiations; cost-benefit models for resource allocation; and spread- sheet models. Software for graphics and vote tally and display also are part of the decision conference facility.

human communication mode: also see Communication activities. Human communication modes include text, voice sketched diagrams, and photographs.**1986** Fanning and Raphael *Until computer teleconferencing systems can encompass several modes of human communication-- e.g. text, voice, sketched diagrams, and photographs.* **1996** Hiltz et al. *Modes of communication (asynchronous computer-mediated communication (CMC) vs. face-to-face).*

human factor: Human factor considerations are critical in the design of GDSS. Human factors could include spatial arrangement of the group members, group size, size and location of public screens, and accommodation for informal as well as formal communication between group members. **1985a** DeSanctis and Gallupe *What human factors considerations are critical in the design of GDSS (eg. spatial arrangement of group members, size and location of public screens, accommodation for "informal" as well as "formal" communication between group members) ?*

human help*:* Human help is a CMC factor relating to the environment (atmosphere). **1981** Turoff et al. (92-93) *The ability of the system to supply human help directly to its users.*

Human relations case: The Human Relations Case is a task or problem that was developed by Bales and used by Hiltz et al.(1980) It is a medium complex, unsettled problems that has no specific “correct” answer **1980** Hiltz et al. (75). *A variable of secondary Interest is problem type. Much experimental literature indicates that the nature of the problem has a great deal to do with group performance. One type of problem that we used is the human relations case as developed by Bales. These are medium complex, unsettled problems that have no specific "correct" answer. The second type was a "scientific" ranking problem (requiring no specific expertise), which has a single correct solution plus measurable degrees of how nearly correct a group's answer may be.*

humanization*:* Humanization is an nteractive system characteristic related to behaviour. **1981** Turoff et al. (91) *Treating the user as an intelligent human being rather than as a slave of the computer.*

hypertext system: Hypertext systems are a category of system that supports groups. This category of systems provide some very general representational tools, such as topic structures and embedded links between documents, with very little other formal knowledge about their domains. **1986** Malone et al. *Most previous systems for supporting group work can be thought of as belonging to one of two categories. In one category, are forms processing, calendar management, and other systems that contain a great deal of formalized knowledge about the application domains they are intended to support (e.g., Greif, 1982 Ellis & Bernal, 1982; Fox et al, 1983; Sluizer & Cashman, 1985). In the other category are electronic mail, computer conferencing, and hypertext systems that provide some very general representational tools (such as topic structures in computer conferences or embedded links between documents) and very little other formal knowledge about their domains (e.g. Engelbart & English, 1968; Hiltz & Turoff, 1978 Trigg, Suchman, & Halasz, 1986).*

Icicle: ICICLE is a groupware system that supports code inspection meetings. **1990** Brothers *Unlike many meeting support systems (e.g., [AhujgO], [Stef871, [Mant88]), ICICLE is in-tended to instantiate the highly structured procedures of code inspection Faga761 … ICICLE's groupware involves a number of forms of structured communication among the inspectors present at the code inspection meeting, Each communications mode is intended to relieve a different form of secretarial burden from the inspectors.*

idea generation: Idea generation is a GSS task category. **2003** Siao *The modules of most GSS reflect the categories of a crude typology of tasks - idea generation, proposal evaluation, alternative selection, and consensus seeking (25, 41). This typology closely resembles the Group Task Circumplex (24), which proposes that all group tasks can be categorized into four types: to generate, to choose, to resolve, and to execute (15, 42). There are three common dimensions that can be integrated into a taxonomy of GSS environments (Figure 1). They are time dispersion, group proximity, and group size (30).*

idea generation model: Idea generation model is a planning and problem solving model that may be implemented in GDSS systems for information gathering, which are used to generate ideas. Electronic brainstorming has been called a software planning model or idea generation technique **1986** Applegate et al. *Four general classes of planning and problem-solving models are implemented in the system: (I) information gathering/idea generation models, (2) information/idea synthesis models, (3) quantitative analysis models and (4) consensus and negotiation/choice models … Four software planning models are available to assist planners with the idea generation and analysis process. They are: (I) Electronic Brainstorming (group brainstorming version); (2) Electronic Brainstorming (individual brainstorming version); (3) Idea Structuring and Analysis; and (4) a callable voting program for interactive idea prioritization … A major component of the GDSS is the incorporation of idea generation, idea structuring and analysis models that enable decision-makers to generate, analyze and prioritize critical issues, strategic options and strategic policies.*

idea generation technique: Electronic brainstorming is an idea generation technique. **1986** Applegate et al. *Brainstorming and other idea generation techniques were popularized during the early 1950s to assist organizations in the innovation process. Alex Osborne (1953), an advertising executive, developed the Structured Brainstorming technique as a methodology for stimulating creative thought within a group setting.*

idea structuring and analysis model: Idea structuring and analysis models are software planning models. Idea structuring and analysis models are a major component of some GDSS. **1986** Applegate et al. *Four software planning models are available to assist planners with the idea generation and analysis process. They are: (I) Electronic Brainstorming (group brainstorming version); (2) Electronic Brainstorming (individual brainstorming version); (3) Idea Structuring and Analysis; and (4) a callable voting program for interactive idea prioritization … A major component of the GDSS is the incorporation of idea generation, idea structuring and analysis models that enable decision-makers to generate, analyze and prioritize critical issues, strategic options and strategic policies.*

idea synthesis model: Idea synthesis model is a planning and problem solving model that may be implemented in GDSS systems for information structuring and prioritising. **1986** Applegate et al.. *Four general classes of planning and problem-solving models are implemented in the system: (I) information gathering/idea generation models, (2) information/idea synthesis models, (3) quantitative analysis models and (4) consensus and negotiation/choice models.*

identification: Identification is one of five main component of anonymity. The other four components are diffused responsibility, proximity, knowledge of other group members, and confidence in the system. **2003** Siao (from Pinsonneault and Heppel [31]) *This assumption was cautioned, however, by Pinsonneault and Heppel (31), who researched the various aspects of anonymity. They discovered that there were five main components to anonymity: (1) identification - ideas and/or comments cannot be associated to individuals; (2) diffused responsibility -responsibility is diffused to all members of a group, not given to one particular person; (3) proximity - how close people sit to one another affects the degree to which they feel that the exchange is anonymous; (4) knowledge of other group members - if people know each other well, they feel that their statements may be recognized; and (5)* *confidence in the system itself- if users are not confident in the system then it is unlikely that they will be confident that their exchange is anonymous.*

impact category: see Facilitator impact.

implementation (1): Implementation is a process that has an impact on technology transfer. Implementation is the process by which the organization embeds the technology in its work. Groupware implementation is a social and technical intervention. Implementation is one aspect of uptake which is the sustained use of the technology for real work. Other aspects of uptake are acquisition, adoption, acceptance, assimilation, routinization and use. **1986** Stasz and Bikson *The study was informed by a Rand-developed framework for understanding technology transfer which suggests that the outcomes or impacts of technology depend on three major classes of variables: characteristics of the organization, characteristics of the technology, and characteristics of the implementation process, i.e., the process by which the organization embeds the technology in its work.* **1990** Bullen *Groupware implementation is simultaneously a social and technical intervention.* **1991** Applegate … a *decision to implement an electronic mail system in an organisation would represent the introduction and assimilation of an established CSCW technology, for which introduction, implementation, and impact have been studied widely.* **2002** Turner and Turner (4) *Uptake - the sustained use of the technology for real work … Inconsistent use of terminology: uptake include acquisition, adoption, acceptance, implementation, assimilation, routinization, and, of course use.*

implementation (2): Implementation is described as a step in the problem solving process in terms of the implementation of the decision. **1984** Huber *any step of the problem-solving process: problem sensing, problem exploration, problem definition, criterion and constraint identification, proposal generation, proposal evaluation, choice, implementation, and performance evaluation. (p.200)* **1987** DeSanctis and Gallupe *Outcomes of meetings may be measured on many dimensions, including decision quality and timeliness, satisfaction with the decision, cost or ease of implementation, member commitment to implementation, or the group's willingness to work together in the future.*

implementation cost: Implementation cost is a characteristic of the implementation process. Outcomes of meetings may be measured on many dimensions. One of these dimensions is cost or ease of implementation. **1986** Stasz and Bikson *The study was informed by a Rand-developed framework for understanding technology transfer which suggests that the outcomes or impacts of technology depend on three major classes of variables: characteristics of the organization, characteristics of the technology, and characteristics of the implementation process, i.e., the process by which the organization embeds the technology in its work.* **1987** DeSanctis and Gallupe *Outcomes of meetings may be measured on many dimensions, including decision quality and timeliness, satisfaction with the decision, cost or ease of implementation, member commitment to implementation, or the group's willingness to work together in the future.*

implementation process characteristic: Implementation process characteristics have an impact on technology transfer. **1986** Stasz and Bikson (319) *The study was informed by a Rand-developed framework for understanding technology transfer which suggests that the outcomes or impacts of technology depend on three major classes of variables: characteristics of the organization, characteristics of the technology, and characteristics of the implementation process, i.e., the process by which the organization embeds the technology in its work.*

implicit coordination: Implicit coordination is where awareness information needed for group activity can be exchanged by direct communication or by indirect communication with the help of the computer system. **1997** Schlichter et al. *Group awareness where co-workers are aware of each other's past, current and possible future activities within the shared environment. The awareness information needed can be exchanged by direct* *communication or by indirect communication with the help of the system (computer mediated communication). This whole process is called implicit coordination.*

inconsistent design: Inconsistent designs can be caused by poor communication and disagreement at meetings. **1986** Begeman et al. *Poor communication and disagreement at meetings can result in inconsistent designs, frustrated efforts, drastically lowered morale, and ultimately to project failure. We have a set of creative ideas which, we hypothesize, can use automated technology to positively impact face-to-face design meetings.*

incorporation: Incorporation is a user behaviour phase when using interactive systems. **1981** Hiltz and Turoff (749) *… the 'incorporation' phase, when the mechanics of the interaction become second nature …*

indirect communication channel*:* Indirect communication channel is a CMC factor relating to communication capabilities. "The ability to set up indirect communication linkages among individuals and groups, such as informing a group of authors what the readers are looking for and not finding in key word searches" **1981** Turoff et al. (92-93). *The ability to set up indirect communication linkages among individuals and groups, such as informing a group of authors what the readers are looking for and not finding in key word searches.*

individual brainstorming: Individual brainstorming can be undertaken using electronic brainstorming software. **1986** Applegate et al. *Four software planning models are available to assist planners with the idea generation and analysis process. They are: (I) Electronic Brainstorming (group brainstorming version); (2) Electronic Brainstorming (individual brainstorming version); (3) Idea Structuring and Analysis; and (4) a callable voting program for interactive idea prioritization.*

individual decision making strategy: Individual decision making strategies include multiattribute utility models, lexicographic models, and non-specified heuristic approaches. **2003** Beroggi *Our theoretical framework of IMGDM will, consequently, distinguish three basic individual decision making strategies, the multiattribute utility model (MAUT) as a compensatory approach, the lexicographic model (LEX) as a non-compensatory approach, and a non-specified heuristic approach (HEU), which does not rely on any analytic concept, allowing decision makers to resort to their own intuition in decision making.*

individual monitors: Individual monitors can be a hardware component of a GDSS. **1985a** DeSanctis and Gallupe *The basic components of any GDSS include hardware, software, people, and procedures. Hardware: Regardless of the specific decision situation, the group as a whole, or each member, must be able to access a computer processor and display information. The minimal hardware equirements of the system include: an input/output device, a processor, a communication line between the I/O device and the processor, and either a common viewing screen or individual monitors for use in displaying information to the group. More sophisticated systems may contain I/O terminals or desktop computers for each group member, several central processors, long-distance communications equipment, and several large viewing screens.*

individual participant characteristic: Individual participant characteristics could include group cohesiveness, motivation, past group history, future relationships. Also see Group characteristics. **1987** Jelassi and Beauclair *While GDSS developers are trying to design systems that will help structure the group process, it is important to acknowledge briefly the characteristics that decision makers bring with them to the decision making environment (10, 27). These include: (1) Individual characteristics of each group member (eg. personality, sex, age, race, status, socio-economic background, competence, and motivation); (2) Group characteristics (eg political orientation, leadership, complexity of the task and circumstances, size of group, and history of its members); and (3) environmental characteristics (eg. setting, scheduling, length of a session, organizational context, and spatial arrangement).* **1988** Dennis et al. *The characteristics of the individual participants, group cohesiveness and motivation, past group history and future* *relationships have also been shown as important in studies of meetings, so they should be considered in the study of EMS.*

Individual responsibility: Individual responsibilities of group members may be uncertain when group members have no experience working together. Diffusion of responsibility, also known as social loafing results when group members fail to take responsibility for their own actions. Communication structures can improve the transparency of individual efforts. **1985a** DeSanctis and Gallupe (7) *Second, special accommodations are needed for groups who have no prior experience working together. In groups that have never worked together before, members may feel uncertain about the exact goals of the group or their individual responsibilities and expectations. Newly-formed groups usually lack cohesion and a structure for operating (Klein & Ritti, 1980).* **1987** Jelassi and Beauclair *This discussion of GDSS design issues is a positive step toward a behaviourally-driven design of group decision support systems. As we have shown, design strategies can be specific to certain group behaviours (eg. diffusion of responsibility) as well as general to computer-based decision support systems (eg. communication and information sharing, consistency and coherence). … diffusion of responsibility: also known as social loafing, results when group members fail to take responsibility for their own actions.* **1988** Ciborra and Olson *Specifically, the communication structure can improve the sharing of information, thus increasing the transparency of individual efforts (Marschak & Radner, 1973). It can signal the beginning and completion of tasks to all group members. It can support the renegotiation of the terms of explicit or implicit contracts that link team members. It can uncover shirking of responsibilities. It can filter out false information used for coverups. It can provide a forum for discussing and exploring the limits of cooperation. It can make the team more open to external incentives and signals - such as competitive pressure. On the other hand. it can buffer the team from external pressures regarded as potentially disruptive to grow performance.* **2000** Stough et al. *Teams share authority, responsibility, leadership, decision making, results, and rewards.*

individual satisfaction measure: Satisfaction measure is a meeting outcome measure. **1987** DeSanctis and Gallupe *Outcomes of meetings may be measured on many dimensions, including decision quality and timeliness, satisfaction with the decision, cost or ease of implementation, member commitment to implementation, or the group's willingness to work together in the future.* **1988** Dennis et al. *Finally, there are many outcomes of a group meeting that may be measured. These include the decision/outcome quality, participant satisfaction with the outcomes and the process, participant confidence in the outcomes, process time required, level of group consensus, number of comments during the meeting, and the number ofalternatives or issues considered.* A widely used model developed by **1991** Applegate (from Hackman [41]) *Hackman [41] defines work group effectiveness in terms of output acceptable to the client, group maintenance and growth, and member satisfaction. These outcome measures are facilitated by knowledge and skill brought to bear on the task, and appropriateness of the task performance strategies implemented by the group.***2003** Lester et al. *We measure individual satisfaction with (a) the facilitator, (b) the agenda, (c) the software (d) the task (e) the group processes, and (f) the group outcomes … This research suggests that a relationship-oriented facilitator style is positively related to five (of six) GSS satisfaction measures--satisfaction with facilitator, agenda, software, task, and process. Positive participant mood at the outset of a GSS meeting is positively related to four measures of satisfaction--satisfaction with facilitator, task, process, and outcome. Surprisingly, negative mood did not adversely affect participant satisfaction as was expected.* **2003** Martz *Much research has compared groups using the electronic meeting environment to groups using the traditional environment and, in so doing, has found differences on two outcome measures: satisfaction and level of consensus … In general, three fundamental measures have been used as proxies for satisfaction; meeting process satisfaction, meeting outcome satisfaction and participation.*

inferential knowledge: Inferential knowledge is derived from stated facts using reasoning and implication. Inferential 'deeper' knowledge is generated by combining a group member's task-related knowledge, training, and experience with the basic factual information. **1999** Shirani et al. *Inferential knowledge is derived from stated facts using reasoning and implication. Inferential 'deeper' knowledge is generated by combining a group member's task-related knowledge, training, and experience with the basic factual information.*

influence tree: Influence tree is a decision analytic technique **1988** Kraemer and King (123) *The software of the decision conference is usually some form of decision analytic technique: decision trees and influence trees; multiattribute expected utility models for single-stage decisions; hierarchical evaluation structures for multiattribute utility analysis; Pareto algorithms for two-party negotiations; cost-benefit models for resource allocation; and spread- sheet models. Software for graphics and vote tally and display also are part of the decision conference facility.*

informal awareness: Informal awareness of a work community is basic knowledge about who is around in general (but perhaps out of site), who is physically in a room with you, and where people are located relative to you. **1997** Schlichter et al. (Greenberg (18)) *Informal awareness of a work community is basic knowledge about who is around in general (but perhaps out of site), who is physically in a room with you, and where people are located relative to you.*

information benefit: Information benefit is one of three kinds of benefits afforded by GDSS. The other two kinds of benefits are affective benefits and protocol benefits. Information benefits iprovided by GDSS technologies could be either providing more useful information or facilitating the application of available factual information to evaluate the assumptions of group members. **1986** Kraemer and King *We find that GDSS systems can provide three kinds of benefits: affective benefits in which participants' attitudes towards cooperation and decision effectiveness are increased by use of GDSS technologies; protocol benefits, in which the important tasks of focusing on key issues and assessing differences of opinion among participants are facilitated; and information benefits in which GDSS technologies either provide more useful information or facilitate the application of available factual information to evaluation of the assumptions of group members.*

information centre: Information centre is a GDSS technology or system category. **1986** Applegate et al. *Systems that fall under the classification of a GDSS include: (I) Decision Conferences (or Decision Rooms), (2) Teleconferencing, (3) Local Ongoing Decision Networks, (4) Remote Ongoing Decision Networks, and (5) Information Centers (Kraemer and King, 1984; DeSanctis and Gallupe.*

information centre software: Information centre software could typically include packaged programs for data management, report generation, data retrieval and query, text-handling, statistical analysis, and mathematical and simulation modelling. **1988** Kraemer and King (122) *The kinds of software typically provided in an information center include packaged programs for data management, report generation, data retrieval and query, text-handling, statistical analysis, and mathematical and simulation modeling. 1985).*

information distortion: Information distortion is a productivity loss in group decision making **1988** Kraemer and King (117) *The idea here is that the primary problems of productivity loss in group decision meetings are from information loss, information distortion, or sub-optimal decisionmaking (ie. not enough issues/alternatives explored).*

information exchange: Information exchange is a group decision task. An EMS has the potential to reduce delays in information exchange. **1986** Bui and Jarke *…there are different tasks in group decision processes that must be supported: -Initiation. How does the group start the collective decision-making process? Should the group elect a person who leads the discussion? -Information exchange. How can a member request or disseminate information? -Analysis. How does the group interpret the results of group discussions or* *decisions? -Consensus testing. What decision technique(s) should be adopted, for example, democratic vote or weighted majority rule?* **1988** Rice and Shook *Because of some of the characteristics of an EMS summarized earlier, use of an EMS has the potential to reduce delays in information exchange, improve maintenance of records and information received, increase coordination of geographically dispersed groups, and improve users' abilities to process large amounts of information [24, 43].* **2003** Huang *More (factual or social) information exchange is vital to constructive arguments that lead a group to a final group decision … Informational influence (eg. Factual information exchange) … Normative influence (eg. Social information exchange).*

Information Exchange Theory: Information Exchange Theory incorporates both the economic and behavioural science traditions in its recognition of the importance of network characteristics and context in group interaction **1988** DeSanctis (11) *Network characteristics, contextual factors, and the meaning of exchange are identified as determinants of the efficiency (minimum cost of exchanges), coordination (synchrony of exchanges), and effectiveness (quality of resulting products or outputs) of interprersonal exchange within the group.* **1988** DeSanctis (from Cartwright and Zender 1968; Fisher, 1980; Hackman and Morris 1975; Hare 1976; Marschak and Radner 1972; Thomas and Fink 1961) *Information exchange theory incorporates both the economic and behavioural science traditions in its recognition of the importance of network characteristics and context in group interaction.*

information gathering model: Information gathering model is a class of planning and problem-solving models implemented in some GDSS systems. **1986** Applegate et al. *Four general classes of planning and problem-solving models are implemented in the system: (I) information gathering/idea generation models, (2) information/idea synthesis models, (3) quantitative analysis models and (4) consensus and negotiation/choice models.*

information giving: Information giving is one of a number of communication activities exhibited in a decision related meeting. Other communication activities could include proposal exploration, opinion exploration, exploration analysis, expressions of preference, argumentation, information seeking, proposal development, proposal negotiation, and socializing. **1987** DeSanctis and Gallupe *The communication activities exhibited in a decision-related meeting include proposal exploration, opinion exploration, analysis, expressions of preference, argumentation, socializing, information seeking, information giving, proposal development and proposal negotiation (Bedau 1984; Poole 1983a).*

information loss: Information loss is a productivity loss in group decision making. See productivity loss.

information processing: Information processing is a group interaction process that includes sharing, redundancy, and integrative complexity. **2000** Pare and Dube *Group interaction processes, namely communication trust, cooperation, information processing (sharing, redundancy, integrative complexity), consensus generating (amount and intensity of disagreement), conformity pressures, and normative regulation (expressions of commitment, satisfaction and solidarity). In turn these group processes form an important basis for the shaping of project outcomes.*

information retrieval: Information retrieval is a group activity. **1984** Huber (200) …*whatever tasks a group may engage in, its members will be found to be carrying out one or more of the following activites: information retrieval (or generation), Information sharing, or information use.(p.200)* **1985a** DeSanctis and Gallupe (from Huber 1984) …*"group" activities which it supports. The basic activities which occur in any group and which, therefore, are in need of computer-based support are: information retrieval, information sharing, and information use (Huber, 1984).*

information seeking: Information seeking is one of a number of communication activities exhibited in a decision-related meeting. Other communication activities could include proposal exploration, opinion exploration, exploration analysis, expressions of preference, argumentation, information giving, proposal development, proposal negotiation, and socializing. **1987** DeSanctis and Gallupe *The communication activities exhibited in a decision-related meeting include proposal exploration, opinion exploration, analysis, expressions of preference, argumentation, socializing, information seeking, information giving, proposal development and proposal negotiation (Bedau 1984; Poole 1983a).*

information sharing: Information sharing is the most typical of the activities in which groups engage and it is one of the two activities most obviously supported by technology, the other being information use. **1984** Huber 200 *Information sharing is the most typical of the activities in which groups engage and it is one of the two activities most obviously supported by technology, the other being information use.* **1987** Jelassi and Beauclair *This discussion of GDSS design issues is a positive step toward a behaviourally-driven design of group decision support systems. As we have shown, design strategies can be specific to certain group behaviours (eg. diffusion of responsibility) as well as general to computer-based decision support systems (eg. communication and information sharing, consistency and coherence).*

information sharing effectiveness: Information sharing effectiveness can be measured using surrogates such as time to decision and decision quality. **2003** Ngwenya and Keim *Time to decision and decision quality were surrogate measures of group information sharing effectiveness.*

information sources for GDSS: Information sources for GDSS are participant inputs, databases, general reference materials, and results of previous conferences. **1988** Kraemer and King *The hardware for the decision conference consists of a medium-sized conference room furnished with a large-screen video projector, a computer, video terminals, hand-held terminals for voting or other input by the participants, and a control terminal for presenting participant inputs in graphic form and for accessing other sources of information (e.g., databases, general reference materials, results of previous conferences).*

information structure: Information structure is represented in information sharing technologies such as documents and databases. **1999** Mark et al. *Information sharing technologies represent, structure and store information, such as documents and databases.*

information use: Information use is an activity carried out by group members. **1984** Huber (200) *…whatever tasks a group may engage in, its members will be found to be carrying out one or more of the following activites: information retrieval (or generation), Information sharing, or information use … Personal entry terminals and appropriate software will enable the group, and each participant in the group, to create and modify the group's information displays. "What if" and other analytic software will enable the group to use information, even ad hoc information entries brought forth during the meeting, as input to interrogations made and responded to in real time.*

information: Three different types of information are textual, relational and numeric. **1984** Huber (203) *The subsequent analysis of group activities made clear that textual and relational information are relatively more important for GDSS than they are for DSS, most of which deal largely with numeric information (p.203)*

informational influence: Information influence is a social influence that contributes to conformity in teams. The other social influence is normative influence. **2001** Schmidt (from Nemeth and Staw 1989) *Nemeth and Staw (1989), social influences (normative and informational) tend to increase group conformity in the following conditions …* (from Deutsch and Gerard 1955) *Normative and informational influences contribute to conformity in teams.*

informational meeting: Informational meeting is a type of meeting **1986** Begeman et al. *Meeting Types include: 1. Exploration and Brainstorming meetings, 2. Informational or*

Presentational meetings, 3. Problem Solving or Decision Making meetings, 4. Negotiation or Resource Allocation meetings 5. Morale Building or Social Structuring meetings.

***informative**:* Informative is an interactive system characteristic related to learning modes. **1981** Turoff et al. (91) *Providing clear information for users on what they are being asked to do in terms of operations or errors.*

inhibitor (1): Inhibitors of idea generation activities appear to be neutralized with the use of electronic brainstorming. Aspects of the technology that inhibit the idea generation process are the size of the computer screen, the keyboard as an unfamiliar interface (for some executives) and the efficiency of the network in handling multiple, simultaneous file transfers. **1986** Applegate et al. *While Electronic Brainstorming does appear to neutralize the group effects that have been suggested as inhibitors of idea generation during group brainstorming and to improve the efficiency of the session by allowing parallel process and automatic recording, specific aspects of the technology that tend to inhibit the idea generation process have been identified. These factors include: (I) the size of the computer screen, (2) the keyboard as an unfamiliar interface metaphor for some executives, and (3) the efficiency of the network in handling multiple, simultaneous file transfers.*

inhibitor (2): A participation inhibitor may include speaking up in front of the boss. **2003** Corbitt and Martz *…participation inhibitors (speaking up in front of the boss).*

initiation: Initiation is a group decision task. Initiation considers how the group starts the collective decision-making process. **1986** Bui and Jarke *… there are different tasks in group decision processes that must be supported: -Initiation. How does the group start the collective decision-making process? Should the group elect a person who leads the discussion? -Information exchange. How can a member request or disseminate information? -Analysis. How does the group interpret the results of group discussions or decisions? -Consensus testing. What decision technique(s) should be adopted, for example, democratic vote or weighted majority rule?*

initiation behaviour: Initiation behaviour is a specific category of verbal behaviour. Initiation behaviour deals with setting or initiation agendas. **1988** Zigurs et al. *Five specific categories of verbal behavior are of interest in this study. 1. Initiation behavior, which deals with setting or intiating agendas. 2. goal-oriented behavior, concerning group goals or group jurisdiction; 3. integrative behavior, which summarizes and integrates contributions of others; 4. implementation behavior, representing an action orientation toward getting the task done; and 5. process behavior, dealing with procedural movement of the group.*

***in-meeting phase**:* The In-meeting phase is sometimes known as 'during meeting' phase or stages. This phase is where people work together to pursue their task. **1986** Begeman et al. *As should be clear from figure 1, our research is concerned with pre-meeting aids, during meeting aids, and post-meeting aids.* **1988** Bostrom and Anson *In-Meeting * Electronic agenda that triggers. monitors and records events (e.g. minutes, committments) * Process support (meeting advisors, group "barometer readings". etc.).* **1998** Greenberg and Gutwin (13) *During meeting activities where people work together face to face to pursue their work.* **2001** Antunes and Ho (from Clawson et al.1995) *Several authors rely on a timing dimension where facilitation is divided in pre-meeting, meeting and post-meeting stages (Bostrom et al. 1993; Clawson et al. 1995).*

***input device**:* Input devices could include a keyboard, touchscreen and mouse. **1984** Huber (195) *A typical GDSS consists of a meeting room with a conference table. Each seating position has a small CRT terminal. Input at these terminals is by keyboard, touchscreen, mouse, or some combination of these devices.* **2001** Zanella and Greenberg (1) *Single Display Groupware (SDG) is a class of computer supported cooperative work (CSCW) application that supports the work of co-located groups (Stewart, Bederson and Druin 1999). The group shares the same display, which can be a large display or a monitor. Each* *member has his or her own input device, allowing all to interact simultaneously with the system.*

input/output device*:* Input/output devices are a basic hardware component of any GDSS. **1985a** DeSanctis and Gallupe *The technology of GDSS: A pictorial representative of a typical GDSS is shown in Figure 1. In this generalized model, a group of decision makers has access to a data base, a model base, and GDSS applications software during the course of a decision-related meeting. There is at least one computer processor, one input output device, and one viewing screen. A "group facilitator" coordinates the group's use of the technology, and there is a flexible, friendly user-interface language available for use by the facilitator or each group member … The basic components of any GDSS include hardware, software, people, and procedures. Hardware Regardless of the specific decision situation, the group as a whole, or each member, must be able to access a computer processor and display information. The minimal hardware equirements of the system include: an input/output device, a processor, a communication line between the I/O device and the processor, and either a common viewing screen or individual monitors for use in displaying information to the group. More sophisticated systems may contain I/O terminals or desktop computers for each group member, several central processors, long-distance communications equipment, and several large viewing screens.*

input/output terminal*:* see Input/output devices

Insight: Insight is a user behaviour phase when using interactive systems. The ‘insight’ phase during which the user understands the general concept of the system and can make at least limited use of it for his or her own purposes. **1981** Hiltz and Turoff (749) (from Bennett 1972) *… the ‘insight’ phase, during which the user understands the general concept of the system and can make at least limited use of it for his or her own purposes …*

integrated data structure*:* Integrated data structure is a CMC factor relating to specialized support software. **1981** Turoff et al. (92-93) *The ability of the users to communicate data in other than free text and the ability of the computer to recognize data items and who has authored them. It is usually assumed that such structures maintain the identity of the creators or suppliers of the data and allow authorship control over the segments of the data structures the user is responsible for. An example of this might be a budget planning system.*

intellectual task: Intellectual tasks are problems with correct answers and require the cooperation of group members to arrive at more accurate judgement **1996** Sia et al. (from McGrath 1984). *Intellectual tasks are problems with correct answers and require the cooperation of group members to arrive at more accurate judgement.*

interaction richness: Interaction richness is the extent to which we can overcome the barriers of space, time and media/document formats in interacting with others. This would include: (1) ability to talk, see, write and draw in both synchronous and asynchronous manner; (2) access relevant reference information; (3) archiving interactions for future review; (4) debate issues, problems, ideas, articles, etc. in open public forums on a global basis. **1996** Barua et al. *Interaction richness: The extent to which we can overcome the barriers of space, time and media/document formats in interacting with others. This would include: (1) ability to talk, see, write and draw in both synchronous and asynchronous manner; (2) access relevant reference information; (3) archiving interactions for future review; (4) debate issues, problems, ideas, articles, etc. in open public forums on a global basis.*

interactive idea prioritization: Callable voting programs are used for interactive idea prioritization. **1986** Applegate et al. *Four software planning models are available to assist planners with the idea generation and analysis process. They are: (I) Electronic Brainstorming (group brainstorming version); (2) Electronic Brainstorming (individual brainstorming version); (3) Idea Structuring and Analysis; and (4) a callable voting program for interactive idea prioritization.*

interactive system characteristic: Interactive system characteristics include issues related to learning modes, adaptability, and behaviour. **1981** Turoff et al. (91). *Definitions of system characteristics common to all interactive systems. A. Learning Accessibility: The knowledge and effort needed by users to gain access to a system. Comprehension: The ability of users to understand as a whole what the system is capable of accomplishing, before having to learn how to do it. Guidance and self-documentation: The ability of the system to provide guidance or training to the user as and when required. Informative: Providing clear information for users on what they are being asked to do in terms of operations or errors. Segmentation: The ability of the user to learn only the minimum in order to carry out a specific task. B. Adaptability Control: The ability of users to feel in control of the computer, while making sure they understand what they are doing and where they are in the interaction. Flexibility and variety: The ability of users to tailor the system to their own style of interaction in carrying out tasks. Leverage and simplicity: The ability of users to execute significant computer operations with a minimum of interface effort (minimization of the number and length of user supplied entries). Modifiability: The ability of users to adapt the system to serve their needs. C. Behavior Humanization: Treating the user as an intelligent human being rather than as a slave of the computer. Regul;arity and predictability: The ability of a user to anticipate the actions of the computer and to expect consistent responses to operations and functions. Responsiveness: The ability of the system to respond quickly and meaningfully to user requests to carry out various operations and functions. D. Error Control Forgiveness and recovery: The ability of the system not to penalize users unnecessarily for mistakes and to provide mechanisms to easily recover from errors. Protection: Protection of the system from damage by a user interaction. Security: Ability to protect the users' data from errors inintentionally or intentionally generated. Reliability: The ability of the system to function without error or loss of data. Also, the frequency and length of instances of the system being unavailable during scheduled operation. Closure: Informing users when an operation has been successfully or unsuccessfully completed.*

interference: Interference is the act of one person hindering, obstructing, or impeding another’s view or actions on a single shared display. **2001** Zanella and Greenberg *the act of one person hindering, obstructing, or impeding another’s view or actions on a single shared display.*

