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Development processes and performance in groups using an electronic meeting system: A comparison of face-to-face, synchronous and asynchronous meeting environments

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University of Hawaii, 1994

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DEVELOPMENT PROCESSES AND PERFORMANCE IN GROUPS USING AN ELECTRONIC MEETING SYSTEM: A COMPARISON OF FACE-TO-FACE, SYNCHRONOUS AND ASYNCHRONOUS MEETING ENVIRONMENTS

A DISSERTATION SUBMITTED TO THE GRADUATE DIVISION OF THE UNIVERSITY OF HAWAII IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN COMMUNICATION AND INFORMATION SCIENCES

DECEMBER 1994

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DEDICATION

This work is dedicated to my parents,
Charles M. and Roberta M. Burke
and to Bonnie and Sean.

When at times I did not, my parents and my wife, Bonnie, always
saw in me the potential for and encouraged my pursuit of
excellence. I wish my father were alive today to share with my
mother, my family, and me this realization of my potential. I
hope to be as supportive of my son Sean as my mother, father,
and Bonnie have been of me.
ACKNOWLEDGMENTS

I have many people to thank for their thoughts, opinions and ideas. My colleagues in the doctoral program and the College of Business Administration provided extensive intellectual exchange. Prominent among them were my good friends Beverley Hope and Rich Halverson. Many of Rich’s ideas were incorporated directly into the design of this study. Judy Kautz always managed to give me just the right words of encouragement at just the right times.

My committee members all offered great support throughout the process. Among them, I am especially indebted to Bill Remus for keeping me focused on the big picture and to Kelly Aune for hours of dialog, much of which stimulated me to think in entirely new directions.

I will honestly never be able to thank Laku Chidambaram enough for his help, support and guidance. Without stifling my ambitions, he provided the intellectual guidance necessary to envision the project, the experience necessary to define it in achievable terms and the discipline necessary to ensure that quality was always the primary objective. Most importantly, he prodded me gently when I needed it, always concerned for my mental and emotional welfare. Somewhere along the way he became my dear friend.

Finally, my wife Bonnie and my son Sean were an oasis of love and life for me during this consuming process. Without them, quite simply, this dissertation would not have been possible. I love you both.
ABSTRACT

Many factors in the current business environment compel organizations to seek global ventures and alliances. Such globalization often results in new organizational structures and behaviors. For example, workteams must be able to perform tasks while members are distributed across geographic and temporal boundaries.

Technology presents opportunities for teams to collaborate in novel ways. However, researchers understand very little of the effect of some of these technologies on groups. This study employed a controlled laboratory experiment to examine group development and communication processes in the context of electronically supported meetings.

In particular, the study explored the following questions:

1. Are behavioral and development dynamics different in groups meeting in structurally different environments?

2. Are communication behaviors and effects different in groups meeting in structurally different environments?

3. Does performance differ between groups meeting in structurally different environments?

These questions were tested using a single factor with three levels repeated observations research design. This study is one of the first to analyze these issues in teams meeting from different places at different times over a period of time. The variables examined are described below.
Independent variable: Meeting environment. Environment was manipulated across three levels - face-to-face, distributed synchronous, and distributed asynchronous.

Dependent variables: Group development, communication effectiveness, and performance. Development was measured by the level of perceived cohesiveness, conflict management, and group process effectiveness. Communication effectiveness was measured by perceptions of social presence, communication effectiveness and satisfaction with the communication interface. Performance was assessed by the quality of the documents produced.

Controlled variables: Technological support, task type, group size, individual differences (through randomization), and time spent on task were all controlled across and within treatments.

Thirty three groups of four members each were evenly divided between and randomly assigned to the three conditions. Results of the study indicate that the structure of the meeting environment may not exhibit a significant impact on group development. On the other hand, environment may affect performance. Some support is shown for the theoretical argument that, over time, groups adapt to and appropriate the structures within which they operate. Further, evidence suggests that structures vary in the extent to which they can be appropriated.
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CHAPTER I - INTRODUCTION

Technology is rapidly altering communication in organizations. For instance, relatively simple technologies like e-mail are beginning to increase the frequency and extent of communication opportunities available. More sophisticated and complex technologies such as Computer Supported Cooperative Work (CSCW) systems and Decision Support Systems (DSS) support and even add structure to various types of communication, meeting, and task activities.

The availability of such technologies promises to change the very nature of organizational meetings. For example, as bandwidth and technology decrease in cost and increase in power, portable communication systems will become ubiquitous. Meetings will be conducted via multi-media workstations from any/every desktop in the workplace. Smaller and more portable personal computing devices may eventually allow meetings to be conducted with group members literally on the move. The result will be that many types of organizational meetings which are currently conducted face to face will instead be conducted with members being geographically distributed, i.e. one will “meet” others without having to leave one's workspace.

1.1 Changing Organizations

1.1.1 Structures

Many domestic organizations are beginning to enter into temporary but significant alliances with overseas partners. These alliances develop quickly in response to the rapid emergence of opportunities and changes in the business
environment (see for example, Byrne, Brandt, and Port, 1993). Swift reaction to environmental dynamics is necessary to gain or maintain strategic and competitive advantage; appropriate use of information and information systems can facilitate the acquisition of competitive advantage (Porter and Millar, 1985; Wiseman, 1988).

Recent discussions of the "Virtual Corporation" provide a closer look into the types of organizations which are likely to succeed in the nineties and beyond. Alliance formation and project development will occur primarily through the efforts of teams of people representing the various affiliated organizations (Byrne, Brandt, and Port, 1993). Wide area networks (WANs) offer a medium for these workteams to conduct many of their tasks.

Many management experts believe that the structure of the modern organization is flattening as layers of middle management disappear from many firms (e.g., Cash, McFarlan, McKenney, and Applegate, 1992). This has resulted from a movement toward downsizing and trimming of costly and unnecessary "organizational fat." The traditional hierarchical structure required managers to channel communication flows from top to bottom and vice versa in the organization. Flatter structures may emphasize the dynamic exchange of information among co-workers -- i.e., horizontal communication -- over routine vertical reporting which typically filters through multiple layers of management. This new emphasis on collaborative interaction, often times unstructured relative to reporting types of communication, provides a potential context for the use of new channels and methods of communication.

Such an organizational evolution also promises a more egalitarian and participatory management style in all types and sizes of organizations. Workers and workteams will continue to become more actively involved in organizational planning, design, and decision making. These teams will need to develop
sophisticated communication networks in order to effectively manage the flow of information within the evolving organizational structures.

1.1.2 Workteams

These workteams of tomorrow will be varied and flexible and engage primarily in "intellectual teamwork;" they will be "people working together over substantial periods of time to create information-intensive products" (Galegher and Kraut, 1990, pp. 65). Johansen (1990) argues that technology will need to support communication and work processes congruent with new and rapidly changing task scenarios and workteam practices.

1.1.3 Globalization

American businesses find themselves competing with foreign rivals for global market share. Firms must engage in global business or risk losing revenues to companies who are willing to explore international markets. The "Virtual Corporation" is, in part, a response to such a need. But the globalization of business introduces a host of challenges concerning the coordination and accomplishment of group tasks. For example, critical difficulties arise in the coordination of activities when collaborating team members are located in different time zones (e.g., employees in Hong Kong and the US). Hence, it has become extremely important to understand the problems which occur with asynchronous global collaboration and communication.

1.1.4 Meeting Environments

The convergence of all these conditions implies that groups will become more prevalent as the primary work units responsible for organizational and job
design, decision making, project development and other activities previously considered part of management's purview. Further, it is clear that electronic communication and meeting technologies, especially the distributed variety, will facilitate those processes in which workteams must engage as they move their organizations into the twenty first century. As Nunamaker et al. point out:

"Meeting environments of the future must seamlessly support the many ways that people work together; as individuals and in groups, face-to-face and geographically dispersed, synchronously and asynchronously." (1993, pp. 125)

The purpose of this study was to examine some of the behavioral and contextual variables which are significant to human interaction in an organization. Specifically, this study looked at group development and communication factors within the structural meeting constraints imposed on distributed workteams. The sum of the structural constraints (e.g., synchronicity of interaction, capacity of communication medium, dispersion of participants, etc.) with which this study was concerned constitutes what will be referred to as the "meeting environment." The issue of interest here is the long-term effect of meeting environment on various group processes and group performance.

1.2 Statement of Problem

Management research in general appears to be lagging the evolution of technological and organizational change. One area which needs to be investigated concerns the impact of modern communication and meeting facilities on various group dynamics and processes. Additionally, research concerning distributed asynchronous teamwork (i.e., different time, different place) is relatively scarce.

This study reviews and integrates research from two distinct, yet related, areas - group decision support systems (GDSS) and computer mediated
communication (CMC). GDSS has been a rather prolific arm of Management Information Systems (MIS) research and offers a considerable amount of information from which to draw. CMC is also a well established area of research examining issues related to electronic modes of communication.

An assumption common to both areas is that technology functions to facilitate communication and information exchange in meetings and, therefore, is integral to the meeting process. Consequently, the effects of technology on meeting processes and outcomes are of concern to practitioners and researchers of information systems. This study extends and unifies current GDSS and CMC research by examining issues related to group communication, behavior, development, and performance.

Some researchers perceive the GDSS/CMC classifications as overly restrictive and too narrowly focused. For instance, Dennis et al. (1988) suggested applying a more ecumenical term which would embrace all forms of electronic meeting support. With the hope of helping to integrate the work from a variety of different and (to some extent exclusive) disciplines and following the lead of Dennis et al., this paper refers to all such support as electronic meeting systems (EMS). EMSs are broadly defined as:

"...systems that use information technology to support the group work that occurs in meetings." (Dennis et al., 1988, pp. 593)

Many variables have been studied in EMS research (see for example, Pinsonneault and Kraemer, 1990) including such independent variables as media type, group size, task, etc. and dependent variables such as time taken, performance, decision quality, number of alternatives generated, satisfaction with decision, etc.
(e.g., Jarvenpaa et al., 1988; Zigurs et al., 1988; Hiltz and Johnson, 1990; Chidambaram and Bostrom, 1993).

Some studies have looked at such decision process characteristics as consensus (e.g., Siegel et al. 1986; Poole et al., 1991) and equality of participation (e.g., Hiltz et al., 1986; Siegel et al., 1986; Lewis, 1987; Connolly et al., 1990); communication processes such as categorization or quantitative analysis of communicative interacts (e.g., Hiltz et al., 1986; Rice and Love, 1987); and perceptions of communication effectiveness (Walther and Burgoon, 1992). The present study focuses on these and other factors which influence group dynamics.

There exists a noticeable paucity of research concerning team processes in electronically mediated groups. While some researchers have studied such processes (e.g., Hiltz et al., 1986; Siegel et al., 1986; Losada et al., 1990; Walther and Burgoon, 1992; Chidambaram and Bostrom, 1993; Chidambaram and Jones, 1993), there is a need to build on and extend these works (Zigurs et al., 1988).

As Losada et al. (1990) argue:

"Opening the black box of group process has been a desideratum for many decades. Unfortunately not enough progress has been made to fully accomplish this objective." (pp. 53)

The aim of the current study is to examine this black box more closely. We need to understand the dynamics underlying the relationships between people, media, and communication (Rice and Love, 1987) and to extend our investigations to include the processes which comprise the fundamentals of workteam communication and development. To fathom group development as a whole, knowledge of the particular interactions and the perceptions of those interactions which occur and recur between input and observed output must be further developed. The current study was designed to discover information which might
help illuminate these communication and development processes in electronically supported groups.

Hence, within a theoretical framework outlined in chapter 3, the following questions were specifically investigated:

1. What differential impact, if any, do structurally disparate environments have on behavioral and developmental dynamics in groups?
2. What differential impact, if any, do structurally disparate environments have on communication behaviors and effects in groups?
3. What differential impact, if any, do structurally disparate environments have on group performance?

As pointed out earlier, some EMS studies have looked at some aspects of the first issue, group development (e.g., Siegel et al. 1986; Lewis, 1987; Chidambaram and Bostrom, 1993). However, many relationships, especially in the contexts of distributed and asynchronous group activities, have yet to be explored. This study is the first to compare the effect of structurally distributed meeting modes on group development processes.

A small but growing body of research exists in the CMC literature which has addressed the second issue, i.e., that of communication factors impacted by "media" (e.g., Rice and Love, 1987; Walther and Burgoon, 1992). However, much of this research focuses on interactions which are not specifically task focused, e.g., ongoing "bulletin board" conferences. The present study examines the differences in communication behaviors (and their effect on the group's development) which occur in distributed task-focused workgroups meeting in different environments.
Finally, many studies in both EMS and CMC have examined performance differences between media types (e.g., Hiltz et al., 1986; Zigurs et al., 1988). However, none has compared performance levels of groups meeting in distributed synchronous and asynchronous modes. One objective of the current study is to determine whether performance varies between groups meeting synchronously and those meeting asynchronously.