Internet application: Internet applications such as Newsgroups and Internet Relay Chat (IRC) provide the asynchronous and synchronous communication capabilities respectively, they do not support multimedia or hypertext linking capabilities like the web. **1996** Barua et al. *Internet applications such as Newsgroups and Internet Relay Chat (IRC) provide the asynchronous and synchronous communication capabilities respectively, they do not support multimedia or hypertext linking capabilities like the web.*

Internet: For many people the Internet is synonymous with the World Wide Web. The Internet also provides a network infrastructure for real-time communication that enables a variety of novel computer applications for supporting collaboration. **1998** Cockburn and Greenberg (777) *For many people the Internet is synonymous with the World Wide Web. However, the Internet also provides a network infrastructure for real-time communication that enables a variety of novel computer applications for supporting collaboration. These applications include audio and video conferencing, shared electronic white-boards, collaborative text editors and so on. Commercial vendors are rapidly developing applications that exploit the real-time communication capabilities of the Internet and examples include Intel's "Proshare" - Netscape"s "CoolTalk", and Microsoft"s "NetMeeting".*

Internet-based group decision environment: Internet-based group decision environments are used by organizations for different purposes, including strategic planning, tactical decision making, and real-time internet conferencing. **2003** Beroggi *Internet-based group decision environments are used by organizations for different purposes, including strategic planning, tactical decision making, and real-time internet conferencing.*

Internet-based multiattribute group decision making(IMGDM): Internet-based multiattribute group decision making is characterized by three aspects, (i) individual interactive decision making, (ii) communication means, and (iii) group consensus reaching. **2003** Beroggi *Internet-based multiattribute group decision making is characterized by three aspects, (i) individual interactive decision making, (ii) communication means, and (iii) group consensus reaching.*

interpersonal characteristic: Interpersonal characteristics include the degree of cooperation in the virtual team and the degree to which certain team members dominate the group processes. **2000** Pare and Dube *Interpersonal characteristics include the degree of cooperation in the virtual team and the degree to which certain team members dominate the group processes.*

invention: Invention relates to the processes of collaboration where ideas are generated and the structuring of roles becomes clear. **1986** Johnson et al. (349). *Coordinator in stages of collaboration I . Overview We can characterize the process of collaboration through phases "invention" (ideas are generated; structuring of roles becomes clearer), "evaluation" (ideas are assessed; ambiguity is reduced); "action" (commitments of who does what are made and fulfilled or not). We will consider the experiences of these two quite different project groups in using the Coordinator for each of these activities.*

inventor role: Inventor role is one of three role of the communication manager in a distributed GDSS. The other two roles are coordinator role and detective role. The inventor role is an extension of the coordinator role. **1986** Bui and Jarke (95) *One can identify at least three specific roles: (1) Coordinator role. The communication manager should coordinate the initial situation analysis and problem definition ... Walton [52] suggests that by installing a communication medium that follows some norms of fairness (e.g., equality of participation, preserving autonomy), information exchange will be more abundant and accurate. (2) Detective role. Problem analysis could be distorted by an individual's attempt to spy on others' activities or by the influence of some members who try to take over an individual's responsibility ... (3) Inventor role. The inventor role is an extension of the coordinator role.*

invisible group dynamics: Invisible group dynamics that may be created are convergence and divergence, depth and breadth, detail and abstraction, and consensus and constrictive conflict. **1998-9** Briggs et al. *The invisible group dynamics that may be created are convergence and divergence, depth and breadth, detail and abstraction, consensus and constrictive conflict, to name but a few.*

knowledge representation technique: Knowledge representation techniques include frames, semantic inheritance networks and production rules **1986** Applegate et al. (18). *The output from all four classes of models serve as input to a knowledge base that provides a mechanism for representing and storing the planning knowledge using a variety of knowledge representation techniques (including frames, semantic inheritance networks and production rules).*

lack of cohesion: Lack of cohesion is a group decision making barrier and a productivity loss. **1985a** DeSanctis and Gallupe (from Klein and Ritti 1980) *Second, special accommodations are needed for groups who have no prior experience working together. In groups that have never worked together before, members may feel uncertain about the exact goals of the group or their individual responsibilities and expectations. Newly-formed groups usually lack cohesion and a structure for operating.*

lack of structure: Lack of structure is a group decision making barrier and a productivity loss. **1985a** DeSanctis and Gallupe (from Klein and Ritti 1980) *Second, special accommodations are needed for groups who have no prior experience working together. In groups that have never worked together before, members may feel uncertain about the exact goals of the group or their individual responsibilities and expectations. Newly-formed groups usually lack cohesion and a structure for operating.*

lack of time for exploration and generation of alternative: Lack of time is a productivity loss in group decision making **1988** Kraemer and King (117) *"Losses" of productivity in group decision making occur because: 1. Discussions are dominated by certain individuals. 2. Low-status members defer to high-status members. 3. Group pressures lead to conformity of thought. 4. Miscommunication among members is common. 5. Insufficient time is spent in problem exploration and generation of alternatives.*

language component: Language component is one of five basic components of a GDSS. The other components are software, hardware, people and procedures. **1984** Huber (195) *As will be seen a GDSS consists of a set of software, hardware, and language components and procedures that support a group of people engaged in a decision-related meeting.*

lean channel: Lean channels are characterized by reduced (or eliminated) nonverbal, paralinguistic, status, and other cues pertaining to social context. **1999** Shirani et al. *Electronic mail, lacks interactivity, temporal and spatial proximity of communicating individuals, and the ability to convey multiple cues. E-mail is, therefore, 'a lean' medium in comparison to GSS.* **2001** Montoya-Weiss et al. *Lean communication environments are characterized by reduced (or eliminated) nonverbal, paralinguistic, status, and other cues pertaining to social context.* **2003** Pauleen (from Daft and Lengel 1986 *while 'lean' channels such as e-mail are more useful for reducing uncertainty (Daft & Lengel, 1986).*

lean communication environment: see Lean channels

learning mode: Learning mode is an interactive system characteristic that includes, accessibility, comprehension, guidance and self documentation, informativeness, and segmentation. **1981** Turoff et al. *The first two issues for which there is disagreement concern modes of learning to use these systems: informativeness and comprehension.*

LENS: LENS is an intelligent communication system. LENS was built on an email system and had four additional characteristics: structured messages, rules for automatic filtering, redistribution lists and message find and display rules **1986** Malone et al. *In addition, the Lens system provides four important optional capabilities: (1) People can use structured message templates to help them compose and read their messages; (2) Receivers can specify rules to automatically filter and classify messages arriving in their mailbox; (3) Senders can include as an addressee of a message, in addition to specific individuals or distribution lists, a special mailbox (currently named "LENS") to indicate that the sender is willing to have this message automatically redistributed to anyone else who might be interested; and (4) Receivers can specify rules that find and show messages addressed to LENS that the receiver would not otherwise have seen.*

less structured task: Less structured tasks are characterised by ambiguity and objectives and criteria, incomplete knowledge of variables affecting outcomes, unclear causal relationships, and unknown alternatives. **1999** Shirani et al. (32) *Less structured tasks are characterised by ambiguity and objectives and criteria, incomplete knowledge of variables affecting outcomes, unclear causal relationships, and unknown alternatives.*

levels of collaboration: Levels of collaboration include coordination, cooperation and co-construction. **1999** Bertelson and Neilson *Levels of collaboration: coordination, co-operation and co-construction.*

leverage and simplicity*:* Leverage and simplicity are an interactive system characteristic related to adaptability. Leverage and simplicity is the ability of users to execute significant computer operations with a minimum of interface effort. **1981** Turoff et al. (91) *The ability of users to execute significant computer operations with a minimum of interface effort (minimization of the number and length of user supplied entries).*

Lexicographic model (LEX): Lexicographic model is a basic individual decision making strategy. Other individual decision making strategies are multiattribute utility model, lexicographic model and non-specific heuristic approaches. Lexicographic model is a non-compensatory approach. **2003** Beroggi *Our theoretical framework of IMGDM will, consequently, distinguish three basic individual decision making strategies, the multiattribute utility model (MAUT) as a compensatory approach, the lexicographic model (LEX) as a non-compensatory approach, and a non-specified heuristic approach (HEU), which does not rely on any analytic concept, allowing decision makers to resort to their own intuition in decision making.*

limited duration: see Duration

linked decision room: Linked decision room is a GDSS technology category that has dispersed proximity of participants and limited duration of the decision making session **1987** Jelassi and Beauclair (from DeSanctis and Gallupe 1985). *DeSanctis and Gallupe (1985) categorize GDSS technology into four separate areas: decision room, local decision network, linked decision rooms, and remote decision networks. They distinguish between the four models in terms of proximity of participants and duration of the decision making session.*

linking and grouping: Linking and grouping is a step in the ordering operation of the brainstorming activity. **1986** Foster and Stefik *Once meeting participants have a window full of items, they are ready to put them into order. There are two basic operations added in this stage: asserting that one idea should be presented before another and asserting that several ideas belong together. Both of the ordering operations, linking and grouping, support incremental decision-making.*

listening: Listening is a communication activity. Other communication activities are talking and observing non-verbal behaviour. **1980** Hiltz et al. *How does this form of communication change the process and outcome of group discussions, as compared to the "normal" face to face (FtF) medium of group discussion, where participants communicate by talking, listening and observing non-verbal behavior, and where there is no lag between the sending and receipt of communication signals?*

local area decision network: Local area decision network is a GDSS technology category that **1988** Dennis et al. *Local Area Decision Nets: There has been a substantial body of work on cross-media comparisons of computer conferencing (CC), led by researchers at the New Jersey Institute of Technology (Hiltz et al.1986; Turoff and Hiltz 1982) and at Carnegie Mellon University (Keisler et al.1984; Sprague, 1980). Computer conferencing fits nicely into the LADN categorization of GDSS, as shown by the groups using these systems in experiments at the above institutions; the groups were small, they worked at the same time, and each group member was isolated.*

local area network: A local area network may be required to allow dispersed group members to communicate with each other. **1985a** DeSanctis and Gallupe *For dispersed groups, a local area network, telephone lines, satellite, or microwave relay may be required to allow group members to communicate with one another. Electronic mail, computer conferencing, audio and video conferencing might also be integrated into the GDSS environment..*

local decision network: Local decision network is a GDSS technology category that has close proximity of participants and ongoing duration of the decision making session. **1987** Jelassi and Beauclair *DeSanctis and Gallupe (1985) categorize GDSS technology into four separate areas: decision room, local decision network, linked decision rooms, and remote decision networks. They distinguish between the four models in terms of proximity of participants and duration of the decision making session.* **1998** Pervan … *the time/place combination may be face-to-face (the 'decision room') , asynchronous but in different places eg. Teleconferencing and videoconferencing), ansynchronous but in the same place (Local decision network), or asynchronous and dispersed (remote decision making).(11).*

locale: Locale is the actual site in which a group collaborates, the actual means by which people communicate, and the actual means by which the work is achieved. **1998** Greenberg and

Roseman *Locale is the actual site in which a group collaborates the actual means by which people communicate, and the actual means by which the work is achieved.*

locking: Locking is used to allow users to utilise objects without conflict. Locking is used so that group members will not interfere with individual work efforts. There are different types of locking: tickle locks, and visual indicators of locked resources. **1989** Ellis and Gibbs *Locking. One solution to concurrency control is simply to lock data before it is modified. For instance, in an editor such as GROVE, outline items could be locked whenever a user places their cursor over an item. There are a number of tech- niques suited to interactive environments which decrease the probability of a lock request being refused. For example, with "tickle locks" [Grie86], a request to a locked resource will be granted if the current holder is inactive. Another tech- nique is to provide participants with visual indicators of locked resources [Stef87] and so decrease the likelihood of requests being issued for locked objects. There are three main problems with locking: First there is the overhead in requesting and obtaining the lock, this may include waiting if the data is already locked. In any case there will be a degra- dation in response time. Secondly, there is the question of granularity. In a text editor it is not clear just what should be locked when the user moves the cursor to the middle of a line and inserts a character. Should the enclosing paragraph or sentence be locked, or just the word or character? Fine granularity locking is less constraining to the participants but entails greater overhead. The third problem is determining when locks should be requested and released.* **1996** Roseman *An example of real time groupware are Text editors that allow editing the same document at the same time (usually with some form of locking so users don't conflict).* **2003** Lee and Albrecht *What makes GroupOutliner more advanced than typical single-user outline tools is that it addresses the needs of group work. For example, it provides locking and conflict resolution so that group members will not interfere with individual work efforts.*

loss of autonomy: Loss of autonomy is a barrier to group work. **1988** Kraemer and King *At the simplest level GDSS provide features aimed at removing common barriers to group work and communication, such as unequal consideration of ideas, dominance by individuals, peer pressure, and loss of autonomy. These features include anonymous input of ideas and preferences, and large screens for instantaneous display of ideas, and secret voting and compilation. The level is illustrated by the electronic boardroom or computer-supported conference room.*

Lotus Notes: Lotus Notes is a commercial Groupware product. Other terms used for Lotus Notes system are GSS and asynchronous DGSS. Lotus Notes is a workflow and document management system **1996** Roseman *Workflow and document management systems like Lotus Notes are the most commonly known groupware applications today.* **1997** Schlichter et al. (from Johansen [20]) *Groupware can involve software, hardware, services and/or group process support ... groupware products are now in use in many commercial environments, for example, Lotus Notes, Microsoft Exchange, IBM's WorkGroup, Novell's GroupWise, Collabra Share, etc. These systems typically integrate a number of tools for communication, workflow, database-sharing, contact management, and group scheduling, and operate across a variety of environments.***1998** Tung and Turban *Asynchronous DGSS: allow distributed participants to log into the same meeting but at different times. Participants can log in and catch up with what is going on in the meeting, enter comments if necessary, and log out of the meeting at various times. E-mail, Voice-mail and messaging workflow management systems (such as in Lotus Notes) are some of the supporting technologies.* **2003** Siao *A number of commercial GSS products (e.g., GroupSystems.com products, Lotus Notes, Microsoft's Exchange, Netscape's Collabra Share, Novell's Groupwise) have also emerged.*

low structure setting: Low structure settings, in electronic meetings, do not prescribe a process. **1990** Austin *Alternatively, research in low structure settings seeks to understand how work activities, social structures, attitudes, and communication patterns are altered by the existence of a new technological capability which does not prescribe a process.* **1992**

McLeod and Liker *Since this literature has been dominated by studies of high structure EMS, we will first review literature relevant to those systems. In the next section, we contrast these with low structure systems and present the study hypotheses.*

LUUUTT model of story telling: **2000** Bonnevier

maintenance behaviour: Maintenance behaviours are required to build and maintain group synergy and momentum (eg. open communications, level of collaborations and participation, level of conflict, level of trust). **2000** Pare and Dube *Maintenance behaviours are required to build and maintain group synergy and momentum (eg. open communications, level of collaborations and participation, level of conflict, level of trust).*

marketplace structure: Marketplace structure is a CMC factor relating to specialized support software. **1981** Turoff et al. (92-93) *Software designed to facilitate payments based on the provision and use of information. For example, the ability of a user to advertise price information and to collect revenues for its use.*

MAUT: see Multi attribute utility model

means of communication: The means of communication is mainly given by the current state-of-the-art Internet technology, in the form of chat-rooms, web-cams, internet telephony, and video conferencing. **2003** Beroggi *The means of communication is mainly given by the current state-of-the-art Internet technology, in the form of chat-rooms, web-cams, internet telephony, and video conferencing.*

measuring performance:Performance can be measured in a number of ways. Perceived net value can be measured in terms of usefulness, that is the degree to which the user believes the technology will enhance job performance. Completion time is another basic measure of product performance. Completion time assumes that there is a relationship between the activities of collaboration and the speed at which a group can perform the task. **1986** Lakin *Vmacs supports the capture for reflection of many aspects of a text graphic performance – both static and dynamics can be stored and measured … Measuring some aspect of a performance implies a level of interpretation or filtering beyond merely recordint it … Statics (measuring things in one frame). Dynamics (measuring things that change over time).* **1998** Briggs et al.(157) *Perceived net value may vary along a number of dimensions. Davis [6, 7, 8] identifies a most prominent instance of perceived value as usefulness, the degree to which the user believes the technology will enhance job performance. If the user thinks the new tool will greatly improve job performance, this might be an instance of a positive perceived value. However, there are other dimensions of perceived value.* **1999** Gutwin and Greenberg (256) *Completion time is a basic measure of product performance. It assumes that there is a relationship between the activities of collaboration and the speed at which a group can perform the task.* **2003** Siao *Since this literature has been dominated by studies of high structure EMS, we will first review literature relevant to those systems. In the next section, we contrast these with low structure systems and present the study hypotheses.***2003** Greasley *WFMS include the following types of function, which can be simulated: - a workflow queue of activities or tasks which need to be performed to achieve a business process often prioritised in a set order according to the business rules; - scheduling - assignment of tasks between a group of people, the workflow queue being queried to issue reminders to staff to perform tasks; - a routeing system for tasks and messages between team members; and - task performance metrics for managers - e.g. task completion time.*

mechanics of collaboration: The mechanics of collaboration may have seven major activities, explicit communication, implicit communication (sometimes called consequential communication), coordination of action, planning, monitoring, assistance, and protection. Much of this information is simply workspace awareness information: who is in the workspace, where they are working, and what they are doing. **1999** Gutwin and Greenberg (247) *Groupware usability: - the degree to which a groupware system supports the* *mechanics of collaboration for a particular set of users and a particular set of tasks.* **2000** Gutwin and Greenberg (2) *Mechanics of collaboration - seven major activities identified. Explicit communication, consequential communication (two types information given off by artifacts as they are manipulated by other (also called feedthrough) and information given off by the characteristic actions of a person's embodiment in the workspace, coordination of action, planning, monitoring. Much of this information is simply workspace awareness information: who is in the workspace, where they are working, and what they are doing … Mechanics - the things that groups have to do, over and above what an individual has to do, in order to carry out a task.* **2001** Potts-Steves et al. (3) *There are seven activities that are covered by the mechanics of collaboration, explicit communication, implicit communication, coordination of action, planning, monitoring, assistance, protection.*

media Continuum: (Chidambaran and Jones 1993) (Kydd and Ferry 1991)

Media space*:* Media Space is a video and audio communication-based virtual shared workspace system. **1994** Ishii et al. *There have been two types of approaches proposed to realize real-time shared workspaces for distributed groups. (1) Multi-user software such as shared-window-systems lLant86, Suzu86, LauwS)OA, Lauw90B, Ahuj90] and special purpose applications [Fost86, Elli90] running on networked workstations. (2) Video and audio communication-based virtual shared work spaces, such as Media Space lStu188, Har190], CRUISER [Root88], VideoDraw [Tang90].*

media Space: Media spaces are computer controllable networks of audio and video equipment used to support synchronous collaboration. They allow simultaneous, two-way transmission of visual and auditory information. **1992** Gaver (17-18) *Media spaces - computer-controllable networks of audio and video equipment used to support synchronous collaboration (Gaver etal 1992, Mentei et al.1991; Buxton & Moran 1990; Moran & Anderson 1990; Root, 1988; Stults 1986). Because they allow simultaneous, two-way transmission of visual and auditory information … Affordances offered by media space systems for perception and interaction. Affordances are properties of the environment that offer actions to appropriate organisms (Gibson, J.J. 1979) … Media spaces convey visual and auditory information between arbitrary points and thus afford remote collaboration.* **1998** Greenberg and Roseman (24) *Media spaces (eg. Abel 1990), physical rooms are connected via always-on video and audio channels. From one physical room, a person can look into another physical room, greet the perple located there, and start conversations. This combines their physical spaces together, albeit in a limited manner.* **2002** Boyle and Greenberg (1) *The Notification Collage media space that provides informal awareness and casual interactions for a distributed community [3]*

Media Synchronicity Theory (MST): Media Synchronicity Theory proposes that communication effectiveness results from matching the communication capabilities of concurrence and feedback to the communication processes of conveyance (the exchange of information) and convergence (the development of a shared meaning about information). **2002** Baker (81) *Media synchronicity Theory (MST) is described as: "the extent to which the environment encourages individuals to work on the same activity, with the same information, at the same time" (p.48) … MST proposes that communication effectiveness results from matching the communication capabilities of concurrence and feedback to the communication processes of conveyance (the exchange of information) and convergence (the development of a shared meaning about information).*

meeting accommodation: Accommodation for informal and formal meetings is a human factor that is critical in the design of GDSS.**1985a** DeSanctis and Gallupe *What human factors considerations are critical in the design of GDSS (eg. spatial arrangement of group members, size and location of public screens, accommodation for "informal" as well as "formal" communication between group members)?*

meeting context:The meeting context can include the organizational structure, the social structure and other background information. **1986** Begeman et al. (4) …*the meeting context* *including the organizational structure, the social structure, and other background information*.

meeting facility: Meeting facility is a collaboration support function usually included in a GDSS (decision conference system). **1988** Kraemer and King (126) *Software for graphics and vote tally and display also are part of the decision conference facility … At a minimum, the conference facility is a single room with a conference table and supporting equipment. …The teleconferencing facility is a GDSS designed primarily to facilitate meetings between groups at two or more locations.* **1995** Bamber and Watson *Meeting structuring tool: Examples include a facility for brainstorming, techniques for rating, ranking, and comparing issues and ideas; and stakeholder analysis.*

meeting increase: Meeting increases may also be called process gains. The purpose of support systems for groups is to increase the groups effectiveness and efficiency. **1984** Huber …*the purpose of group decision support systems is to increase the effectiveness of decision groups by facilitating the interactive sharing and use of information among group members and also between the group and the computer.* **1992** McLeod and Liker *Degree of task focus: The research literature on group decision making has shown that structuring a group's task processes will increase task focus (eg. Delbecq_etal 1975), which is expected to increase performance quality The tools provided by high structure EMS are intended to have this effect. Empirical studies have found that use of structured EMS decision tools does increase task focus (McLeod, in press; Lim and Benbasat 1991) … Anonymity removes social barriers to participatiuon that stem from evaluation apprehension and social status differences. The increased inputs from all group members should also result in increased decision quality.* **1999** Furst et al. *Group synergy factors reflect the ways in which group members interact to maximize important group outcomes, such as the diversity of ideas generated (Nemeth, 1993) member involvement (Lawler1986), and increased group efficiency and productivity (Hammer & Champy 1993).* **2001** Burke (from Caouette and O'connor *This parallel input feature, along with the anonymity of the comments, has been found to reduce communication barriers among group members, resulting in increased generation of ideas (Caouette & O'Connor, 1998; Dennis & Gallupe, 1993).*

meeting loss outcome: These may be inconsistent designs, frustrated efforts, drastically lowered morale, and project failure **1986** Begeman et al. *Poor communication and disagreement at meetings can result in inconsistent designs, frustrated efforts, drastically lowered morale, and ultimately to project failure. We have a set of creative ideas which, we hypothesize, can use automated technology to positively impact face-to-face design meetings.*

meeting loss: Meeting losses may be poor communication, disagreements, group pressure to conform, production blocking, lack of motivation, evaluation apprehension, information loss, information distortion, not enough alternatives explored, and lack of air time. **1986** Begeman et al. *Poor communication and disagreement at meetings can result in inconsistent designs, frustrated efforts, drastically lowered morale, and ultimately to project failure. We have a set of creative ideas which, we hypothesize, can use automated technology to positively impact face-to-face design meetings.* **1986** Kraemer and King *The idea here is that the primary problems of productivity loss in group decision meetings are from information loss, information distortion, or sub-optimal decisionmaking (ie. not enough issues/alternatives explored) … At the simplest level GDSS provide features aimed at removing common barriers to group work and communication, such as unequal consideration of ideas, dominance by individuals, peer pressure, and loss of autonomy. These features include anonymous input of ideas and preferences, and large screens for instantaneous display of ideas, and secret voting and compilation. The level is illustrated by the electronic boardroom or computer-supported conference room.* **1987** Jelassi and Beauclair *Pressure toward group consensus is often cited as contributing to the condition known as "groupthink" – the group loses sight of itself as a part of its environment and fails to take into account disconfirming or outside information (14). There is also pressure from within the group to gain consensus and restrict opinions that are not in agreement with the* *group's. This is a situation that we want to avoid since it may lead to risky decisions. The group may fail to generate numerous alternatives, and may suffer from an overall lack of creativity. What can we provide through computerized support that would help groups reduce unwarranted pressure toward group consensus and possible "groupthink"?* **2001** Dennis and Wixom *Parallelism is the ability of group members to simultaneously enter information. No participant needs to wait for others to finish before contributing information. The need to wait to speak (termed production blocking) has been identified as a major cause of poor performance in verbally interacting groups [16, 30]. Parallelism mitigates production blocking resulting in process gains [20, 46]. Anonymity, on the other hand, enables group members to contribute comments without being identified, which may increase the motivation to participate. Without anonymity, individuals, particularly low status participants, may withhold ideas due to negative evaluation apprehension [16, 30] or may feel pressured to conform to the group majority or senior participants' views.* **2001** Genuchten et al. *Process losses (for example, air time and participant apprehension) [24]. Anonymity reduces the reluctance to contribute information, because it shields the contributor from group reaction and deindividualizes the interaction [7].*

meeting outcome: Meeting outcomes may be measured on many dimensions. Some of these dimensions are efficiency, effectiveness, decision quality, timeliness, participant satisfaction with the decision, participant satisfaction with the process, participant confidence in the outcome, level of group consensus, cost or ease of implementation, member commitment to implementation, the group’s willingness to work together in the future. **1987** DeSanctis and Gallupe (591) *Outcomes of meetings may be measured on many dimensions, including decision quality and timeliness, satisfaction with the decision, cost or ease of implementation, member commitment to implementation, or the group's willingness to work together in the future.* **1988** Dennis et al. (596) *Finally, there are many outcomes of a group meeting that may be measured. These include the decision/outcome quality, participant satisfaction with the outcomes and the process, participant confidence in the outcomes, process time required, level of group consensus, number of comments during the meeting, and the number of alternatives or issues considered.* **1991** Nunamaker et al. *Meeting outcomes eg. Efficiency, effectiveness, satisfaction) depend upon the interaction within the meeting process of these group, task, and context factors with the EMS components the group uses (eg. Anonymity).*

meeting phase*:* There are three meeting phases or stages, pre meeting, during meeting and post meeting. **1986** Begeman et al. *As should be clear from figure 1, our research is concerned with pre-meeting aids, during meeting aids, and post-meeting aids.* **1988** Bostrom and Anson *Post Meeting * Creating meeting minutes/chapter * Monitoring commitments* **1988** Watson et al. *Degree of post-meeting consensus is the major dependent variable of the study. In addition to consensus, various other dependent measures have been taken, including members' perceptions of the outcome and decision process, and equality of influence.* **1998** Greenberg and Gutwin *Pre-meeting setup: setting goals, getting participants, collecting materials … During meeting activities where people work together face to face to pursue their work … Post-meeting tear-down, where documents are created and distributed to others (which could also lead into the next meeting).* **2001** Antunes and Ho (from Bostrom et al. 1993) *several authors rely on a timing dimension where facilitation is divided in pre-meeting, meeting and post-meeting stages (Bostrom et al. 1993; Clawson et al. 1995).*

meeting structure: Meeting structures are considered in terms of the amount of structure (structured or unstructured) and the degree of sharing (private, subgroup, public). **1986** Begeman et al. *For example, the interaction method of meeting [DOYL85] suggests that there should be a facilitator, who is a leader charged with keeping the meeting balanced and on a correct course, and a recorder who maintains, and makes publicly visible, the group memory. Other options may imply that, rather than restricting access to the group memory and the public display, equal access for all might be preferred. Within all of these* *structures, the types of information that may be presented, manipulated, and captured during a meeting can be categorized according to the amount of its structure (binary, structured, or unstructured), and according to the degree of sharing (private, subgroup, or public).* **1988** Watson et al. *First, the GDSS provides a meeting structure for the group. By providing a menu of facilities, such as idea generation, rating, ranking, and voting, the system suggests that the group consider the procedures they use in reaching their decisions.*

meeting structuring tool: Meeting structuring tool: examples include a facility for brainstorming, techniques for rating, ranking, and comparing issues and ideas; and stakeholder analysis. **1995** Bamber and Watson *Meeting structuring tool: Examples include a facility for brainstorming, techniques for rating, ranking, and comparing issues and ideas; and stakeholder analysis.*

meeting success factor: Meeting success factors include planning the meeting, group attributes, a good agenda, personal abilities of facilitator, planning and problem solving skills of facilitator. **1984** Huber (203) *It was also noted that major factors in GDSS success are the capabilities of the users and their aides in, managing a decision group and drawing appropriately on the GDSS technology. This fact supported the belief that vendor support may be critical to GDSS success in the great majority of applications.* **2001** Antunes and Ho *Niederman et al. (1996) also studied the critical factors that, from the facilitators' point of view, had more influence in the meeting success. Although 32% of the respondents elected group attributes (such as commitment or buy-in) as the critical factor of success, a high number of high-experienced facilitators (25%) mentioned having a good agenda. This study also identified critical factors to the facilitators' individual success. Personal abilities were elected by 74%, but it is interesting to note that planning and problem-solving skills were also mentioned by 14% of the respondents. On a sequel to this study, Niederman and Volkema (1996) reported that facilitators find agendas to have impact on meeting outcomes (3.3–4.4 on a scale of 1–5), particularly on the quality of outcomes.*

meeting support system: see Electronic meeting system

meeting system: Meeting system is a class of CSCW systems. The other three classes are messaging systems, conferencing systems, and coauthoring systems. **1996** Barua et al. (from Rodden 1991) *Group work: is based on spatial (local or remote) and temporal relationships (asynchronous or synchronous), analogous to geographically scope and real-time ability. He further uses this relationship to separate CSCW systems into four classes, messaging systems, conferencing systems, meeting systems and co-authoring systems.*

meeting type: Meeting types include exploration and brainstorming meetings, informational or presentational meetings, problem solving or decision making meetings, negotiation or resource allocation meetings, morale building or social structuring meetings **1986** Begeman et al. *Meeting Types include: 1. Exploration and Brainstorming meetings, 2. Informational or Presentational meetings, 3. Problem Solving or Decision Making meetings, 4. Negotiation or Resource Allocation meetings 5. Morale Building or Social Structuring meetings.*

meeting: A meeting is any activity where people come together, whether at the same place at the same time, in in different places at different times. A meeting fulfils a specific function, it is scheduled and organised according to an agenda, it is usually attended by an invited group of people, and it often takes place regularly. Formal meetings are usually understood as officially convened, with fixed membership and agendas. **1984** Huber (195) *a GDSS consists of a set of software, hardware, and language components and procedures that support a group of people engaged in a decision-related meeting.* **1991** Nunamaker et al. *Meeting- any activity where people come together, whether at the same place at the same time, or in different places at different times.* **1999** Bergqvist et al. *A typical meeting (Jay 1993) takes place in a meeting room. It fulfils a specific function, it is scheduled and organised according to an agenda, it is usually attended to by an invited group of people,* *and it often takes place regularly. Formal meetings are usually understood as officially convened, with fixed membership and agendas.*

member commitment: Member commitment is a meeting outcome measure. Member commitment could be to the group, the decision, the process or the implementation of the decision. **1987** DeSanctis and Gallupe (591) *Outcomes of meetings may be measured on many dimensions, including decision quality and timeliness, satisfaction with the decision, cost or ease of implementation, member commitment to implementation, or the group's willingness to work together in the future.*

member status issue: Member status issues can be a productivity loss in group decision making **1988** Kraemer and King (117) *How might GDSS's help increase productivity of decision meetings? Huber (1982a) provides the following succinct assessment of the issue: I. Effective group decision making requires: 1. Meeting the need of the situation. 2. Ensuring that members are satisfied with the process. 3. Enabling members to meet and work successfully in the future. II. "Losses" of productivity in group decision making occur because: 1. Discussions are dominated by certain individuals. 2. Low-status members defer to high-status members. 3. Group pressures lead to conformity of thought. 4. Miscommunication among members is common. 5. Insufficient time is spent in problem exploration and generation of alternatives*

mental model: Mental models consisting of knowledge, beliefs, needs, norms, emotions, goals are the implicit theories determining behaviour. They are influenced by someone’s background (education) and experiences. These models are important, and their implicit nature asks for explication, for which several techniques are available. **1997** Hofstede et al. *Mental models include knowledge, beliefs, needs, norms, emotions, goals. These models are important,, since they determine actual behaviour, and their implicit nature asks for explication, for which several techniques are available.* **1997** Hofstede et al. *Mental models, consisting of knowledge, beliefs, needs, norms, emotions, goals, are the implicit theories determining behaviour. They are influenced by someone’s background (education) and experiences.*

menu: A GDSS provides a menu of facilities, such as idea generation, rating, ranking and voting. Menus in a GDSS prompt for input of text, data, or votes by group members. **1985a** DeSanctis and Gallupe *Group Features: - Numerical and graphical summarization of group members' ideas and votes - Menus which prompt for input of text, data, or votes by group members - Program(s) for specialized group procedures, such as calculation of weights for decision alternatives; anonymous recording of ideas; formal selection of a group leader; progressive rounds of voting toward concensus-building; or elimination of redundant input during brainstorming - Method of analysing prior group interactions and judgments ? Text and data transmission among the group members, between the group members and the facilitator, and between the group members and a central computer processor - The GDSS software may be designed to support a specific decision or a class of decisions.* **1988** Watson et al. *First, the GDSS provides a meeting structure for the group. By providing a menu of facilities, such as idea generation, rating, ranking, and voting, the system suggests that the group consider the procedures they use in reaching their decisions.*

message based stereotyping:Message based stereotyping is a type of stereotyping found in virtual teams. The other two types are physical appearance/behaviour-based and technology-based. **2003** Sarker et al. *In addition to confirming the conceptual bases of trust, the instrument validation process found that stereotyping in virtual teams can be of 3 distinct types: message-based, physical appearance/behavior-based, and technology-based.*