Thus, the present study integrates and extends several bodies of current research concerned with perceptions of *development and communication processes in distributed workteams*.

1.3 Importance of Research

In this section the steps taken in this study to overcome some of the problems and shortcomings in earlier EMS research are discussed. This section also addresses how the current project will add to and extend previous studies.

1.3.1 Group Development and Communication

Issues associated with group development are important to organizations (McGrath, 1984) and have been examined by some EMS researchers (e.g., Walther, 1992a). However, a review of the extant literature reveals many questions relevant to electronic group processes that have yet to be addressed. One such issue concerns the relationship between perceptions of group processes (e.g., cohesion) and perceptions of communicative effectiveness in technology supported meetings. Most GDSS and CMC studies have investigated either development factors (e.g., Jarvenpaa et al., 1988) or communication factors (e.g., Rice and Love, 1987), but few have looked at both. Yet, many argue that group processes are dependent on interpersonal communication (e.g., McGrath, 1984; Fisher and Ellis, 1990). In this
study, both developmental and communication factors were studied in electronically supported groups.

1.3.2 EMS Research and Time

Another important issue which concerns behavioral research in general (McGrath, 1988) and EMS research in particular (Chidambaram, 1989), is the importance of employing temporally appropriate methodologies when examining group processes. Groups in real life tend to meet repeatedly over long periods of time. However, as Walther (1992) points out, most lab studies examine ad-hoc groups meeting for a single session. Results from single session studies must be interpreted with this limitation in mind. The current study explores group development by observing work teams over four sessions spanning four weeks. Thus, unlike one shot designs, this study examines group development over time adding realism and relevance to current research.

1.3.3 Implications of Research

The practical significance of this study is that managers in organizations will have a better understanding of the problems which work teams encounter when using technology repeatedly to conduct collaborative tasks across space and time. Distributed work groups are likely to encounter difficulties very different from those confronting collocated groups. Further, groups which are not able to conduct activities synchronously are likely to encounter very different problems than do synchronous groups. Therefore, the comparison of the effect of such structural meeting constraints on the development and communication processes of work groups is an essential contribution of this study. By assessing activities
from a structurational perspective, group participants are observed in the process of adapting their structures as a means of overcoming structural impediments.

1.4 Overview of Dissertation

Chapter II discusses the theoretical foundations underpinning the research framework used in this study. Weaknesses in current social interaction theory are pointed out and the fundamental principles of structuration theory, as a more explanatory alternative, are described. The significance of this chapter is that, herein is argued that group development, as an instance of social interaction, is governed by rules and constraints known as structures. Further, all interaction also redefines those structures within which they occur. Understanding interaction in this way leads to the acknowledgment that the process of structuration is a means by which people adapt, not only their actions, but also their environment, to suit their needs. This study takes the position that such adaptation extends to the perceptions and use of technology by groups.

Chapter III presents a review of prior literature. Research relevant to the issues raised in Chapter II is discussed at length in this chapter. The chapter represents an attempt to integrate two disparate fields -- GDSS and CMC -- in light of some of their common objectives. Limitations of the research are discussed and the strategies employed by this study to avoid these limitations are also outlined.

Chapter IV provides a detailed explanation of the various components of the research model introduced in Chapter II. The chapter describes each of the
concepts outlined in the model and provides insight into the nature of the relationships between the factors. The chapter also integrates the concepts within the theoretical perspective proposed earlier.

Chapter V gives a detailed statement of the problem. This chapter describes the various ways in which the components of the framework outlined in Chapters II and IV were operationalized for the purposes of the current study. From the problem analysis, three sets of hypotheses are developed; one deals with behavioral structures, another concerns socio-technical structures, and the third relates to performance issues.

Chapter VI describes the research methodology. The experimental design, subjects, task, training, system functions, controls and treatments are explained in detail. Additionally, the major results and lessons learned from the pilot study are reviewed.

Chapter VII focuses on the results of the data analyses. The statistical methods used in the study are described and applied to test the hypotheses. The results of those tests are explained in detail. SPSSx on a VAX computer is the statistical package used to analyze the data and the multivariate analysis of variance (MANOVA) for repeated measures is the primary analytic technique employed.

Chapter VIII presents a discussion of the results from the statistical analyses and interprets those findings in terms of the theory outlined earlier. Assumptions and limitations of the study are described along with the
implications of the findings for both researchers and organizations and issues for future research.

Finally, the task materials, instruments employed, judge’s evaluation worksheets and all other information relevant to the study are presented in the appendices.
CHAPTER II - THEORETICAL FOUNDATIONS

This chapter begins by outlining the theory which encompasses the research framework used in this study. Following that, it briefly describes two theories of technology use which are particularly relevant to the investigation of electronic meeting environments and which will be addressed further as the hypotheses are developed. The discussion continues by introducing a research model which provides an integrative view of the variables of interest to this study. (Note: a detailed explanation of the framework is provided in Chapter IV) Finally, the chapter broaches the concept of the relative mutability of structures and the significance of this characteristic to the structuration process.

2.1 Adaptive Structuration Theory

Adaptive Structuration Theory (AST) presents a theoretical framework for discussing the relationships between individuals whose interaction is mediated by technology and the characteristics of the technology being used. Recently, Poole and DeSanctis (19894) and others (e.g., Orlikowski, 1991; Banks and Riley, 1992; Gopal et al., 1992-93) have prescribed AST as an approach for looking at the impact of people on systems and conversely, the effect of systems on people. Although a few EMS researchers, for instance Gopal et al. (1992-93) and Poole and Lind (1991), have applied structurational concepts in an empirical context, most AST work to date has been rather theoretical in nature. The fundamentals of AST are discussed in detail next.
2.1.1 Social Interaction

Adaptive Structuration Theory (AST) offers an integrating conceptual perspective for examining a variety of social interactions. The use of technology by humans in virtually any setting, but especially in an organizational context, is an important dimension (or perhaps more accurately, an extension) of social interaction.

a) Problems in Explaining the Nature of Social Structures

Giddens (1979, 1984) presents a view of social interaction which differs from traditional perspectives. Most earlier ontological and social theoretical frameworks explain meaning in life, and all which issues from that (e.g., society), as being substantially tied to one of two distinct essences. For some (e.g., structural functionalists) the objective world (i.e., the world external to our personal consciousnesses) and its attendant rules, norms, and structures determine human action. That is, human action is constrained by the contexts and social structures within which such acts occur. For example, when a person engages another in conversation, the interaction is guided by certain socially accepted norms of conversational protocol. Thus, socially posited rules set the context for the interaction and, consequently, determine much of the interaction.

For others (e.g., symbolic interactionists) human agency and intent are at the core of social construction. People create social meaning and structures by the very process of interaction. That is, by their actions, individuals cause the construction of social norms. For example, when two strangers meet, they may tend to act rather cautiously and formally toward each other as prescribed by certain structural social customs. However, as they interact they might begin to discover that they share much in common. This discovery redefines the nature of their relationship and new
rules are established governing future interaction. In this way, structures are emergent phenomena, dependent for their existence on human interaction. Social meaning is, thus, derived through human agency.

There are philosophical problems inherent in this dualism. Each position has merit, but, at the core of the argument each essentially precludes the other. In other words, it is problematic to assume that social structure derives primarily from either preexisting social rules or human intentions. For example, assuming that structures are the determinants of interaction, how is it, then, that rules and structures change? On the other hand, if human agency is the determinant of social reality, to what extent must that human behavior be constrained by these structures?

A more general and important criticism of both positions, however, is that they fail to adequately resolve the juxtapositioning of macro and micro social processes. In general, the structuralist-objectivist position has difficulty explaining emergent individual patterns of behavior while the interactionist-subjectivists fail to properly account for the influence of macro level social structures and institutions on individual behaviors. For a detailed accounting of this problematic dualism pertaining to many prominent social theories see Turner (1991).

The relevance of social theory to the study of group activities in organizations is critical. On the one hand are those who would argue that a meeting environment and its attendant characteristics determine group processes. A case in point is the technological deterministic argument that technology design characteristics result in particular patterns of use. That is, technologies are only appropriate for very specific uses (e.g., Short et al., 1976; Daft and Lengel, 1986). The practical consequence of this perspective is that, if true, then designers need to build a number of systems or features to support a large array of human interaction activities. However, the reality is that even a relatively simple and one dimensional
technology like the telephone is used more creatively than was expected until recently (e.g., phone cells which provide “anytime-anywhere” accessibility). Thus, building costly adaptive systems may be unnecessary.

Opposing the structuralists are those who believe that the actors are most responsible for the outcome regardless of meeting environment. To continue the technology example, interactionists would contend that those who use a technology are the primary determinants in the study and design of that technology. One need only consider the ergonomic issues which have plagued computer users over the years to understand that, frequently, technology is developed with little initial regard for its potential impact on human users. Hence, the structuralist-subjectivist dualism has resulted in theoretical and practical problems which need to be resolved.

b) From Dualism to Duality

If we wish to account for the full range of social interaction we need to bridge these opposing perspectives. That is, continuing to try to explain the complex results of group meeting processes in either subjectivist or structural terms promises to be less than satisfactory. Giddens (1979) has attempted to unify the viewpoints with his theory of structuration. Rather than placing the determination of social reality at either end of the theoretical spectrum, Giddens argues that the social context is constructed at the nexus of human agency and social structures. Social reality is a result of the interaction between knowing actors and the rules which constitute society. Giddens maintains that the structures which emerge from these interactions then constrain and influence subsequent human action which, in turn, further impacts and restructures social norms.
Orlikowski, (1991) refers to this as the duality of structures. Duality describes the complex and perhaps infinitely recursive nature of the interaction between structures and human activity. Hence, it is inappropriate to emphasize the significance of one over the other in the course of social interaction. Structures affect action which in turn affects structures resulting in continuously evolving modes of interaction

c) Adaptive Structuration Theory

Poole (1983) has developed a structurational theory of group development which has its roots in Giddens' social theory of structuration. The underlying concept is that social and group structures, e.g., roles, rules, norms, facilities, media, environments, etc., act as constraints within which groups must function; at the same time these structures are restructured or altered through their use so as to better serve the specific needs of the group. That is, groups may tend to appropriate comparable structures in different ways depending on such factors as task and group personality. Through this appropriation process, the structure is altered for future application, often with unintended consequences.

This process is recursive and can be cumulative in that the resultant structure constrains future activities which causes the development of even newer structural forms and so on. The changes in the forms may be subtle or radical. Evidence of this phenomena which Poole refers to as "adaptive structuration" has been documented through several studies (e.g., Gopal et al., 1992-93; Chidambaram and Bostrom, 1993).
**d) Applying Lessons Learned**

From this discussion it is clear that researchers need to further understand the details and implications of the various processes which comprise group activity. As argued earlier, an important question concerns the effect of technology on the development of the group. Specifically, Poole and Roth (1989) have developed a relatively comprehensive contingency model of group decision development which can be applied to group development in general.

One issue of concern relates to the level of analysis. For example, Poole and Roth (1989) present a high-level typology of variables which are integral to the group structuring process. Among the variables they postulate as structurally significant are cohesiveness, power concentration, conflict history, and group size. In order to understand particular effects in terms of structuration, however, it is necessary to appropriately operationalize these constructs. How are these variables and constructs applied, mediated, or used differently through various modalities of interaction? This study focuses on three of Poole's constructs (i.e., cohesiveness, power concentration -- i.e., in terms of participatory domination -- and conflict history) which will be described in detail in Chapter IV and operationalized in Chapter V. Group size, also a construct of concern in Poole and Roth's theory, was controlled in this study.

While several researchers have begun to investigate the structuration of group processes at a microlevel (for the most notable example, see Poole and DeSanctis, 1992), analyses of structurational processes are relatively scarce. Applying AST and its integrating characteristics as a research framework, this study examines the relationships between media, context, and processes in work groups at the level of individual perception.
2.1.2 Evidence in Support of AST

Recently some studies have empirically examined the validity of AST in the context of group behavior. Gersick (1988, 1989) in a longitudinal study of “real” groups in naturally occurring organizational and community settings, found that groups tended to settle into stable periods of activity directly following their first meeting. However, in every case she observed (n=8, but across a diverse range of task types), the group underwent a definite change in activity pattern at precisely the temporal mid-point in the process. Upon realizing that the allowable time period was half gone, groups redirected their activity patterns by ending one stable period and quickly establishing a second period of stable activity (exhibiting a pattern different than in the first stable period) which lasted until time expired. Gersick terms this phenomena “punctuated equilibrium.”

From an AST perspective, such a pattern of behavior can be explained as a “new” understanding at the halfway point by group members of existing structural constraints. Members perceived that they reached some epochal point and embarked on a period of transition. The transition entailed a restructuring of earlier behavioral patterns into new behaviors which they felt were more appropriate in light of their new understanding of environmental circumstances.