***message find and display rule*:** Message find and display rules are characteristics of the LENS email system. **1986** Malone et al. (2) *Receivers can specify rules that find and show messages addressed to LENS that the receiver would not otherwise have seen.*

message linking: Message linking is used to manage communication, keep records and develop group memory. **1990** Bullen *The need represented in our interviews, (i.e., comments on the value of message linking), is one which should be carefully investigated by both designers and installers of groupware. People use message linking to: w manage communications and documents b keep records b develop 'group memory'.*

messaging system: Messaging systems is one of four classes of CSCW systems. The other four are conferencing systems, meeting systems and co-authoring systems. **1996** Barua et al. (from Rodden 1991) *Group work: is based on spatial (local or remote) and temporal relationships (asynchronous or synchronous), analogous to geographically scope and real-time ability. He further uses this relationship to separate CSCW systems into four classes, messaging systems, conferencing systems, meeting systems and co-authoring systems.* **1988** Whitescarver et al. *User functionality: Computer-Mediated Communications systems being developed at NJIT (EIES II and TEIES) reflect the hypothesis that the next generation of these systems need to be designed for everyday use. It is assumed that messaging and computer-based conferencing will serve as the principal communications medium in an organization.(p.262)*

message template: Structured message templates can help to provide automatic aids for composing messages to be sent, selecting, sorting and prioritizing messages that are received, responding automatically to some messages, and suggesting likely responses to other messages. **1986** Malone *Semi- structured messages can help provide automatic aids for: (1) composing messages to be sent, (2) selecting, sorting, and prioritizing messages that are received, (3) responding automatically to some messages, and (4) suggesting likely responses to other messages.*

messaging: Messaging is a communication medium and a functional component of a CMC system. Messaging systems are one of four classes of CSCW systems. Lotus Notes is an advanced messaging system. **1978** Turoff and Hiltz *A private message system where an individual can send a private communication to any other individual or set of individuals, such as a group.* **1996** Barua et al. *…separate CSCW systems into four classes, messaging systems, conferencing systems, meeting systems and co-authoring systems.***1998** Hein Keenan and Rein *Notes is an advanced messaging system.*

microwave relay: Microwave relay may be required to allow dispersed group members to communicate with one another. **1985a** DeSanctis and Gallupe *For dispersed groups, a local area network, telephone lines, satellite, or microwave relay may be required to allow group members to communicate with one another. Electronic mail, computer conferencing, audio and video conferencing might also be integrated into the GDSS environment.*

MIS Planning and Decision Laboratory: MIS Planning and Decision Laboratory used the PLEXSYS planning system, as a research facility for the study of planning and decision processes in organizations **1986** Applegate et al. (16) *The MIS Planning and Decision Laboratory has been constructed to provide a research facility for the study of the planning and decision process while top executives from a variety of organizations use the laboratory to conduct actual planning sessions for their organization.*

miscommunication: Miscommunication is a productivity loss in group decision making **1988** Kraemer and King (117) *How might GDSS's help increase productivity of decision meetings? Huber (1982a) provides the following succinct assessment of the issue: I. Effective group decision making requires: 1. Meeting the need of the situation. 2. Ensuring that members are satisfied with the process. 3. Enabling members to meet and work successfully in the future. II. "Losses" of productivity in group decision making occur because: 1. Discussions are dominated by certain individuals. 2. Low-status members defer to high-status members. 3. Group pressures lead to conformity of thought. 4. Miscommunication among members is common. 5. Insufficient time is spent in problem exploration and generation of alternatives.*

morale building meeting: Morale building meeting is a meeting type. **1986** Begeman et al. *Meeting Types include: 1. Exploration and Brainstorming meetings, 2. Informational or Presentational meetings, 3. Problem Solving or Decision Making meetings, 4. Negotiation or Resource Allocation meetings 5. Morale Building or Social Structuring meetings.* **1987** Cook et al. *There are also a variety of meeting types, distinguished by their main goals or purpose: 1. exploration and brainstorming meetings, 2. information sharing or presentation meetings, 3. problem-solving or decision-making meetings, 4. negotiation or resource allocation meetings, and 5. morale building or social structuring meetings.*

mode of communication: see Communication medium.

model base: Model base is a software component of GDSS systems. **1985a** DeSanctis and Gallupe *Software The software components of the GDSS include a database, a model base, specialized application program(s) to be used by the group, and an easy-to-use, flexible user interface.* **2001** Carneiro *The architecture of this GDSS integrates the following features: ? a database* **-** *it contains a set of data obtained from a case study which is being analysed in order to select a strategic decision; ? a model base that consists of specialised application programs to be used by the group; ? group functioning procedure (GFP)* **-** *it is a set of rules allowing the definition and control of a decision makers' group meeting plan; and ? an easy-to-use, flexible interface* **-** *allows presenting the relationships and the data in a simple format that is understandable for the participants making the decisions*

model management: Model management is one of three basic functions of DSS and GDSS **1986** Bui and Jarke *The careful design of a communication manager as a fourth DSS component, in addition to dialogue manager, data manager, and model manager, is, therefore, a crucial prerequisite of a distributed GDSS.*

model manager: Model manager is a component of a GDSS **1986** Bui and Jarke *The careful design of a communication manager as a fourth DSS component, in addition to dialogue manager, data manager, and model manager, is, therefore, a crucial prerequisite of a distributed GDSS.*

mode of appropriation: Mode of appropriation has four construct dimensions, level of use, attitudes towards the GSS, level of consensus, and level of control. **1996** Hiltz et al. *Four dimensions of the construct (level of use, attitudes toward the GSS, level of consensus, and level of control).*

mode of awareness: There are four modes of awareness. These modes can be described by two orthogonal classifications, coupling and synchrony. Coupled awareness where participants have the same focus of work such as working on the same artifact and are aware of each other. Uncoupled awareness where information is independent of the user’s current focus of work. Synchrony where participants may either by aware synchronously where participants have knowledge about events that happen concurrently. Asynchronous awareness is where participants have knowledge about events in the past. **1997** Schlichter et al. *Four modes of awareness (16) These modes can be described by two orthogonal classifications: (1) Coupling: there is the coupled awareness (participants have the same focus of work, eg. They work on the same shared artifact and are aware of each other) and uncoupled awareness (" information independant of the user's current focus of work") (2) Synchrony: Participants may either be aware synchronously (knowledge about events that happen currently) or asynchronously (knowledge about events in the past).*

mode of communication: see Communication modes.

modifiability: Modifiability is an interactive system characteristic related to adaptability. **1981** Turoff et al. (91) *The ability of users to adapt the system to serve their needs.*

modification of documents: Modification of documents is supported by text editors **1992** Shu *Text editors that support group creation and modification of documents and software code (Kaiser_etal1987, Leland etal 1988, Galegher&Kraut 1990, Neuwirth_etal1990).*

modify: Modify relates to information use. It refers to the manipulation of text by changing it in some way. **1986** Lakin *Manipulation includes generating, moving, modifying and erasing text-graphic objects.*

morale: Meeting loss outcomes may be inconsistent designs, frustrated efforts, drastically lowered morale, and project failure **1986** Begeman et al. *Poor communication and disagreement at meetings can result in inconsistent designs, frustrated efforts, drastically lowered morale, and ultimately to project failure. We have a set of creative ideas which, we hypothesize, can use automated technology to positively impact face-to-face design meetings.* **1997** Salisbury et al. (from Bollen and Hoyle 1991) *Perceived cohesiveness - emcompasses an individuals sense of belonging to a particular group and his or her feelings of morale associated with membership in the group. Perceived cohesiveness reflects an individual's appraisal of their relationship to the group. Such a perception by individuals relative to their group could be linked to group formation, maintenance, or even productivity in some situations.*

MST: see Media Synchronicity Theory.

multi attribute utility model (MAUT): Multi attribute expected utility model is a group task model. It is a decision analytic technique for single stage decisions. **1984** Huber (196) *For example, one system provides the capability for a group to construct and employ a decision tree, and that is about all it does. Another provides the capability for a group to identify and analyse the multi-attribute utility functions of its members. Yet another provides the capability for a group to obtain its members' strengths of feeling about the importance of different organizational goals and the performance of organizational units with regard to these goals and to use the resulting values in an organizational analysis algorithm.* **1986** Applegate et al. *In addition, prior to this research, the focus of existing systems was primarily to provide support for a small number of specific group tasks (e.g., structuring or decision alternatives using decision tree models, analysis of group preferences using multi-attribute utility models and group consensus and negotiation models). Support for the idea generation phase of the problem-solving process was discussed by Huber (1984) but was not implemented in the existing systems.* **1988** Kraemer and King (123) *The software of the decision conference is usually some form of decision analytic technique: decision trees and influence trees; multiattribute expected utility models for single-stage decisions; hierarchical evaluation structures for multiattribute utility analysis; Pareto algorithms for two-party negotiations; cost-benefit models for resource allocation; and spread- sheet models. Software for graphics and vote tally and display also are part of the decision conference facility.* **2003** Beroggi *Our theoretical framework of IMGDM will, consequently, distinguish three basic individual decision making strategies, the multiattribute utility model (MAUT) as a compensatory approach, the lexicographic model (LEX) as a non-compensatory approach, and a non-specified heuristic approach (HEU), which does not rely on any analytic concept, allowing decision makers to resort to their own intuition in decision making.*

negative evaluation apprehension: Negative evaluation apprehension is a process loss in meetings. Negative evaluation apprehension is an inhibitor when working in a group. Anonymity is used as a means to reduce apprehension and increase interaction. **1990** Connolly et al. *On the negative side, working in a group might inhibit a contributor who anticipated embarrassment, hostile evaluation, conformity pressures or other punishments for proposing an unusual idea (Collaros and Anderson, 1969).* **2001** Dennis and Wixom *Parallelism is the ability of group members to simultaneously enter information. No participant needs to wait for others to finish before contributing information. The need to wait to speak (termed production blocking) has been identified as a major cause of poor performance in verbally interacting groups [16, 30]. Parallelism mitigates production blocking resulting in process gains [20, 46]. Anonymity, on the other hand, enables group members to contribute comments without being identified, which may increase the motivation to participate. Without anonymity, individuals, particularly low status* *participants, may withhold ideas due to negative evaluation apprehension [16, 30] or may feel pressured to conform to the group majority or senior participants' views [24]. Anonymity reduces the reluctance to contribute information, because it shields the contributor from group reaction and deindividualizes the interaction [7].*

negotiation meeting: Negotiation meeting is a meeting type. Other types of meeting include exploration and brainstorming meetings, informational or presentational meetings, problem solving or decision making meetings, and morale building or social structuring meetings. **1986** Begeman et al. *Meeting Types include: 1. Exploration and Brainstorming meetings, 2. Informational or Presentational meetings, 3. Problem Solving or Decision Making meetings, 4. Negotiation or Resource Allocation meetings 5. Morale Building or Social Structuring meetings.*

network communication: Network communication is a CSCW issue. Network communication is an impact issue when implementing CBIS in an organization. **1986** Stasz and Bikson (320) *Issues in computer-supported cooperative work: Our field study assessed a number of impacts of the organization's transition to a computer- based information system. Here we discuss five: training, dissemination, hierarchical vs. network communications, centralized vs. decentralized decisionmaking, and cooperative work between different technologies and systems.*

NGT: see Nominal group technique

Nominal Group Technique (NGT): Nominal group technique is a 'structured group process', 'behavioural group technique' or 'decision structuring technique' sometimes included as a general function of GDSS (decision conference system). The nominal group technique (NGT) consists of four main steps: silent idea generation, round robin recording of ideas, preliminary voting on items of importance and discussion, and final group decision making or voting. **1984** Huber (195) *One such approach has been the use of structured group management techniques such as the Nominal Group Technique and the Delphi technique [Delbecq, Van de Van and Gustafson, 1975, Van Grundy 1981].* **1985a** DeSanctis and Gallupe *A variety of decision making approaches could be used, such as ordinary group process or Nominal Group Technique, but essentially the process would involve using the GDSS to show the decision makers the current situation in terms of markets and finances, etc. and to facilitate the generation and evaluation of ideas.* **1986** Bui and Jarke *Behavioral group techniques, such as the Delphi method and the Nominal Group Technique, can be used more efficiently with electronic support [20, 51]* **1987** Stefik et al. *The Delphi method (22) and the Nominal Group method (20), for example, are techniques for structuring group problem solving that have been used with and without computer support.* **1988** Kraemer and King (126) *A 'structured group process or 'behavioural group technique' or 'decision structuring technique' sometimes included as a general function of GDSS (decision conference system).* **1997** Nunamaker (from Nunamaker et al.1991) *Process structure refers to process techniques or rules that direct the pattern, timing or content of an interaction. Some familiar examples of process structure include nominal group technique (NGT) and the development and following of a shared agenda. Proces structure improves group performance by reducing or eliminating many sources of process losses and increasing or providing opportunities for many sources of process gains.* **2003** Ngwenya and Keim *The nominal group technique (NGT) consists of four main steps: silent idea generation, round robin recording of ideas, preliminary voting on items of importance and discussion, and final group decision making or voting*

non-verbal behaviour: Non verbal behaviour is a channel of communication. Participants communicate by talking, listening and observing non-verbal behaviour. Non-verbal behaviour can include body language, gestures, and facial expressions. Lean communication systems often lack non-verbal information. **1980** Hiltz et al. *How does this form of communication change the process and outcome of group discussions, as compared to the "normal" face to face (FtF) medium of group discussion, where participants communicate* *by talking, listening and observing non-verbal behavior, and where there is no lag between the sending and receipt of communication signals?* **1988** Zigurs et al. *Four channels of communication were available: verbal, non-verbal, written, and electronic, with each channel defined according to the skills required to use it, its features, capacity, and impact on the receiver.* **1995** Aiken et al. *Although using a GDSS results in many advantages over verbal meetings, there are also some disadvantages: a. Slow Communication. Most people type slower than they speak, and in some cases, group participants may be unable to type at all. Most people would rather talk than type ... When groups reach a size of eight to ten people, the advantage of parallel communication tends to outweigh the disadvantage of slow typing, and the use of a GDSS becomes more efficient. b. Resistance to Change. Another disadvantage is the human trait of resistance to change ... c. Lack of Media Richness. Because a GDSS meeting relies primarily on written information, other forms of communication are minimized. For example, body language and facial expressions can help group members determine if a comment is meant to be funny or sarcastic in an oral meeting, but this media richness is lost in a GDSS meeting ... d. Possible Increase in Conflict. Another concern with the use of a GDSS is that there could be an increase in conflict and animosity due to anonymity in the meeting ... e. Possible Loss of Some Key Participants. Some people who normally dominate a verbal meeting may tend to "drop out" of electronic meetings because they are unable to use their strong verbal skills, although shyer people may participate more. f. Misuse of the Technology ... g. Costs. A GDSS facility could involve a considerable monetary commitment and may not be cost efficient unless it gains acceptance and is used regularly and properly.***1998** Prinz et al. *Communicative behaviours are the means through which group members can influence each other and create standards of behaviour: eg. By observing each other's actions, or by explicit and implicit communication [28]* **2001** Montoya-Weiss et al. (from Dennis 1996) *In other words, a groupware system like Lotus Notes does not have the capacity to convey the multiple cues that characterize human conversation. Gestures and non-verbal nuances, cues about social influence, symbolic content, and contextual cues are not captured or transmittable. These limitations make interaction and consensus building difficult (Dennis, 1996; Straus, 1996) … Lean communication environments are characterized by reduced (or eliminated) nonverbal, paralinguistic, status, and other cues pertaining to social context.*

normative influence: Normative influence is a social influence that contributes to group conformity. The other type of social influence is informational influence. Normative influence notebooks are a functional component of some CMC systems. **2000** Pare and Dube *Group interaction processes, namely communication trust, cooperation, information processing (sharing, redundancy, integrative complexity), consensus generating (amount and intensity of disagreement), conformity pressures) and normative regulation (expressions of commitment, satisfaction and solidarity). In turn these group processes form an important basis for the shaping of project outcomes.* **2001** Schmidt (from Nemeth and Staw 1989) *According to Nemeth and Staw (1989), social influences (normative and informational) tend to increase group conformity in the following conditions …* (from Deutsch and Gerard 1955) *Normative and informational influences contribute to conformity in teams.* **2003** Huang *Normative influence (eg. Social information exchange)****notebooks:*** *Notebooks for text composition. A functional component of a CMC system.*

normative regulation: Normative regulation is a group interaction process that includes expressions of commitment, satisfaction and solidarity. **2000** Pare and Dube *Group interaction processes, namely communication trust, cooperation, information processing (sharing, redundancy, integrative complexity), consensus generating (amount and intensity of disagreement), conformity pressures, and normative regulation (expressions of commitment, satisfaction and solidarity). In turn these group processes form an important basis for the shaping of project outcomes.*

numeric information: Numeric information is seen as less important than textual and relational information when analysing the activity of groups using GDSS. However numeric information is collected in some GDSS. **1984** Huber (203) *The subsequent analysis of group activities made clear that textual and relational information are relatively more important for GDSS than they are for DSS, most of which deal largely with numeric information.*

numerical and graphical summarization: Numerical and graphical summarization are techniques for displaying group member ideas and votes. **1985a** DeSanctis and Gallupe. *Group Features - Numerical and graphical summarization of group members' ideas and votes - Menus which prompt for input of text, data, or votes by group members - Program(s) for specialized group procedures, such as calculation of weights for decision alternatives; anonymous recording of ideas; formal selection of a group leader; progressive rounds of voting toward consensus-building; or elimination of redundant input during brainstorming - Method of analyzing prior group interactions and judgments - Text and data transmission among the group members, between the group members and the facilitator, and between the group members and a central computer processor*

observing non-verbal behaviour: Observing non-verbal behaviour is a communication activity. see Non-verbal behaviour.

ongoing duration: The duration of a meeting or communication session can be short term, limited or ongoing. (Huber 1984) **1986** Applegate et al. *Systems that fall under the classification of a GDSS include: (I) Decision Conferences (or Decision Rooms), (2) Teleconferencing, (3) Local Ongoing Decision Networks, (4) Remote Ongoing Decision Networks, and (5) Information Centers (Kraemer and King, 1984; DeSanctis and Gallupe, 1985).* **1987** Jelassi and Beauclair *DeSanctis and Gallupe (1985) categorize GDSS technology into four separate areas: decision room, local decision network, linked decision rooms, and remote decision networks. They distinguish between the four models in terms of proximity of participants and duration of the decision making session.***2002** Morris et al. *System usage is commonly operationalized in four ways in the literature: frequency of use, duration of use, variety of applications used, and variety of tasks performed.*

opinion exploration: Opinion exploration is a communication or group exchange activity exhibited in a decision-related meeting. **1987** DeSanctis and Gallupe *The communication activities exhibited in a decision-related meeting include proposal exploration, opinion exploration, analysis, expressions of preference, argumentation, socializing, information seeking, information giving, proposal development and proposal negotiation (Bedau 1984; Poole 1983a).* **1995** Balthazard and Gargeyal *electronic voting and discussion technique (EVDT) at MIT, a computer polling method where individuals in the group would enter their opinions as votes in a system[31, 32].*

ordering stage: To put ideas in order. This is a stage of organizing ideas using a meeting tool known as Cognoter. There are two "ordering operations", linking and grouping, which support incremental decision-making" **1986** Foster and Stefik (10) *To put ideas in order. This is a stage of organizing ideas using a meeting tool known as Cognoter. There are two "ordering operations", linking and grouping, which support incremental decision-making.*

organization: An organization is an interrelated combination of structure, tasks, technology, and people, such that changes in one component affect the other components. **2002** Morris et al. (from Leavitt 1965). *Organization: an interrelated combination of structure, tasks, technology, and people, such that changes in one component affect the other components*

organizational analysis algorithm: Organizational analysis algorithms models are planning tools that support quantitative decision analysis. The models are sometimes incorporated in GDSS. **1984** Huber (196) *(when discussing GDSS) … Yet another provides the capability for a group to obtain its members' strengths of feeling about the importance of different organizational goals and the performance of organizational units with regard to these goals and to use the resulting values in an organizational analysis algorithm.* **1986** Applegate et al. *A major component of the GDSS is the incorporation of idea generation, idea structuring and analysis models that enable decision-makers to generate, analyze and prioritize critical* *issues, strategic options and strategic policies.* **1986** Kraemer and King *These techniques might include: planning tools such as brainstorming, stakeholder identification and analysis, or organization analysis; modeling tools that support qualitative and quantitative decision analysis such as decision trees, risk analysis, social judgment analysis or multiattribute utility analysis;*

organizational characteristic: A technology transfer issue. Organizational characteristics are … **1986** Stasz and Bikson (319) *A technology transfer issue. Organizational characteristics are…*

organizational context: The larger context in which the group meeting occurs. This may include, organizational situation (culture), experimental situation, and individual incentives and rewards systems. Two main factors in the organizational context that influence work group process and structure are task uncertainty and goal congruence among group members. **1988** Dennis et al. (596). *The larger context in which the group meeting occurs. This may include, organizational situation (culture), experimental situation, and individual incentives and rewards systems.* **1988** Ciborra and Olson *There are two main factors in the organizational context that influence work group process and structure: task uncertainty and goal congruence among group members. Task uncertainty varies in that the more uncertain the task, the greater the amount of information required to be processed by team members for coordination purposes (Galbraith,l977). Sources of task uncertainty may be internal to the group (e.g., lack of experience with a new manufacturing technology) or external (e.g., market turbulence).*

organizational memory: Organizational memory, (also referred to as a shared textbase) is a collection of text data from e-mail, electronic bulletin board, or group conferencing systems. when the memory stores the text data collected from a group activity, it is often called group memory. It is an important corporate resource that can be used in problem solving, customer support and others. **2000** Stough et al. *Organizational memory (or shared textbase) is a collection of text data from e-mail, electronic bulletin board, or group conferencing systems. when the memory stores the text data collected from a group activity, it is often called group memory. It is an important corporate resource that can be used in problem solving, customer support and others.*

organizational model: Organizational models can influence virtual team structure. They are cooperative models, delegation models and consultative models. **2000** Pare and Dube (from Gorton and Motwani 1996) *Organizational models that can influence virtual team structure. The models in question are cooperative (all members share overall project management responsibilities), delegation models (a supervisor assumes overall management but delegates specific responsibilities) and consultative models (specific tasks are sub-contracted to outside experts).*

organizational structure*:* Organizational structure is an environmental characteristic in the electronic meeting context **1986** Begeman et al. *the meeting context including the organizational structure, the social structure, and other background information.* **1987** Jelassi and Beauclair *While GDSS developers are trying to design systems that will help structure the group process, it is important to acknowledge briefly the characteristics that decision makers bring with them to the decision making environment (10, 27). These include: (1) Individual characteristics of each group member (eg. personality, sex, age, race, status, socio-economic background, competence, and motivation); (2) Group characteristics (eg political orientation, leadership, complexity of the task and circumstances, size of group, and history of its members); and (3) environmental characteristics (eg. setting, scheduling, length of a session, organizational context, and spatial arrangement).*

outcome measures: Outcome measures are used to calculate meeting success. Outcome measures that determine work group effectiveness and efficiency can be; output acceptable to the client, group maintenance and growth, member satisfaction, level of consensus, and effective group process. **1991** Applegate (from Hackman [41]) *A widely used model developed by Hackman [41] defines work group effectiveness in terms of output acceptable to the client, group maintenance and growth, and member satisfaction. These outcome measures are facilitated by knowledge and skill brought to bear on the task, and appropriateness of the task performance strategies implemented by the group. The influence of these process effectiveness criteria on outcome effectiveness criteria is mediated by the presence of sufficient material resources required to accomplish the task. Organisation context, group design, and group synergy influence the development of effective group processes. Goodman and collegues [37] and Gladstein [35], although agreeing with Hackman on the key determinants for work group effectiveness, suggest developing research models in finer detail. (p. 20)* **2003** Martz *Much research has compared groups using the electronic meeting environment to groups using the traditional environment and, in so doing, has found differences on two outcome measures: satisfaction and level of consensus.*

outcome variables: Outcome variables of meetings may include effectiveness, efficiency and member satisfaction. **1992** Lewis and Whiteley. *Other studies since then (6, 7, 14, 18, 19, 27, 29) have continued to focus on task and participant impacts. A recent integrative study (5) which summarixed GDSS lav and field studies reported that these studies focused on three key outcome variables: Effectiveness, Efficiency, and Member Satisfaction. Again, these are all impacts that involve the task/decision, or the participants and group process.***1992** McLeod and Liker *Equality of participation and influence and degree of task focus have been the most frequently studied process variables in the EMS literature, and decision quality and group member satisfaction have been the most frequently studied outcome variables (Dennis et al.1988, Pinsonneault and Kraemer, 1989, McLeod in press).*

overall preference: Overall preference is a broad satisfaction measure based on a comparison of two systems. It assumes that there is a relationship between overall usability and preference, that participants will prefer a system that better supports the activities of collaboration. **1999** Gutwin and Greenberg *Overall preference is a broad satisfaction measure based on a comparison of two systems. It assumes that there is a relationship between overall usability and preference, that participants will prefer a system that better supports the activities of collaboration.*

parallel input: The parallel input feature, along with the anonymity of the comments, has been found to reduce communication barriers among group members, resulting in increased generation of ideas. **2001** Burke *Parallel input feature, along with the anonymity of the comments, has been found to reduce communication barriers among group members, resulting in increased generation of ideas (Caouette and O'Connor, 1998; Dennis and Gallupe 1993).*

parallelism: Parallelism is the ability of group members to simultaneously enter information. No participant needs to wait for others to finish before contributing information. Parallelism mitigates production blocking resulting in process gains. Parallelism is one of three asynchronous groupware characteristics. **2001** Dennis and Wixom *Parallelism is the ability of group members to simultaneously enter information. No participant needs to wait for others to finish before contributing information. The need to wait to speak (termed production blocking) has been identified as a major cause of poor performance in verbally interacting groups [16, 30]. Parallelism mitigates production blocking resulting in process gains [20, 46]. Anonymity, on the other hand, enables group members to contribute comments without being identified, which may increase the motivation to participate. Without anonymity, individuals, particularly low status participants, may withhold ideas due to negative evaluation apprehension [16, 30] or may feel pressured to conform to the group majority or senior participants' views [24]. Anonymity reduces the reluctance to contribute information, because it shields the contributor from group reaction and deindividualizes the interaction [7].* **2001** Schmidt (from Dennis and Valacich 1999) *Third, asynchronous groupware possesses three characteristics that greatly reduce the cognitive* *and communication limitations present in synchronous contexts: rehearsability, parallelism, and reprocessability (Dennis & Valacich, 1999).*

parcel-post model of communication: Communication as the passage of information from one person to another. **1998** Riva and Galimberti *Communication as the passage of information from one person to another is becoming obsolete.This model usually called the parcel-post model (Shannon and Weaver 1949), is now being radically challenged, partly because of some of the peculiar features of electronic environments, so as the asymmetry between message sender and message receiver.*