This was only one study and may not be considered compelling evidence of AST. Nonetheless, such a course of events may correspond to group development processes in general. However, AST is a relatively new theoretical perspective and more empirical research is necessary in order to decompose the structural environment and to understand the systemic relationships and the nature of the structuration process.
2.1.3 Summary

Social interaction is best described from a structurational perspective. AST argues that structures continually evolve out of an interaction between intentional agency and existing structural constraints. The emergent structures enable and constrain subsequent social activities. Structures take many forms. Rules of interaction, roles assumed by individuals and tools which people employ in the course of social interaction are all examples of structural components of the social context. Understanding these structures (both relational and technical) and the process of their evolution is critical to understanding human interaction in general and group activities in particular. With respect to the role which technological structures assume in group processes, two theories, often applied in EMS research, are especially relevant to the present study. These theories are briefly outlined in the next section.

2.2 Theories Regarding Technological Structures

2.2.1 Social Presence Theory

Social presence refers to the extent to which one feels the presence and salience of a person with whom one is interacting. Social presence theory (Short et al., 1976) argues that some media are more efficient than others for relational communication. On the other hand, Short et al. maintain that other media are better suited for non-relational -- e.g., task focused -- communication, depending on the degree to which the media exhibit social presence. For purposes of this study,
"relational," used in the context of interactions and structures, refers to aspects of the interaction which involve social/personal issues and thoughts as opposed to "task" related issues. Specifically, Short et al. assert that face-to-face interaction is most effective with respect to socio-emotional communication requirements because of the capacity of the medium to transmit proximal, facial, and other nonverbal cues. In contrast, computerized media such as electronic bulletin boards permit the transmission of fewer types of visual and non-verbal cues. Therefore, non face-to-face media are less effective for interpersonal communication.

Since different media exhibit varying capacities for social presence, social presence may be considered a variable structural characteristic of the medium. Further, the capacity of a medium to transmit the various types of non-verbal cues is measurable, i.e., the relative social presence of a medium can be quantified. Communicators are, therefore, likely to choose a medium depending on the transmission requirements of the intended message and the relative capacities of the media available. Implicitly, in a group and task setting which requires relational interaction (e.g., conflict laden or long term projects), performance is likely to suffer if the environment mediating the interaction lacks in social presence. Further, social presence theory suggests that aspects of group development which require relational communication, e.g., cohesion, are likely to be less responsive in distributed environments than in face-to-face settings.
2.2.2 Media Richness Theory

Information equivocality -- i.e., the potential for having more than one interpretation -- is inherent in most social interactions and must be reduced to a minimum if mutual understanding is to occur. Interaction can be seen as the exchange of symbols, which represent jointly understood meanings, in order to clarify issues not yet agreed upon by both participants. Thus, the more able interactants are to convey information, the greater the potential for reducing total equivocality.

Daft and Lengel (1986) and Trevino et al (1990) argue that media vary in the amount of information they can deliver. Therefore, media can be characterized by their "richness," i.e., according to their capacity to reduce equivocality and, thereby, to facilitate shared understanding. The term "media," as used by Daft and Lengel, denotes the environment (e.g., face-to-face or telephone) within which information exchange and communication occur. Hence, meeting environments can be said to vary in "richness."

The richness of a medium is determined by four media factors including feedback immediacy (i.e., interactivity), cue transmission capacity, use of natural language and personal focus (i.e., the extent to which the medium allows the inclusion of personal information like emotions). For example, face-to-face communication allows instant feedback, has the capacity to transmit many types of verbal and nonverbal cues, allows the use of natural language and accommodates highly personal communication foci. Thus, face-to-face is a very rich environment
for communication. Leaner media, such as e-mail, written memos, flyers, etc., differ from face-to-face and among themselves along all four dimensions of information richness. For instance, written memos convey a limited amount of cue types (e.g., text, exclamation points, signatures, etc.) and tend to lack immediacy.

Implicit in this view of media is that different environments will be suitable for different purposes. A group which has no history of interaction between members working on a task which requires a great amount of issue clarification is likely to perform poorly in the “lean” environment. Conversely, with the capability to communicate more types of messages, groups have the potential to perform relatively better in a “richer” environment.

2.2.3 Summary

Social presence and media richness theories lead to similar conclusions about the role of technical structures in human interaction. Specifically, both theories presume that the process and, consequently, the outcome of an interaction is constrained to some extent by the environment’s technical characteristics. Thus, both theories propose that techno-structural properties are determinants of the interaction process. In doing so, they assume a one sided explanation for technology effects. Social presence and media richness proponents -- like the structural functionalists -- attribute cause and effect to the structure (i.e. technological determinism) without regard to the intentions and inventiveness of the agents acting in the environment. Nonetheless, these theories have had a
positive effect in generating critical discourse concerning the impact of technical structures on group interaction and development.

2.3 Time As A Structural Factor

Time has been overlooked in much of the earlier EMS work and, in fact, has been ignored in most social science research (McGrath, 1988). With respect to behavioral research, time can be treated as an independent variable, a dependent variable or as a methodological factor (McGrath, 1988). Because group interaction and structurational processes occur over time, the present study treats time as a methodological factor which is neither manipulated nor measured. However, time is clearly a structural factor in that it is both a resource (allowing action to occur) and a constraint. For example, since action takes place in time, having more time to do the work may afford actors greater opportunity to accomplish their objectives. In this sense, time is a resource. On the other hand, time is also a constraint since most organizational activities must be performed within some fixed temporal period. Because it impinges on interaction, time was controlled in this study.

2.4 A Structurational Model of Group Interaction

Because group interaction is a dynamic process, it is appropriate to view group development from an input-process-output perspective, as presented graphically by the model in Figure 2.1. According to this model, differences in structural characteristics of the meeting mode (inputs) coupled with the influence of process boundary variables such as duration of the process (time) will result in
corresponding differences in the way participants perceive the state of process factors such as communication and behavior (processes). Because the components in a system of human interaction exhibit reciprocal effects (Giddens, 1984), perceptions of the group processes are influential in determining individual and group behaviors. Hence, in the spirit of structuration theory, this study takes the position that group members’ perceptions of structural factors, e.g., cohesion and communication effectiveness, are indicators of and agents in the restructuring of group development processes. Changes in process states and perceptions of the process states will determine the group’s performance along a variety of measures (outputs).

2.5 Structural Mutability

In Figure 2.1, the three major elements of the framework, i.e., inputs, processes, and outputs, combine to form the structural context of any activity. Each of these contextual elements can be decomposed into a myriad of structural factors; the variables of interest in this study constitute a subset of the structural whole.

*Note to Figure 2.1: After this model was developed, a broader model with components which resemble portions of the model depicted here was discovered in Mennecke et al. (1993). The resemblance is unintentional but the independent development of two similar frameworks may provide some validation of the models.
Figure 2.1: Research Framework
The hypotheses tested in this study rest on the premise that structures vary in their tendency toward permanence. Some structures are extremely rigid and resistant to alteration; these can be called “immutable.” Others are quite malleable and may be termed “mutable.” For example, the social norm that one should not take another’s life is an immutable structure. While there are situations where killing is acceptable, it is still a social truth that there are many situations where killing is never acceptable. In contrast, other norms of behavior may be very fluid. For instance, someone may answer the telephone in a casual style but, upon realizing that the caller wields some amount of power (e.g., a prospective employer), may immediately alter the tone of their response to a more appropriately formal one. People behave toward others based on their knowledge of others’ status, demeanor, and other factors which, at first meeting, may be misinterpreted or overlooked. As the interaction proceeds, a more accurate or complete understanding of these characteristics begins to emerge and the participants adjust their behavior according to these new understandings. Thus, structural factors may exhibit differing degrees of flexibility.

If structures do vary in this way, then the particular characteristics of the structuration process may depend accordingly on the mutability of the structures. Softer, more mutable structures will likely evolve more readily than the less mutable structures. In a context where most of the structures are fluid, we would expect to observe greater rates of change than in a situation dominated by rigid structures, i.e., heavily constrained.
In the context of the problem examined in this study, environmental factors -- e.g., the fact that some groups had to meet asynchronously and the technology they were required to use -- are extremely rigid structures. However, some of the relational factors, e.g., cohesion or other aspects of the group process, are more mutable and can change quite easily. Therefore, the relational structures are expected to exhibit a greater tendency to change than the socio-technical factors.

Both types of structures are expected to exhibit structurational processes and, thus, should not be viewed as either subjectively or structurally focused. Further, it should be noted that mutability is not the only factor which determines a structure’s capacity for change. For example, a groups’ motivation to perform may affect its rate of structural adaptation. Moreover, structures may be more or less imperative as the situation dictates. This study takes the position that relative mutability is an important and measurable factor related to structural change.

### 2.6 Summary

This chapter began with an explanation of structuration theory as a potentially more explanatory alternative to structuralist and interactionist social theories. Two technologically deterministic theories which are relevant to EMS research were then outlined. The chapter also introduced the conceptual framework used in designing this study explaining that the components are actually the structural rules and resources which comprise the interaction environment. The chapter concluded with a discussion of an essential premise
that structures vary in their permanence and that the nature and direction of the structuration process depend in part on the mutability of the structures. The next chapter will provide a review and integration of research relevant to the theory and model discussed in this chapter.
CHAPTER III - LITERATURE REVIEW

This chapter presents a review and an integration of electronic meeting systems (EMS) studies which focused on factors relevant to the research model proposed in the previous chapter. Most research which addresses the issues investigated in this study tend to be classified into one of two areas. Group decision support systems (GDSS, also known as group support systems - GSS) are systems which generally structure group meetings and provide tools that support decision making and other group processes. Computer mediated communication (CMC) refers to systems which originally focus on facilitating the communication between individuals as well as between group participants. However, GDSSs have evolved to support the full range of group activities including communication (e.g., Ventana Corporation’s GroupLink) while CMC systems frequently support decision making in addition to communication (e.g., EIES at the New Jersey Institute of Technology). Because the fundamental process underlying all group interaction is communication, the bifurcation of GDSS and CMC research is somewhat arbitrary. Moreover, differentiating between GDSS and CMC is counterproductive to the extent that such polarization prevents synergy between researchers in both areas. In this study GDSS and CMC are seen as non-orthogonal dimensions of environmental support (i.e., EMS) within which groups perform. Hence, theories, paradigms and research from the two fields need to be unified; the present study provides a starting point.
This chapter is organized into five sections. The first two sections discuss prior studies in the context of either the relational or the socio-technical structures proposed by the structurational research model shown in Figure 2.1. The third section presents a summary of the limitations of prior research. The fourth section discusses strategies used in the current study to avoid earlier limitations and the final section briefly summarizes the chapter.

### 3.1 Relational Structures

An investigation of EMS research reveals that many behavioral factors have been examined (Table 3.1). Cohesion is one of the most important group structures in small group research (McGrath, 1984). Thus, cohesion and the various structures which impact on cohesiveness (e.g., influence, attraction, affection, communication patterns, etc.) together comprise the first category of behavioral variables. Conflict management is another structure which affects development in groups. Finally, satisfaction from working with groups derives from the effectiveness of the procedural structures within which the group operates and the group's perceptions of those processes.

#### 3.1.1 Cohesiveness and Related Structures

Curiously, as important as cohesion is to groups, it was examined directly in only one of the studies reviewed here. Chidambaram (1989) compared computer supported versus non-supported groups (i.e., those having access to manual decision aids such as flip charts, etc.) over four decision making sessions.
The profiles over time of the non-GDSS groups were significantly different from the profiles of the GDSS groups. Chidambaram predicted that computer supported groups would experience greater cohesion since the system would provide anonymity, increasing the likelihood of participation while also keeping the groups focused on task issues rather than personal issues.

GDSS groups reported less cohesiveness than manual groups in the first two sessions. This may have been because using the system forced the supported groups to contribute their ideas in parallel, creating an atmosphere wherein the members were working individually without interaction. Whereas, the non-supported groups were forced to interact, perhaps building cohesiveness in the process. However, in the final two sessions, the GDSS groups reported more cohesiveness than the manual groups thus supporting the structurational argument that, over time, technical structures (e.g., the GDSS) can be adapted in ways which facilitate the appropriate development of behavioral structures.

These findings may have been because the non-supported groups, by interacting more frequently than supported groups initially, generated issues of conflict which were destructive in the long term. On the other hand, GDSS groups may have experienced relatively less interaction in the first two sessions resulting in less conflict later on. The fact that conflict management was also initially better in non-supported groups but became worse in the final sessions is consistent with and supports the foregoing explanations.

Other variables which have been examined in EMS research and which bear directly on cohesion include influence, consensus, and relational factors such
as affection, self disclosure, informality and impression formation. Influence is important to cohesion since the degree of cohesion is known to vary with influence (McGrath, 1984). Influence is the process of bringing a group member into alignment with one's own beliefs or opinions or of altering another's conduct. As members converge in opinions, they experience greater mutual attraction and greater cohesion. Kiesler et al. (1984) found greater choice shift -- indicating greater influence -- in synchronous computer conferencing and asynchronous e-mail than in face-to-face meetings. Thus, EMS supported groups can, in some circumstances, reach consensus at least as well as face-to-face groups. One reason may be that CMC depersonalizes interaction thus allowing people to abandon choices more readily than in a less anonymous environment like face-to-face. Conversely, both Gallupe (1985) and Hiltz et al. (1986) reported that face-to-face groups expressed more agreement than computer supported groups, substantiating arguments that CMC is less relational and, therefore, less influential.