Pareto algorithm: Pareto algorithm is a decision analytic technique for two party negotiations. Pareto algorithm is sometimes included as software in a decision conference system. **1988** Kraemer and King (123) *The software of the decision conference is usually some form of decision analytic technique: decision trees and influence trees; multiattribute expected utility models for single-stage decisions; hierarchical evaluation structures for multiattribute utility analysis; Pareto algorithms for two-party negotiations; cost-benefit models for resource allocation; and spread- sheet models. Software for graphics and vote tally and display also are part of the decision conference facility.*

participant mood: Participant mood can be positive or negative and may have an impact on GSS satisfaction and effectiveness. **2003** Lester et al. *This study investigates the effects of facilitator style (task-oriented vs. relationship- oriented) and participant mood (positive and negative affect) on multiple measures of Group Support Systems (GSS) satisfaction and effectiveness.*

participant skills: Participant skills is a team member characteristic. Participant skills decline if they are not utilized. Virtual team members usually have high-performance team skills. **1984** Huber (198) *The first follows from the previous idea; because user skills (ie. Facilitator skills, chauffeur skills, and participants skills) decline if they are not utilized, (p.198)* **1999** Bailey and Lumley *Technology based teams are deeply commited to each other's success - they are interdependent via technology. These teams use technology to communicate and to create. Their members have high-performance team skills; they work and learn anything, anytime, anywhere, together and apart. They use technology to enhance working as a team.* **2000** Pare and Dube (from Gladstein 1984) *Team member's characteristics, such as skills and expertise job tenure, spoken language(s), self-motivation, and ability to work in groups, have been connected to group processes and outcomes.*

participant: The participants or group member in the electronic meeting are the actual people in the organization who are involved in making a decision. **1988** Kraemer and King (123) *The participants in the decision conference are the actual people in the organization who are involved in making a decision*

participation inhibitor: Participation inhibitors are a form of disruptive behaviour in meetings. A participation inhibitor example is speaking up in front of the boss. Parallel and simultaneous input in meeting systems help to minimize the impact of participation inhibitors. **2003** Corbitt and Martz *participation inhibitor (speaking up in front of the boss). …Nunamaker, et al. (1991) posit the main advantages of this technology are: parallel and simultaneous input, e.g. all participants talk at once; opportunities for equal input; a full unbiased record of a group's activities that are recorded by the computer; anonymity, so that some of the traditional participation inhibitors (speaking up in front of the boss) are minimized; and, mechanisms can be encoded into the software that discourage disruptive behavior by individual group members.*

participation level: Participation level is a GSS research variable. Participation levels are influenced by levels of task difficulty in GSS learning environments. **2001** Burke *This study is an examination of how GSS learning environments face-to-face vs. distant) and task difficulty level (simple vs. difficult) influenced participation levels and social presence among accounting students working collaboratively on an accounting task*

passive interaction style: Passive interaction style is one of three general team interaction styles. The other two are constructive and aggressive styles. Passive interaction style places greater emphasis on fulfilment of affiliation goals only, maintaining harmony in the group, and limiting information sharing, questioning and impartiality **2000** Potter et al. (from Cooke and Szumal 1994) *Passive style places greater emphasis on fulfillment of affiliation goals only, maintaining harmony in the group, and limiting information sharing, questioning and impartiality*

patterned action: Patterned action created in the process of action and interaction **1992** McLeod and Liker *In contrast, we take the perspective shared by organizational theorists such as Weick (1979), Van Maanen (1979), and Barley (1986) who reject this static deterministic view, and rather characterize social structures as "patterned action, interaction, behaviour and cognition" (Barley 1986, p.79). Thus, we see group structure as an emergent pattern created in the process of action and interaction (giddens 1979, Poole et al, 1985, Thierauf 1989, Bostrom et al.1990). Structure, as defined here, exists in all groups. Thus technology provides an "occasion for structuring" (Barley 1989), not a deterministic cause of structure.*

peer group learning*:* see Collaborative learning **1984** Huber *The labels given to collaborative or group learning are many; among them are: "cooperative learning, collective learning, study circules, team learning …" (Bouton and Garth, 1983), and ":peer-group learning" or syndicates")Collier, 1980).*

peer pressure*:* Peer pressure is a barrier to group work **1988** Kraemer and King *At the simplest level GDSS provide features aimed at removing common barriers to group work and communication, such as unequal consideration of ideas, dominance by individuals, peer pressure, and loss of autonomy. These features include anonymous input of ideas and preferences, and large screens for instantaneous display of ideas, and secret voting and compilation. The level is illustrated by the electronic boardroom or computer-supported conference room … Also known as 'pressure to conform'.* **1998** Briggs et al. *The invisible group dynamics that may be created are convergence and divergence, depth and breadth, detail and abstraction, consensus and constrictive conflict, to name but a few. Because a team may elect to contribute anonymously, people need not fear retribution from peers or superiors if they contribute unpopular ideas.*

people: People are basic components of any GDSS. A team is a collection of people working together for some specific purpose. **1985a** DeSanctis and Gallupe *However, the basic components of any GDSS include hardware, software, people and procedures. Each of these components is now considered in some detail.* **1992** O'Dwyer and Giser (from Coleman 1997) *Groupware has stuck as an umbrella term for these products as it combines the two ideas at the heart of its conception and implementation: "group" and Ware" = people + technology.* **1997** Nunamaker et al. (from Webster's Dictionary) *Team: a collection of people working together for some specific purpose.*

perceived anonymity: Perceived anonymity may be more important than actual anonymity. Three types of anonymity are environmental, content-based and procedural. **1998** Gavish and Gerdes *If anonymity is being used as a device to encourage a more open and frank exchange of information, a system's perceived level of anonymity may be more important than its actual anonymity … Types of anonymity: Anonymity can be viewed as a composite of three types of anonymity - environmental, content-based and procedural. Environmental anonymity refers to the extent to which environmental factors affect the anonymity of the communication system. These factors include such elements as: the number of individuals involved in the communication session, the proximity of these individuals, and the level of inter-group familiarity. Content-based anonymity - " the extent to which the source of a specific contribution can be identified through the contribution content. Procedural anonymity dealing with the communication protocols.*

perceived cohesiveness: Perceived cohesiveness encompasses an individuals sense of belonging to a particular group and his or her feelings of morale associated with membership in the group. Perceived cohesiveness reflects an individual's appraisal of their relationship to the group. Such a perception by individuals relative to their group could be linked to group formation, maintenance, or even productivity in some situations. Group cohesiveness is a group characteristic. **1991** Nunamaker et al. *Group characteristics that can affect processes and outcomes include (but not limited to) group size, group proximity, group composition (peers or hierarchical), group cohesiveness, etc.* **1997** Salisbury et al. (from Bollen and Hoyle 1991). *Perceived cohesiveness - emcompasses an individuals sense of belonging to a particular group and his or her feelings of morale associated with membership in the group. Perceived cohesiveness reflects an individual's appraisal of their relationship to the group. Such a perception by individuals relative to their group could be linked to group formation, maintenance, or even productivity in some situations.*

perceived net value: Perceived net value is an attitude, a valenced subjective assessment in response to all the perceived likely consequences of changing from existing technology to the proposed technology. **1998** Briggs et al. *Perceived net value is an attitude, a valenced subjective assessment in response to all the perceived likely consequences of changing from existing technology to the proposed technology.*

perceived value: Perceived value has both a magnitude and a direction. It can be small or large, it can be positive, neutral, or negative. **1998** Briggs et al. *Perceived value has both a magnitude and a direction. It can be small or large, it can be positive, neutral, or negative.*

performance (1): Performance of group activities is defined as having three major factors: effectiveness as defined by decision quality or number of ideas generated, efficiency as defined by the time to complete the task, and participants' satisfaction with the process or outcomes. **1988** Dennis et al. *The exact type of task is very important to group performance (Poole et al.1985), so any study of performance must clearly define the nature of the task performed.* **1995** Whitman et al.*Gallupe and DeSanctis (1988), among others. Few studies directly distinguish and examine the dynamics of groups as teams (as opposed to randomly associated groups of individuals) with regard to the commonly examined group performance variables of decision quality, decision efficiency, and interpersonal behavior, nor the decision perception variables of individual satisfaction, procedural justice and equity of the decision process.* **2001** Dennis and Wixom *We follow the approach of Drazin and Van de Ven [17], Benbasat and Lim [2] and Dennis and Kinney [10], who defined performance in terms of three major factors: (1) effectiveness as defined by decision quality or number of ideas generated, (2) efficiency as defined by the time to complete the task, and (3) participants' satisfaction with the process or outcomes.* **2001** Antunes and Ho (from Miranda and Bostrom 1999) *Miranda and Bostrom (1999) concerns improving the future group performance, which extends the scope from the specific problem and process at hand towards continued progress review*

performance (2): Performance of software products is determined by the relative amount of resources used, under stated conditions. **1986** Fanning and Raphael *Reliability and performance. If the system took more than a couple of seconds to respond to a keystroke, or crashed more than once a week, it would not be acceptable and any other advantages it might have would be moot.* **2002** Sikorski (from ISO/IEC 9126-1) *The capability of the software product to provide appropriate performance, relative to the amount of resources used, under stated conditions*

performance evaluation (1): Performance evaluation relating to the evaluation of group activities. Performance evaluation is a step in the problem-solving process. **1984** Huber (200*)…any step of the problem-solving process: problem sensing, problem exploration, problem definition, criterion and constraint identification, proposal generation, proposal evaluation, choice, implementation, and performance evaluation.* **1987** DeSanctis and Gallupe *The Performance/Satisfaction Tradeoff: Perhaps the most difficult issue that researchers and organizations must address with regard to GDSS is the designed balance between decision quality and satisfaction with the group process.* **1999** Shirani et al. *Task* *characteristics: groups may generate ideas, choose a preferred solution, negoriate conflicting views of interests, or engage in competition with an opponent or against some performance standard (28).*

performance evaluation (2): Performance evaluation relating to the evaluation of systems. **1986** Fanning and Raphael *Reliability and performance. If the system took more than a couple of seconds to respond to a keystroke, or crashed more than once a week, it would not be acceptable and any other advantages it might have would be moot.* **1999** Gutwin and Greenberg *Completion time is a basic measure of product performance. It assumes that there is a relationship between the activities of collaboration and the speed at which a group can perform the task. (p,.256)*

performance outcome: Performance outcome of groups can include quality and creativity. **1996** Hiltz et al. *Performance outcome (quality and creativity).*

personal artifact: Personal artifacts are things created, manipulated, and owned by one and only one person. **1999** Greenberg et al. *Personal artifacts are things created, manipulated, and owned by one and only one person.*

personal computer terminals*:* A means to reduce productivity losses in group decision making **1988** Kraemer and King (117) *GDSS's could help alleviate these problems by providing: 1. Personal computer terminal for each participant. 2. Public display screen for all. 3. Computing/communication capability for accessing data bases; communicating with the group leader, and the public display. 4. Software for word processing, data access and management, graphics, and "controls" to allow public or anonymous communications with others or the group.*

perspective awareness: Perspective awareness relates to what are members of the remote group thinking and why. **2000** Jang et al. *Perspective awareness – groups often complained that they did not really understand why remote teammates failed to take up a suggestion, or how they thought about a particular contribution. Even when they did respond, it was not always clear how to interpret these responses due to differences in training, backgrounds, institutional contexts, etc. We have considered this to be a lack of perspective awareness (What are they thinking and why).*

photograph*:* A photograph is a human communication mode that can be used in computer teleconferencing systems. **1986** Fanning and Raphael *Until computer teleconferencing systems can encompass several modes of human communication-- e.g. text, voice, sketched diagrams, and photographs.*

physical value: Physical value of a new information system may be positive or negative. **1998-9** Briggs et al. *Physical value: A new system might affect the health and wel-being of the prospective user in a variety of ways. For example, the new system might impose far less eye strain (positive physical value), or it might increase the noise level (negative physical value).*

planning and problem solving model: Different planning and problem solving models are implemented in GDSS systems. These general classes of models include information gathering or idea generation models, information or idea synthesis models, quantitative analysis models, and group consensus and negotiation or choice models. **1986** Applegate et al., *Four general classes of planning and problem-solving models are implemented in the system: (I) information gathering/idea generation models, (2) information/idea synthesis models, (3) quantitative analysis models and (4) consensus and negotiation/choice models.* **1986** Kraemer and King. *These techniques might include: planning tools such as brainstorming, stakeholder identification and analysis, or organization analysis; modeling tools that support qualitative and quantitative decision analysis such as decision trees, risk analysis, social judgment analysis or multiattribute utility analysis.* **1987** Stefik et al. *Remote conferencing that rely mostly on computers rather than video: known as computer conferencing, these systems include electronic mail, editors, voting mechanisms, shared* *files, and archiving, but do not provide structure for the conferences based on any models of group problem-solving processes.* **1991** Nunamaker et al. *Task structure refers to techniques, rules, or models for analysing task-related information to gain new insight (12), such as those within computer models or Decision Support Systems (DSS).*

planning session facilitator: Planning session facilitators assist the group in their planning activities providing access to a workbench of quantitative and qualitative decision aids for identification of issues and ideas, surfacing assumptions, stakeholder and identification, competitive analysis, and other enterprise and situation analysis activities **1986** Applegate et al. (17) *Planning session facilitators assist the group in their planning activities providing access to a workbench of quantitative and qualitative decision aids for identification of issues and ideas, surfacing assumptions, stakeholder identification, competitive analysis and other enterprise and situation analysis activities.*

planning: Some types of planning activities are carried out in a shared workspace, such as dividing up the task, reserving areas of the workspace for future use, or plotting courses of action by simulating them in the workspace. **2001** Potts-Steves et al. *Some types of planning activities are carried out in a shared workspace, such as dividing up the task, reserving areas of the workspace for future use, or plotting courses of action by simulating them in the workspace.*

Plexsys toolkit: Plexsys toolkit includes a number of tools, such as session director, electronic brainstorming, issue analyser, voting, topic commenter, policy formation, organizational infrastructure, stakeholder identification and assumption surfacing, and alternative evaluator. **1988** Dennis et al. *Examples of tools in the PLEXSYS toolkit include: ? Session director – guides the facilitator or group leader in selection of the tools to be used in a session and generates an agenda. Default times and output reports are listed and may be modified at the group's discretion. ? Electronic brainstorming – supports idea generation, allowing group members to simultaneously and anonymously share comments on a specific question ? Issue analyser – helps group members identify and consolidate key focus items resulting from idea generation. Support is also provided for integrating external information to support identified focus items ? Voting – provides a variety of prioritising methods including Likert scales, rank ordering, and multiple choice. All group members cast private ballots. Accumulated results are displayed. ? Topic commenter – supports idea solicitation and provision of additional detail in conjunction with a list of topics. Each topic may have subtopics. Participants enter, exchange, and review information on self-selected topics ? Policy formation – supports the group in developing a policy statement or mission through iteration and group consensus ? Organizational infrastructure – provides support for capturing characteristics of organizational data sets, information systems, and structure to provide a foundation for impact analysis. ? Stakeholder identification and assumption surfacing – is used to systematically evaluate the implications of a proposed policy or plan. Stakeholder assumptions are identified, scaled, and graphically analysed. ? Alternative evaluator – provides multicriteria decision-making support. Alternatives can be examined under flexibly weighted criteria to evaluate decision scenarios and tradeoffs.*

political value: Political value of a new information system may be positive or negative. **1998-9** Briggs et al. *Political value: By changing the way people access information and work together, a new information system may cause power shifts in an organization. For example, a new system might allow prospective users at remote locations to participate in decision making meetings at headquarters (a positive political value), or it might increase pressure from outside constituencies (a negative political value).*

pooled: Pooled is a mode of the prioritization process or coordination method. The other two modes are sequential and aggregated. In the Co-OP system, in pooled mode all group members can collectively enter a common priority vector. Pooled can also refer to one of four coordination method that groups use; parallel, pooled, sequential and reciprocal. The parallel method is where individuals approach the problem independently. Pooled is the same as parallel except that a standard is utilized to formulate a group result, such as a group vote. Sequential is where all group members undertake the problem-solving phase in a sequential manner, and reciprocal is where changes made in one part of the problem can force other group members to reconsider other parts of the problem. **1986** Bui and Jarke (90) *Co-OP can perform the prioritization process in three modes: -Pooled: All group members collectively enter a common priority vector. -Sequential: Group members, according to their expertise, assign priority to a subset of criteria. -Aggregated: Each member assigns individual weights first; then individual priorities are aggregated using a predetermined computation rule.* **1998** Tung and Turban (from Turoff et al.[36]) *Organizational group activities divided into four coordination methods that groups use. They are parallel, where individuals approached the problem independently; pooled, same as parallel except a standard is utilized to formulate a group result such as group vote; sequential, where all group members undertake the problem-solving phases in a sequential manner and, reciprocal, where changes made in one part of the problem can force other group members to reconsider other parts of the problem, such as in a case where consistency relations are imposed.*

poor communication: Poor communication is a productivity and meeting loss. Poor communication at meetings can result in inconsistent designs, frustrated efforts, drastically lowered morale, and ultimately to project failure. **1986** Begeman et al. *Poor communication and disagreement at meetings can result in inconsistent designs, frustrated efforts, drastically lowered morale, and ultimately to project failure.*

post-meeting phase: The phases of a meeting are divided into pre-meeting, during (or in) meeting, and post meeting. Activities undertaken in the post meeting phase can include, degree of post meeting conensus, member's perceptions of the outcome and decision process, and equality of influence., creating minutes, and monitoring commitment. **1986** Begeman et al. *As should be clear from figure 1, our research is concerned with pre-meeting aids, during meeting aids, and post-meeting aids.* **1988** Watson et al. *Degree of post-meeting consensus is the major dependent variable of the study. In addition to consensus, various other dependent measures have been taken, including members' perceptions of the outcome and decision process, and equality of influence.* **1988** Bostrom and Anson *Post Meeting * Creating meeting minutes/chapter * Monitoring commitments.* **2001** Antunes and Ho *Several authors rely on a timing dimension where facilitation is divided in pre-meeting, meeting and post-meeting stages (Bostrom et al. 1993; Clawson et al. 1995).*

pre meeting phase: The phases of a meeting are divided into pre-meeting, during (or in) meeting, and post meeting. Activities undertaken in the pre meeting phase can include, setting goals, getting participants and collecting materials. **1986** Begeman et al. *As should be clear from figure 1, our research is concerned with pre-meeting aids, during meeting aids, and post-meeting aids.* **1988** Dennis et al. *One of the most important activities of any group process is the pre meeting planning. Key tasks during this step are setting the objectives for the meeting, ensuring that participants understand these objectives and the roles they will plan, and designing the agenda to meet these objectives.* **1998** Greenberg and Roseman *Pre-meeting setup: setting goals, getting participants, collecting materials.*

preference aggregation: Preference aggregation includes additive ranking, multiplicative ranking, sums of the ranks approach, sums of outranking relations approach **1986** Bui and Jarke (92) *MCDMs provide an elegant frame- work for the following important GDSS tasks: (1) Representing multiple viewpoints of a problem. From a database perspec- tive, the MCDM decision matrix can be viewed as a particular kind of derived relation whose rows represent decision alternatives and whose columns represent criteria or viewpoints by which the alternatives are judged. (2) Aggregating the preferences of multiple decision makers according to various group norms. MCDM and game theory have developed different weighting schemes for criteria and measures of fairness for multiperson decisions [28, 35, 361. (3) Organizing the decision process … The Co-OP group model bank contains* *four techniques for preference aggregation and some negotiation support modules. The former include additive ranking, multiplicative ranking, the sums-of-the-ranks approach, and the sums- of-the-outranking-relations approach [6]. Unless otherwise specified, the Co-OP group module automatically searches for all aggregation techniques compatible with the MCDM used by any individual decision maker.*

preference task: Preference tasks require decision making on issues without right answers and are based on values and norms. Since group members may possess different values, the resolution of preference tasks is likely to involve conflicts. **1987** DeSanctis and Gallupe *In the case of CHOOSING tasks, where alteranatives are known and in need of evaluation by group members, the objectives of GDSS technology should be to aid in the selection of either the correct solution (in intellective tasks) or the socially preferred solution (for preference tasks).* **1996** Sia et al. (from McGrath 1984) *Preference tasks require decision making on issues without right answers and are based on values and norms. Since group members may possess different values, the resolution of preference tasks is likely to involve conflicts.* **2003** Huang *Preference task is a task in which no correct answer exists, and the solution is based on personal preferences (McGrath, 1984)*

prejudice: Prejudice can be a major barrier to effective group decision making. **1985a** DeSanctis and Gallupe *the major barrier to effective group decision making is any condition which prevents the free expression of ideas in a group (Janis, 1972; Kolasa 1975; Van de Ven & Delbecq 1974). A number of events may lead to this problem. For example, group members may feel a strong pressure to conform, thus stifling the input of non-conforming ideas to the decision process, or certain members may regard other members as more competent or higher in status than they are (Hoffman, 1965). The extent to which group members are active in the group is also affected by the group's initial evaluation of the contributions of various members. People whose ideas are initially accepted by the group are likely to increase their participation, while those whose suggestions are rejected may withdraw from the discussion (Oakes et al.1960; Pepinsky et al.1958).* **1998** Knoll and Jarvenpaa *Collaboration constraints are lack of expertise, time, or money; or the presence of competition or conventional wisdom (prejudices of the day).*

pre-session guidance: Pre session guidance is an important factor for the success of electronic meetings. **1986** Applegate et al. *An important theme that was identified, however, was that a key to the success of the Electronic Brainstorming model for idea generation was the methodology that has been employed for using the model. This was supported by the comments on the post-session questionnaire that indicate that (I) the guidance prior to the meeting, (2) the ability to obtain on-the-spot, compiled versions of the ideas and (3) the face-to- face discussion of the ideas guided by the planning session facilitator were important factors for the success of the idea generation process.*

pressure to conform: Pressure to conform is also known as 'peer pressure'. Presure to conform stifles the decision making process. Structured approaches help to alleviate this problem. **1985a** DeSanctis and Gallupe (7) (from Hoffman 1965) …*the input of non-conforming ideas to the decision process, or certain members may regard other members as more competent or higher in status than they are.* **1986** Kraemer and King *How might GDSS's help increase productivity of decision meetings? Huber (1982a) provides the following succinct assessment of the issue: I. Effective group decision making requires: 1. Meeting the need of the situation. 2. Ensuring that members are satisfied with the process. 3. Enabling members to meet and work successfully in the future. II. "Losses" of productivity in group decision making occur because: 1. Discussions are dominated by certain individuals. 2. Low-status members defer to high-status members. 3. Group pressures lead to conformity of thought. 4. Miscommunication among members is common. 5. Insufficient time is spent in problem exploration and generation of alternatives.* **1987** DeSanctis and Gallupe *The key effect of structured approaches appears to be increasing member participation (White et al.1980), focusing the problem, avoiding conformity pressures, and keeping the group on track (Gallupe 1985).* **1990** Connolly et al. *On the negative side, working in a group might* *inhibit a contributor who anticipated embarrassment, hostile evaluation, conformity pressures or other punishments for proposing an unusual idea (Collaros and Anderson, 1969).* **2001** Dennis and Wixom *Without anonymity, individuals, particularly low status participants, may withhold ideas due to negative evaluation apprehension [16, 30] or may feel pressured to conform to the group majority or senior participants' views [24]. Anonymity reduces the reluctance to contribute information, because it shields the contributor from group reaction and deindividualizes the interaction [7].*

private information sharing: Private information sharing relates to the degree of information sharing. Private information is not shared **1986** Begeman et al. *Unstructured information is information which is not in a regular form, and which cannot be readily interpreted by a computer. For designers, this frequently takes the form of private sketches on the personal workstation (row 3, column 1) or public sketches on the electronic blackboard (row 3, column 3).*

privileges and protection*:* Privileges and protection is a CMC factor relating to specialized support software. **1981** Turoff et al. (92-93) *The ability of the system to preserve the access privilege structure provided by the author of material and to deal with read, write, edit and utilize access both on the part of the sender and receiver. In some instances it is necessary to allow a function triggered by a user to access material for utilization that was supplied by another user. However, the user making use of this material would not necessarily have reading privileges for that material. An example is being able to ask of someone else's calendar if they can meet on a certain date and time. This is "utilize" access and is different from the more standard forms of access usually provided on interactive systems. The ability of the user to understand the forms of access and to make use of them as well as to be able to track their use by others on his or her material is a further aspect of this factor.*

problem definition: Problem definition is the third step in the problem solving process. **1984** Huber (200) A*ny step of the problem-solving process: problem sensing, problem exploration, problem definition, criterion and constraint identification, proposal generation, proposal evaluation, choice, implementation, and performance evaluation.*

problem exploration: Problem exploration is the second step in the problem solving process. **1984** Huber A*ny step of the problem-solving process: problem sensing, problem exploration, problem definition, criterion and constraint identification, proposal generation, proposal evaluation, choice, implementation, and performance evaluation.* **1986** Kraemer and King *Huber (1982a) provides the following succinct assessment of the issue: I. Effective group decision making requires: 1. Meeting the need of the situation. 2. Ensuring that members are satisfied with the process. 3. Enabling members to meet and work successfully in the future. II. "Losses" of productivity in group decision making occur because: 1. Discussions are dominated by certain individuals. 2. Low-status members defer to high-status members. 3. Group pressures lead to conformity of thought. 4. Miscommunication among members is common. 5. Insufficient time is spent in problem exploration and generation of alternatives.*

problem sensing: Problem sensing is the first step in the problem solving process. **1984** Huber A*ny step of the problem-solving process: problem sensing, problem exploration, problem definition, criterion and constraint identification, proposal generation, proposal evaluation, choice, implementation, and performance evaluation. (p.200)*

problem solving meeting: Problem solving meeting is a meeting type. **1986** Begeman et al. *Meeting Types include: 1. Exploration and Brainstorming meetings, 2. Informational or Presentational meetings, 3. Problem Solving or Decision Making meetings, 4. Negotiation or Resource Allocation meetings 5. Morale Building or Social Structuring meetings.*

problem solving process: There are nine steps in the problem solving process, problem sensing, problem exploration, problem definition, criterion and constraint identification, proposal generation, proposal evaluation, choice, implementation, and performance evaluation. **1984**

Huber …*any step of the problem-solving process: problem sensing, problem exploration, problem definition, criterion and constraint identification, proposal generation, proposal evaluation, choice, implementation, and performance evaluation.*

problem type: Problem type also known as task type, can impact group performance. Two problem types used in prior studies are Bales human relations case and scientific ranking problem. **1980** Hiltz et al. *A variable of secondary Interest is problem type. Much experimental literature indicates that the nature of the problem has a great deal to do with group performance. One type of problem that we used is the human relations case as developed by Bales. These are medium complex, unsettled problems that have no specific "correct" answer. The second type was a "scientific" ranking problem (requiring no specific expertise), which has a single correct solution plus measurable degrees of how nearly correct a group's answer may be … The factors were mode of communication (face-to-face vs. computerized conference) and problem type (human relations vs. a more "scientific" ranking problem with a correct answer).*

problems of productivity loss: see Process loss

procedure: Procedures are a basic component of a GDSS that support a group of people engaged in a decision-related meeting. **1984** Huber *As will be seen a GDSS consists of a set of software, hardware, and language components and procedures that support a group of people engaged in a decision-related meeting. (p.195)* **1985a** DeSanctis and Gallupe *The basic components of any GDSS include hardware, software, people, and procedures.* **1988** Watson et al. *First, the GDSS provides a meeting structure for the group. By providing a menu of facilities, such as idea generation, rating, ranking, and voting, the system suggests that the group consider the procedures they use in reaching their decisions.*

process facilitation: Process facilitation attempts to help the group in structuring the process by which it uses the available GSS tools. **2001** Dennis and Wixom *Facilitation has two key dimensions: process facilitation and content facilitation [4, 35]. Process facilitation attempts to help the group in structuring the process by which it uses the available GSS tools. Content facilitation attempts to improve task performance directly by offering insights, interpretations, or opinions about the task and various decision alternatives available to the group.*

process gain: Process gains (for example, participant synergy). **2001** Genuchten et al. *Process gains (for example, participant synergy).*

process loss: Process losses can include airtime, production blocking, poor motivation, negative evaluation apprehension, and pressure to conform. Process losses can be reduced by using parallel and anonymous input of ideas. **1986** Kraemer and King **1997** Nunamaker et al. (from Nunamaker et al. 1991) *Process structure refers to process techniques or rules that direct the pattern, timing or content of an interaction. Some familiar examples of process structure include nominal group technique (NGT) and the development and following of a shared agenda. Proces structure improves group performance by reducing or eliminating many sources of process losses and increasing or providing opportunities for many sources of process gains. …Task structure also improves group performance by increasing process gains and reducing process losses.* **2001** Genuchten et al. *Process losses (for example, air time and participant apprehension).* **2001** Pauleen and Yoong (from Walther and Burgoon 1992) *According to Walther and Burgoon (1992), strong relational links are associated with enhanced creativity, motivation, increased morale, better decisions and fewer process losses.* **2001** Dennis and Wixom *Parallelism is the ability of group members to simultaneously enter information. No participant needs to wait for others to finish before contributing information. The need to wait to speak (termed production blocking) has been identified as a major cause of poor performance in verbally interacting groups [16, 30]. Parallelism mitigates production blocking resulting in process gains [20, 46]. Anonymity, on the other hand, enables group members to contribute comments without being identified, which may increase the motivation to participate. Without anonymity,* *individuals, particularly low status participants, may withhold ideas due to negative evaluation apprehension [16, 30] or may feel pressured to conform to the group majority or senior participants' views [24]. Anonymity reduces the reluctance to contribute information, because it shields the contributor from group reaction and deindividualizes the interaction [7].*

process measure: Process measures relate to the teamwork elements of groupware usability. They look for patterns in behavioural or verbal activity during a collaborative session and connect these to issues of effectiveness or efficiency. Process measures are often obtained by observation or through video and audio protocol analysis. **1999** Gutwin and Greenberg *Process measures relate to the teamwork elements of groupware usability. They look for patterns in behavioural or verbal activity during a collaborative session and connect these to issues of effectiveness or efficiency. Process measures are often obtained by observation or through video and audio protocol analysis.*

process satisfaction: Process satisfaction is a measure of meeting success. **1986** Kraemer and King (from Huber 1982) *How might GDSS's help increase productivity of decision meetings? Huber (1982a) provides the following succinct assessment of the issue: I. Effective group decision making requires: 1. Meeting the need of the situation. 2. Ensuring that members are satisfied with the process. 3. Enabling members to meet and work successfully in the future. II. "Losses" of productivity in group decision making occur because: 1. Discussions are dominated by certain individuals. 2. Low-status members defer to high-status members. 3. Group pressures lead to conformity of thought. 4. Miscommunication among members is common. 5. Insufficient time is spent in problem exploration and generation of alternatives.* **2003** Martz *In general, three fundamental measures have been used as proxies for satisfaction; meeting process satisfaction, meeting outcome satisfaction and participation.*

process structure: Process structure refers to process techniques or rules that direct the pattern, timing or content of this communication [12], such as an agenda or process methodology such as Nominal Group Technique (NGT) **1997** Nunamaker (from Numamaker et al. 1991) *Process structure refers to process techniques or rules that direct the pattern, timing or content of an interaction. Some familiar examples of process structure include nominal group technique (NGT) and the development and following of a shared agenda. Process structure improves group performance by reducing or eliminating many sources of process losses and increasing or providing opportunities for many sources of process gains.*

process support: Process support refers to the communication infrastructure, media, channels, and devices, electronic or otherwise, that facilitate communication among members, Two common examples are an electronic communication channel and an electronic whiteboard. **1988** Bostrom and Anson *In-Meeting * Electronic agenda that triggers. monitors and records events (e.g. minutes, committments) * Process support (meeting advisors, group "barometer readings". etc.)***1991** Nunamaker et al. *Process support refers to the communication infrastructure (media, channels, and devices, electronic or otherwise) that facilitates communication among members (12), such as an electronic communication channel or blackboard. …Process support functions (ie. Parallel communication, group memory, anonymity).*

process team: Process teams are teams of people who undertake routine and standardised activities or tasks. Process work is the most common form of work. It exists in all organisations and has the following structure: it is predictable, it repeats, it is standardised, it takes a short time to conclude, and it maintains the status quo of organisational processes. **2000f** Thomsett *Process teams are teams of people who undertake routine and standardised activities or tasks. Process work is the most common form of work. It exists in all organisations and has the following structure: it is predictable, it repeats, it is standardised, it takes a short time to conclude, and it maintains the status quo of organisational processes.*

process of collaboration: see Collaboration phases

processor: A computer processor is part of the technology of a typical GDSS. **1985a** DeSanctis and Gallupe *The technology of GDSS: A pictorial representative of a typical GDSS is shown in Figure 1. In this generalized model, a group of decision makers has access to a data base, a model base, and GDSS applications software during the course of a decision-related meeting. There is at least one computer processor, one input output device, and one viewing screen. A "group facilitator" coordinates the group's use of the technology, and there is a flexible, friendly user-interface language available for use by the facilitator or each group member.*

product measure: Product measures relate to the taskwork elements in groupware usability, and measure aspects of the outcome of a task. Product measures are based on the assumption that the usability of a system will influence the group's success in completing the domain task. They judge collaboration outcomes in terms of quality or time. **1999** Gutwin and Greenberg (247) *Product measures relate to the taskwork elements in groupware usability, and measure aspects of the outcome of a task. Product measures are based on the assumption that the usability of a system will influence the group's success in completing the domain task. They judge collaboration outcomes in terms of quality or time.*

production blocking: Production blocking is the need to wait to speak which is an obstacle to contribution. This has been identified as a major cause of poor performance in verbally interacting groups. **1990** Connolly et al. *Combining individual efforts into a group output opens the possibility of free riding or social loafing (cf Harkins and Petty 1982; Kerr and Brunn 1981). And the mechanics of the combining process itself might provide obstacles to contribution (ie. Production blocking), as in ideas which are forgotten or edited while their originator waits for an opportunity to speak (Lamm and Trommsdorff 1973).* **2001** Dennis and Wixom *Parallelism mitigates production blocking resulting in process gains [20, 46].*

production rule*:* Production rule is a knowledge representation technique used for representing knowledge in a knowledge base. **1986** Applegate et al. *The output from all four classes of models serve as input to a knowledge base that provides a mechanism for representing and storing the planning knowledge using a variety of knowledge representation techniques (including frames, semantic inheritance networks and production rules).*

productivity loss in group decision making: see process loss.

productivity: The capability of the software product to enable users to expend appropriate amounts of resources in relation to the effectiveness achieved in a specified context of use (Relevant resources may include time, effort, materials or financial costs). **1996** Hiltz et al. *Effective communication (during the requirements definition process) is associated with improved productivity and higher quality systems (Curtis 1988)* **2002** Sikorski (ISO/IEC 9126-1 draft) *The capability of the software product to enable users to expend appropriate amounts of resources in relation to the effectiveness achieved in a specified context of use (Relevant resources may include time, effort, materials or financial costs).*

program model: Program model holds that organizational decisions are consequences of programs and the programming of units involved in the decision situation. Programs are standards, group norms, budget limits, and so forth. Programming is the prior professional training, biases, reinforcements, and other cognitive backgrounds of the individuals involved. **1998** Kraemer and King (137). *Program model holds that organizational decisions are consequences of programs and the programming of units involved in the decision situation. Programs are standards, group norms, budget limits, and so forth. Programming is the prior professional training, biases, reinforcements, and other cognitive backgrounds of the individuals involved.*

project failure: Project failure is a possible outcome of poor communications and disagreement at meetings. **1986** Begeman et al. *Poor communication and disagreement at meetings can result in inconsistent designs, frustrated efforts, drastically lowered morale, and ultimately* *to project failure. We have a set of creative ideas which, we hypothesize, can use automated technology to positively impact face-to-face design meetings.*