On the other hand, Zigurs et al. (1988) compared GDSS supported to non-supported groups and found no differences in amount of influence behavior attempted, although supported groups tended to exhibit more evenly distributed influence behavior attempts than non-supported groups. The study did not measure effects of influence per se, e.g., choice shift. However, in measuring specific effects, Watson et al. (1988) examined computer support versus no support and manual support (i.e., access to a flip chart, agenda, etc.) and found no differences in level of post-meeting consensus. More recently, Kinney and Dennis (1994) also found no differences between face-to-face, synchronous CMC and asynchronous CMC among dyads with respect to consensus change. Finally, in a path analysis of data gathered by Watson (1988), Poole and Lind (1991) found that level of technological support (number and types of GDSS features offered) and level of
total system use directly impacted the fulfillment of communication functions in group interaction with respect to consensus change, though the nature of the impact is not clear. When taken as a whole, prior results concerning EMS and influence are mixed and raise more questions than they answer. However, evidence does suggest that, in some circumstances EMS can support interpersonal influence.

Relational (i.e., socio-emotional) interaction in groups is a vehicle for defining relationships between participants. Assessment of others, which results from relational communication, is important in establishing trust and engaging in consensus building. Hiltz et al. (1986) found that, in general, face-to-face meetings exhibited more socio-emotional exchange (e.g., tension release, joking, etc.) and CMC had more task related exchange. These results provide some support for the argument that CMC is a less personalized and less relationally oriented medium than face-to-face interaction.

However, Walther (1992) assessed relational communication in 32 groups engaged in either asynchronous CMC or face-to-face meetings over a period of time working on three tasks. Surprisingly, CMC groups reported higher perceptions of immediacy/affection than face-to-face groups. That immediacy/affection decreased over time in both conditions was also unexpected. Also counter to expectations, perceived similarity/depth, a relational construct indicating the extent of self disclosure and interest in one's communication partners, was greater in CMC than face-to-face groups. Employment of informal communication devices (e.g., contractions like "You'd be better off..." instead of "You would be better off...") may indicate relational closeness. Also surprisingly, Walther found informality was perceived to be higher in CMC than in face-to-face meetings. Finally, and equally unanticipated, CMC showed higher levels of social than task communication orientation relative to face-to-face groups. Thus, social presence theory and earlier
research results notwithstanding, CMC groups generally perceived their interactions as more relational and, therefore, more personal than the face-to-face groups. Walther argues that this finding may be explained by the fact that asynchronous participants were not limited to meeting during fixed time periods; thus, they had more opportunity than face-to-face groups to pursue non-task oriented exchanges.

In interpreting the results of this study, two further issues are noteworthy. First, relational perceptions appeared not to differ between the two conditions in the first session. In other words, there may have been no difference between face-to-face and CMC conditions in their relational capacities to begin with. In the context of social presence theory, such a result is problematic since the media clearly differ in communicative capacity. Therefore, with respect to relational communication, either there are truly no differences between environments or some aspect of the research design (e.g., the instrument) may be suspect. In either case, the results need to be validated. Also, if face-to-face and CMC are equally effective in the beginning, why would they be expected to differ later? The author does not address these issues. Another important point concerning these findings is that time and condition exhibited no interaction, i.e., CMC groups did not improve any more over time in their perceptions of relational structures than did face-to-face groups.

Walther (1993) also found that although initial impressions of communicating partners were more developed in face-to-face groups than in CMC groups, over time CMC groups increased more than face-to-face groups in impression development. The CMC groups approached but did not equal face-to-face groups in absolute impression level. Walther suggests that perhaps more time would have permitted complete convergence since the face-to-face groups exhibited no significant change over time in impression formation.
Walther's research is important because it is one of only a few longitudinal EMS studies which specifically evaluates relational interaction in collocated and distributed meeting conditions during task performance. Overall, although results with respect to socio-emotional interaction in the context of EMS are mixed, nonetheless, evidence suggests that electronically mediated interaction is capable of producing relational development and, consequently, can facilitate cohesion over time. The relative paucity of studies investigating cohesion and related structural variables highlights the need for a better understanding of relational development in EMSs, especially in distributed settings.

3.1.2 Conflict

Conflict, though unavoidable in most long term group situations, need not be detrimental to the group process (e.g., Ross, 1989). Indeed, when managed appropriately, conflict can lead to the surfacing and shared understanding of problematic assumptions and opinions paving the way for effective problem solving. Thus, understanding how the meeting environment affects groups' handling of conflict is essential to developing effective EMSs. Gallupe (1985) compared 24 groups of three members in a decision making task with two levels of task difficulty and two levels of support (GDSS and no GDSS). GDSS supported groups experienced greater conflict than non-supported groups at both levels of task difficulty indicating that the potential exists for development processes to destabilize in GDSS conditions. Such destabilization could negatively affect members' perceptions and group performance.

Chidambaram (1989) determined that GDSS groups exhibited less ability to manage conflict than manual groups in the first two of four sessions. However, the supported groups reported greater ability to manage conflict than non-supported
groups in the final two sessions. Miranda and Bostrom (1993), comparing 25 computer supported and non-supported groups in a longitudinal study across five sessions (the first was a training session), found that computer supported groups experienced less interpersonal conflict and less issue based conflict than non-supported groups.

These results suggest that, initially, a GDSS may constitute a barrier to conflict management, although how a GDSS impedes conflict management is not clear at this time. Perhaps lack of familiarity with the GDSS restricts the members' ability to deal with conflict. On the other hand, some structural characteristic, e.g., media impersonalness, may initially prevent appropriate conflict management but later be adapted to suit the group’s needs. Because the non-supported groups had to interact during the first sessions to produce ideas while the supported groups could focus on the technology, the non-supported groups may have sowed the seeds of conflict which later developed into problems and which technology focused groups avoided.

On the other hand, these results also provide support for the structurational argument that groups may adapt (i.e., appropriate or use differently as contrasted with adopting) a technology more effectively over time. That is, GDSSs may provide structured and focused procedural support as well as some degree of anonymity, both of which may facilitate appropriate conflict management.

3.1.3 Group Processes

The final relational dimension addressed in this study encompasses process structures such as satisfaction with the process, perceived focus on task issues versus personality issues, participatory inhibition and equality, perceptions of a collaborative climate and confidence in the decision. The extent to which these
factors increase over time determines how the process as a whole is perceived and how effective it is in terms of performance.

In terms of satisfaction with the process, Gallupe (1985) found that GDSS supported groups were less satisfied than non-supported groups. Jarvenpaa et al. (1988), in a field experiment with three groups found no difference in satisfaction with the process while Easton et al. (1989) report that GDSS supported groups exhibited greater satisfaction than non-supported groups. Valacich et al. (1994) report that satisfaction was greater for distributed dyads when performing an intellective task (i.e., primarily information gathering) but higher for face-to-face groups when performing a value laden decision making task. Thus, EMS supported dyads can achieve satisfaction with the overall process, but the level of satisfaction may depend, in part, on the task. The results shed no conclusive light on the role of EMS environment in satisfaction.

Confidence in the decision reached may also be related to general process satisfaction. Gallupe (1985) found that confidence in the decision decreased when supported with a GDSS. In contrast, Valacich et al. (1994) reported greater solution satisfaction with distributed than face-to-face dyads performing a low equivocality task. Beauclair (1987) reported no differences in decision satisfaction between computer supported and non-supported groups. Clearly, the results with respect to process and outcome satisfaction are mixed and inconclusive at best, suggesting that more studies are necessary to sort out these differences. Further, as indicated in Valacich et al. (1994), task may have been a confound in earlier studies and future research needs to address that possibility.

One might argue that EMS mediated interaction is less immediate and interactive and, therefore, presumably less personal than face-to-face interaction. Consequently, face-to-face participants would be expected to spend more time on
personal issues and less time on task related matters relative to distributed groups. Indeed, such were the findings reported in Hiltz et al. (1986) and Kutsko and Smith (1991). However, contrasting results were obtained in several important studies. Face-to-face groups exhibited greater task focus than distributed EMS groups in Smith and Vaneczek (1989) and in Valacich et al. (1994) while Kiesler et al. (1984) found collocated and distributed groups to be about equal in task focus. In the Smith and Vaneczek study, task directedness was actually measured as “perceived progress toward goal” rather than focus on task. Thus, perceptions may have been that face-to-face interaction was more effective rather than being more task focused per se. One explanation for face-to-face groups being more task focused than mediated groups may be that EMS groups spent more time on relational interaction simply because it was difficult to accomplish. In any case, the reasons for the conflicting findings are not immediately clear and better theory and more studies are needed to explore the causes of the results.

Participation is critical to group process and performance and is one of the most frequently studied constructs in EMS research. In task performance, considering a larger number of ideas, issues, perspectives and so on is generally thought to lead to improved output. Implicit in this assumption is that in order for the group to realize higher contribution levels, all members must participate fully. Hence, equality of participation is crucial to effective group performance (Fisher and Ellis, 1990). Inhibition is related to participation because inhibited members are less likely to contribute to the proceedings than uninhibited members.

Results with regard to equality of participation are as varied as those relative to the preceding structures. Kiesler et al. (1984) report less disinhibition (i.e., greater inhibition) occurs in face-to-face groups leading to less equal
participation than in EMS groups. In a field study, Sproull and Kiesler (1986) also found that face-to-face participants reported greater inhibition than e-mail interactants. Along the same lines, Jessup et al. (1990) found more equal participation in anonymous EMS settings than when the EMS allowed identification. Further, Kutsko and Smith (1991) report a less collaborative climate in face-to-face than in distributed EMS groups. These findings support the argument that EMSs are less personal, and afford more anonymity than face-to-face environments, resulting in a greater tendency to “speak out” without fear of retribution. A computer supported environment, to the extent that it requires participants to type in their contributions, may also prevent dominant members from controlling the process, creating a working environment perceived as more collaborative.

Furthermore, many studies found no difference at all between EMS supported and non-supported environments in terms of participatory equality (e.g., Gallupe, 1985; Beauclair, 1987; Jarvenpaa et al., 1988; Watson et al., 1988; Easton et al., 1989). Similarly, Smith and Vanecek (1989) found that equality of participation did not differ between face-to-face and asynchronous environments when both were supported with an EMS. The findings of these latter studies further support the premise that distributed EMS supported groups are, at least, no worse off than face-to-face groups in terms of participation equality.

Conversely, Lewis (1987) and Valacich et al. (1994) found that face-to-face groups reported greater equality than either non-supported or distributed
supported groups. The results from these latter two studies are counter to prevailing theory and to the majority of the findings to date regarding equality of participation; future research should be directed toward resolving this conflict.

Consistent and conclusive observations are difficult to make with respect to the research findings along all three behavioral dimensions reviewed in this section. Though most studies have used decision making (i.e., type four) tasks according to McGrath’s (1984) task typology, the tasks used differed in nature across the studies making comparison of results problematic. Moreover, the studies reviewed here employed different systems, tools, instruments and experimental designs. In light of the design differences between studies, drawing generalizable conclusions is a problem.

3.2 Socio-Technical Structures

Socio-technical structures, one of the two factors of interest discussed in Chapter II, include various environmental characteristics such as social presence and media richness. Short et al. (1976) argued that media, i.e., interaction environments, vary in personalness largely as a function of the capacity of the environment to carry various types of cues. Media richness (e.g., Daft and Lengel, 1986; Trevino et al., 1990) is a similar construct that also argues that environments differ in cue carrying capacity. For example, video conferencing is richer than computer conferencing because the visual environment allows the conveyance of many more types of cues than CMC. Until recently, very few EMS researchers have examined either social presence or media richness in depth.
Sproull and Kiesler (1986) determined that face-to-face groups perceived their environment as exhibiting more social presence than distributed EMS supported groups. Chidambaram and Jones (1994) found mixed results; adding computer support decreased social presence for face-to-face groups but did not change perceptions of social presence in distributed asynchronous groups that were already using audio conferencing. In a longitudinal study, Dufner et al. (1994) examined effects due to level of EMS support. All groups used an EMS but differed in the level of support they received from the EMS. Generally, the groups using higher level tools perceived the system as more flexible, more personal, capable of greater feedback, more useful and a richer medium, thus resulting in better discussion quality. Hence, structuring the CMC work space to allow linking of related dialogue -- the distinguishing support feature in the Dufner et al. study -- appears to increase the perceived meaningfulness of the exchange. These findings highlight the significance of system and tool differences as a component of experimental variability -- a potential confound which many researchers have failed to consider when designing their studies.