Project NICK*:* Project NICK was a project of the STP Design Interface Group. Researchers from MCC during Project NICK identified four **meeting classes**. Face to face, physically distributed, temporally distributed, and temporally and physically distributed (Cook et al. 1987). **1986** Begeman et al. (1) *Nick is a project of the STP Design Interface Group, named after a contemporary of Leonardo's who is better known by his last name: Machiavelli. …Project Nick is concerned with understanding the dynamics of meetings and improving meetings… Project Nick is not predicated upon any one particular meeting management technique, but is attempting to understand and augment some of the important meeting aspects.* **1990** Halonen et al. (from Cook et al.[33]) *Similarly, Cook and his colleagues [33] report that users of the Project Nick groupware considered the ability to send messages anonymously to be a useful feature. A second potential limitation of hardware sharing concerns the granularity of the units shared. With hardware sharing, an entire machine with all of its applications is shared by the group.*

project team: Project teams are fundamentally different from process teams. Project teams undertake project work and, by nature, this work is creative, dynamic and non-routing. Project work is unpredictable, unique, difficult to standardize, takes a long time to conclude and it changes the status quo of organizational processes. **2000f** Thomsett *Project teams are fundamentally different from process teams. Project teams undertake project work and, by nature, this work is creative, dynamic and non-routing. Project work is unpredictable, unique, difficult to standardize, takes a long time to conclude and it changes the status quo of organizational processes.*

proposal development: Proposal development is a communication or group exchange activity that can be undertaken in a decision related meeting. **1987** DeSanctis and Gallupe *The communication activities exhibited in a decision-related meeting include proposal exploration, opinion exploration, analysis, expressions of preference, argumentation, socializing, information seeking, information giving, proposal development and proposal negotiation (Bedau 1984; Poole 1983a) … We propose that GDSS researchers begin systems design by aiming to support group exchange activities (proposal development, opinion exploration, expressions of preference, argumentation, socialization, etc.), and be less concerned about the precise sequencing of these activities.*

proposal evaluation: Proposal evaluation is a step in the problem solving process. **1984** Huber *…any step of the problem-solving process: problem sensing, problem exploration, problem definition, criterion and constraint identification, proposal generation, proposal evaluation, choice, implementation, and performance evaluation.* **2003** Siao *The modules of most GSS reflect the categories of a crude typology of tasks - idea generation, proposal evaluation, alternative selection, and consensus seeking (25, 41). This typology closely resembles the Group Task Circumplex (24), which proposes that all group tasks can be categorized into four types: to generate, to choose, to resolve, and to execute (15, 42). There are three common dimensions that can be integrated into a taxonomy of GSS environments (Figure 1). They are time dispersion, group proximity, and group size (30).*

proposal exploration: Proposal exploration is a communication activity that could be used in a decision related meeting. **1987** DeSanctis and Gallupe *The communication activities exhibited in a decision-related meeting include proposal exploration, opinion exploration, analysis, expressions of preference, argumentation, socializing, information seeking, information giving, proposal development and proposal negotiation (Bedau 1984; Poole 1983a).*

proposal generation: Proposal generation is a step in the problem-solving process. **1980** Huber (200) *…any step of the problem-solving process: problem sensing, problem exploration, problem definition, criterion and constraint identification, proposal generation, proposal evaluation, choice, implementation, and performance evaluation.*

proposal negotiation: Proposal negotiation is a communication activity that could be used in a decision related meeting. **1987** DeSanctis and Gallupe *The communication activities exhibited in a decision-related meeting include proposal exploration, opinion exploration, analysis, expressions of preference, argumentation, socializing, information seeking, information giving, proposal development and proposal negotiation (Bedau 1984; Poole 1983a).*

proprietary conferencing:

protection: Protection is an interactive system characteristic related to behaviour of the user. **1981** Turoff et al. (91) *Protection of the system from damage by a user interaction.*

protocol benefit: Protocol benefit is one of three kinds of benefits that GDSS systems can provide. The other two are affective benefits, and information benefits. Protocol benefits in which the important tasks of focusing on key issues and assessing differences of opinion among participants are facilitated. **1986** Kraemer and King *We find that GDSS systems can provide three kinds of benefits: affective benefits in which participants' attitudes towards cooperation and decision effectiveness are increased by use of GDSS technologies; protocol benefits, in which the important tasks of focusing on key issues and assessing differences of opinion among participants are facilitated; and information benefits in which GDSS technologies either provide more useful information or facilitate the application of available factual information to evaluation of the assumptions of group members.*

proximity of participants: see group proximity

public artifact: Public artifacts are created by cooperating group members, are considered owned by the group rather than any individual member, and can be viewed and manipulated by all. **1999** Greenberg et al. (1) *Public artifacts are created by cooperating group members, are considered owned by the group rather than any individual member, and can be viewed and manipulated by all.* **1999b** Greenberg (2) *Public artifact is information held by the computer can be seen, heard, and acted upon in an easy and natural way by the people inhabiting the area around the computer.*

public display: A public display is a key attribute in a decision room. Public display is a means to reduce productivity losses in group decision making **1988** Kraemer and King (117) *GDSS's could help alleviate these problems by providing: 1. Personal computer terminal for each participant. 2. Public display screen for all. 3. Computing/communication capability for accessing data bases; communicating with the group leader, and the public display. 4. Software for word processing, data access and management, graphics, and "controls" to allow public or anonymous communications with others or the group.* **1994** Chen et al. *Electronic meeting systems (EMS) typically include several networked stations, large computer-controlled public displays, audio-video equipment, and electronic meeting software).* **1998** Greenberg and Boyle (1) *SharedNotes - a system that allows people to create and manipulate both personal and public notes between two devices: a personal digital assistant (PDAs, in this case the 3COM Palm Pilot), and a shared public display (also known as single display groupware) implemented in GroupKit (RosemanGreenberg1996)* **2002** Prinz et al. *Synchronous groupware system [24] enables its users to work simultaneously on the same document using several computers connected via a network. While SDG only supports co-located users working with one single public display, SGS provides the possibility for real time collaboration on a shared document as, eg. in tightly coupled [29, 30] meeting-room collaboration using several computational devices at once. ...The SGS we use is BEACH.*

public display screen: Public display screen is an input/output device. A means to reduce productivity losses in group decision making **1984** Huber (200) *Information sharing is the most typical of the activities in which groups engage and it is one of the two activities most obviously supported by technology, the other being information use. Of course vendors and technologies, including traditional technologies such as slide projectors, are already* *serving the information sharing market very well. General GDSS, however, may possess several useful capabilities that are far beyond those provided by traditional information sharing technologies. For example, the group can decide during the meeting that it wants to see data contained in the organization's database and can, In real time, have it's chauffeur retrieve and display the data on the public screen so that the facts can be collectively known.* **1988** Kraemer and King (117). *GDSS's could help alleviate these problems by providing: 1. Personal computer terminal for each participant. 2. Public display screen for all. 3. Computing/communication capability for accessing data bases; communicating with the group leader, and the public display. 4. Software for word processing, data access and management, graphics, and "controls" to allow public or anonymous communications with others or the group.* **1988** Poole et al. *GDSSs emphasize written media over spoken communication. Public and private screen displays force people to express their positions in writing. ...* **1994** Chen et al. *Electronic meeting systems (EMS) typically include several networked stations, large computer-controlled public displays, audio-video equipment, and electronic meeting software).*

public information sharing: Public information sharing relates to the degree of information sharing. Public information is available to everyone. **1986** Begeman et al. *Within all of these structures, the types of information that may be presented, manipulated, and captured during a meeting can be categorized according to the amount of its structure (binary, structured, or unstructured), and according to the degree of sharing (private, subgroup, or public).*

public information display: Public information display issues include front screen type and number, information format (eg text or graphics) multi-media presentation support, teleconferencing concerns, and provision of an electronic podium. **1988** Dennis et al. *Public Information Display: Public information display issues include front screen type and number, information format (eg. text or graphics) multi-media presentation support, teleconferencing concerns, and provision of an electronic podium. Presentation media should provide a wide range of support and should not restrict decision-maker communication. Front screen projection of individual workstation screens and consolidation group information, audio and video recording, optical disk technology, electronic blackboards, and overhead projection systems all play a role in providing a full measure of presentation media support.*

public screen size: Public screen size is a human factor that is critical to the design of GDSS. Screen size has been identified as a factor that can inhibit the idea generation process. **1985a** DeSanctis and Gallupe *What human factors considerations are ciritical in the design of GDSS (eg. spatial arrangement of group members, size and location of public screens, accommodation for "informal" as well as "formal" communication between group members) ?* **1986** Applegate et al. *While Electronic Brainstorming does appear to neutralize the group effects that have been suggested as inhibitors of idea generation during group brainstorming and to improve the efficiency of the session by allowing parallel process and automatic recording, specific aspects of the technology that tend to inhibit the idea generation process have been identified. These factors include: (I) the size of the computer screen, (2) the keyboard as an unfamiliar interface metaphor for some executives, and (3) the efficiency of the network in handling multiple, simultaneous file transfers.*

public screen: see Public display screen

pull technology: Pull technology means that users select messages or other information to read.. **1998** Dennis et al. *Newsgroups are "pull" technologies, in that users select which messages to read…..Proprietary conferencing systems and groupware systems are pull technologies too but they offer the ability to select participants and define their privileges.*

push technology: Push technology is a broadcast or 'push' approach of e-mail and listservs. **1998** Dennis et al. …*the broadcast or 'push' approach of e-mail and listservs was more appropriate than the 'pull' approach of the Web groupware system.*

quality of meeting output: Quality of meeting output is an effectiveness measure. Quality of meeting output can include more ideas, more unique ideas, greater levels of consensus, satisfaction. **1998** Tung and Turban (from Ocker et al.[28]) *Effectiveness of meetings in terms of creativity, quality and satisfaction.* **1999** Gutwin and Greenberg (247) *Product measures relate to the taskwork elements in groupware usability, and measure aspects of the outcome of a task. Product measures are based on the assumption that the usability of a system will influence the group's success in completing the domain task. They judge collaboration outcomes in terms of quality or time.* **2001** Dennis and Wixom *We follow the approach of Drazin and Van de Ven [17], Benbasat and Lim [2], and Dennis and Kinney [10], who defined performance in terms of three major factors: (1) effectiveness as defined by decision quality or number of ideas generated, (2) efficiency as defined by the time to complete the task, and (3) participants' satisfaction with the process or outcomes.* **2003** Corbitt and Martz *In addition to the quality of meeting outputs (more ideas, more unique ideas, greater levels of consensus, etc.), we propose that when evaluating groupware, social concerns should not be disregarded..* **2003** Davison et al. *Certainly communication quality and frequency, as well as the availability of appropriate communication technologies, are critical to the success of virtual teams.* **2003** Ngwenya and Keim *Time to decision and decision quality were surrogate measures of group information sharing effectiveness.*

quantitative analysis model: Quantitative analysis models are planning and problem solving models that may be implemented in GDSS systems for analysing purposes. Other planning and problem solving models include information gathering/idea generation models, information/idea synthesis models, and consensus and negotiation/choice models. **1986** Applegate et al. *Four general classes of planning and problem-solving models are implemented in the system: (I) information gathering/idea generation models, (2) information/idea synthesis models, (3) quantitative analysis models and (4) consensus and negotiation/choice models.*

Quilt: Quilt is an interactive multi-user co-authoring system. Quilt provides parallel editing capability whereby collaborators divide up the task so that each writer works on a different part of the document at the same time. Then the document is reassembled in an integration stage. Other systems of this type are SharedBook, ShrEdit, and GroupSystems GroupWriter. **1989** Ellis and Gibbs *Transactions. Transaction mechanisms have been used for concurrency control in interactive multi-user systems (for example, CES or Quilt), but, these are loosely-coupled systems and have less demanding response time requirements.* **1990** Halonen et al. (167) *Further, hardware sharing does not preclude the use of groupware programs. Available groupware designed specifically for synchronous meetings, and even asynchronous groupware (for example, argumentation tools, such as gIBIS [2], or coauthoring tools, such as Quilt [71) can be used in a hardware sharing environment.* **1997** Nunamaker et al. *Parallel editing: Collaborators divide up the task so that each writer works on a different part of the document at the same time. Then the document is reassembled in an integration stage. Examples of these are Quilt, SharedBook, ShrEdit (64), and GroupSystems GroupWriter (58)*

ranking: Ranking is a rank correlation measure. Ranking is used for consensus reaching in group decision making meetings. **1980** Hiltz et al. *A variable of secondary Interest is problem type. Much experimental literature indicates that the nature of the problem has a great deal to do with group performance. One type of problem that we used is the human relations case as developed by Bales. These are medium complex, unsettled problems that have no specific "correct" answer. The second type was a "scientific" ranking problem (requiring no specific expertise), which has a single correct solution plus measurable degrees of how nearly correct a group's answer may be.* **2003** Beroggi (from Beroggi 1999) *Different approaches to consensus reaching in group decision making exist, including voting principles and game analytic methods (Beroggi 1999, Chapter 9). A most important measure of consensus reaching among decision makers' preference rankings is a rank correlation measure.*

real-time (synchronous) groupware: Real-time groupware is groupware that lets people work together at the same time. **1989** Ellis and Gibbs *Real-time groupware systems are characterized by the following: * highly interactive - response times must be short. * real-time - notification times must be comparable to response times. * distributed - in general, one cannot assume that the participants are all connected to the same machine or even to the same local area network. * volatile - participants are free to come and go during a session. *ad hoc - generally the participants are not following a pre-planned script, it is not possible to tell a priori what information will be accessed. *focused - during a session there is high degree of access conflict as participants work on and modify the same data. *external channel - often participants are connected by an external (to the computer system) channel such as an audio or video link.* **1996** Roseman *Real-time groupware is groupware that lets people work together at the same time.*

reciprocal editing: Reciprocal editing is when collaborators work together to create a common document, mutually adjusting their activities in real time to take into account each other's changes. An example of such an editor is MULE. **1997** Nunamaker et al. *Reciprocal editing: Collaborators work together to create a common document, mutually adjusting their activities in real time to take into account each other's changes. One example of such an editor is MULE [61]*

redistribution list: Redistribution lists are a characteristic of the LENS email system**.** Senders can include as an addressee of a message, in addition to specific individuals or distribution lists, a special mailbox (currently named "LENS") to indicate that the sender is willing to have this message automatically redistributed to anyone else who might be interested. **1986** Malone et al. (2) *Senders can include as an addressee of a message, in addition to specific individuals or distribution lists, a special mailbox (currently named "LENS") to indicate that the sender is willing to have this message automatically redistributed to anyone else who might be interested…*

reflective: Reflective in text-graphic manipulation means reflecting on a piece of text-graphics previously developed, for further manipulation, to improve group output. **1986** Lakin *Reflective: Text-graphic manipulation for working groups can be reflective: that is, using a piece of text-graphics which refers to some aspect of a text-graphic performance. …Reflection manifests itself in two concrete features of text-graphic manipulation. The first is simply the storage and retrieval of static images and image dynamics from performances. The second feature is measurement (one way academics like to reflect on performing).*

regularity and predictability: Regularity and predictability are interactive system characteristic related to behaviour. **1981** Turoff et al. (91) *The ability of a user to anticipate the actions of the computer and to expect consistent responses to operations and functions.*

rehearsability: Rehearsability is an asynchronous groupware characteristic that greatly reduces the cognitive and communication limitations present in synchronous contexts. **2001** Schmidt (from Dennis and Valacich 1999) *Third, asynchronous groupware possesses three characteristics that greatly reduce the cognitive and communication limitations present in synchronous contexts: rehearsability, parallelism, and reprocessability (Dennis & Valacich, 1999).*

relational information: Relational information and textual information is more important for GDSS than they are for DSS. **1984** Huber *The subsequent analysis of group activities made clear that textual and relational information are relatively more important for GDSS than they are for DSS, most of which deal largely with numeric information (p.203)*

reliability and performance: Reliability and performance are system purchase evaluation issue related to system scalability. Reliability is also an interactive system characteristic related to behaviour. If the system took more than a couple of seconds to respond to a keystroke, or crashed more than once a week, it would not be acceptable and any other advantages it might have would be moot. **1981** Turoff et al. (91) *The ability of the system to function* *without error or loss of data. Also, the frequency and length of instances of the system being unavailable during scheduled operation.* **1986** Fanning and Raphael (294). *System scalability ... Ease of use. Users with an unimaginable variety of backgrounds and prejudices all become instant critics of how a system should have been designed, the first time a confusing command is encountered. Customizability and support. Whether obtained from a vendor or developed in house, the expertise would have to be available to tailor the system to the unique needs of our company and then to address further problems that would undoubtedly arise in the future; we cannot consider depending on any operational tool without such assurance. Reliability and performance. If the system took more than a couple of seconds to respond to a keystroke, or crashed more than once a week, it would not be acceptable and any other advantages it might have would be moot. Easy accessibility from the normal workplace. The typical user must be able to obtain the equipment and support necessary to use the system from his/her normal workplace without inordinate effort.*

reluctance to contribute: Anonymity reduces the reluctance to contribute information in a group meeting, because it shields the contributor from group reaction and deindividualizes the interaction. **2001** Dennis and Wixom *Anonymity, on the other hand, enables group members to contribute comments without being identified, which may increase the motivation to participate. Without anonymity, individuals, particularly low status participants, may withhold ideas due to negative evaluation apprehension [16, 30] or may feel pressured to conform to the group majority or senior participants' views [24]. Anonymity reduces the reluctance to contribute information, because it shields the contributor from group reaction and deindividualizes the interaction [7].*

remote conferencing: Remote conferencing is one of four styles of real-time interactions. The other three are face to face meetings, casual real time interactions and multi-user applications. Two aspects of remote conferencing are distinguished here, tele-presence and tele-data. **1990** Greenberg and Chang *General computer support for four styles of real- time interactions are distinguished and surveyed: 1) face to face meetings; 2) remote conferencing; 3) casual real time interaction; and 4) multi-user applications. Each topic is introduced, motivations discussed, and the key technical systems and related research described …Two aspects of remote conferencing are distinguished here: tele-presence and tele-data.*

remote decision making: Remote decision making means asynchronous and dispersed. **1998** Pervan *…the time/place combination may be face-to-face (the 'decision room') , asynchronous but in different places eg. Teleconferencing and videoconferencing), ansynchronous but in the same place (Local decision network), or asynchronous and dispersed (remote decision making).(11).*

remote decision network: Remote decision network is a GDSS technology category that has dispersed proximity of participants and ongoing duration of the decision making session. **1987** Jelassi and Beauclair (from DeSanctis and Gallupe 1985). *DeSanctis and Gallupe (1985) categorize GDSS technology into four separate areas: decision room, local decision network, linked decision rooms, and remote decision networks. They distinguish between the four models in terms of proximity of participants and duration of the decision making session.*

rent portable system: Rent portable system is a delivery mode in which GDSS can be made available to users. **1984** Huber (199) *There are at least three modes in which GDSS can be made available to users …for the GDSS to be permanently installed at the user's or customer's site … Another delivery mode is for the vendor to rent the system on an on-call basis … The third delivery mode is as a vendor-site installation where the software, hardware, staff, and so forth are all provided for a fee ... (p199)*

resource allocation meeting: Resource allocation meeting is a type of organizational meeting **1986** Begeman et al. *Meeting Types include: 1. Exploration and Brainstorming meetings, 2. Informational or Presentational meetings, 3. Problem Solving or Decision Making* *meetings, 4. Negotiation or Resource Allocation meetings 5. Morale Building or Social Structuring meetings.*

response time: Response time is the time taken to access data, modify data, or notify users of changes. Response times must be as short as possible. **1989** Ellis and Gibbs *WYSIWIS interfaces have two implications on concurrency control. First response times are important - the time taken to access data, modify data, or notify users of changes must be as short as possible. Secondly, if the concurrency control scheme entails the use of modes where actions of one user are not immediately seen by the others, then the effect of these modes on the group's dynamics must be considered and only allowed if they are not disruptive.*

responsiveness*:* Responsiveness is an interactive system characteristic related to behaviour. **1981** Turoff et al. (91) *The ability of the system to respond quickly and meaningfully to user requests to carry out various operations and functions.*

rich channel: Rich channels are also described as media richness or interaction richness. Richness is the capacity of communication media to convey cues and facilitate shared understanding in a timely manner. Rich media allow the conveyance of multiple cues (verbal, paraverbal, and nonverbal) and support rapid bidirectional communication (interactivity and feedback). **1989** Sheffield *The Effect of Verbal Communication Computer conferencing and decision rooms may be characterized by the efficiency of the communication media they support, and by their ability to convey social and emotional information ("media richness").***1996** Barua et al. *Interaction richness: the extent to which we can overcome the barriers of space, time and media/document formats in interacting with others. This would include: (1) Ability to talk, see, write and draw in both synchronous and asynchronous manner; (2) access relevant reference information; (3) archiving interactions for future review; (4) debate issues, problems, ideas, articles, etc. in open public forums on a global basis.* **2001** Schmidt (from Daft and Lengel 1986) *Daft and Lengel defined richness as the capacity of communication media to convey cues and facilitate shared understanding in a timely manner. Rich media allow the conveyance of multiple cues (verbal, paraverbal, and nonverbal) and support rapid bidirectional communication (interactivity and feedback). Conversely, in lean communication environments, team members are unable to convey nonverbal and paraverbal cues, and there are often delays between the time a message is sent and a response is received.* **2003** Pauleen (from Daft and Lengel 1986) *Rich channels, such as face-to-face and video conferencing, enable rapid feedback, the use of varied social cues and personalization of use, helping to resolve equivocality (Ngwenyama & Lee, 1997),*

robustness: Robustness refers to recovery from unusual circumstances, typically these are component failures. Groupware must achieve robustness to user actions. **1989** Ellis and Gibbs *Robustness. Traditionally robustness refers to recovery from unusual circumstances, typically these are component failures - the crash of a site or a communications link. While these are also concerns of groupware systems, there is also a second form of robustness these systems must achieve, in particular, robustness to user actions.*

roomware: Roomware are a combination of information devices and physical objects such as walls, chairs and tables in a room. **1997** Streitz et al. *roomware – combination of information devices and physical objects in a room eg. walls, chairs, tables.*

satellite*:* Satellites are communication equipment that is used for dispersed groups. **1985a** DeSanctis and Gallupe *For dispersed groups, a local area network, telephone lines, satellite, or microwave relay may be required to allow group members to communicate with one another. Electronic mail, computer conferencing, audio and video conferencing might also be integrated into the GDSS environment.*

satisfaction: Satisfaction refers to the comfort and acceptability of use. Freedom of discomfort, and positive attitude to the use of the product. **2002** Sikorski (ISO 9241-11) *The comfort* *and acceptability of use.* **2002** Sikorski (ISO 13407) *Freedom of discomfort, and positive attitude to the use of the product.*

satisfaction measure: GSS satisfaction measures – satisfaction with facilitator, agenda, software, task, process and outcome. Satisfaction measures can relate to both teamwork and taskwork, but focus on the participant's own beliefs about the activities of collaboration. Satisfaction measures are usually obtained with questionnaires and interviews. **1999** Gutwin and Greenberg *Satisfaction measures can relate to both teamwork and taskwork, but focus on the participant's own believs about the activities of collaboration. These measures record participants subjective experience with the groupware system, and whether the participants find the system to be a good setting for collaboration. Satisfaction measures are usually obtained with questionnaires and interviews.* **2003** Lester et al. *This research suggests that a relationship-oriented facilitator style is positively related to five (of six) GSS satisfaction measures – satisfaction with facilitator, agenda, software, task, and process. Positive participant mood at the outset of a GSS meeting is positively related to four measures of satisfaction – satisfaction with facilitator, task, process, and outcome.* **2003** Martz *In general, three fundamental measures have been used as proxies for satisfaction; meeting process satisfaction, meeting outcome satisfaction and participation.*

saturation: Saturation is a user behaviour phase when using interactive systems. **1981** Hiltz and Turoff (749) *… the 'saturation' phase where the system is perceived as inadequate for meeting new requirements users evolve as a result of experience.*

scaling: Scaling is a dynamic manipulation feature in graphics editors. **1986** Lakin *Manipulations include dragging, erasing and scaling.* **1987** Stefik et al. *A subsequent version of Boardnoter will go beyond the chalkboard by adding capabilities for copying, moving, resizing, linking with rubber band lines, grouping, and smoothing (neatening), and for using and scaling selections from a set of predrawn images.*

Scientific ranking task: Scientific ranking task has a single correct solution plus measurable degrees of how nearly correct a group's answer may be. **1980** Hiltz et al. (75) *has a single correct solution plus measurable degrees of how nearly correct a group's answer may be.*

searching of databases and analysis: Searching of databases and analysis is a means to reduce productivity losses **1988** Kraemer and King (117) *GDSS's can reduce these losses by allowing anonymity of contribution to the discussions, searching of data bases and doing analyses to answer question,, and displaying individuals' inputs to the public screen for open discussion.*

secretarial function: Secretarial functions undertaken by a conference agent include conference initialization and termination, pre-staging and logging. **1990** Lauwers and Lantz *…the conference agent is also responsible for: 0 floor control: Processing user input with respect to whether or not that user is currently authorized to generate input for a particular application or applications ... l workspace management: Determines the manner in which shared windows are "grouped" within the shared workspace, including window layout ... l dynamic reconfiguration: Handling latecomers and the departure of participants prior to termination of the conference ... l secretarial functions: These include conference initialization and termination, pre-staging, and logging. Architecturally, one can think of these functions as being provided by a conference secretary module.*

security: Security is an interactive system characteristic related to behaviour. Security is the ability to protect the users' data from errors unintentionally or intentionally generated. **1981** Turoff et al. (91)*Ability to protect the users' data from errors unintentionally or intentionally generated.* **1988** Dennis et al. *Support Issues: Support issues include breakout and conference rooms, high quality printers and copiers, gallery seating for observers, handicap access, security, redundancy in hardware and easy data recovery, observation rooms, and time stamping of voice and data in conjunction with video taping.*

***segmentation**:* Segmentation is an interactive system characteristic related to learning modes. **1981** Turoff et al. (91) *The ability of the user to learn only the minimum in order to carry out a specific task.*

self-defined commands: Self defined commands are capabilities of CMC systems that long term, regular users found valuable. **1981** Hiltz and Turoff *Among the capabilities which long term, regular users found valuable are group conferences, notebooks for text composition, and self-defined commands.*

semantic inheritance network: Semantic inheritance networks is a class of knowledge representation model whose output is used to provide input to a knowledge base. **1986** Applegate et al. *The output from all four classes of models serve as input to a knowledge base that provides a mechanism for representing and storing the planning knowledge using a variety of knowledge representation techniques (including frames, semantic inheritance networks and production rules).*

***semi-structured messages**:* Semi structured messages enable people to communicate non-routine information without the constraints of a rigid structure. **1986** Malone et al. (103) *Enable computers to automatically process a range of information. They enable people to communicate non-routine information without the constraints of a rigid structure* **1986** Malone et al.(102) *Semi-structured messages can help provide automatic aids for: (1) composing messages to be sent, (2) selecting, sorting, and prioritizing messages that are received, (3) responding automatically to some messages, and (4) suggesting likely responses to other messages*.

sense of community: Sense of community is a CMC factor relating to atmosphere. **1981** Turoff et al. (92-93) *The ability of the system to provide features, such as membership and interest directories, which allow users to form communities of interests as needed*.

sequential: Sequential is a mode of the prioritization process. Sequential mode is when group members, according to their expertise, assign priority to a subset of criteria. **1986** Bui and Jarke *Co-OP can perform the prioritization process in three modes: -Pooled: All group members collectively enter a common priority vector. -Sequential: Group members, according to their expertise, assign priority to a subset of criteria. -Aggregated: Each member assigns individual weights first; then individual priorities are aggregated using a predetermined computation rule.*

sequential editing: Sequential editing: collaborators divide up the task so that the output of one stage is passed to the next writer for individual work. Editors that support this process are called mark up tools. Examples of these include ForComment, as well as recent extensions to popular word-processing programs such as Microsoft Word and Lotus WordPro. **1997** Nunamaker et al. *Sequential editing: collaborators divide up the task so that the output of one stage is passed to the next writer for individual work. Editors that support this process are called mark up tools. Examples of these include ForComment, as well as recent extensions to popular word-processing programs such as Microsoft Word and Lotus WordPro.*

sharable artefact: see shared artifact.

shared artifact: Shared artifacts provide different views of the same object and must also allow a wide variety of working modes ranging from individual to collective work. **1997** Schlichter et al. *A simple example of a shared artifact is the group document which is jointly authored by a group of authors. Besides different views of the same object, shared artifacts must also allow a wide variety of working modes ranging from individual to collective work*

shared ground rules: Shared ground rules are also referred to as tangible shared team meanings or protocols, which may include the four basic team elements, the team structure (eg leadership and role differentiation), team identity (eg. team goals), team interdependence (eg. team coordination), and team history (eg. the frequency of team meeting). **2003** Huang et al. *In general, two types of dialogue outcomes can be generated. The first type can be termed as shared ground rules of a team (or tangible shared team meanings), which may include the four basic team elements discussed in the introduction--the team structure (e.g., leadership and role differentiation), team identity (e.g., team goals), team interdependence (e.g., team coordination), and team history (e.g., the frequency of team meeting). The second type is a kind of shared team conventions and norms (or intangible shared team meanings), which may guide team interactions consciously (e.g., respecting differences in team interactions), and most of the time, maybe unconsciously (e.g., a team norm may exist in some cultures where ideas given by senior people will be automatically and unconsciously considered with higher weights in team interactions).* **2003** Davison et al. *When goal agreement has been achieved, teams can focus on their mutual expectations with regard to communication quality, frequency, etc. It is suggested that teams ground these expectations in a set of protocols that govern all their interactions, i.e. the establishment of group ground rules or protocols. Sample protocols could include: decide on which communication tools you intend to use (e.g., email, Blackboard, etc.) and ensure that you have regular access to these communication tools; check email at least every 12 hours; send email at least every 24 hours; identify days when communication may not be possible (e.g., weekends, public holidays); be cognizant of time zone differences between team members, as well as variations such as daylight savings schemes (p.531)*

shared objects: The shared objects are texts, lists, trees, graphics and so on. The participants may all contribute synchronously on their own workstations. **1998-9** Briggs et al. *The shared objects are texts, lists, trees, graphics, and so on. The participants may all contribute on their own workstations. Thus people do not forget what they want to say while waiting for a turn to speak, nor do they ignore other speakers in order to remember what they want to say when they get the floor. The invisible group dynamics that may be created are convergence and divergence, depth and breadth, detail and abstraction, consensus and constrictive conflict, to name but a few. Because a team may elect to contribute anonymously, people need not fear retribution from peers and superiors if they contribute unpopular ideas.*

shared physical workspaces: Shared physical workspaces allow people to maintain up-to-the-minute knowledge about others' interaction with the workspace. Examples are whiteboards, control panels, and tabletops. Shared physical workspaces and the artifacts they contain act as a stage and offer props for rich person-to-person interaction. **1996** Gutwin and Greenberg *Shared physical workspaces allow people to maintain up-to-the-minute knowledge about others' interaction with the workspace. This knowledge is workspace awareness, part of the glue that allows groups to collaborate effectively … Shared physical workspaces (such as chalkboard, a control panel, or a tabletop) and the artifacts in them act as stage and props for rich person-to-person interaction).* **1997** Greenberg *Shared physical workspaces (such as whiteboards, control panels, and tabletops) and the artifacts they contain (sketches, control, documents, structured drawings) act as a stage and offer props for rich person-to-person interaction.*

shared view systems: Shared view systems are shared groupware workspaces. **1998** Greenberg and Gutwin *Shared groupware workspaces have been around for quite a while (engelbart and English, 1968) both as shared view systems and groupware drawing editors.*

shared window system: Shared window systems are multi-user systems for real-time collaboration. Shared window systems enable existing applications to be shared in the context of a real-time teleconference. **1990** Lauwers and Lantz *Shared window systems enable existing applications to be shared in the context of a real-time teleconference. The development and successful use of several such systems, albeit within limited user communities, testifies to the merits of the basic idea. However, experience to date has suggested a number of areas that have not been adequately addressed, namely: spontaneous interactions, shared workspace management, floor control, and annotation* *and telepointing.* **1990** Ishii *There have been two types of approaches proposed to realize real-time shared workspaces for distributed groups. (1) Multi-user software such as shared-window-systems lLant86, Suzu86, LauwS)OA, Lauw90B, Ahuj90] and special purpose applications [Fost86, Elli90] running on networked workstations. (2) Video and audio communication-based virtual shared work spaces, such as Media Space lStu188, Har190], CRUISER [Root88], VideoDraw [Tang90].*

shared workspace activity: These include sharing information, pointing to specific items, marking, annotating, and editing. These can be supported by shared screen systems, shared window systems, and multi user editors [8] **1994** Ishii et al. *Shared workspace activities include sharing information, pointing to specific items, marking, annotating, and editing. These activities can be supported by computer-based groupware, including shared screen systems, shared window systems, and multiuser editors [8]*

shared workspace system: Shared workspace systems (such as BSCW) allows multiple users to share a common workspace where they can store documents. **2000** Prequica et al. *Shared workspace systems (such as BSCW), allows multiple users to share a common workspace where they can store documents.*

shared workspace: Shared workspace is a physical space where people can undertake some joint activities. **1997** Gutwin and Greenberg *Shared workspace is a physical space where people can undertake some joint activity. We restrict ourselves to flat, medium-sized surfaces on which objects can be put, and around which a small group of people can collaborate. This kind of workspace includes control panels, whiteboards, desks, navigation charts, and tabletops.* **2000** Gutwin and Greenberg (from McGrath 1984) *Tasks in shared workspaces usually involve: a. creation of new artifacts, b. organization of existing artifacts, c. exploration of the space or of a set of artifacts, d. construction of larger objects from component pieces, or e. the management of an autonomous system represented in the workspace. (p.2)*

***shuffling**:* Shuffling is the organized moving of image groups in text-graphics performances. **1986** Lakin (262) *One general purpose manipulation important across many different styles of text-graphic performance is shuffling. Shuffling is the organized moving of image groups … Shuffling is supported in vmacs by the generalized grouping structures … these structures can be created very rapidly, on the fly in the course of a performance.*

SIMSCRIPT: SIMSCRIPT is a modelling language that is used in decision modelling software **1988** Kraemer and King (118-119) (from Adelman 1984) *Decision modeling software is specifically aimed at supporting group decision making and includes modeling languages (eg. SIMSCRIPT, DYNAMO), decision structuring techniques such as stakeholder analysis, brainstorming, nominal group technique, and Delphi technique, and specialized software for decision analysis techniques such as utility and probability assessment, multi attribute utility analysis, and multiattribute weighting analysis.*

single display groupware (SDG): Single Display Groupware is a class of computer supported cooperative work (CSCW) application that supports the work of co-located groups. SDG focuses on the use of one display and several input devices connected to it to overcome the fact that current input-device hardware (as eg. touch screen) allows for only one user interacting at a time – even though there are drivers announced which will enable, eg. interactive whiteboards, to handle two input streams at a time. Single display groupware (SDG) supports face-to-face collaborators working over a single shared display, where all people have their own input device. Although SDG is simple in concept, there are surprisingly many problems in how interactions within SDG are managed. **1991** Greenberg and Boyle (1) *SharedNotes - a system that allows people to create and manipulate both personal and public notes between two devices: a personal digital assistant (PDAs, in this case the 3COM Palm Pilot), and a shared public display (also known as single display groupware) implemented in GroupKit (RosemanGreenberg1996)* **1999** Greenberg et al. (1) *Single display groupware or SDG, where people gather face to face and work around a* *large shared public computer display.* **2001** Zanella and Greenberg *Single display groupware (SDG) supports face-to-face collaborators working over a single shared display, where all people have their own input device. Although SDG is simple in concept, there are surprisingly many problems in how interactions within SDG are managed. Single Display Groupware is a class of computer supported cooperative work (CSCW) application that supports the work of co-located groups (Steward, Bederson and Druin 1999). The group shares the same display, which can be a large display or a monitor. Each member has his or her own input device, allowing all to interact simultaneously with the system.* **2002** Prante et al. *SDG focuses on the use of one display and several input devices connected to it to overcome the fact that current input-device hardware (as eg. touch screen) allows for only one user interacting at a time – even though there are drivers announced which will enable, eg. interactive whiteboards, to handle two input streams at a time.*

situational analysis activity*:* Situation analysis activities are quantitative decision aids that may be provided in GDSS systems. **1986** Applegate et al. *Planning session facilitators assist the group in their planning activities providing access to a workbench of quantitative and qualitative decision aids for identification of issues and ideas, surfacing assumptions, stakeholder identification, competitive analysis and other enterprise and situation analysis activities.*

situational characteristic*:* Situational characteristics influence whether a task-oriented or relationship-oriented leader will be more effective. **1991** Nunamaker et al. *Situational characteristics (ie. Group, task, and context) establish an initial balance, which the group may alter by using an EMS.* **2003** Lester et al. *Fiedler (1978) identifies three situational characteristics that influence whether a task-oriented or relationship-oriented leader will be more effective: 1) leader-member relations – the extent to which the group trusts, respects, and follows the leader's directions, 2) position power – the extent to which the leader's position influences others in a desired direction, 3) task structure – the extent to which a task is specified and defined as opposed to unstructured and ambiguous.*

sketched diagram: Sketched diagrams are a mode of communication used in shared workspaces systems. **1986** Fanning and Raphael *Until computer teleconferencing systems can encompass several modes of human communication-- e.g. text, voice, sketched diagrams, and photographs,* **1997** Greenberg (243) *Shared physical workspaces (such as whiteboards, control panels, and tabletops.) and the artifacts they contain (sketches, control, documents, structured drawings) act as a stage and offer props for rich person-to-person interaction.* **1998** Greenberg and Gutwin *GroupSketch and GroupDraw (Greenberg, Roseman, Webster and Bohnet 1992) were workstation-based multi-user sketch and drawing applications.*

slide projector: Slide projectors are part of the hardware required for an electronic meeting room to facilitate interaction among participants. **1984** Huber (200) *Information sharing is the most typical of the activities in which groups engage and it is one of the two activities most obviously supported by technology, the other being information use. Of course vendors and technologies, including traditional technologies such as slide projectors, are already serving the information sharing market very well. General GDSS, however, may possess several useful capabilities that are far beyond those provided by traditional information sharing technologies. For example, the group can decide during the meeting that it wants to see data contained in the organization's database and can, In real time, have it's chauffeur retrieve and display the data on the public screen so that the facts can be collectively known.* **1985a** DeSanctis and Gallupe *A large U-shaped table is equipped with networked microcomputers that are recessed into the table to facilitate interaction among participants. A microcomputer attached to a large screen projection system is also on the network which permits display of work done at individual workstations or of aggregated information from the total group. Break-out rooms are equipped with microcomputers that are networked to the microcomputers at the main conference table.* **1988** Kraemer and King *Electronic Boardroom: The electronic boardroom is the most elementary of the GDSSs and differs little from its nonelectronic parent except that the audiovisual technology is computer* *based, primarily in the form of computer graphics, computer "storyboards," or computer controlled audiovisuals (eg. slide projectors, video projectors, movie projectors) used for presentations.*

small group interaction: Small group interaction is a characteristic of decision rooms. A small group ranges in size from three to 24 people. **1987** Jelassi and Beauclair … *the face-to-face, close proximity, synchronous GDSS type commonly known as "war room" [30] or a "decision room" [6]. The decision room features computerized support in addition to traditional small group interaction.* **1992** McLeod and Liker *The small group literature has repeatedly found that when left to their own devices, task-oriented groups often evolve structures that are suboptimal and sometimes even dysfunctional to task accomplishment (Hackman and Kaplan 1974, Hall and Watson 1970, Steiner 1972). A number of studies have shown that providing specific rules and resources for task interaction (ie. attempting to influence group structures), can lead to improved group performance along a number of dimensions, such as information shaving (Stasser et al, 1989), task quality (Delbecq et al, 1975), conflict resolution (Hall and Watson 1970) and individual member satisfaction (Delbecq et al.1975, Green and Taber, 1980). Having a task-appropriate structure facilitates information exchange (Stasser et al, 1989, Thomspon and Tuden 1964) and ensures that all group members have opportunities to participate (Green and Taber 1976). High structure EMS provide specific structuring techniques – the rules and resources to govern interaction – to help groups overcome the process losses (Steiner 1972) resulting from the suboptimal structures they typically develop on their own.* **1995** Aiken et al. *Decision Room: A small group in a face-to-face meeting. A decision room supports a small group ranging in size from three to approximately 24 people who need to meet face-to-face. Some decision rooms (such as the SAMM system at the University of Minnesota) can support a group no larger than 10 people while others (such as the facilities at the University of Arizona or IBM) can support larger groups.*

social awareness: Social awareness is the information that a person maintains about others in a social or conversational context. **1997** Gutwin and Greenberg *Social awareness is the information that a person maintains about others in a social or conversational context: things like whether another person is paying attention, their emotional state, or their level of interest.* **1997** Schlichter et al. (from Greenberg [8]) *Different sub-types of awareness: informal awareness, group-structural awareness, social awareness, and workspace awareness*

social control: Social controls such as direct supervision, physical proximity, shared experiences, and social trust. **2001** Montoya-Weiss et al. (from Jarvenpaa et al. 1998) *In virtual teams, the dispersed asynchronous communication context renders inoperable many of the usual forms of social control, such as direct supervision, physical proximity, shared experiences, and social trust (Jarvenpaa et al., 1998).*

social cue: Social cues such as gestures, nonverbal nuances, cues about social influence, symbolic content, and contextual cues are not captured or transmittable. **2001** Montoya-Weiss et al. *Lean communication environments are characterized by reduced (or eliminated) nonverbal, paralinguistic, status, and other cues pertaining to social context.* **2003** Pauleen (from Ngwenyama and Lee 1987) *Rich channels, such as face-to-face and video conferencing, enable rapid feedback, the use of varied social cues and personalization of use, helping to resolve equivocality (Ngwenyama & Lee, 1997).*

social influence: Social influences are normative and informational **2001** Schmidt *In other words, a groupware system like Lotus Notes does not have the capacity to convey the multiple cues that characterize human conversation. Gestures and nonverbal nuances, cues about social influence, symbolic content, and contextual cues are not captured or transmittable. These limitations make interaction and consensus building difficult (Dennis, 1996; Straus, 1996). According to Nemeth and Staw (1989), social influences (normative and informational) tend to increase group conformity.*

social interaction spaces: Digital cities, community networks, portals such as eBay and Slashdot, and older technologies based on electronic bulletin board systems, newsgroups and mailing lists are just some of the examples of social interaction spaces. **2002** Girgensohn et al. *Digital cities, community networks, portals such as eBay and Slashdot, and older technologies based on electronic bulletin board systems, newsgroups and mailing lists are just some of the examples of social interaction spaces.*

social judgement analysis: Social judgement analysis is a social group process or behavioural group technique that is sometimes included in the general functions of a GDSS (decision conference system). **1987** DeSanctis and Gallupe *A Level 2 GDSS might provide automated planning tools, or other aids commonly found in individual decision support systems, for group members to work on and view simultaneously, again using a large common screen. Modeling tools to support analysis that ordinarily are performed in a qualitative fashion, such as social judgment formation, risk analysis, or multiattribute utility methods can be introduced to the group via a Level 2 GDSS* **1988** Kraemer and King (126) *These techniques might include: planning tools such as brainstorming, stakeholder identification and analysis, or organization analysis; modeling tools that support qualitative and quantitative decision analysis such as decision trees, risk analysis, social judgment analysis or multiattribute utility analysis.*

***social loafing**:* Social loafing is also known as diffusion of responsibility or free riding. Social loafing is a group behaviour issue. Social loafing results when group members fail to take responsibility for their own actions. **1987** Jelassi and Beauclair (147) *Diffusion of responsibility : also known as social loafing, results when group members fail to take responsibility for their own actions.* **1990** Connolly et al. *Combining individual efforts into a group output opens the possibility of free riding or social loafing (cf Harkins and Petty 1982; Kerr and Brunn 1981). And the mechanics of the combining process itself might provide obstacles to contribution (ie. Production blocking), as in ideas which are forgotten or edited while their originator waits for an opportunity to speak (Lamm and Trommsdorff 1973).* **2003** Wood and Blyth *The facilitator, where possible, provides an open environment for discussion and combats social-loafing through encouraging those naturally less outspoken menbers to contribute through structured or unstructured means (21), and ensures the focus of the group is maintained on the issue at hand.*

Social presence: Social presence is a GSS research variable. **1988** Rice and Shook *Accessibility and Appropriateness Affect Outcomes Independently of Usage Individuals' evaluations of the EMS studied here seem related to perceptions about how well the system is able to satisfy certain communication requirements, in addition to the extent to which the respondent used the system. This result supports the importance of the concepts of social presence and information richness, as well as models of media choice that argue that outcomes are based upon contextual factors as well as upon levels of usage [12,41,44, 47].* **2001** Burke *This study is an examination of how GSS learning environments race-to-face vs. distant) and task difficulty level (simple vs. difficult) influenced participation levels and social presence among accounting students working collaboratively on an accounting task.* **2001** Montoya-Weiss et al. (from Zack 1993) *Virtual teams typically communicate via technology that is lean, low in social presence, and low in interactivity (Zack, 1993).*

social protocol: To assist with social protocols, technical measures such as access control, concurrency control, undo, version control, and turn-taking have been implemented. **1989** Ellis and Gibbs *Some of these challenges [Elli88b] reside in the areas of group interfaces, access control, social protocols, and coordination of group operations ...Concurrency control also has novel aspects within groupware as we will demonstrate in this paper.* **2001** Baker et al. (9) *To assist with social protocols, technical measures such as access control, concurrency control, undo, version control, and turn-taking have been implemented.*

social structure: Social structure is part of an electronic meeting context. Social structures are characterized as patterned action, interaction, behaviour and cognition. **1986** Begeman et al.

the meeting context including the organizational structure, the social structure, and other background information. **1990** Austin *Alternatively, research in low structure settings seeks to understand how work activities, social structures, attitudes, and communication patterns are altered by the existence of a new technological capability which does not prescribe a process.* **1992** McLeod and Liker (from Barley 1986, p.79) *In contrast, we take the perspective shared by organizational theorists such as Weick (1979), Van Maanen (1979), and Barley (1986) who reject this static deterministic view, and rather characterize social structures as "patterned action, interaction, behaviour and cognition" (Barley 1986, p.79).*

social structuring meeting: Social structuring meeting is one of a variety of meeting types that is distinguished by the main goals or purpose. **1986** Begeman et al. *Meeting Types include: 1. Exploration and Brainstorming meetings, 2. Informational or Presentational meetings, 3. Problem Solving or Decision Making meetings, 4. Negotiation or Resource Allocation meetings 5. Morale Building or Social Structuring meetings.* **1987** Cook et al. *There are also a variety of meeting types, distinguished by their main goals or purpose: 1. exploration and brainstorming meetings, 2. information sharing or presentation meetings, 3. problem-solving or decision-making meetings, 4. negotiation or resource allocation meetings, and 5. morale building or social structuring meetings.*

social value: Social value can be positive or negative. Adopting a new system could affect the personal relationships of prospective users. **1998-9** Briggs et al.*Social value: adopting a new system could affect the personal relationships of prospective users. For example, the new system might reduce the amount of overtime work required, which could leave more time for family and friends (positive social value). On the other hand, the new system might eliminate the need for some face-to-face teamwork, reducing the hours a cohesive team spends together (negative social value).*

social variable: Social variables can include trust and openness. **2003** Corbitt and Martz *…variables of a more social nature, such as trust and openness …*

socializing: Socializing is a communication activity relating to group behaviour. **1987** DeSanctis and Gallupe *The communication activities exhibited in a decision-related meeting include proposal exploration, opinion exploration, analysis, expressions of preference, argumentation, socializing, information seeking, information giving, proposal development and proposal negotiation (Bedau 1984; Poole 1983a).* **2003** Huang et al. *Group behaviours such as socializing, norming and conflicting could still be functioning in group interaction processes.*

SODA: SODA is a group interaction technique. SODA is built upon the Cognitive Mapping Technique (based on Kelly, 1955, and originally developed by Eden, Sims and Jones, 1979) which aims to capture the wisdom of a group in a form that is both useful for the group to work on and from which a strategy or portfolio of actions can be generated. **1989** Ackermann (4) *A group interaction technique. SODA is built upon the Cognitive Mapping Technique (based on Kelly, 1955, and originally developed by Eden, Sims and Jones, 1979) which aims to capture the wisdom of a group in a form that is both useful for the group to work on and from which a strategy or portfolio of actions can be generated.*

software code: Software code can be created and modified using some text editors **1992** Shu *Text editors that support group creation and modification of documents and software code (Kaiser_etal1987, Leland etal 1988, Galegher&Kraut 1990, Neuwirth_etal1990).*

software for vote tally: Software for graphics and vote tally and display are part of the decision conference facility. **1986** Kraemer and King *The software of the decision conference is usually some form of decision analytic technique: decision trees and influence trees; multiattribute expected utility models for single-stage decisions; hierarchical evaluation structures for multiattribute utility analysis; Pareto algorithms for two-party negotiations; cost-benefit models for resource allocation; and spread- sheet models. Software for graphics and vote tally and display also are part of the decision conference facility.*

software planning models: Four software planning models are available to assist planners with the idea generation and analysis process. They are Electronic brainstorming for both individuals and groups, Idea structuring and analysis, and a callable voting program for interactive idea prioritization. **1986** Applegate et al. *Four software planning models are available to assist planners with the idea generation and analysis process. They are: (I) Electronic Brainstorming (group brainstorming version); (2) Electronic Brainstorming (individual brainstorming version); (3) Idea Structuring and Analysis; and (4) a callable voting program for interactive idea prioritization.*

spatial: Spatial can be local or remote. Spatial refers to a certain geographical area. **1986** Bui and Jarke *Group communication situations can be classified according to at least four different dimensions [241: (1) Spatial distance among decision makers distinguishes between decision making in the same location (e.g., in a meeting) and remote decisions (via teleconferencing, electronic mail, telephones, etc.).* **1996** Barua et al. *Geographical scope refers to the spatial dimension of a GSS or collaborative system, ie. The ability of a system to cover a certain geographical area.*

spatial arrangement: Spatial arrangements are environmental characteristics that decision makers bring with them to the decision making environment. **1985a** DeSanctis and Gallupe *What human factors considerations are ciritical in the design of GDSS (eg. spatial arrangement of group members, size and location of public screens, accommodation for "informal" as well as "formal" communication between group members)?* **1987** Jelassi and Beauclair *Environmental characteristics - setting, scheduling, length of a session, organizational context, and spatial arrangements.*

spatial structure: **1986** Lakin *It is a major premise of this paper that text-graphics performed for working groups have spatial and temporal structure.* **2002** Prante et al. (107) *Mind mapping system (Mind-Manager from Mindvision) enforces a hierarchical structuring of the idea space with the Mind-Map notation, ie. Ideas are graphically connected via branches. Mind-maps are popular among many creative teams, probably because the enforced spatial structure in the external representation facilitates building an internal representation of the group's shared space of ideas.*

special purpose communication structure*:* A CMC factor relating to communication capabilities. The ability of the system to supply or be adapted to supply special purpose communication structures for activities such as facilitating, and providing protection from information overload by filtering, which allow direct or indirect communications among the users. **1981** Turoff et al. (92-93) *The ability of the system to supply or be adapted to supply special-purpose communication structures for activities such as facilitating, providing protection from information overload by filtering, allowing participation by very large groups through rules of order, incorporating systems such as personalized calendars which allow direct or indirect communications among the users*.

specialized application program: Specialized application programs are software components of GDSS. **1985a** DeSanctis and Gallupe (5) Software *The software components of the GDSS include a database, a model base, specialized application program(s) to be used by the group, and an easy-to-use, flexible user interface …The most distinguishing technological component of the GDSS is specially- developed applications software that supports the group in the decision process.*

specialized support software: Specialized support software is a CMC factor. Specialized support software includes integrated data structures, user simulations, privileges and protection, and marketplace structures. **1981** Turoff et al. *Specialized Support Software Integrated data structures: The ability of the users to communicate data in other than free text and the ability of the computer to recognize data items and who has authored them. It is usually assumed that such structures maintain the identity of the creators or suppliers of the data and allow authorship control over the segments of the data structures the user is responsible for. An example of this might be a budget planning system. User simulations:*

The ability of a system to develop tailored programs to simulate aspects of users' communication behavior, and thereby augment their communication capabilities by acting as an intermediary. A simple example would be a background task to carry out a search while the user is off line. Privileges and protection: The ability of the system to preserve the access privilege structure provided by the author of material and to deal with read, write, edit and utilize access both on the part of the sender and receiver. In some instances it is necessary to allow a function triggered by a user to access material for utilization that was supplied by another user. However, the user making use of this material would not necessarily have raeding privileges for that material. An example is being able to ask of someone else's calendar if they can meet on a certain date and time. This is "utilize" access and is different from the more standard forms of access usually provided on interactive systems. The ability of the user to understand the forms of access and to make use of them as well as to be able to track their use by others on his or her material is a further aspect of this factor. Marketplace structures: Software designed to facilitate payments based on the provision and use of information. For example, the ability of a user to advertise price information and to collect revenues for its use.

speech characteristic: Speech process characteristics such as backchannel communication, interruptions, overlaps, and turn-taking, were effective in examining face-to-face interactions. **1999** Gutwin and Greenberg *Measurable speech process characteristics – backchannel communication, interruptions, overlaps, and turn-taking were effective in examining face-to-face interactions.*

spreadsheet model: Spreadsheet models are a decision analytic technique **1988** Kraemer and King (123). *The software of the decision conference is usually some form of decision analytic technique: decision trees and influence trees; multiattribute expected utility models for single-stage decisions; hierarchical evaluation structures for multiattribute utility analysis; Pareto algorithms for two-party negotiations; cost-benefit models for resource allocation; and spread- sheet models. Software for graphics and vote tally and display also are part of the decision conference facility.*

stakeholder satisfaction: Stakeholder satisfaction includes the satisfaction of key people from the parent organization, the client organization, and the project team. **2000** Pare and Dube *Stakeholder satisfaction includes the satisfaction of key people from the parent organization, the client organization, and the project team.*

static image: Static and dynamic images can be stored and measured in graphic editors. Static images can be stored and measured. Statics allow measuring things in one frame. **1986** Lakin *Vmacs supports the capture for reflection of many aspects of a text-graphic performance – both statics and dynamics can be stored and measured … Statics (measuring things in one frame).*

status attribute: Status attributes are gained by combining events to form some kind of longer-lived information. A status might be a list of active users, a list of working areas or the reachability of certain hosts on the network. **1997** Schlichter et al. *Status attributes are gained by combining events to form some kind of longer-lived information. A status might be a list of active users, a list of working areas or the reachability of certain hosts on the network.*

stereotyping: Stereotyping in virtual teams can be of three distinct types: message-based, physical appearance/behaviour-based, and technology-based. **2003** Sarker et al. *In addition to confirming the conceptual bases of trust, the instrument validation process found that stereotyping in virtual teams can be of 3 distinct types: message-based, physical appearance/behaviour-based, and technology-based.*

storing and retrieving performance: Storing and retrieving performance is undertaken by a graphics editors. It is useful to capture a performance so that the group may reflect upon it. **1986** Lakin *In Vmacs a performance is a sequence of text-graphics manipulation events and* *the corresponding images. It is useful to capture a performance so that we may reflect upon it.*

storing and retrieving resources: Storing and retrieving resources within an organization is undertaken using a directory. **2003** Bose *The basic concept of a directory is a way of identifying, storing and retrieving resources within the organization or resources that are related to the organization.*

strategic decision making: see decision making.

strategic options and strategic policy: Strategic options and strategic policy can be generated, analysed and prioritized using models that are major components of GDSS. **1986** Applegate et al. *A major component of the GDSS is the incorporation of idea generation, idea structuring and analysis models that enable decision-makers to generate, analyze and prioritize critical issues, strategic options and strategic policies.*

structure: Structure is a text-graphic manipulation feature. The use of definable spatial patterns of text and graphics **1986** Lakin (264) *It is a major premise of this paper that text-graphics performed for working groups have spatial and temporal structure.*

structured approach: Structured approaches appear to increase member participation, focus the problem, help to avoid conformity pressures and keep the group on track. **1987** DeSanctis and Gallupe *The key effect of structured approaches appears to be increasing member participation (White et al.1980), focusing the problem, avoiding conformity pressures, and keeping the group on track (Gallupe 1985).*

structured decision analysis: Structured decision analysis is provided in support of decision conferences. **1986** Kraemer and King *Several general observations can be made based on information about these systems. 1. There are about three general functions and 1-2 dozen specific functions that are provided in support of decision conferences: a. structured decision analysis decision trees multiattribute utility b. structured group process social judgment analysis delphi technique nominal group technique c. collaboration support data management graphic display decision documentation tutoring decision analysis consultation group process facilitation meeting facility vote tabulation and display*

structured group management technique: Also referred to as group behavioural techniques, behavioural group techniques, group problem solving techniques, process techniques, group structuring methods and decision making approaches. Examples of structured group management techniques are Delphi method and Nominal group technique **1984** Huber (195) *One such approach has been the use of structured group management techniques such as the Nominal Group Technique and the Delphi technique [Delbecq, Van de Van and Gustafson, 1975, Van Grundy 1981].* **1986** Bui and Jarke *Behavioral group techniques, such as the Delphi method and the Nominal Group Technique, can be used more efficiently with electronic support [20, 51]* **1987** DeSanctis and Gallupe *Turoff and Hiltz (1982) have experimented with automating the Delphi method and the Nominal Group Technique, and Huber (1982) has discussed the possibility of automating similar group structuring methods that can be cumbersome and ineffective when administered manually.*

structured group process: see Behavioural group techniques. Structured group process is a general function of GDSS (decision conference systems), including social judgement analysis, Delphi technique, and Nominal Group Technique (NGT).

structured information: Structured information is information (typically non-binary) which has regular form and can be readily interpreted by a computer. This might include lists, matrices, templates, and flowcharts. **1986** Begeman et al. (5) … *is information (typically non-binary) which has regular form and can be readily interpreted by a computer. This might include lists, matrices, templates, and flowcharts.*

structured interaction process: Structured interaction process (electronic meeting agenda) is a GSS structure. **1997** Nunamaker (from Romano et al.1997b) *Unstructured interactions:*

document sharing, discussion and news groups. **2003** Huang (from Bostrom and Anson 1992) *GSS structures are: anonymity (ie. Communicators do not know owners of expressed ideas in group interaction process); simultaneity (ie. Group members can input their ideas simultaneously via computer keyboards); electronic recording and display; structured interaction process (eg. electronic meeting agenda); and enhanced information processing (eg. electronic data processing or electronic voting) (Bostrom and Anson 1992).*

structured meeting: Structured meetings often use process tools provided by the computer-based information technology. Structured meetings are enhanced through process facilitation. Process facilitation ensures that an equality of participation is achieved, blind alleys are not overly explored, and time is managed appropriately. **1986** Begeman et al. *For example, the interaction method of meeting [DOYL85] suggests that there should be a facilitator, who is a leader charged with keeping the meeting balanced and on a correct course, and a recorder who maintains, and makes publicly visible, the group memory. Other options may imply that, rather than restricting access to the group memory and the public display, equal access for all might be preferred. Within all of these structures, the types of information that may be presented, manipulated, and captured during a meeting can be categorized according to the amount of its structure (binary, structured, or unstructured), and according to the degree of sharing (private, subgroup, or public).* **2002** DeVreede et al. (from Eden 1990) *Process facilitation provides structure and general support to groups during the meeting. It involves ensuring that an equality of participation is achieved, blind alleys are not overly explored, and time is managed appropriately.* **2002** Wood and Blyth *GSS is a computer-based information technology which provides a set of structured meeting process tools ... The facilitator, where possible, provides an open environment for discussion and combats social-loafing through encouraging those naturally less outspoken menbers to contribute through structured or unstructured means (21), and ensures the focus of the group is maintained on the issue at hand.*

structured message template: Structured message templates are used to help people compose and read messages in a text messaging CMC system. **1986** Malone et al. (2) *In addition, the Lens system provides four important optional capabilities: (1) People can use structured message templates to help them compose and read their messages; (2) Receivers can specify rules to automatically filter and classify messages arriving in their mailbox; (3) Senders can include as an addressee of a message, in addition to specific individuals or distribution lists, a special mailbox (currently named "LENS") to indicate that the sender is willing to have this message automatically redistributed to anyone else who might be interested; and (4) Receivers can specify rules that find and show messages addressed to LENS that the receiver would not otherwise have seen.*

structured message: Structured messages are a characteristic of the LENS email system. People can use structured message templates to help them compose and read their messages. **1986** Malone et al. (2). *In addition, the Lens system provides four important optional capabilities: (1) People can use structured message templates to help them compose and read their messages; (2) Receivers can specify rules to automatically filter and classify messages arriving in their mailbox; (3) Senders can include as an addressee of a message, in addition to specific individuals or distribution lists, a special mailbox (currently named "LENS") to indicate that the sender is willing to have this message automatically redistributed to anyone else who might be interested; and (4) Receivers can specify rules that find and show messages addressed to LENS that the receiver would not otherwise have seen. Semi-structured messages can help provide automatic aids for: (1) composing messages to be sent, (2) selecting, sorting, and prioritizing messages that are received, (3) responding automatically to some messages, and (4) suggesting likely responses to other messages.*

structured task: Structured tasks are routine with well-established methods for handling them; they have a limited and well-defined solution space; they entail little use of human judgement. Also structured tasks are simple, have a small and finite set of possible solutions, and do not require much cooperation from group members (3). **1999** Shirani et al.