Kinney and Dennis (1994) tested some explicit and implicit propositions of both social presence and media richness theories by comparing dyads engaged in decision making tasks with two levels of equivocality. Some met face-to-face while others met via synchronous or asynchronous CMC. The study determined that face-to-face groups perceived greater media richness than both distributed conditions; further, synchronous groups reported richer media than asynchronous groups. Social presence was perceived higher in face-to-face groups than distributed groups,
although distributed synchronous interaction surprisingly exhibited no more social presence than asynchronous communication. The results indicate that there were differences in perceived richness and social presence between face-to-face and EMS, however, there may not be any practical differences since satisfaction and performance did not differ. Further, since media richness theory implies that performance will differ relative to task-media fit, the results do not support media richness theory per se. Valacich et al. (1994) did find some support for media richness theory when face-to-face dyads reported greater perceived media richness, social presence, equality, and exhibited better performance results than the CMC groups. Once again, the existence of conflicting conclusions highlights the need for further study to sort out the practical and theoretical implications of computer mediated group interactions.

The capacity of the environment to facilitate both communication quality and quantity is a structural factor which bears significantly on group processes. Quality and quantity of communication require examination especially in the context of asynchronous interaction where communication behaviors are likely to assume very different patterns than in face-to-face interaction. As with the accounts of preceding factors, results regarding communication structures also vary considerably. Chidambaram and Jones (1994) found that an EMS improved perceptions of communication effectiveness in dispersed groups using audio conferencing but did not change perceived communication quality in face-to-face groups. Dufner et al. (1994) reported that adding more EMS tools for support increased groups’ perceptions of the usefulness and quality of the environment for communication but Kinney and Dennis (1994) found no differences between face-
to-face and distributed groups (both synchronous and asynchronous) in overall communication satisfaction.

With respect to quantity, some studies report that distributed EMS groups engaged in less communication than face-to-face groups (e.g., Kiesler et al., 1984; Hiltz et al., 1986; Smith and Vanecek, 1989) and Jessup et al. (1990) found that EMS supported anonymous groups produced more comments than EMS identified groups. Watson (1988) reported less communication in supported than non-supported groups while Jarvenpaa et al. (1988) detected no differences between them. Thus, results tend to indicate that, with respect to both communication quality and quantity, EMS supported groups can communicate, though perhaps not to the same extent nor with the same effectiveness as face-to-face groups. The problem for future research is to determine under what specific conditions EMS do support effective communication and to explore the causal relationships.

3.3 Performance

Performance results also range the spectrum. Many different measures for performance have been used such as time to decision, number of alternatives generated, quality of decision and decision satisfaction (e.g., Jarvenpaa et al., 1988; Hiltz and Johnson, 1990; Zigurs et al., 1988; Chidambaram and Bostrom, 1993). Differences among the studies in measures may well account for the variability of outcomes. In general, face-to-face groups have performed better than distributed groups (e.g., Kiesler et al., 1984; Valacich et al., 1994) and EMS
supported groups have outperformed non-supported groups (e.g., Lewis, 1987; Bostrom and Miranda, 1993). Only one study (Gallupe, 1985) reports non-supported groups performing better than supported groups but several report no differences in performance either between EMS and non-supported or between face-to-face and distributed EMS groups (e.g., Beauclair, 1987; Jarvenpaa et al., 1988; Chidambaram, 1989; Smith and Vanecek, 1989; Easton et al., 1989; Kinney and Dennis, 1994). Performance findings, like the others discussed in this section, are mixed and inconclusive. However, results can be made more meaningful and comparable if researchers build on earlier studies by standardizing performance measures and criteria.

### 3.4 Limitations Of Prior Research

This review of relevant EMS research suggests that:

- Many experiments employed one time meetings, ignoring potential effects of longer term group development.
- Numerous studies used decision tasks, a rather limited representation of organizational activity.
- Results have been mixed and, at times, contradictory.
- Few of the studies examined cohesiveness and related structures -- an important dimension of group development.
- Although communication is critical to group development, few studies have focused on issues relevant to communication quality.
- In spite of the increasing opportunities and requirements for distributed interaction, a majority of the studies have ignored factors relevant to asynchronous interchange.
3.5 Strategies To Avoid Earlier Limitations

The use of zero history groups meeting only one time limits generalizing the results to organizational settings where groups often meet multiple times in the course of a task. The design employed in the present study required groups to meet one hour a week over the course of four weeks. This design provided a more realistic context than one session experiments.

Many previous studies employed decision making types of tasks; organizational teams frequently engage in other types of activities (e.g., design projects). The current study adds to existing knowledge by assessing group processes in the context of a project development task. Group members had to create a policy document which required coordinating and developing consensus on assumptions, approach, style, presentation and other activities inherent in collaborative writing.

Participation has also been examined, often with mixed results. The variability may be due to the fact that EMSs differed widely across experiments. To further add to potential variability, studies generally used different systems and different tools. Frequently, treatments within studies were also supported differently. Thus, the variance in findings may have been attributable to differences between tools and features rather than differences between settings. The design used in the current study entailed assigning the identical tool to all treatments, thus eliminating feature as a potential source of variance.

Cohesion is essential to group development and performance (McGrath, 1984) yet cohesion was directly investigated in only one study and indirectly measured (i.e., via related structures such as influence) in only a handful of
studies. In the present study, cohesion is considered central to the group process and is specifically examined.

The relative lack of EMS research concerning communication quality issues is also a problem. Communication is central to group interaction (e.g., Fisher and Ellis, 1990) and researchers must analyze group communication in order to truly understand group development. This study measures communication effectiveness factors in electronically supported environments.

Finally, very few of the studies reviewed here incorporated asynchronous interaction into their research design. Because distributed interaction is becoming an organizational way of life, this study focuses on the effects of asynchronous meetings.

3.6 Summary

This review has presented a discussion of the strengths and weaknesses of research relevant to groups meeting in electronically supported settings. The table in Appendix A presents a concise and visual integration of the EMS studies covered in this literature review. The following issues are the raison d'être for this study:

- The field of EMS research in general is very broadly focused and the studies have borne inconclusive and sometimes conflicting results.
- A variety of theoretical approaches have been guiding research raising the issue that perhaps the field needs to be theoretically unified.
• Results indicate that some of the theories motivating EMS research (e.g., social presence and media richness) require more validation if they are to remain applicable.
• There have been very few longitudinal studies, despite the fact that many real world groups meet more than one time.
• Organizational reality also mandates the need to study groups in the performance of tasks other than decision making.
• Finally, although asynchronous collaboration is becoming an increasingly important meeting mode, relatively few projects to date have focused on such interaction.
Chapter IV - RESEARCH FRAMEWORK

This chapter presents a detailed explanation of the various components of the research model introduced in Chapter II (see Figure 2.1). As discussed in Chapter II, the motivation for the current study is that structuration theory is more explanatory of group interaction and development processes than either structuralist or interactionist oriented social theories. Moreover, the components of the framework are actually structural rules and resources which comprise the interaction environment and the continually changing relationships among these structures are critical to group development. The present chapter extends the earlier discussion by first defining and then detailing each of the concepts outlined in the model. Finally, the chapter provides insight into the nature of the relationships between those factors.

4.1 Inputs

One factor which constrains group processes is the general way in which groups of individuals work together. The three environments represented here, i.e., face-to-face, dispersed synchronous, and dispersed asynchronous occur in typical organizational settings and correspond to the cells in Figure 4.1.

Note that in Figure 4.1., in the asynchronous condition, spatial dispersion is not a factor and therefore plays no role in the condition, i.e., when meeting at different times, it makes no difference whether members use the same space (e.g., when people work shifts) or different spaces (e.g., when members are geographically dispersed).
The overall meeting environment incorporates several important characteristics which are discussed next.

![Diagram: Dispersion Of Participants]

**Figure 4.1: Dispersion Of Participants**

### 4.1.1 Technology Support

Many GDSS studies to date have compared groups with different levels of system support such as computer support versus no computer support (e.g., Chidambaram et al., 1990-91; Lewis, 1987). Such studies were important as a method of comparing the potential effectiveness of computer-supported versus non-computer-supported settings. However, as argued earlier, there is also a need to look at potential differences in the broader set of structural characteristics, i.e., the environment as a whole where EMS support is only one element of the entire context. In other words, system support can be eliminated as a source of variance by supporting all groups with the same EMS. In that way, differences in interactivity among meeting environments rather than between types or levels of computer support can be examined. Thus, the current framework differs from that used in most earlier projects.
4.1.2 Physical Dispersion

As illustrated in Figure 4.1. above, meeting participants can be either collocated, i.e., in the same place or physically distributed, i.e., in different places. In the current framework, physical dispersion is defined such that no two people can interact without employing some type of communication medium (in reality, all interaction -- including face-to-face -- is mediated and environments differ primarily in the degree of mediation they render). Consequently, the interaction of group members located in different rooms -- as long as there is no opportunity for face-to-face conversation -- is equivalent to interaction across greater distances and simulates meeting in a distributed organizational setting.

4.1.3 Temporal Dispersion

Temporal dispersion refers to the degree to which people are close to each other in time, i.e., working together or separated across time. Another way to view temporal dispersion is to consider the synchronicity or degree of interactivity of group members.

*Face-to-face* meetings are very common and are the most immediate and interactive. A second mode describes people meeting at the same time while in different places (e.g., telephone conference calling). Such a setting is termed *distributed-synchronous* for purposes of this study. These meetings are somewhat less interactive than face-to-face meetings because dispersed interaction permits fewer types of message transmission. For example, one is not able to convey any kinesic signals to a receiver when participating in a conference call. Thus, physical dispersion of participants tends to limit the types of messages one can transmit.
The least interactive of the three environments is the *distributed-asynchronous* setting. In this condition people meet at different times. Hence, not only are cueing capabilities attenuated due to proximity constraints, but, the temporal delay between message transmission and message reception invokes another set of communication barriers with which work groups must contend.

EMSs support the latter two meeting modes with a level of interactivity much greater than traditional media like letters or inter-office memos. While such technologies provide new opportunities for distributed teamwork, this mode of interaction is not without its problems. For example, since hours or days may elapse before one teammate has the opportunity to interact with what another member has previously contributed, asynchronous meetings may be rather frustrating. Some of the problems expected to occur in the context of asynchronous meetings could result from interruptions to normal rhythmic processes found among work groups.

McGrath (1988, 1990) argues that, because individual and group behaviors are rhythmic in nature, some exogenous structures impact interaction in a way that *paces* those interactions. For example, Kelly (1988) shows that externally imposed deadlines significantly affect task activity patterns. Thus, external factors can significantly impact the rhythmic patterns of processes which are critical to the continued coherence and stability of the group. From this, two points follow. First, interruptions and delays (which are by definition, counter rhythmic) have the potential to disrupt any patterns which may have been established during earlier meetings. Thus, the development dynamics of groups meeting asynchronously are likely to be quite different than those of groups meeting synchronously, whether dispersed or face-to-face. Therefore, it is
necessary to manipulate the level of interaction in order to measure the effects of interaction differences on various development processes.

Secondly, and perhaps more importantly, the existence of external pacing raises the question as to why some structures are more likely to be altered than others? For example, in the Kelly (1988) study, why did the task activity patterns change rather than characteristics in the exogenous structure? In this case, clearly, if something had to “give,” then the task activities are more likely to be altered than the time constraints, i.e., the group may have greater ability to influence certain of their own patterns of behavior than to obtain extensions of deadlines. The reason is that time constraints are examples of what may be described as relatively “immutable” structures while, in comparison, rate of activity may be more easily amended, i.e., it is a “mutable” structure. Note that the mutability of structures will always be relative to other structures in the same context. The concept of structural mutability and its implications for group development are addressed more completely later in this chapter.

4.1.4 Channel Capacity

Channel capacity refers to the capability of the environment to transmit various types of communication cues. For instance, face-to-face interaction allows “backchanneling” of nonverbal messages, such as dress and facial expressions, which are unavailable via computer mediated dialog. Similarly, the telephone permits the use of “vocalics,” e.g., raising one’s voice, which are not available (in exactly the same way) in computer mediated communication. As will be explained later, communication effectiveness is thought by some to depend on channel capacity (e.g., Trevino et al., 1990).
4.2 Processes

McGrath (1984) argues that three processes in particular -- cohesion, communication and conformity -- are critical to the dynamics of group development. He further asserts that these three processes are interdependent since each has been found to covary with the others.

MIS researchers examined some of these processes (e.g., Hiltz et al., 1986; Walther and Burgoon, 1992; Kinney and Dennis, 1994; Valacich et al., 1994). Most EMS studies to date have focused on synchronous interaction (i.e., primarily face-to-face). However, group process research needs to include conditions under which groups are likely to interact in the future, e.g., spatial and temporal dispersion.