Structured tasks are routine with well-established methods for handling them; they have a limited and well-defined solution space; they entail little use of human judgement. Also structured tasks are simple, have a small and finite set of possible solutions, and do not require much cooperation from group members (3).

study circle: see Collaborative learning **1990** Hiltz *The labels given to collaborative or group learning are many; among them are: "cooperative learning, collective learning, study circles, team learning …" (Bouton and Garth, 1983), and ":peer-group learning" or syndicates")Collier, 1980).*

sub optimal decision making: Sub-optimal decision making is a productivity loss in group decision making **1988** Kraemer and King (117) *The idea here is that the primary problems of productivity loss in group decision meetings are from information loss, information distortion, or sub-optimal decisionmaking (ie. not enough issues/alternatives explored).*

subgroup information sharing: Sub-group information sharing relates to the degree of information sharing. Subgroup information is only shared to a defined group of people **1986** Begeman et al. *Within all of these structures, the types of information that may be presented, manipulated, and captured during a meeting can be categorized according to the amount of its structure (binary, structured, or unstructured), and according to the degree of sharing (private, subgroup, or public).*

subject: Subject is another term for participant. **1986** Applegate et al. *Gallupe (1986) presented research design factors that were considered in a study of the influence of a GDSS on decision quality, decision time and group confidence in the decision. He presents a series of research design issues and recommendations for GDSS research. These include the task, subjects, setting, dependent measures and GDSS design and implementation/acquisition.* **1989** Eveland and Bikson *From items in the interview tapping relationships among respondents, we constructed three measures reflecting varying degrees of interpersonal attachment." (1) Recognition, or reflecting other task force members with which a subject is familiar at least by recognizing the name or face; (2) Knowing, or a reciprocal acknowledgement between pairs of subjects in the task force that they know each other well; (3) Contact, or having been in touch with any of the other task force members (in person, by phone, by memo, and/or by computer) in the past two weeks.*

symmetry: Symmetry is the flow and control of information. **2000** Greenspan et al. *Symmetry - flow and control of information.*

synchronous: Synchronous is a communication systems format and a characteristic of a decision room. Synchronous means in the same or different places, but at the same time. **1987** Jelassi and Beauclair (145) *The face-to-face, close proximity, synchronous GDSS type commonly known as "war room" [30] or a "decision room" [6]. The decision room features computerized support in addition to traditional small group interaction.* **1996** Hiltz et al. *Synchronously (same or different places, but at the same time).* **1997** Roseman and Greenberg *Synchronously - working together at the same time.* **2000** Greenspan et al. *Synchrony (synchronous-asynchronous).*

synchronous collaboration: Synchronous collaboration means that two or more people are communicating with one another instantly, they might both be involved in a private chat, or they might both be accessing the same file or document and editing it at the same time. **1998** Hein et al. *Synchronous collaboration means that two or more people are communicating with one another instantly, they might both be involved in a private chat, or they might both be accessing the same file or document and editing it at the same time.*

synchronous coupled: Synchronous coupled is a classification of modes of workspace awareness. **1999** Hayashi et al.(from Fuchs et al. 1995) *Modes of workspace awareness classified into four categories: synchronous-coupled, asynchronous-coupled, synchronous-uncoupled, and asynchronous-uncoupled (Fuchs etal 1995).*

synchronous DGSS: Synchronous DGSS allow distributed participants to interact with one another in a 'real-time' mode, ie. they interact with one another at the same time. The participants are distributed across multiple sites linked by various communication technologies. **1998** Tung and Turban *Synchronous DGSS allow distributed participants to interact with one another in a 'real-time' mode, ie. they interact with one another at the same time. The participants are distributed across multiple sites linked by various communication technologies. Some of the supporting technologies are screen sharing, whiteboard, audio-conferencing, and various types of video-conferencing. These technologies can be carried on the intranet, internet, corporate or public networks, or VANs.*

synchronous groupware system: Synchronous groupware includes telephone video-conferencing, and whiteboarding. It is rather slow in many cases, due to the limited capacity of current transmission channels. Synchronous groupware system [24] enables its users to work simultaneously on the same document using several computers connected via a network. While SDG only supports co-located users working with one single public display, SGS provides the possibility for real time collaboration on a shared document as, eg. in tightly coupled [29, 30] meeting-room collaboration using several computational devices at once. **1997** Hofstede et al. *Synchronous groupware includes telephone video-conferencing, and whiteboarding. It is rather slow in many cases, due to the limited capacity of current transmission channels* **2002** Prante et al. *Synchronous groupware system [24] enables its users to work simultaneously on the same document using several computers connected via a network. While SDG only supports co-located users working with one single public display, SGS provides the possibility for real time collaboration on a shared document as, eg. in tightly coupled [29, 30] meeting-room collaboration using several computational devices at once.*

synchronous interaction:Synchronous interaction is a rich channel. Synchronous interaction is an orderly process wherein verbal and non-verbal cues help regulate the flow of conversation, facilitate turn taking, provide immediate feedback, and convey subtle meanings. **2001** Montoya-Weiss et al. (from McGrath 1991) *Synchronous interaction is an orderly process wherein verbal and nonverbal cues help regulate the flow of conversation, facilitate turn taking, provide immediate feedback, and convey subtle meanings. In lean, asynchronous communication environments, the conveyance of cues is hindered, feedback is delayed, and interruptions or long pauses in communication often occur.*

synchronous messaging: Synchronous messaging includes Chat, IM, and MUDs. **2002** Handel and Herbsleb. *Synchronous messaging (Chat, IM, MUDs).*

synchronous uncoupled: Synchronous uncoupled is a classification of modes of workspace awareness. **1999** Hayashi et al.(from Fuchs et al. 1995) *Modes of workspace awareness classified into four categories: synchronous-coupled, asynchronous-coupled, synchronous-uncoupled, and asynchronous-uncoupled (Fuchs etal 1995).*

synchrony: Synchrony refers to both synchronous and asynchronous.. **1997** Schlichter et al. (from [16]) *Synchrony: Participants may either be aware synchronously (knowledge about events that happen currently) or asynchronously (knowledge about events in the past).* **2000** Greenspan et al.*Synchrony (synchronous-asynchronous).*

syndicate: see Collaborative learning. **1990** Hiltz et al. *The labels given to collaborative or group learning are many; among them are: "cooperative learning, collective learning, study circules, team learning…" (Bouton and Garth, 1983), and ":peer-group learning" or syndicates")Collier, 1980).*

system: System is an integrated composite that consists of one or more of the processes, hardware, software, facilities, and people, that provides capability to satisfy a stated need or objective. **2002** Sikorski (ISO/IEC 9126-1 draft) *An integrated composite that consists of* *one or more of the processes, hardware, software, facilities, and people, that provides capability to satisfy a stated need or objective.*

***system capability**:* System capabilities of CMCs are group conferences, notebooks for text composition, self defined commands **1981** Hiltz and Turoff, *Among the capabilities which long term, regular users found valuable are group conferences, notebooks for text composition, and self-defined commands.* **1984** Huber (195) *The paper focuses on three major issues in the design of these systems: 1) System capabilities, 2) System delivery modes, and 3) system design strategies, and discusses the relationship of these issues to system use and survival.*

system characteristic: System characteristics common to all interactive systems are divided into four groupings, learning, adaptability, behaviour, and error control. Learning includes accessibility, comprehension, guidance and self-documentation, informative, and segmentation. Adaptability includes control, flexibility and variety, leverage and simplicity, and modifiability. Behaviour includes humanization, regularity and predictability, and responsiveness. Error control includes forgiveness and recovery, protection, security, reliability and closure. **1981** Turoff et al. *Definitions of system characteristics common to all interactive systems. A. Learning Accessibility: The knowledge and effort needed by users to gain access to a system. Comprehension: The ability of users to understand as a whole what the system is capable of accomplishing, before having to learn how to do it. Guidance and self-documentation: The ability of the system to provide guidance or training to the user as and when required. Informative: Providing clear information for users on what they are being asked to do in terms of operations or errors. Segmentation: The ability of the user to learn only the minimum in order to carry out a specific task. B. Adaptability Control: The ability of users to feel in control of the computer, while making sure they understand what they are doing and where they are in the interaction. Flexibility and variety: The ability of users to tailor the system to their own style of interaction in carrying out tasks. Leverage and simplicity: The ability of users to execute significant computer operations with a minimum of interface effort (minimization of the number and length of user supplied entries). Modifiability: The ability of users to adapt the system to serve their needs. C. Behavior Humanization: Treating the user as an intelligent human being rather than as a slave of the computer. Regularity and predictability: The ability of a user to anticipate the actions of the computer and to expect consistent responses to operations and functions. Responsiveness: The ability of the system to respond quickly and meaningfully to user requests to carry out various operations and functions. D. Error Control Forgiveness and recovery: The ability of the system not to penalize users unnecessarily for mistakes and to provide mechanisms to easily recover from errors. Protection: Protection of the system from damage by a user interaction. Security: Ability to protect the users' data from errors inintentionally or intentionally generated. Reliability: The ability of the system to function without error or loss of data. Also, the frequency and length of instances of the system being unavailable during scheduled operation. Closure: Informing users when an operation has been successfully or unsuccessfully completed.*

system chauffeur: System chauffeur's role is one of an unobtrusive analyst, managing the technology and acting as a scribe. **1984** Huber (198) … *if the group "facilitator" or the system "chauffeur" of a GDSS gets stuck* … **1985a** DeSanctis and Gallupe *The "people" component of the GDSS includes the group members and a "group facilitator" who is responsible for the smooth operation of the GDSS technology when it is in use. The facilitator's role is a flexible one. He or she may be present at all group meetings and serve as the group's "chauffeur" operating the GDSS hardware and software and displaying requested information to the group as needed.* **2002** Wood and Blyth *Chauffeur's role was essentially one of an unobtrusive analyst, managing the technology and acting as a scribe during the'open' sessions in which the focus group discussed project risks.*

system delivery mode: System delivery modes in which GDSS can be made available to users are: permanent installation at the user's site, vendor renting on an on-call basis, and vendor site installation for a fee. **1984** Huber (199) *There are at least three modes in which GDSS can be made available to users … for the GDSS to be permanently installed at the user's or customer's site … Another delivery mode is for the vendor to rent the system on an on-call basis … The third delivery mode is as a vendor-site installation where the software, hardware, staff, and so forth are all provided for a fee …*

system design strategy: System design strategies is one of three major issues in design. The other two are system capabilities and system delivery modes. **1984** Huber (195) *The paper focuses on three major issues in the design of these systems: 1) System capabilities, 2) System delivery modes, and 3) system design strategies, and discusses the relationship of these issues to system use and survival. (p.195) … A discussion of GDSS design strategies led to the conclusion that an activity-driven design strategy was superior to either a technique-driven or task-driven strategy. (p.203).* **1987** Jelassi and Beauclair *This discussion of GDSS design issues is a positive step toward a behaviourally-driven design of group decision support systems. As we have shown, design strategies can be specific to certain group behaviours (eg. diffusion of responsibility) as well as general to computer-based decision support systems (eg. communication and information sharing, consistency and coherehce).*

system evaluation issue: System evaluation issues are often considered in relation to usability. Usability is the capability of the software product to be understood, learned, used and attractive to the user, when used under specified conditions. The components of usability, learnability, operability, attractiveness, and compliance. A usability framework could consist of nine dimensions, visual clarity, consistency, compatibility, informative feedback, explicitness, flexibility and control, error prevention and correction, ease of learning and ease of use. **1988** Grudin *Evaluation of groupware "in the field" is remarkably complex due to the number of people to observe at each site, the wide variability that may be found in group composition, and the range of environmental factors that play a role in determining acceptance, such as user training, management buy-in, and vendor follow-through (e.g., Lucas, 1976; Gaffney, 1985; White, 1985; Ehrlich, 1987b). Establishing success or failure will be easier than establishing the underlying factors that brought it about.* **2002** Sikorski (from ISO.IEC 9126-1) *Usability: The capability of the software product to be understood, learned, used and attractive to the user, when used under specified conditions. The components of usability, learnability, operability, attractiveness, compliance.* **2002** Sikorski (from ISO/IEC 14598-5 (draft)) *Evaluation: Technical operation that consists of producing an assessment of one or more characteristics of a software product according to a specified procedure. [Evaluation of software product].* **2003** Siao *This paper reports the evaluation of an existing GSS. Our usability framework consists of nine dimensions: visual clarity, consistency, compatibility, informative feedback, explicitness, flexibility and control, error prevention and correction, ease of learning, and ease of use.*

system purchase evaluation issue: System purchase evaluation issues for a computer teleconferencing system may include: convenient support for different types of discussions, system scalability, ease of use, customizability and support, reliability and performance, and accessibility **1986** Fanning and Raphael *Our selection of a computer teleconferencing system is itself a good example of how distributed HP workgroups operate…The following new, modified, or clarified requirements evolved as major considerations in our final decision: Convenient support for different types of discussions…system scalability…ease of use…customizability and support…reliability and performance…easy accessibility from the normal workplace.*

system scalability: System scalability is a system purchase evaluation issue for computer teleconferencing systems. **1986** Fanning and Raphael (294). *System scalability The pilot experiment would not only have to be economically and technically feasible on its own, but it would then have to be amenable to an order of magnitude expansion without visible discontinuities.*

system usage: System usage is perceived as daily use, frequency of use, number of applications used, duration, and number of tasks supported **1988** Rice and Shook *The second conclusion is that there are many conceptual and practical meanings of system usage. This study distinguished between duration and frequency as forms of usage.* **2000** Morris et al. (from Igbaria, Guimaraes, Davis 1995). *System usage are perceived daily use, frequency of use, number of applications used, and number of tasks supported … System usage is commonly operationalized in four ways in the literature: frequency of use, duration of use, variety of applications used, and variety of tasks performed.*

talking: Talking is a communication activity. Participants communicate by talking, listening and observing non-verbal behaviour. **1980** Hiltz et al. *How does this form of communication change the process and outcome of group discussions, as compared to the "normal" face to face (FtF) medium of group discussion, where participants communicate by talking, listening and observing non-verbal behavior, and where there is no lag between the sending and receipt of communication signals?*

task: Task is a set of problems and issues confronting a group that aims to seek a solution acceptable to its members. McGrath (1984) has developed a comprehensive typology of tasks, which in its lowest level of detail encompasses four tasks of generating, executing, negotiating and choosing. **1991** Applegate ([68]) *planning, creativity, intellective, decision making, cognitive conflict, mixed motive, competitive, and performance task.***1991** Applegate (20) *March and Simpson [65] describe tasks as either routine (structured) or nonroutine (unstructured).* **2000** Gutwin and Greenberg (2) (from McGrath 1984*) Tasks in shared workspaces usually involve: a. creation of new artifacts, b. organization of existing artifacts, c. exploration of the space or of a set of artifacts, d. construction of larger objects from component pieces, or e. the management of an autonomous system represented in the workspace*.**2003** Huang *Task is a set of problems and issues confronting a group that aims to seek a solution acceptable to its members. Task characteristics can determine the amount of and type of information that must be extracted and exchanged by a group to accomplish a task and are among major determinants of information exchange pattern in a group (Poole 1978)*

task behaviour: Task behaviours are those needed to solve problems that prevent the group’s objectives from being achieved. **2000** Pare and Dube *Task behaviours are those needed to solve problems that prevent the group’s objectives from being achieved.*

task characteristic: Task characteristics can be routine (structured or non routine (unstructured. Another way to characterize the tasks is along the rational/irrational dimension, task complexity, and time to assess issues and alternatives. Task characteristics include the activity required to accomplish the task (eg. idea generation, decision choice) such as task complexity. analysability and predictability . **1988** Dennis et al. (596). *The second class of variables then deals with the task faced by the group. One way to characterize the task is along the rational/irrational" dimension. Also task complexity can be measured by the number of issues and alternatives that must be considered and the time required to identify and assess the issues and alternatives (Hackman, 1968; Shaw 1932; Shaw, 1973).* McGrath’s task circumplex. **1989** Pinsonneault and Kraemer *Five contextual variables appear to be important in the behavioural research on groups: personal factors, situational factors, group structure, technological support, and task characteristics. Personal factors refer to the attitudes, behaviours, and motives of individual group members. Four personal factors have been found to affect group processes in organization behavior.* **1991** Nunamaker et al. *Task characteristics include the activity required to accomplish the task (eg. Idea generation, decision choice), task complexity, etc.* **1991** Applegate (from March and Simpson [65]) *Although these frameworks provide a useful way to classify tasks, many researchers find it helpful to define tasks in terms of their characteristics. March and Simpson [65], for example, describe tasks as either routine (structured) or nonroutine (unstructured), and Perrow characterises tasks on the basis of analysability and predictability.* **1999** Shirani et al. *Task characteristics: groups may generate ideas, choose a* *preferred solution, negoriate conflicting views of interests, or engage in competition with an opponent or against some performance standard (28)* **2003** Huang *Task characteristics can determine the amount of and type of information that must be extracted and exchanged by a group to accomplish a task and are among major determinants of information exchange pattern in a group (Poole 1978)*

Task Circumplex: The Group Task Circumplex proposes that all group tasks can be categorized into four types: to generate, to choose, to resolve and to execute. **1984** McGrath **2003** Siao *The modules of most GSS reflect the categories of a crude typology of tasks - idea generation, proposal evaluation, alternative selection, and consensus seeking (25, 41). This typology closely resembles the Group Task Circumplex (24), which proposes that all group tasks can be categorized into four types: to generate, to choose, to resolve, and to execute (15, 42). There are three common dimensions that can be integrated into a taxonomy of GSS environments (Figure 1). They are time dispersion, group proximity, and group size (30).*

task difficulty level: Task difficulty level (simple vs difficult) is a GSS research variable. **2001** Burke *This study is an examination of how GSS learning environments race-to-face vs. distant) and task difficulty level (simple vs. difficult) influenced participation levels and social presence among accounting students working collaboratively on an accounting task.*

task level: The task level suggests which generic GDSS module is most adequate to carry out an activity. **2001** Antunes and Ho (from Hwang and Lin 1987) *To afford this continuity, we decided to extend the decision model to cover tool selection (see right portion of Table 2 for details). Besides the zones, strategies and activities defined by the Kaner's model, we added two more levels of detail designated task and tool. The task level suggests which generic GDSS module is most adequate to carry out an activity. It defines four generic modules: creative confrontation, polling of experts/participation, systematic structuring, and implementing and controlling. This classification was adopted from Hwang and Lin (1987).*

task structure: Task structure refers to techniques, rules or models for analysing task related information to gain new insights. Task structure can relate to the extent to which a task is specified and defined as opposed to unstructured and ambiguous. Task structure assists groups performing a better analysis of task information and in developing a better shared understanding. Task structure also improves group performance by increasing process gains and reducing process losses. Some task structure techniques include problem modelling, multi-criteria decision making, stakeholder analysis and the value chain technique. **1995** Whitman et al. *Overall, the experiment was determined to examine the breadth of GSS type applications, examining tasks of generation in group comments, negotiations, in group discussion, and choosing, in item rankings and voting. These categories, proposed by DeSanctis and Gallupe (1987), present a multi- dimensional taxonomy of task structures as supported by the computer-aided decision support.* **1997** Nunamaker (from Nunamaker et al.1991) *Task structure refers to techniques, rules or models for analysing task-related information to gain new insights. Examples include computer model rule sets and decision support system rule sets. Task structure assists groups performing a better analysis of task information and in developing a better-shared understanding. Task structure also improves group performance by increasing process gains and reducing process losses. Some task structure techniques include problem modelling, multi-criteria decision making, stakeholder analysis and the value chain technique.* **2003** Lester et al. (from Fiedler 1978) *Fiedler (1978) identifies three situational characteristics that influence whether a task-oriented or relationship-oriented leader will be more effective: 1) leader-member relations--the extent to which the group trusts, respects, and follows the leader's directions, 2) position power--the extent to which the leader's position influences others in a desired direction, 3) task structure-- the extent to which a task is specified and defined as opposed to unstructured and ambiguous.*

task support: Task support refers to the information and communication infrastructure for task-related activities. Examples of task support include access to external information and support for computation or decision making. **1997** Nunamaker (from Nunamaker et al.1991) *Task support refers to the information and communication infrastructure for task-related activities. Examples of task support include access to external information and support for computation or decision making.*

task type: Task type can be categorized in different ways. McGrath (1994) identified four main task or problem types which were to generate (ideas or plans), to choose (a correct answer or preferred solution), to negotiate (conflicts of interest or power), and to execute (in competition or cooperation). Another way to categorize decision process tasks could be initiation, information exchange, analysis, and consensus testing. The task types could be intellectual or preference tasks.**1980** Hiltz et al. *The chief independent variable of interest is the impact of computerized conferencing on a communications mode upon the process and outcome of group decision making, as compared to face-to-face discussions. Two different types of tasks were chosen, and group size was set at five persons*. **1986** Bui and Jarke *There are different tasks in group decision processes that must be supported: -Initiation. How does the group start the collective decision-making process? Should the group elect a person who leads the discussion? -Information exchange. How can a member request or disseminate information? -Analysis. How does the group interpret the results of group discussions or decisions? -Consensus testing. What decision technique(s) should be adopted, for example, democratic vote or weighted majority rule?* **1987** DeSanctis and Gallupe *In the case of CHOOSING tasks, where alteranatives are known and in need of evaluation by group members, the objectives of GDSS technology should be to aid in the selection of either the correct solution (in intellective tasks) or the socially preferred solution (for preference tasks).* **1988** Dennis et al.(596) *Task type has been categorized by McGrath (1984) who developed a taxonomy of eight group tasks which provides a more precise method for analysing and discussing tasks.* **1996** Sia et al. (from McGrath 1984) *Task type: intellectual and preference tasks are two important ones because they are commonly performed by groups*. **2002** Baker *Using McGrath's (1984) classification of four main task types – to generate (ideas or plans), to choose (a correct answer or preferred solution), to negotiate (conflicts of interest or power) and to execute (in competition or cooperation)*.

Task-driven design: Task driven design is a design strategy that derives the necessary system features from an examination of user tasks. **1984** Huber (200) *When the numerous combinations from these two dimension (and possibly (others) are overlaid on the variety of problem types and contexts faced by private andpublic sector organizations. It is clear that the possible decision-group tasks are beyond numeration. This fact makes it difficult to employ a design strategy that derives the necessary system features from an examination of user tasks.*

taxonomy of GSS environment: There are three common dimensions that can be integrated into a taxonomy of GSS environments. They are time dispersion, group proximity, and group size. **2003** Siao *There are three common dimensions that can be integrated into a taxonomy of GSS environments. They are time dispersion, group proximity, and group size.*

team: Team is a collection of people working together for some specific purpose. Team is a collection of individuals who interact more extensively than group members to produce a deliverable, who are evaluated based on the team outcome, and who are accountable as a team (instead of or in addition to individual accountability) for team outcomes. **1997** Nunamaker et al. (from Webster's Dictionary) *Team: a collection of people working together for some specific purpose.* **1998** Ciborra and Patriotta. *Team – a collective way of working, collaboration, the intimacy of staying together and sharing.* **1999** Furst et al. (from Sundstrom et al. 1990) *Team: as collections of individuals who interact more extensively than group members to produce a deliverable, who are evaluated based on the team outcome, and who are accountable as a team (instead of or in addition to individual* *accountability) for team outcomes.* **1999** Furst et al. *Co-located collectivities are those groups or teams whose members are within close proximity of each other and for whom the dominant mode of communication is face-to-face. Members of co-located groups or teams typically work in the same physical location or come together regularly and frequently to meet in the same location.* **2000** Stough et al. *Teams share authority, responsibility, leadership, decision making, results, and rewards.*

team building: Also see group development. Team building, the process of taking a collection of individuals with different needs, backgrounds, and expertise and transforming them by various methods into an integrated, effective work unit. **1996** Kraemer and King …*and group process tools from the organization development field such as process observation, team building and reality testing.* **1995** Whitman et al. *While these studies have demonstrated that GSS can enhance cohesion, they do not address the effect that team development will have on the GSS experience. In work environments, the development of higher levels of team cohesion and commitment is associated with higher productivity and unidimensionality of team attitudes toward performance (Scott and Townsend, 1994).*

team facilitator role: The role of the team facilitator is to move the team towards its objectives by encouraging collaboration. This is done through a sustained process of relationship building, idea generation, prioritisation and selection. **2001** Pauleen and Yoong (from Kimball 2000) *The role of the team facilitator is to move the team towards its objectives by encouraging collaboration. This is done through a sustained process of relationship building, idea generation, prioritisation and selection.*

team history: Team history can include the frequency of team meetings. **2003** Huang et al. *…team history (e.g., the frequency of team meeting).*

team identity: Team identity is defined as the acceptance of team goals and collective commitment to put team goals ahead of individual goals **1999** Furst et al. (from Gaertner et al.1989). *Team identity is defined as the acceptance of team goals and collective commitment to put team goals ahead of individual goals.* **2003** Huang et al. *team identity (e.g., team goals).*

team interaction style:A team's interaction styles can affect performance. Components of a team's interaction style can be positive or negative behaviours. Group interaction can be analysed in terms of three general styles: constructive, passive and aggressive. **2000** Potter et al.(from Watson and Michaelsen 1988) *Team's interaction style can affect performance. They identified positive and negative behaviours as components of group interaction style. Three groups of behaviours (expectations of performance and integration, leadership, and cohesiveness) contributed to team performance on an intellective task while one group of negative behaviours (eg non-involvement, withholding of information) detracted.* **2000** Potter et al. (from Cooke Szumal 1994) *Group interaction can be analysed in terms of three general styles: constructive, passive and aggressive. The constructive style is characterized by a balanced concern for personald group outcomes, cooperation, creativity, free exchange of information, and respect for others' perspectives. The constructive style enables group members to fulfil both needs for personal achievement as well as needs for affiliation. The passive style places greater emphasis on fulfilment of affiliation goals only, maintaining harmony in the group, and limiting information sharing, questioning and impartiality. The aggressive stile places greater emphasis on personal achievement needs, with personal ambitions placed above concern for group outcome. Aggressive groups are characterized by competition, criticism, interruptions, and overt impatience*

team interdependence: Team interdependence can include team coordination. **2003** Huang et al. *…team interdependence (e.g., team coordination)…*

team learning: see Collaborative learning. **1990** Hiltz *The labels given to collaborative or group learning are many; among them are: "cooperative learning, collective learning,* *study circles, team learning…" (Bouton and Garth, 1983), and ":peer-group learning" or syndicates" (Collier, 1980).*

team structure: Team structure can include leadership and role differentiation. **2003** Huang et al. *the team structure (e.g., leadership and role differentiation),*

TeamFocus: TeamFocus is a commercial GDSS product from IBM **1995** Aiken et al. *The most widely-used commercial GDSS products (GroupSystems from Ventana, TeamFocus from IBM, and VisionQuest from Collaborative Technologies)*

teamware: Teamware products that are oriented towards modest-sized teams and organizations. A good teamware package should meet objectives that include: reducing unnecessary communication by filtering and organizing, allowing users to build an archive of decisions, organizing information beyond electronic text. **1998** Greenberg and Roseman …*teamware products (including TeamWave) that are oriented towards modest - sized teams and organizations (Wong, 1998).* **1998** Angus and Gallagher *Lotus development's instantTeamRoom 1.5 is reviewed. A good teamware package should meet objectives that include: 1. Reducing unnecessary communication by filtering and organizing: 2. Allowing users to build an archive of decisions both made and rejected, and 3. organizing information beyond electronic text. Lotus teamware offering was designed to service short-lived projects staffed largely by knowledge-workers. Its design serves that audience well, with the minimum administration model, half hour set-up procedure, and low out-of-pocket cost. TeamRoom's interface is a 4 pane Web-browser view that is nearly identifical to the Web view of any Domino discussion database. The collaboration features of TeamRooms are highly directed and sparse. There is little support for one-to-one communication in the application. TeamRoom's sorting and filtering capabilities are elementary.*

teamwork: Process measures relate to the teamwork elements of groupware usability. Groupware usability is the extent to which a groupware system allows teamwork to occur, effectively, efficiently and satisfactorily, for a particular group and a particular group activity. Teamwork involves several activities: for example, group members must communicate, organize joint action, provide assistance, coordinate activity, divide labour, and monitor each other's work. **1999** Gutwin and Greenberg (247) *Teamwork involves several activities: for example, group members must communicate, organize joint action, provide assistance, coordinate activity, divide labour, and monitor each other's work…. Real-time groupware systems are subject to these criteria as well, but now two kinds of activity must be considered: taskwork and teamwork … Process measures relate to the teamwork elements of groupware usability. They look for patterns in behavioural or verbal activity during a collaborative session and connect these to issues of effectiveness or efficiency. Process measures are often obtained by observation or through video and audio protocol analysis … Satisfaction measures can relate to both teamwork and taskwork, but focus on the participant's own beliefs about the activities of collaboration. These measures record participants' subjective experience with the groupware system, and whether the participants find the system to be a good setting for collaboration. Satisfaction measures are usually obtained with questionnaires and interviews.* **2002** Pinelle et al. *Groupware usability: the extent to which a groupware system allows teamwork to occur – effectively, efficiently, and satisfactorily – for a particular group and a particular group activity.*

technical measure: Technical measures such as access control, concurrency control, undo, version control, and turn-taking. **2001** Baker et al. (9) *Technical measures such as access control, concurrency control, undo, version control, and turn-taking have been implemented.*

technique driven design: Technique driven design is one of three GDSS design strategies. The other two strategies are activity-driven design and task-driven design. **1984** Huber et al. (203) *A discussion of GDSS design strategies led to the conclusion that an activity-driven design strategy was superior to either a technique-driven or task-driven strategy.*

technology characteristic: Technology characteristics have a major impact on technology transfer. **1986** Stasz and Bikson (319) *The study was informed by a Rand-developed framework for understanding technology transfer which suggests that the outcomes or impacts of technology depend on three major classes of variables: characteristics of the organization, characteristics of the technology, and characteristics of the implementation process, i.e., the process by which the organization embeds the technology in its work.*

technology facilitation: Technology facilitation seems to be common in generic-purpose GDSS which have agenda tools, participant rosters and support technology configurations. **2001** Antunes and Ho *Technology facilitation seems to be common in generic-purpose GDSS, SAMM, GroupSystems, and MeetingWorks all have agenda tools, participant roster and support technology configuration.*

technology transfer: Technology transfer suggests that the outcomes or impacts of the introduction of technology to organizations depend on three major classes of characteristics., which include organization characteristics, technology characteristics, and implementation process characteristics **1986** Stasz and Bikson. *The study was informed by a Rand-developed framework for understanding technology transfer which suggests that the outcomes or impacts of technology depend on three major classes of variables: characteristics of the organization, characteristics of the technology, and characteristics of the implementation process, i.e., the process by which the organization embeds the technology in its work.*

teleconferencing: Teleconferencing is another term for linked decision rooms. Teleconferencing systems are a set of technologies developed to support group work. Computer-based conferencing systems include computer conferencing (email meetings), desktop conferencing, teleconferencing, video conferencing and multimedia conferencing. Teleconferencing can be audio, video, and computer. **1986** Applegate et al. *Systems that fall under the classification of a GDSS include: (I) Decision Conferences (or Decision Rooms), (2) Teleconferencing, (3) Local Ongoing Decision Networks, (4) Remote Ongoing Decision Networks, and (5) Information Centers (Kraemer and King, 1984; DeSanctis and Gallupe, 1985).* **1988** Egido *Teleconferencing systems and services, are the main set of technologies developed thus far to support group work. Within this set of technologies, videoconferencing is often thought of as a new, futuristic communication mode that lies between the telephone call and the face-to- face meeting … Not surprisingly, the potential for substituting various forms of telework (neighborhood work centers, remote data terminals, teleconferencing) for intracity travel, and various forms of teleconferencing (audio, video, computer) for intercity travel became the subject of national and international policy discussions, with research peaking during 1972- 76 (Kraemer, 1982)* **1998** Pervan *… the time/place combination may be face-to-face (the 'decision room') , asynchronous but in different places eg. Teleconferencing and videoconferencing), ansynchronous but in the same place (Local decision network), or asynchronous and dispersed (remote decision making).(11).***2000** Stough et al. *Many types of computer-based conferencing systems exist today including computer conferencing (e-mail meeting), desktop conferencing, teleconferencing, video conferencing, and multimedia conferencing.*

telephone line: Telephone lines may be required for dispersed groups to communicate with one another. **1985a** DeSanctis and Gallupe *For dispersed groups, a local area network, telephone lines, satellite, or microwave relay may be required to allow group members to communicate with one another. Electronic mail, computer conferencing, audio and video conferencing might also be integrated into the GDSS environment.*

telepresence: Telepresence where inter-personal cues are transmitted such as body language, gaze direction, gestures, and spatial relations. **1990** Greenberg and Chang *Two aspects of remote conferencing are distinguished here: tele-presence and tele-data.* **1998** Greenberg and Roseman *Telepresence where inter-personal cues are transmitted such as body language, gaze direction, gestures, and spatial relations.*

telework: There are various forms of telework, such as neighbourhood work centers, remote data terminals, and teleconferencing. **1988** Egido *Not surprisingly, the potential for substituting various forms of telework (neighborhood work centers, remote data terminals, teleconferencing) for intracity travel, and various forms of teleconferencing (audio, video, computer) for intercity travel became the subject of national and international policy discussions, with research peaking during 1972- 76 (Kraemer, 1982).* **1998** Townsend et al. (21) *Telework is usually limited to relatively independent job categories that involve low levels of collaboration.*

temporal patterning problems: Temporal patterning refers to the rhythms by which groups synchronize their activities. **2001** Montoya-Weiss et al. *Temporal patterning refers to the rhythms by which groups synchronize their activities. Three generic temporal patterning problems are inherent in any group activity: temporal ambiguity, conflicting temporal interests and requirements, and scarcity of temporal resources (McGrath 1991).*

temporal structure: Temporal structure relates to time. Text graphics performed for working groups have spatial and temporal structure. **1986** Lakin (256) *It is a major premise of this paper that text-graphics performed for working groups have spatial and temporal structure.*

text: Text is a communication mode **1986** Fanning and Raphael *Until computer teleconferencing systems can encompass several modes of human communication-- e.g. text, voice, sketched diagrams, and photographs.*

text and data transmission: Text and data transmission is a GDSS group feature. Text and data transmission can be among group members, between group members and the facilitator, and between the group members and a central computer processor. **1985a** DeSanctis and Gallupe (5) *Text and data transmission among the group members, between the group members and the facilitator, and between the group members and a central computer processor.*

***text editing**:* Text editing is a CMC factor relating to text processing. Text editing is the direct modification of text during the composition process. **1981** Turoff et al. (92-93) *The direct modification of text during the composition process*.

text editors: Text editors support group creation and modification of documents and software code. **1992** Shu *Text editors that support group creation and modification of documents and software code (Kaiser_etal1987, Leland etal 1988, Galegher&Kraut 1990, Neuwirth_etal1990).***1998** Cockburn and Greenberg … *the Internet also provides a network infrastructure for real-time communication that enables a variety of novel computer applications for supporting collaboration. These applications include audio and video conferencing, shared electronic white-boards, collaborative text editors and so on.***1996** Roseman *An example of real time groupware are Text editors that allow editing the same document at the same time (usually with some form of locking so users don't conflict).*

***text formatting**:* Text formatting is a CMC factor relating to text processing. Text formatting is the ability to have the computer set up formats for text such as paragraphing, tables, spacing, and margins. **1981** Turoff et al. (92-93) *The ability to have the computer set up formats for text such as paragraphing, tables, spacing, margins, etc*.

***text-graphic**:* Text-graphics have both spatial and temporal structure. **1986** Lakin (256) *It is a major premise of this paper that text-graphics performed for working groups have spatial and temporal structure.*

text graphic manipulation feature: Text-graphic manipulation features include generating, moving, modifying, erasing, agility, generality, structure and dynamics **1986** Lakin (264) *Manipulation includes generating, moving, modifying and erasing text-graphic objects.*

***text mobility**:* Text mobility is a CMC factor relating to text processing. Text mobility is the ability to move text around the system, such as from a message into a personal notebook.