4.2.1 Relational Structures

a) Cohesiveness

Group cohesion -- one of three principal dimensions of group development -- is defined as the aggregate of the interpersonal attractions of individual group members to each other and to the group as a whole (McGrath, 1984). Cohesiveness increases as the individuals in a team perceive that both individual and common goals can be achieved through group action. Festinger (1954) pointed out that when individuals perceive others in a group as holding views divergent from their own, they feel less attracted to the group. One mechanism by which individuals attempt to align others with what they feel should be a common goal is interpersonal influence. McGrath (1984) argues that interpersonal attraction is dependent on communication; as people communicate they increase the potential for attraction which generates pressures toward agreement (i.e.,
conformity). Perceptions of cohesion should, therefore, be affected by the extent to which a meeting environment facilitates interpersonal communication. General consensus in the small group literature indicates that cohesiveness is also positively correlated with performance (see for example, McGrath, 1984).

**b) Conflict Management**

Conflict is unavoidable, but if managed properly can be helpful rather than destructive (see for example, Ross, 1989). The primary method for dealing appropriately with conflict is through clarification of issues and working toward consensus. Both of these strategies rely on effective interaction. It follows that effectiveness of a group's conflict management will depend in part on the ability of the members to communicate clearly.

**c) Satisfaction With Group Processes**

Fisher and Ellis (1990) argue that satisfaction with the group process is important to the group's overall morale and is dependent, in part, on participation and communication. When members perceive their own participation to be contributory and that their interaction is goal directed, they tend to be more satisfied in general with the group process. Thus, when participation is inhibited, members are more likely to be dissatisfied with the process. Communication is the process of clarifying issues and, if effective, helps keep members focused (Fisher and Ellis, 1990) but, when impeded, can cause misunderstanding and frustration leading to discontent with the process.
4.2.2 Socio-Technical Structures

a) Social Presence

Short et al. (1976) argued that those media which transmit greater amounts of information simultaneously (including nonverbal and backchannel information) are said to possess greater social presence, i.e., they are more friendly, emotional, and personal (Hiemstra, 1982) and convey a more compelling sense of the presence of the communicative partner. Those media which allow the transmission of fewer types of information are said to exhibit less social presence and are less expressive in general while being more depersonalized and business-like (Hiemstra, 1982).

b) Communication Effectiveness

Rogers (1986) argues that communication effectiveness refers to the extent to which communication results in convergence toward mutual understanding. A fundamental assumption in both social presence theory (Short et al., 1976) and media richness theory (e.g., Daft and Lengel, 1986) is that media vary in their capacity to carry information. For example, face-to-face communication allows the expression of a variety of verbal and nonverbal messages while telephone communication permits transmission of far fewer types of messages. A specific communication medium (e.g., the computer) is only one component of the entire communication environment (e.g., computer + telephone + fax, etc.). Further, environments exhibit sets of structural characteristics which allow them to carry more or less information relative to others. Another assumption implicit in both theories is that less capacity results in a general reduction in communicative effectiveness.
Communication is a significant dimension of group development (e.g., McGrath, 1984; Fisher and Ellis, 1990) which requires a shared contextual understanding among participants (Rogers, 1986). Thus, it follows that, in groups where communication is impeded -- e.g., as a result of reduced channel capacity -- then communication effectiveness is diminished. When this occurs, the development processes are likely to differ from processes in groups which have access to higher capacity communication environments.

**c) Communication Interface**

Participants' perceptions of the communication environment as a structure which either facilitates or impedes exchange with others is also important in determining the overall effectiveness of the environment. If the communication interface is perceived as difficult to use or overly constrictive, usage would be expected to decrease. Reduced usage would result in attenuated group development unless communication could be augmented or enhanced through other means.

**4.3 Outputs - Task Performance**

All of the above will impact, to some extent, the output of the group. In order to determine the nature of the impact, a method of comparing outcomes must be decided upon. Researchers have looked at a variety of performance factors relative to EMSs (e.g., Hiltz et al., 1986; Siegel et al., 1986; Lewis, 1987; Jessup et al., 1990; Chidambaram and Jones, 1994). The reason performance is a popular measure is intuitively obvious. For a technology to have practical application, managers will expect it to facilitate work, increase productivity, improve work effectiveness, or enhance perceived quality of work life. Thus, it is
critical to determine under what conditions the application of a technology may have either a deleterious or enhancing effect on group performance.

4.4 Time

Relatively few MIS studies have observed the effects of EMSs on groups over time (exceptions are Kraut et al., 1987-88; Chidambaram, 1989; Walther, 1992). Most projects to date have employed designs wherein subjects meet only one time for a specific task (see for example Kiesler et al., 1984; Siegel et al. 1986; Lewis, 1987; Connolly et al., 1990). Groups in real organizations, however, seldom meet only once; generally, organizational groups meet on multiple occasions over a period of time.

Group development is a cumulative process and groups are likely to behave differently later in their existence than in their early stages. Regardless of the theory of group development one assumes (i.e., linear or non-linear) time is a significant dimension of group development. Syntheses of the various frameworks which have evolved in the group development literature exist elsewhere (e.g., Chidambaram and Bostrom, 1993a) so a review will not be attempted here. One assumption, however, which appears common to all development models is that groups exhibit different behaviors at different times during the course of the task.

The key to understanding the implications of group maturation is in understanding the consequences of and the changes in relational behaviors (e.g., cohesion and conflict management) during the development process. Thus, in order to accurately analyze process effects in groups it is necessary to employ longitudinal study designs. In the research model presented here, time is assumed to be a boundary variable, constraining while simultaneously enabling group
processes. However, time bounds the context in several ways. For example, the number of sessions -- i.e., the duration of the entire task exercise -- is one way in which time constrains the meeting process. Another boundary is the length of time each session is allowed to consume. Thus, time enables and constrains on multiple levels and must be accounted for accordingly. Theoretical assumptions and implications of time relative to the specific process variables are explained in the hypotheses section of the paper.

4.5 Interdependence of Factors

Group processes do not occur in a vacuum. Every group acts within some context and contexts can vary greatly. The current study examines factors relevant to group activity in the context of electronically supported meetings. Rice and Love (1987) assert that we need to better understand the relationships between people, media, and communication. However, from a systems perspective (e.g., Bertalannfy, 1951; Boulding, 1956), human interaction is viewed as a complex system of interrelated and continuously covarying activities. Therefore, understanding human interaction must begin with analysis of the relationships between the various components of the system.

Within the context of AST, viewing the components as an integrated system is especially important. AST argues that the structuration process is continuously recursive and, therefore, infinitely interwoven. Thus, in the meeting environment, relational structures, technical structures, behavior, performance and members’ perceptions are all interrelated and each of the individual components must be examined with this in mind. The framework employed in this study was
designed to illustrate aspects of each of the components as they relate to one another and as they constitute the context of the entire meeting environment.

4.6 Summary

This chapter has further developed the conceptual model presented in Chapter II. This chapter also discussed the relationships between the components of the research framework and the necessity to view the meeting environment as a system whose parts are interdependent. The next chapter provides a detailed discussion of the way the model was operationalized for purposes of the current study and then presents the hypotheses which were tested.
CHAPTER V - DETAILED PROBLEM STATEMENT

The objective of this study is to evaluate group development and communication processes in the context of electronically supported meetings. Perceptions of these processes will vary systematically as a function of the type of meeting environment within which groups interact. AST suggests that perceptions of the relevant processes are likely to evolve over time as members explore, alter and employ environmental structures in novel ways. Moreover, groups' perceptions are expected to exhibit different rates of change depending on the relative mutability and the severity of the structural impediment.

5.1 Overview of Experiment

In this study, 33 groups of four members collaborated in writing a policy document. After being randomly formed and assigned to different meeting environments (i.e., the independent variable), groups met four times for a total of four hours, excluding a one hour training session. Questionnaires were administered after each session to assess members’ perceptions with respect to the dependent variables, i.e., cohesiveness, conflict management, process satisfaction, social presence, communication effectiveness and satisfaction with the communication interface. Quality of the final document -- also a dependent variable -- was evaluated by a panel of experts as the measure of group performance. All other structural variables (see Figure 2.1) were controlled or randomized to minimize their effect in this study.

Thus, the study was designed to measure the differential impact of meeting environment on a) the development of relational and socio-technical structures over time and b) group performance. The following sections provide detailed discussions
of the elements of the research model as they were operationalized in this study. Table 5.1 presents a summary of the variables and their operationalization. The chapter concludes with a presentation of the hypotheses derived from the theories discussed in Chapter II.

Table 5.1: Operationalization of the Relevant Variables

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>OPERATIONALIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Independent Variables:</strong></td>
<td></td>
</tr>
<tr>
<td>Meeting environment</td>
<td></td>
</tr>
<tr>
<td>Face-to-face</td>
<td>Same room - same time</td>
</tr>
<tr>
<td>Distributed synchronous</td>
<td>Different room - same time</td>
</tr>
<tr>
<td>Distributed asynchronous</td>
<td>Different room - different time</td>
</tr>
<tr>
<td><strong>Controlled Variables:</strong></td>
<td></td>
</tr>
<tr>
<td>Technology</td>
<td>Identical for all groups</td>
</tr>
<tr>
<td>Task</td>
<td>Planning (type 1)</td>
</tr>
<tr>
<td>Group size</td>
<td>Four member groups</td>
</tr>
<tr>
<td>Individual differences</td>
<td>Random assignment of members to groups and groups to conditions</td>
</tr>
<tr>
<td>Time allowed (two levels)</td>
<td></td>
</tr>
<tr>
<td>Session</td>
<td>One hour each session</td>
</tr>
<tr>
<td>Task</td>
<td>Four sessions total</td>
</tr>
<tr>
<td><strong>Dependent Variables:</strong></td>
<td></td>
</tr>
<tr>
<td>Cohesiveness</td>
<td>Post session questionnaire (Seashore's Index of Group Cohesiveness)</td>
</tr>
<tr>
<td>Conflict management</td>
<td>Post session questionnaire (previously validated)</td>
</tr>
<tr>
<td>Group process</td>
<td>Post session questionnaire</td>
</tr>
<tr>
<td>Social presence</td>
<td>Post session questionnaire (previously validated)</td>
</tr>
<tr>
<td>Communication effectiveness</td>
<td>Post session questionnaire (previously validated)</td>
</tr>
<tr>
<td>Communication interface</td>
<td>Post session questionnaire (previously validated)</td>
</tr>
<tr>
<td>Performance</td>
<td>Evaluation by a panel of expert judges</td>
</tr>
</tbody>
</table>
5.2 Independent Variables

5.2.1 Meeting Environment

Meeting environment was manipulated by randomly assigning groups to one of three different meeting modes. The three modes were face-to-face, dispersed-synchronous, and dispersed-asynchronous. The three treatments were identical in all respects other than their spatial/temporal dispersion; of course, differences in dispersion result in other structural differences, e.g., interactivity, capacity for verbal communication, etc. The reason for investigating meeting environment is to measure the effect of dispersion on group processes and performance in electronically supported meetings. By controlling all other variables and manipulating only dispersion, the effect of distributed meetings on group development can be precisely determined.

5.3 Controlled Variables

5.3.1 Technology

As noted in the prior research section, earlier studies compared different types of technologies or systems. The objective of the present study was specifically to measure the impact of temporal and spatial dispersion on groups in meetings. To do that, the design required all groups to use the same functional tool within the same EMS, thus, precluding variability due to system or tool differences. Providing only one tool and conducting the exercise over four sessions was intended to permit the measurement of the appropriation (i.e., adaptive manipulation) of environmental structures. If groups had been able to use different types of tools or support, differences in dependent variables might have been attributable to the
support employed. By limiting support to one tool, any measurable change over time among target variables should, therefore, be due to differences in the way groups used and adapted the same system -- i.e., adaptive structuration.

5.3.2 Task

McGrath (1984) argues that task is an important consideration in the activity of any group. This study required all groups to perform the same task thereby eliminating task-type as a confounding factor. The task used here is a type 1 -- i.e., planning -- task relative to McGrath's (1984) Task Circumplex.

The task used in this study entailed developing a set of organizational guidelines and then collaboratively formulating them into a policy document through a shared group writing tool. Such cooperative writing tasks are suitable for simulating group interaction in the organization because they are:

"prevalent in the workplace...and entail properties characteristic of many different complex collaborative tasks...," (Horton and Biolsi, 1992, pp. 4).

Thus, the task was designed to replicate certain aspects of collaboration in the organization such as the critical evaluation of ideas and opinions and their organization into a plan of action. Similar activities occur, for example, in continuous improvement (i.e., TQM) and software development types of projects. However, in the current study the task was designed so that participants did not have to possess the extensive technical expertise required in software design or TQM tasks. The rationale for this approach was that using a more technical task would have reduced the number of qualified subjects available, thus, decreasing the potential sample size.
Finally, pilot study post-session analysis indicated that in many cases interaction was minimal. In order to encourage more interaction in the main study, each participant was asked to assume the role of a department head in the organization. The roles were designed to be somewhat conflictive and participants were told they should try to communicate their department’s needs to their teammates in the course of designing the policy document. Descriptions of the roles are presented in Appendix F.

5.3.3 Group Size

A review of the literature reveals no "ideal" group size; rather, appropriateness of size is a function of the task at hand and the factors with the potential to affect group processes (e.g., individual members' traits and knowledge base). Valacich et al. (1993) regard this phenomena as the logical group size requirement. Typical group size in the studies reviewed earlier was between three and five. Along the same lines, groups of four were used in this study. The study was designed so that all groups were of identical size in order to preserve comparability across conditions. Problems in scheduling, subject availability and mortality arose, however, resulting in four groups being comprised of three members. The problems and their implications for experimental validity are addressed more fully in Chapter VIII.

5.3.4 Individual Differences

McGrath (1984) argues that differences in cognitive orientation, if not controlled for, can lead to differences in group behaviors and performance. In this study, participants were randomly assigned to groups and groups randomly assigned
to treatments in order to prevent the occurrence of any systematic effect due to individual differences.

5.3.5 Time Spent on Task

All groups were allocated exactly one hour during each of the four sessions. No group or member was allowed to exceed the time limit. In the two pilot studies and the main study, almost all participants used the full hour in all sessions. All groups met for all of the four sessions.

5.4 Dependent Variables

Investigating change over time is an important aspect of the design of this study; therefore, all dependent measures (except performance) were gathered four times. Identical questionnaires were administered to participants during the final ten minutes of each session. Following are discussions of the specific variables targeted in this study.

5.4.1 Cohesiveness

Cohesiveness refers to the extent to which members of groups feel attracted to each other and to the group as a whole. This construct also includes perceptions of solidarity and convergence of opinions. Seashore (1954) developed an Index of Group Cohesiveness which has been used often to measure cohesiveness of work teams and was modified by Chidambaram (1989) to better suit the context of a student group. The modified version was used in the current study. The modified index measures cohesion by totaling the scores of five items using a semantic differential scale with values ranging from one to five. Higher scores indicate greater perceived cohesion. In the Chidambaram study the five items had a
construct reliability (Cronbach's alpha) of 0.82. The complete questionnaire which measured cohesiveness -- along with the constructs discussed in the next two sections, conflict management and satisfaction with group processes -- is presented in Appendix G.

5.4.2 Conflict Management

Appropriate management of conflict is important in determining the effectiveness of a team. Conflict can destroy feelings of togetherness, attraction and cohesion in a group if it is not recognized and handled properly. Gallupe (1985) found that GDSS groups experienced higher levels of conflict although results from later studies appear to contradict his findings (e.g., Chidambaram, 1989; Miranda and Bostrom, 1993). Hence, GDSSs may decrease interpersonal conflict by facilitating focus on issues and processes rather than focusing on personal issues, as often happens in open face-to-face discussions. Such a focus may reduce the potential for conflict among electronically supported groups. The present study employed four items from Appendix G to investigate the potential for perceptions of conflict management to differ across diverse meeting environments. Conflict management, which had been validated in earlier studies (e.g., Chidambaram, 1989), was measured by four items in the current study.

5.4.3 Satisfaction With the Group Process

Seven items from the instrument in Appendix G constituted the scale measuring the perceived satisfaction with group processes. The extent to which some members dominate the sessions and others are prevented from contributing
may impact how participants feel toward the process. Other significant factors relative to satisfaction with group processes include effectiveness of leadership and coordination, task focus, and perceptions about whether fellow members are appropriately analytical in their approach to the solution. Members’ feelings about these issues were explored with the scale measuring group process satisfaction.

5.4.4 Social Presence

Perceived social presence indicates how compelling or immediate a user feels the presence of a communicative partner. In more constrained or more mediated interaction (e.g., letter writing), the presence of another is likely to be less compelling than in less mediated communication (e.g., face-to-face discussions). In this study, social presence was measured using a previously validated questionnaire (Short et al., 1976) presented in Appendix H. The seven items comprising this factor were reverse coded so that a high score indicates positive perceptions and a low score indicates negative perceptions of the communication environment.

5.4.5 Communication Effectiveness

Given the central role of communication in group interaction, communication effectiveness is critical to task performance and the development process. Thus, items which address the perceived communicative meaningfulness, pleasantness, accessibility, accuracy and speed of interaction of the setting constitute a general measure of the communication effectiveness of the
environment. Eight items from the questionnaire in Appendix H comprised this factor.

5.4.6 Communication Interface

In his review of the literature, Steinfeld (1986) concludes that a communication channels' primary characteristics are utility, accessibility, convenience, ease of use and personalness. In the present study, personalness and accessibility were examined with respect to social presence and communication effectiveness, respectively, as discussed above. Utility, ease of use and convenience were included in the communication interface construct. The items comprising communication interface measured the restrictiveness, simplicity and ease of use of the environment relative to the communication needs of the members.

5.4.7 Performance

Performance was measured by judging the quality of the final document based on such criteria as scope and depth of issues covered, potential effectiveness of the program prescribed and the tone of the document. A panel of eleven expert judges -- many of whom were instructors in the College of Business Administration -- were recruited from the University of Hawaii. Each judge rated nine documents and each of the 33 documents was evaluated by three judges providing $3 \times 33 = 99$ evaluations in total. See Appendix J for the instructions and scoring form provided to the judges.
5.5 Hypotheses

Specific expectations regarding differences between meeting environments for the variables relevant to this study are detailed in this section. Table 5.2 indicates, for each characteristic, the level that each environment is expected to exhibit. The hypotheses discussed below follow from the relationships listed in this table.

Table 5.2: Structural Characteristics of Meeting Environments

<table>
<thead>
<tr>
<th>Factor</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F-t-F</td>
</tr>
<tr>
<td>Cohesion</td>
<td>High</td>
</tr>
<tr>
<td>Influence</td>
<td>High</td>
</tr>
<tr>
<td>Immediacy</td>
<td>High</td>
</tr>
<tr>
<td>Group Processes</td>
<td>High</td>
</tr>
<tr>
<td>Social Presence</td>
<td>High</td>
</tr>
<tr>
<td>Comm Interface</td>
<td>High</td>
</tr>
<tr>
<td>Comm Capacity</td>
<td>High</td>
</tr>
<tr>
<td>Interactivity</td>
<td>High</td>
</tr>
<tr>
<td>Anonymity</td>
<td>Low</td>
</tr>
</tbody>
</table>

5.5.1 Rationale

Several premises underlie the hypotheses put forth in this study. First, due to techno-structural differences, environments vary in their relative capacity to transmit information (Short et al, 1976; Daft and Lengel, 1986). Some
environments permit the transmission of more types of messages than others. For example, telephone conference calling -- an increasingly common meeting environment -- carries information like tone, amplitude and backchannel cues; all of which are absent in electronic mail. Similarly, face-to-face environments exhibit greater communication capacity than either of the distributed conditions while synchronous environments, because feedback is less delayed, have greater communication capacity than asynchronous environments.

Further, as explained earlier, communication is important to all of the dependent variables of interest in this study. Consequently, the face-to-face groups were expected to report greater levels than distributed groups for all variables; similarly, synchronous groups should exhibit higher perceived levels of the dependent variables than asynchronous groups.

Secondly, AST argues that, because social structures are not equally appropriate in all situations, they evolve as they are applied differently in different circumstances. For example, critical evaluation among a team of engineers might spur the individuals to develop more creative solutions, whereas, in high level diplomatic sessions, even a little criticism can stall the process. Socio-technical structures emerge through a similar process of adaptation.

These arguments suggest that, if motivation to perform is sufficiently high, people may explore novel ways to alter aspects of their environment when the structures impede progress. If such is the case, distributed groups can be expected to manipulate structures differently than their face-to-face counterparts -- perhaps in unforeseen ways -- as they attempt to compensate for different environmental
shortcomings. Therefore, although face-to-face groups should report greater levels of cohesion, conflict management, etc. than distributed groups initially, distributed groups can be expected to report generally increasing values for all variables as time progresses and as they find ways to use the environmental structures differently.

Some structures, however, are more readily altered than others. Hence, because they are expected to be more mutable than the socio-technical structures (e.g., social presence or communication effectiveness), relational structures such as cohesion, conflict management, influence behavior and communication behavior should exhibit changes sooner than socio-technical structures.

Thus, over time, distributed groups were expected to converge with the collocated groups faster in their perceptions of the relational structures than in their perceptions of the socio-technical structures (see Table 5.3 for a summary of relative structural mutability). Greater relative mutability was also expected to permit convergence to begin sooner with the relational structures than with the socio-technical structures. In light of the foregoing general principles, Table 5.4 presents a preview of the hypotheses presented in the following sections.

<table>
<thead>
<tr>
<th>Table 5.3: Relative Mutability of Environmental Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mutable</td>
</tr>
<tr>
<td>cohesion</td>
</tr>
<tr>
<td>Social Presence</td>
</tr>
<tr>
<td>Time Constraints</td>
</tr>
</tbody>
</table>

72
<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1:</td>
<td>Cohesiveness will differ across treatments over time.</td>
</tr>
<tr>
<td>H1a:</td>
<td>Cohesiveness will initially be greater in face-to-face groups than in distributed groups.</td>
</tr>
<tr>
<td>H1b:</td>
<td>Over time, distributed groups will converge with face-to-face groups in cohesiveness.</td>
</tr>
<tr>
<td>H2:</td>
<td>Perceived conflict management will differ across treatments over time.</td>
</tr>
<tr>
<td>H2a:</td>
<td>Perceived conflict management will initially be greater in distributed groups than in face-to-face groups.</td>
</tr>
<tr>
<td>H2b:</td>
<td>Over time, distributed groups will experience a greater increase in perceived effective conflict management than face-to-face groups.</td>
</tr>
<tr>
<td>H3:</td>
<td>Satisfaction with the group process will differ across treatments over time.</td>
</tr>
<tr>
<td>H3a:</td>
<td>Satisfaction with the group process will initially be less in face-to-face groups than in distributed groups.</td>
</tr>
<tr>
<td>H3b:</td>
<td>Over time, distributed groups will converge with face-to-face groups in satisfaction with group processes.</td>
</tr>
<tr>
<td>H4:</td>
<td>Perceived social presence will differ across treatments over time.</td>
</tr>
<tr>
<td>H4a:</td>
<td>Social presence will initially be greater in face-to-face groups than in distributed groups.</td>
</tr>
<tr>
<td>H4b:</td>
<td>Over time, distributed groups will converge with face-to-face groups in perceived social presence.</td>
</tr>
<tr>
<td>H5:</td>
<td>Perceived communication effectiveness will differ across treatments over time.</td>
</tr>
<tr>
<td>H5a:</td>
<td>Communication effectiveness will initially be greater in face-to-face groups than in distributed groups.</td>
</tr>
<tr>
<td>H5b:</td>
<td>Over time, distributed groups will converge with face-to-face groups in perceptions of communication effectiveness.</td>
</tr>
<tr>
<td>H6:</td>
<td>Perceptions of the communication interface will differ across treatments over time.</td>
</tr>
<tr>
<td>H6a:</td>
<td>Perceptions of the communication interface will initially be greater in face-to-face groups than in distributed groups.</td>
</tr>
<tr>
<td>H6b:</td>
<td>Over time, distributed groups will converge with face-to-face groups in perceptions of the communication interface.</td>
</tr>
<tr>
<td>H7:</td>
<td>Distributed groups will perform at least as well as face-to-face groups.</td>
</tr>
</tbody>
</table>
5.5.2 Relational Structures

a) Cohesiveness

As discussed earlier, cohesiveness is interdependent with communication, interpersonal influence, and conformity (Festinger, 1954; McGrath, 1984). According to social-impact theory (Latané, 1981), one of the three essential components of influence is immediacy. Immediacy in this context is defined as either temporal or spatial proximity and the degree of social-impact bears an inverse relation to proximal distance. Clearly there are differences between environments examined in this study in terms of both temporal and spatial proximity, and interactions in the environments will differ correspondingly. That is, face-to-face is the most immediate of the three conditions in spatial and temporal proximity and, therefore, affords the most immediate interaction. Distributed-synchronous groups are more temporally immediate than asynchronous groups and their interaction is expected to exhibit more immediate characteristics (e.g., less time delay in feedback).

Lack of immediacy introduces barriers to processes such as self disclosure and influence. Self disclosure is the process whereby people communicate facts about themselves to others in order to establish mutual trust and commitment to the relationship (Gilbert, 1976). Reciprocity is a critical element in the degree of self disclosure (Fisher and Ellis, 1990) in that one is likely to disclose personal information only to the extent that the recipient will reciprocate with self disclosure of their own. As spatial and temporal distance increase, the opportunities to disclose personal information and to reciprocate diminish.
Relationships among these variables, though not always linear, may be represented as follows.

| Immediacy | Reciprocity | Self Disclosure | Cohesion |

Hence, face-to-face groups should experience greater immediacy, self-disclosure, reciprocity, and influence than distributed-synchronous groups and synchronous groups should experience more than asynchronous groups. Since cohesion varies with influence (McGrath, 1984), one would expect cohesiveness to exhibit corresponding effects.