1981 Turoff et al. (92-93) *The ability to move text around the system, such as from a message into a personal notebook.*

text notebook: Text notebooks can be a useful CMC capability. **1981** Hiltz and Turoff *Among the capabilities which long term, regular users found valuable are group conferences, notebooks for text composition, and self-defined commands.*

text processing: Text processing is a CMC factor. Text processing includes text editing, text formatting, document formatting, text mobility, text retrieval and linkages, text referencing, and active and adaptive text. **1981** Turoff et al. *Text Processing Text editing: The direct modification of text during the composition process. Text formatting: The ability to have the computer set up formats for text such as paragraphing, tables, spacing, margins, etc. Document formatting: The ability to format a document by paging and incorporating such things as headings. Text mobility: The ability to move text around the system, such as from a message into a personal notebook. Text retrieval and linkages: The relationships, indexes and linkages set up to relate items of text to one another, and to the possibilities of dealing with non-linear type documents such as in "hypertext". Virtual text referencing: The ability to reference and incorporate existing text items in new text items in a virtual manner. Active and adaptive text: The ability of text to incorporate programs or functions that are executed as part of the delivery mechanism to readers. This includes the ability of text to contain forms or surveys for the reader to respond to and make conditional on various factors or specific responses what the reader actually sees.* **1985a** DeSanctis and Gallupe *Basic Features - Text and data file creation, modification, and storage for group members - Word processing for text editing and formatting - Learning facilities for naive GDSS users - On-line *'help" facilities - Worksheets, spreadsheets, decision trees, and other means of graphically displaying numbers and text - State-of-the-art database management which can handle queries from all participants, create subschemas as necessary for each participant, control access to public, or corporate, databases, etc.*

***text retrieval and linkage**:* Text retrieval and linkages are CMC factors relating to text processing. The relationships, indexes and linkages set up to relate items of text to one another, and to the possibilities of dealing with non-linear type documents such as in "hypertext". **1981** Turoff et al.*The relationships, indexes and linkages set up to relate items of text to one another, and to the possibilities of dealing with non-linear type documents such as in "hypertext".*

***textual information**:*Textual and relational information are relatively more important for GDSS than they are for DSS. **1984** Huber (203) *The subsequent analysis of group activities made clear that textual and relational information are relatively more important for GDSS than they are for DSS, most of which deal largely with numeric information.*

time (1): Time may refer to the response to having time controlled by a system..**1992** Lewis and Whiteley *Several prominent impact categories were generated by facilitators (see Table 3). They included: facilitator comfort (a feeling of being at ease with the process) and the energizing element (is it depleted or enhanced through GDSS?); group temperament or ambience, and the use of humor in the group; control (does the facilitator lose any of it to the technology?). Additionally, time, or the response to having it controlled by a system caused enough comment to warrant further investigation. One of the central features of MeetingWare is the ability to preserve anonymity of ideas as individuals privately "talk" to the keyboard instead of upfronting before a group of colleagues.*

time (2): Time may refer to response time of a system. **1989** Ellis and Gibbs *WYSIWIS interfaces have two implications on concurrency control. First response times are important - the time taken to access data, modify data, or notify users of changes must be as short as possible. Secondly, if the concurrency control scheme entails the use of modes where actions of one user are not immediately seen by the others, then the effect of these modes on the group's dynamics must be considered and only allowed if they are not disruptive*

time (3): Time may refer to usage time ie. time spent on a system. **1988** Rice and Shook *Usage An important concept in the study of information systems in general is usage. We focus on two dimensions, the form and the source, of usage measures here (these are discussed in greater detail in [55]). The form of usage data may include, among other types of usage, duration (or the total amount of time spent on a system), and frequency (or the number of accesses or entries to a system). With respect to computer systems, these forms of usage are typically called connect time and log-ons, respectively.*

time (4): Time may refer to the amount of time necessary for meetings or each activity. Time is a productivity resource. **1996** Hiltz et al. *Efficiency measures - time to decision.* **2001** Montoya-Weiss et al. *Teams typically use a variety of coordination mechanisms to manage temporal problems; these include scheduling (deadlines), synchronization (aligning the pace of effort among members), and allocation of resources (specifying the time to be spent on specific tasks) (McGrath, 1991).* **2003** Ngwenya and Keim *Time to decision and decision quality were surrogate measures of group information sharing effectiveness.*

time (5): Time may refer to temporal relationships, that is whether a meeting or other groupwork is synchronous or asynchronous. **1987** Cook et al. *We identify four meeting classes: (1) Face-to-face meetings (constrained by space and time). ... (2) Physically distributed meetings (constrained by time) ... (3) Temporally distributed meetings (constrained by space) ... (4) Temporally and physically distributed meetings (unconstrained by space and time).* **1996** Barua et al. (from Rodden [16]) *Temporal relationships (asynchronous or synchronous).*

time dispersion: Time dispersion refers to synchronous (at the same time) or asynchronous (at different times). **1995** Gavish et al. *Time dispersion: meetings can be synchronous or asynchronous*

time pressure: Time pressure is a context characteristic when working in a group. **1991** Nunamaker et al. *Context characteristics include organizational culture, time pressure, evaluative tone (eg. Critical or supportive), reward structure (eg. Non versus individual versus group) etc.*

time stamping: Time stamps are used in dependency detection relating to concurrency control. Time stamps are used to detect conflicting operations. Conflicts are resolved by manual intervention. **1988** Dennis et al. *Support Issues: Support issues include breakout and conference rooms, high quality printers and copiers, gallery seating for observers, handicap access, security, redundancy in hardware and easy data recovery, observation rooms, and time stamping of voice and data in conjunction with video taping.* **1989** Ellis and Gibbs *Dependency-detection. One recent proposal for concurrency control in groupware systems is the dependency-detection model [Stef87]. Dependency detection is based on the use of timestamps to detect conflicting operations; conflicts are resolved by manual intervention.*

Time/space framework: The time component describes the time when interactions between group members occur, and the place component describes the location of the group members during interactions. **2003** Bose (from Turban and Aronson 2001) *The time component describes the time when interactions between group members occur, and the place component describes the location of the group members during interactions.*

timeliness: Timeliness is a dimension of meeting outcomes **1987** DeSanctis and Gallupe *Outcomes of meetings may be measured on many dimensions, including decision quality and timeliness, satisfaction with the decision, cost or ease of implementation, member commitment to implementation, or the group's willingness to work together in the future.*

tool selection: Tool selection is afforded in some GDSS systems. The system provides a suggestion to the group as to which tool to use. **2001** Antunes and Ho (12) (from Hwang and Lin 1987) *To afford this continuity, we decided to extend the decision model to cover tool selection (see right portion of Table 2 for details). Besides the zones, strategies and* *activities defined by the Kaner's model, we added two more levels of detail designated task and tool. The task level suggests which generic GDSS module is most adequate to carry out an activity. It defines four generic modules: creative confrontation, polling of experts/participation, systematic structuring, and implementing and controlling. This classification was adopted from Hwang and Lin (1987).*

traditional communicative cue: Traditional communicative cues include facial expression, gesture, and vocal inflection. **1998** Townsend et al. *Traditional communicative cues:(ie. facial expression, gesture, and vocal inflection).*

training: Training is an organizational impact when changing to a new computer-based information system. **1986** Stasz and Bikson (320) *Issues in Computer-Supported Cooperative Work: Our field study assessed a number of impacts of the organization's transition to a computer- based information system. Here we discuss five: training, dissemination, hierarchical vs. network communications, centralized vs. decentralized decisionmaking, and cooperative work between different technologies and systems.* **1988** Grudin *Evaluation of groupware "in the field" is remarkably complex due to the number of people to observe at each site, the wide variability that may be found in group composition, and the range of environmental factors that play a role in determining acceptance, such as user training, management buy-in, and vendor follow-through (e.g., Lucas, 1976; Gaffney, 1985; White, 1985; Ehrlich, 1987b). Establishing success or failure will be easier than establishing the underlying factors that brought it about.*

transaction mechanism: Transaction mechanisms have been used for concurrency control in looseley-coupled interactive multi-user systems. These systems have less demanding response time requirements than tightly-coupled systems. **1989** Ellis and Gibbs *Transactions. Transaction mechanisms have been used for concurrency control in interactive multi-user systems (for example, CES or Quilt), but, these are loosely-coupled systems and have less demanding response time requirements. For groupware systems there are a number of problems. First there is the complication of distributed concurrency control algorithms based on transaction processing and the subsequent cost to response time. Secondly, if transactions are implemented using locks there are the problems mentioned above, while if some other method is used, such as timestamps, a user's actions may be aborted by the system. (Only aborts explicitly requested by the user should become visible at the user interface.)*

transition: Transition is the period of time that starts when some person in an organization expresses interest in using a new technology and that ends when a community of users has become self-sustaining. **1998** Briggs et al. *Transition: the period of time that starts when some person in an organization expresses interest in using a new technology and that ends when a community of users has become self-sustaining.*

trust: Trust refers to the likelihood that team memers will live up to their colleagues expectations. Two dimensions of trust are dependable task completion and benevolence towards others. Trust can be viewed from a rational or social perspective. **1998** Jarvenpaa et al. *Trust can be viewed from a rational or social perspective. Most research on trust takes a rational perspective [15]. The relational perspective centers on the calculus of self interest. Increases in trust decrease transaction costs of relationships because individuals have to engage less in self-protective actions in preparation for the possibility of others' opportunistic behaviour [16].* **1999** Furst et al. *Trust represents an important antecedent of synergistic work group behaviour (Mayer et al.1995). Trust refers to the likelihood that team memers will live up to their colleagues expectations (Mayer et al.1995; Jarvenpaa et al.1998). Two dimensions of trust are dependable task completion and benevolence towards others.*

trustworthy: Trustworthy means competent, reliable, concerned about and attentive to the trusting person, similar in background or social values. **2000** Greenspan et al. *Trustworthy* *means competent, reliable, concerned about and attentive to the trusting person, similar in background or social values.*

turn-taking: Turn-taking is a technical measure. **2001** Baker et al. *Technical measures such as access control, concurrency control, undo, version control, and turn-taking have been implemented.*

tutoring: Tutoring is a collaboration support function usually included in a GDSS (decision conference system) **1988** Kraemer and King (126) *Several general observations can be made based on information about these systems. 1. There are about three general functions and 1-2 dozen specific functions that are provided in support of decision conferences: a. structured decision analysis decision trees multiattribute utility b. structured group process social judgment analysis delphi technique nominal group technique c. collaboration support data management graphic display decision documentation tutoring decision analysis consultation group process facilitation meeting facility vote tabulation and display.*

undo: Undo is a technical measure that reverses the execution of a key stroke. In group work undo and other technical measures assist with social protocols. **1989** Ellis and Gibbs *Reversible Execution. This is another recent proposal for concurrency control in groupware systems. With reversible execution [Sari85], operations are executed immediately but information is kept so that they may be undone later if necessary. Many optimistic concurrency control mechanisms fall within this category [Bern87].* **2001** Baker et al. *Technical measures such as access control, concurrency control, undo, version control, and turn-taking have been implemented … To assist with social protocols, technical measures such as access control, concurrency control, undo, version control, and turn-taking have been implemented.*

uncertainty: Uncertainty is a user behaviour phase when using interactive systems. The uncertainty phase, during which the learner has to overcome hesitancy and anxiety. **1981** Hiltz and Turoff *… into the 'uncertainty' phase, during which the learner has to overcome hesitancy and anxiety …*

uncoupled awareness: Uncoupled awareness is one of four categories of modes of workspace awareness. Uncoupled awareness means information independent of the user's current focus of work. **1997** Schlichter et al. *Four modes of awareness (16) These modes can be described by two orthogonal classifications: (1) Coupling: there is the coupled awareness (participants have the same focus of work, eg. They work on the same shared artifact and are aware of each other) and uncoupled awareness (" information independant of the user's current focus of work") (2) Synchrony: Participants may either be aware synchronously (knowledge about events that happen currently) or asynchronously (knowledge about events in the past) … There is the coupled awareness (participants have the same focus of work, eg. they work on the same shared artifact and are aware of each other) and uncoupled awareness (information independent of the user's current focus of work).* **1999** Hayashi et al. *Modes of workspace awareness classified into four categories: synchronous-coupled, asynchronous-coupled, synchronous-uncoupled, and asynchronous-uncoupled (Fuchs etal 1995).*

undesirable effect: Undesirable effects of GSS are reduced consensus and confidence. **2003** Lester et al. *GSS has demonstrated both desirable effects (greater participation, better quality decisions) and undesirable effects (reduced consensus and confidence) in previous research (Fjermestad and Hiltz, 1999; Benbasat and Lim, 1993).*

unequal consideration of ideas: Unequal consideration of ideas, also known as evaluation of contributions is a barrier to group work **1988** Kraemer and King (123). Also known as 'evaluation of contributions' **1986** Kraemer and King *At the simplest level GDSS provide features aimed at removing common barriers to group work and communication, such as unequal consideration of ideas, dominance by individuals, peer pressure, and loss of autonomy. These features include anonymous input of ideas and preferences, and large* *screens for instantaneous display of ideas, and secret voting and compilation. The level is illustrated by the electronic boardroom or computer-supported conference room.*

unstructured information*:* Unstructured information is information which is not in a regular form, and which cannot be readily interpreted by a computer. **1986** Begeman et al. (5) *Unstructured information is information which is not in a regular form, and which cannot be readily interpreted by a computer.*

unstructured interaction: Unstructured interactions: document sharing, discussion and news groups. **1997** Nunamaker (from Romano et al.1997a)*Unstructured interactions: document sharing, discussion and news groups.*

unstructured meeting*:* Meetings can be categorized according to the amount of its structure (binary, structured, or unstructured. **1986** Begeman et al. (5) *Within all of these structures, the types of information that may be presented, manipulated, and captured during a meeting can be categorized according to the amount of its structure (binary, structured, or unstructured), and according to the degree of sharing (private, subgroup, or public).*

unstructured task: Unstructured tasks are nonroutine. Unstructured tasks require a great deal of decision maker insight, judgement and evaluation and have no definite boundaries or well-understood procedures. Incompleteness, conflicting task objectives, inconsistent task inputs and large solution space may also make the task more ill structured. Task ambiguity or equivocality, involving multiple and conflicting interpretations about a situation, is another feature of unstructured tasks. (Lakin 1986) **1991** Applegate *March and Simpson [65], for example, describe tasks as either routine (structured) or nonroutine (unstructured), and Perrow characterises tasks on the basis of analysability and predictability.* **1999** Shirani et al. *Unstructured tasks require a great deal of decision maker insight, judgement and evaluation and have no definite boundaries or well-understood procedures. Incompleteness, conflicting task objectives, inconsistent task inputs and large solution space may also make the task more ill structured. Task ambiguity or equivocality, involving multiple and conflicting interpretations about a situation, is another feature of unstructured tasks (38).*

usability: Usability is the capability of the software product to be understood, learned, used and attractive to the user, when used under specified conditions. The components of usability could include learnability, operability, attractiveness, compliance. Usability dimensions could include visual clarity, consistency, compatibility, informative feedback, explicitness, flexibility and control, error prevention and correction, ease of learning, and ease of use. **2002** Sikorski (ISO/IEC 9126-1 (CD proposal) *Usability: The capability of the software product to be understood, learned, used and attractive to the user, when used under specified conditions. The components of usability, learnability, operability, attractiveness, compliance.* Sikorski (ISO 9241-11) *Usability: The extent to which a product can be used by specific users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.* **2003** Siao *This paper reports the evaluation of an existing GSS. Our usability framework consists of nine dimensions: visual clarity, consistency, compatibility, informative feedback, explicitness, flexibility and control*

usage: Usage are perceptions about how well the system is able to satisfy certain communication requirements, in addition to the extent to which the respondent used the system. **1988** Rice and Shook *Accessibility and appropriateness affect outcomes independently of usage individuals' evaluations of the EMS studied here seem related to perceptions about how well the system is able to satisfy certain communication requirements, in addition to the extent to which the respondent used the system…An important concept in the study of information systems in general is usage.*

usage measures*:* Usage measures are considered by two dimensions, the form of usage measure and the source of usage measure. The form of usage data relates to the group use and may include usage, duration and frequency. The source of usage measure from the computer system may include connect time, and number of log-ons. **1988** Rice and Shook *We focus* *on two dimensions, the form and the source, of usage measures here (these are discussed in greater detail in [55]). The form of usage data may include, among other types of usage, duration (or the total amount of time spent on a system), and frequency (or the number of accesses or entries to a system). With respect to computer systems, these forms of usage are typically called connect time and log-ons, respectively … This study distinguished between duration and frequency as forms of usage.* **2002** Morris et al. (from Igbaria et al. 1995) *System usage are perceived daily use, frequency of use, number of applications used, and number of tasks supported.*

usage patterns: Usage patterns are data relating to use, collected by computer systems during user interaction. **1978** Turoff and Hiltz *The subjective reactions of users of EIES to this form of communication and to specific features of the system have been reported elsewhere (Hiltz, 1978a, 1978b). In this paper, we wish to present data on usage patterns collected by the EIES monitoring system, and our interpretations of what these data show about adaptation to this form of human communication.*

use: see Information use

user behaviour phase: User behaviour phases when using interactive systems are, uncertainty, insight, incorporation and saturation **1981** Hiltz and Turoff *Phases of User Behavior One classical model of user behavior in interactive systems with which one can compare our data was developed by Bennett [2]. He generalizes user behavior into the "uncertainty" phase, during which the learner has to overcome hesitancy and anxiety; the "insight" phase, during which the user understands the general concept of the system and can make at least limited use of it for his or her own purposes; the "incorporation" phase, when the mechanics of the interaction become second nature; and the "saturation" phase where the system is perceived as inadequate for meeting new requirements users evolve as a result of experience.*

user capability: User capabilities are a major factor in GDSS success. **1984** Huber (203) *It was also noted that major factors in GDSS success are the capabilities of the users and their aides in, managing a decision group and drawing appropriately on the GDSS technology. This fact supported the belief that vendor support may be critical to GDSS success in the great majority of applications. (p.203)*

user interface: User interface is a software component of a GDSS. Interfaces for GDSS should be easy-to-use and flexible. **1985a** DeSanctis and Gallupe *Software The software components of the GDSS include a database, a model base, specialized application program(s) to be used by the group, and an easy-to-use, flexible user interface.*

user simulation*:* User simulation is a CMC factor relating to specialized support software. User simulation is the ability of a system to develop tailored programs to simulate aspects of users' communication behavior, and thereby augment their communication capabilities by acting as an intermediary. **1981** Turoff et al. *The ability of a system to develop tailored programs to simulate aspects of users' communication behavior, and thereby augment their communication capabilities by acting as an intermediary. A simple example would be a background task to carry out a search while the user is off line.*

user site installation: User site installation is a delivery mode for GDSS. User site installation is when the GDSS is permanently installed at the user's or customer's site. **1984** Huber (199) *There are at least three modes in which GDSS can be made available to users … for the GDSS to be permanently installed at the user's or customer's site … Another delivery mode is for the vendor to rent the system on an on-call basis … The third delivery mode is as a vendor-site installation where the software, hardware, staff, and so forth are all provided for a fee ...*

vendor support: Vendor support is a major factor in GDSS success. **1984** Huber (203) *It was also noted that major factors in GDSS success are the capabilities of the users and their aides in, managing a decision group and drawing appropriately on the GDSS technology.*

This fact supported the belief that vendor support may be critical to GDSS success in the great majority of applications.

version control: Version control is a technical measure. **2001** Baker et al. *Technical measures such as access control, concurrency control, undo, version control, and turn-taking have been implemented.*

video conferencing: Video conferencing might be integrated into the GDSS environment. The Internet provides a network infrastructure for real-time communication that could include video conferencing. **1985a** DeSanctis and Gallupe *Electronic mail, computer conferencing, audio and video conferencing might also be integrated into the GDSS environment.* **1988** Egido *Teleconferencing systems and services, are the main set of technologies developed thus far to support group work. Within this set of technologies, videoconferencing is often thought of as a new, futuristic communication mode that lies between the telephone call and the face-to- face meeting.* **1998** Cockburn and Greenberg (777) *For many people the Internet is synonymous with the World Wide Web. However, the Internet also provides a network infrastructure for real-time communication that enables a variety of novel computer applications for supporting collaboration. These applications include audio and video conferencing, shared electronic white-boards, collaborative text editors and so on. Commercial vendors are rapidly developing applications that exploit the real-time communication capabilities of the Internet and examples include Intel's "Proshare" - Netscape"s "CoolTalk", and Microsoft"s "NetMeeting".*

video projector: Video projector is an output device for decision conference systems. Video projector is part of the hardware in a conference room. **1986** Kraemer and King *The hardware for the decision conference consists of a medium-sized conference room furnished with a large-screen, video projector, a computer, video terminals, hand-held terminals for voting or other input by the participants, and a control terminal for presenting participant inputs in graphic form and for accessing other sources of information (e.g., databases, general reference materials, results of previous conferences).*

video terminal: Video terminal is an input device for a decision conference. Video terminal is part of the hardware in a conference room. **1986** Kraemer and King *The hardware for the decision conference consists of a medium-sized conference room furnished with a large-screen video projector, a computer, video terminals, hand-held terminals for voting or other input by the participants, and a control terminal for presenting participant inputs in graphic form and for accessing other sources of information (e.g., databases, general reference materials, results of previous conferences).*

VideoDraw*:* VideoDraw is a video and audio communication-based virtual shared workspace. **1990** Ishii *There have been two types of approaches proposed to realize real-time shared workspaces for distributed groups. (1) Multi-user software such as shared-window-systems lLant86, Suzu86, LauwS)OA, Lauw90B, Ahuj90] and special purpose applications [Fost86, Elli90] running on networked workstations. (2) Video and audio communication-based virtual shared work spaces, such as Media Space lStu188, Har190], CRUISER [Root88], VideoDraw [Tang90].*

Virtual classroom*:* The objective of a Virtual Classroom is to improve the access to advanced educational experiences through allowing students and instructors to participate in remote-learning communities at times and places convenient to them, using personal computers at home, or on campus or at work. **1990** Hiltz et al. *The objectives of a VC are: * The improvement of access to advanced educational experiences through allowing students and instructors to participate in remote-learning communities at times and places convenient to them, using personal computers at home, on a campus or at work. * The improvement of the quality and effectiveness of education through using the computer to support a collaborative learning process. * Collaborative learning is defined as learning that emphasizes group or cooperative efforts among faculty and students. It stresses active participation and interaction by both students and instructors. Knowledge is gained through* *an active dialogue that enables the sharing of ideas and information (see Bouton and Garth, 1983; Whipple, 1987).*

virtual team: Virtual teams are composed of coworkers geographically and organizationally linked through telecommunications and information technologies attempting to achieve an organizational task…Virtual teams rarely if ever, meet in a face-to-face setting. They may be set up as temporary structures, existing only to accomplish a specific task, or may be more permanent structures, used to address ongoing issues, such as strategic planning. One whose members are united by the tasks on which they are collaborating, not by geography or membership in a large organization. **1996** Townsend et al. *Virtual teams are composed of coworkers geographically and organizationally linked through telecommunications and information technologies attempting to achieve an organizational task … Virtual teams rarely if ever, meet in a face-to-face setting. They may be set up as temporary structures, existing only to accomplish a specific task, or may be more permanent structures, used to address ongoing issues, such as strategic planning.* **1997** Hofstede et al. *Virtual team is a team whose members do not necessarily meet face-to-face. Rather, they employ communication technologies such as electronic mail, videoconferencing or whiteboarding. Such technologies are often labelled groupware, computer supported cooperative work (CSCW), or group decision support systems (GDSS).* **2000** LeMay *Virtual teams are groups of geographically dispersed coworkers that work together using IT to communicate.* **2000** O'Brien *One whose members are united by the tasks on which they are collaborating, not by geography or membership in a large organization.* **2003** Pauleen and Yoong *Virtual teams are a relatively new phenomenon and Jarvenpaa and Leidner (1999) define them as temporary, culturally diverse, geographically dispersed, electronically communicating workgroups.*

virtual team management issue: Virtual team management issues are internal, external, technological and societal. **2000** Potter et al. *Virtual team management issues as internal (eg. identification of processes and characteristics of effective virtual teams), external (eg. team boundaries, gatekeeping, external communication), technological (support systems), and societal (implications for individuals and society).*

virtual team purpose: Virtual team purpose goes beyond a mission statement that is put on the wall and forgotten. Purpose must be translated into action steps that become the basis for the work people will do together. It requires cooperative goals, interdependent tasks, and concrete results. **1999** Lipnack and Stamp *Virtual team purpose goes beyond a mission statement that is put on the wall and forgotten. Purpose must be translated into action steps that become the basis for the work people will do together. It requires cooperative goals, interdependent tasks, and concrete results.*

virtual team success: Critical to the success of virtual teams are communication quality and frequency, and the availability of appropriate communication technologies. **2003** Davison et al. *Certainly communication quality and frequency, as well as the availability of appropriate communication technologies, are critical to the success of virtual teams.*

virtual team-based negotiation factors: Virtual team-based negotiation is based on a variety of factors, including goal agreement, communication effectiveness, and the use of communications technology. **2003** Davison et al. (518) *The virtual team-based negotiation is dependent upon a variety of factors, including goal agreement, communication effectiveness, and the use of communications technology, among others.*

virtual text referencing: Virtual text referencing is a CMC factor relating to text processing. The ability to reference and incorporate existing text items in new text items in a virtual manner. **1981** Turoff et al. *The ability to reference and incorporate existing text items in new text items in a virtual manner.*

VisionQuest: VisionQuest is a commercial GDSS product from Collaborative Technologies **1995** Aiken et al. *The most widely-used commercial GDSS products (GroupSystems from Ventana, TeamFocus from IBM, and VisionQuest from Collaborative Technologies)*

visual action: In shared workspaces, visual actions can provide evidence of understanding or misunderstanding. **2002** Gutwin and Greenberg *When people converse, they require evidence that their utterances have been understood. In verbal communication, a common form of this evidence is back-channel feedback. In shared workspaces, visual actions can also provide evidence of understanding or misunderstanding (Clark 1996).*

visual evidence: When people converse, they require evidence that their utterances have been understood. In verbal communication, back-channel feedback is common. In shared workspaces, visual actions can provide evidence of understanding. **2002** Gutwin and Greenberg *When people converse, they require evidence that their utterances have been understood.*

visualisation technique: Visualisation techniques supply collaborators with the awareness they require for managing the ebb and flow of moving between individual and shared activities. Visualisation techniques include radar overviews, fisheye views, and transparent layers. **1999** Greenberg (1) *Visualisation techniques that supply collaborators with the awareness they require for managing the ebb and flow of moving between individual and shared activities: radar overviews, fisheye views, and transparent layers.*

vote tabulation and display: Vote tabulation and display is a collaboration support function usually included in a GDSS (decision conference system) **1988** Kraemer and King (126) *Several general observations can be made based on information about these systems. 1. There are about three general functions and 1-2 dozen specific functions that are provided in support of decision conferences: a. structured decision analysis decision trees multiattribute utility b. structured group process social judgment analysis delphi technique nominal group technique c. collaboration support data management graphic display decision documentation tutoring decision analysis consultation group process facilitation meeting facility vote tabulation and display.*

voting*:* Voting is a CMC factor relating to communication capabilities. Provision of voting scales which may be associated with items for responses by others, with feedback to participants. **1981** Turoff et al. *Provision of voting scales which may be associated with items for responses by others, with feedback to participants.***1985a** DeSanctis and Gallupe

war room: see Decision room. **1987** Jelassi and Beauclair (from Widener 1981) *The face-to-face, close proximity, synchronous GDSS type commonly known as war room:[30] or a 'decision room' [6]. The decision room features computerized support in addition to traditional small group interaction.*

WFMS: see Workflow management system.

Workflow management system: Workflow management systems include the following types of function, which can be simulated: a workflow queue of activities or tasks which need to be performed to achieve a business process; scheduling, a routeing system for tasks and messages between team members; and task performance metrics for managers. **2003** Greasley *WFMS include the following types of function, which can be simulated: a workflow queue of activities or tasks which need to be performed to achieve a business process often prioritised in a set order according to the business rules; scheduling – assignment of tasks between a group of people, the workflow queue being queried to issue reminders to staff to perform tasks; a routeing system for tasks and messages between team members; and task performance metrics for managers – eg. task completion time.*

work group effectiveness: Work group effectiveness is described in terms of output – outcome measures: acceptable to client, group maintenance and growth and member satisfaction. **1991** Applegate (20) (from Hackman [41]) *A widely used model developed by Hackman*

[41] defines work group effectiveness in terms of output acceptable to the client, group maintenance and growth, and member satisfaction. These outcome measures are facilitated by knowledge and skill brought to bear on the task, and appropriateness of the task performance strategies implemented by the group. The influence of these process effectiveness criteria on outcome effectiveness criteria is mediated by the presence of sufficient material resources required to accomplish the task. Organisation context, group design, and group synergy influence the development of effective group processes. Goodman and collegues [37] and Gladstein [35], although agreeing with Hackman on the key determinants for work group effectiveness, suggest developing research models in finer detail.

working group graphic: Working group graphics relates to the manipulation of text-graphics on a computer screen using a graphics editor. Also known as text graphics performance. Working group graphics have both spatial and temporal structures. **1986** Lakin (256) *It is a major premise of this paper that text-graphics performed for working groups have spatial and temporal structure.*

workspace awareness*:* Workspace awareness, the up-to-the-moment understanding of another person's interaction with the shared space. At the simple level it involves knowledge of who is present, where they are working, and what they are doing. Workspace awareness is used in collaboration to coordinate activity, to simplify verbal communication, to provide appropriate assistance, and to manage movement between individual and shared work. **1990** Greenberg and Chang *The [design] workspace can be composed of: notebooks, whiteboards, shared sheets of paper on a table, tracing paper, networked computer workstations, and combinations thereof.* **1996** Gutwin and Greenberg *The affordances of physical workspaces allow people to maintain awareness of others' locations, activities, and intentions relative to the task and to the space-awareness that enables them to work together more effectively.* **1997** Schlichter et al. (from Greenberg [18]) *Different sub-types of awareness: informal awareness, group-structural awareness, social awareness, and workspace awareness.* **1999** Gutwin and Greenberg (244) *Workspace awareness, the up-to-the-moment understanding of another person's interaction with the shared space. At the simple level it involves knowledge of who is present, where they are working, and what they are doing. Workspace awareness is used in collaboration to coordinate activity, to simplify verbal communication, to provide appropriate assistance, and to manage movement between individual and shared work.***1999** Hayashi et al. (Fuchs et al. 1995) *Modes of workspace awareness classified into four categories: synchronous-coupled, asynchronous-coupled, synchronous-uncoupled, and asynchronous-uncoupled.*

workspace capability: Workspace capabilities may be portable, eraseable, simultaneously accessible, layerable, and editable. The composition of the workspace determines what capabilities are afforded and thus plays a major role in structuring the participant's workspace activity. **1990** Greenberg and Chang *These diverse options represent a variety of capabilities: portable, eraseable, simultaneously accessible, layerable, editable. The composition of the workspace determines what capabilities are afforded, and thus plays a major role in structuring the participants' workspace activity (Tang, 1989 page 66).*

WYSIWIS: *Pronounced "Whizzy whiz". WYSIWIS stands for What you see is what I see. WYSIWIS refers to the presentation of consistent images of shared information to all participants.* ***1987*** *Stefik et al. WYSIWIS (what you see is what I see – pronounced "Whizzy whiz"), which refers to the presentation of consistent images of shared information to all participants.* ***1989*** *Ellis and Gibbs WYSIWIS interfaces have two implications on concurrency control. First response times are important - the time taken to access data, modify data, or notify users of changes must be as short as possible. Secondly, if the concurrency control scheme entails the use of modes where actions of one user are not immediately seen by the others, then the effect of these modes on the group's dynamics must be considered and only allowed if they are not disruptive … The work on WYSIWIS (what-you-see-is-what-I-see) interfaces [12, 13], has shown the importance of providing each* *participant with information on the activity of other group members. Shared windows, remote cursors and telepointing are all useful constructs for depicting group activity. However, WYSIWlS interfaces present problems of real estate management (its easy enough for one person to clutter a display) and distraction (e.g.., having someone close a window just as one is about to use it).* ***1996*** *Greenberg and Roseman Strict WYSIWIS, where the visuals are kept identical across all displays.*