In view of AST, however, groups over time can be expected to appropriate environmental structures (e.g., the technology) in ways which help them overcome initial structural limitations. In other words, as members interact over time and they explore novel ways to communicate and compensate for media, temporal and spatial deficiencies, those in distributed environments should begin to converge with collocated groups in cohesiveness. Walther (1992) found that face-to-face groups experienced cohesion building in initial periods and tended to level off in later sessions. Therefore, as distributed groups learn to adapt the technology, they can be expected to increase in cohesiveness at a greater rate than that exhibited by face-to-face groups during the period when collocated groups will be leveling off.

Specifically, face-to-face groups should exhibit greater cohesion in the first session than synchronous groups and synchronous groups should exhibit greater cohesion than asynchronous groups. However, as time progresses, groups in distributed environments should discover ways to adapt the technology so as to overcome structural limitations. By manipulating various environmental
structures, in the later periods when cohesion development in face-to-face groups is leveling off, dispersed groups are able to develop the cohesion required for the task. Thus, this study predicts an over time effect differing among environments, i.e., differences in profiles of perceived cohesion. Further, the slope describing cohesion should be greater in the distributed conditions than in the face-to-face one, i.e., distributed groups will converge over time with face-to-face groups in cohesiveness.

The hypotheses concerning cohesion are summed up as follows:

H1: Cohesiveness will differ across treatments over time.

H1a: Cohesiveness will initially be greater in face-to-face groups than in distributed groups.

H1b: Over time, distributed groups will converge with face-to-face groups in cohesiveness.

b) Conflict Management

Witteman’s (1991) review of conflict literature suggests that interpersonal conflict in the context of group activities can be either functional or dysfunctional depending on the nature of the conflict which is largely determined by its source.

“...substantive conflict involves an intellectual opposition among participants deriving from the content of the group’s agenda or specific ideas presented in discussion, whereas affective conflict represents emotional clashes or interpersonal struggles.” (Witteman, 1991, pp. 26)

Thus, to the extent that interaction can be made to focus away from social issues which have the potential to lead to emotional or interpersonal disagreements and focus more toward task issues, the process may be more substantive and, therefore, more productive. This is not to say that conflict is
always counterproductive. To the contrary, many agree that interpersonal conflict is an integral and necessary part of the group process. For example Fisher and Ellis, (1990) contend that, because conflict is unavoidable in the course of interpersonal interaction, lack of conflict indicates apathy or non-willingness to participate. Non-participation, in turn, precludes the development of cohesion. Since participation implies instances of disagreement, to some extent interpersonal conflict is normal and even necessary in the development of group cohesiveness. Thus, a group’s development of cohesiveness may be expected to reflect, to a degree, their pattern of conflict management.

For detrimental conflict to be prevented, the group needs to be able to effectively manage conflict which does arise. To successfully work through disagreement, members need to be able to choose from a variety of strategies. Littlejohn (1989) argues that strategies for managing conflict can be broadly categorized as passive, distributive or integrative. Passive strategies include ignoring or avoiding conflict or submitting to others in the face of disagreement. Distributive strategies include requesting, persuading and demanding techniques which emphasize outcomes favoring one party over another. Integrating includes disclosure and problem solving, both of which are aimed at generating mutually satisfactory solutions. Passive strategies preclude direct discussion or interaction while both distributive and integrative strategies require explicit acknowledgment of the disagreement and discussion towards either concession (i.e., distribution) or neutral evaluation (i.e., integration).
Generally, passive strategies are thought to be ineffective in long term conflict management and ought to be prevented when possible. However, an environment which prohibits interaction in general may be helpful in terms of preventing disruptive conflict in particular. Thus, a less interactive and immediate environment which restricts the exchange of social information such as status or power cues, may also focus participants more on task issues leading to less dysfunctional conflict (e.g., Chidambaram, 1989). Miranda and Bostrom, (1993) and Gallupe (1985) also found less interpersonal conflict in EMS supported groups than in non-supported groups. One conclusion which can be drawn from these studies is that technologically supported environments may deter dysfunctional conflict to the extent that they mediate -- and thus impede -- interpersonal interaction. Further, the structure which an EMS brings to a meeting may serve to reduce the potential for conflict which arises when deciding how to establish meeting procedures (Miranda and Bostrom, 1993). Together, these results suggest that face-to-face groups can be expected to experience more interpersonal conflict than distributed groups.

However, as pointed out above, some conflict is essential for group cohesion and development. Thus, active management strategies must be supported to ensure proper group development. Since a primary objective for active conflict management is issue clarification, such strategies presume the desire of the members and the capacity of the environment to maintain open dialogue. Therefore, the environment which affords the most effective
communication ought to help most toward that end. This argument suggests that, although face-to-face groups are expected to encounter more conflict than distributed groups in early sessions, because they are working in an environment with greater communication capacity than distributed groups, they ought to be better able than distributed groups to actively manage what conflict does arise. However, a major problem remains since the more interactive the environment is, the greater will be the opportunity for continued interpersonal conflict.

Thus, in the long term, distributed groups can be expected to experience less conflict than face-to-face groups. Moreover, as conflict does arise, AST suggests that, over time, distributed groups will be able to discover ways of actively handling it. Therefore, face-to-face groups are expected to exhibit profiles indicating greater amounts of conflict and less effective management of it over all four sessions.

The hypotheses concerning ability to manage conflict are summed up as follows:

**H2:** Perceptions of conflict management will differ across treatments over time.

**H2a:** Perceived conflict management will initially be greater in distributed groups than in face-to-face groups.

**H2b:** Over time, distributed groups will experience a greater increase in perceived effective conflict management than face-to-face groups.

**c) Satisfaction with Group Process**

Group processes consist of several important factors. For example feeling that one has contributed to the group activity is critical to effective group
performance (Fisher and Ellis, 1990). Thus, when participation is hindered by the presence of dominating individuals, especially those whose influence is inhibitive rather than facilitative, performance can suffer. Fisher and Ellis' review of the literature suggests that several other factors are also critical to effective performance in groups. Effective groups need to make a thorough assessment of the alternatives available and to vigorously evaluate the validity of each other's assumptions and opinions.

Meeting environments appear to influence several aspects of interaction. For example, some systems increase participant anonymity (e.g., Jessup et al., 1990) while others are helpful at equalizing participation (e.g., Siegel et al., 1986). Factors such as participants' assumptions, opinions and alternatives are related to participation in that they can be explored more critically and more fully in groups where members are not reluctant to participate. Thus, to the extent that distributed EMS interaction leads to deindividuation, it may make members more likely to critically evaluate ideas presented by others than would face-to-face interaction.

Given that participation is necessary for communication, the extent to which an EMS fosters participation and the nature of that participation will affect the extent to which effective information exchange will occur. Research has shown that EMS supported environments can lead to increased equality of participation (e.g., Siegel et al., 1986). This is because the limited cueing capacity of computer mediated interaction prevents some social message transmission (for example, vigorous head shaking or dominant conversational tones). EMSs also offer greater anonymity when entering comments; in such a situation, anonymity may lead to deindividuation (Jessup et al., 1990). As people become deindividuated, they become less inhibited and less concerned with potential
criticism and more likely to contribute ideas. In view of earlier findings, face-to-face groups can be expected to experience less equal participation than distributed groups. There is no apparent reason, however, to expect any participatory inequality between the two distributed conditions.

Moreover, face-to-face groups are not likely to experience much change in participatory equality over time. After all, patterns of behavior in groups appear to become structures early on (Gersick, 1988) leading to the conclusion that many behavioral patterns established early in the development process (e.g., dominance) remain throughout the group's lifetime. Power inequity may be quite difficult to overcome when the presence of the dominant individual is immediate, as is the case in face-to-face interaction.

On the other hand, power structures in distributed EMS groups may not be as static in the long term. AST suggests that individuals who are highly motivated to control the group process may become creative in devising methods to assert their dominance in spite of the inherent neutrality of the EMS, thus altering the power balance. For example, assertiveness might be projected through the use of capital letters when typing in comments. In the face of persistent aggression, some members of distributed groups may try to withdraw from participation leading to decreased satisfaction with the process.

The factors discussed in this section combine to constitute overall satisfaction with the group process and the hypotheses concerning these perceptions are summed up as follows:

H3: Satisfaction with the group process will differ across treatments over time.

H3a: Satisfaction with the group process will initially be greater in distributed groups than in face-to-face groups.
H3b: Over time, distributed groups will converge with face-to-face groups in satisfaction with group processes.

5.5.3 Socio-Technical Structures

a) Social Presence

Social presence theories (e.g., Short et al., 1976) and media richness theories (e.g., Trevino et al., 1990) take similar positions in arguing that media vary in the amount and type of information which they are capable of processing. Richer media, e.g., face-to-face, are more capable of reducing ambiguity and also elicit greater perceptions of social presence than leaner media, e.g., e-mail. Specifically, Short et al. (1976) assert that face-to-face is most efficient because it allows transmission of many proximal, facial and other nonverbal cues. Leaner media, e.g., written memos, have less capacity for reducing ambiguity because they allow few if any nonverbal cues and generally result in less perceived social presence. Leaner media may be preferred, however, for transmitting large quantities of information which are critical in reducing uncertainty.

In light of the preceding observations and recent research findings regarding collocated versus distributed meetings (e.g., Chidambaram and Jones, 1994), face-to-face meetings supported with EMS are expected to exhibit greater social presence than either of the distributed conditions -- i.e., synchronous EMS or asynchronous EMS.

Furthermore, immediacy (as defined earlier) may depend in part on the capacity for transmission of various types of cues. Spatial proximity constrains both quantity and type of nonverbal communication while temporal proximity influences interactivity and reciprocity. For example, increasing temporal
distance (time lapse) between communicative interacts can lead to a reduced perception of the importance of the message. Hence, distributed synchronous groups will perceive greater social presence than asynchronous groups.

AST suggests that, as group members become increasingly acquainted with both the shortcomings and the functions of a medium, they may discover methods of using it to express themselves more fully. Thus, users can be expected to explore aspects of the medium in ways which will result in increased social presence.

The hypotheses concerning perceptions of social presence are summed up as follows:

H4: Perceived social presence will differ across treatments over time.
H4a: Perceived social presence will initially be greater in face-to-face groups than in distributed groups.
H4b: Over time, distributed groups will converge with face-to-face groups in perceived social presence.

b) Communication Effectiveness

Communication is the crux of group interaction. Groups which cannot exchange information effectively have more difficulty establishing shared understanding and norms and are, therefore, likely to be less cohesive (e.g., Fisher and Ellis, 1990; McGrath, 1984). Moreover, coordinating activities, surfacing assumptions, exploring alternatives and evaluating solutions -- activities required for the current task -- depend on effective communication. Media richness theory (Daft and Lengel, 1986) suggests that effective performance of task activities will depend on the capacities of the media employed. By extension, the characteristics
of the entire communication environment will influence task related procedures. As outlined above, the face-to-face environment exhibits considerably more capacity for interaction, therefore, the face-to-face groups will have a decided advantage in accomplishing the activities required for successful task completion. Hence, distributed groups are expected to report less communication effectiveness than the collocated groups. However, in accord with the theoretical principles discussed earlier, the distributed groups are more likely to employ novel techniques to deal with environmental limitations.

The hypotheses concerning perceptions of communication effectiveness are summed up as follows:

**H5:** Perceived communication effectiveness will differ across treatments over time.

**H5a:** Perceived communication effectiveness will initially be greater in face-to-face groups than in distributed groups.

**H5b:** Over time, distributed groups will converge with face-to-face groups in perceptions of communication effectiveness.

c) **Communication Interface**

Communication interface refers to the characteristics of the environment with which the participants interact when communicating. Issues like the simplicity and ease of interacting afforded by the environment are likely to determine usage. For example, if communicating requires learning how to use a complex new technology, participants may be likely to use a more familiar medium instead, even though it may be less appropriate for the task.
Since turning to someone to talk to them is easier and simpler than using a computer system, face-to-face groups are likely to rate their interface more satisfactory than are distributed groups who are limited to computer mediated interaction. Asynchronous groups face the additional problem of delayed interaction which may result in them scoring the interface lower than both other types of groups. Once again, however, over time distributed groups are expected to experiment with ways to compensate for environmental inadequacies.

The hypotheses concerning perceptions of the communication interface are summed up as follows:

**H6**: Perceptions of the communication interface will differ across treatments over time.

**H6a**: Perceptions of the communication interface will initially be greater in face-to-face groups than in distributed groups.

**H6b**: Over time, distributed groups will converge with face-to-face groups in perceptions of the communication interface.

### 5.5.4 Output

**Performance**: The earlier discussion concerning media capacity suggests that some meeting modalities will be more effective for communication exchange required in the joint creation of a complex document. Thus, the conditions providing the greatest channel capacity and the greatest opportunity for effective and immediate interaction would be expected to result in better task performance than problematic environments in initial sessions. However, by the end of the
exercise, distributed groups may have learned how to effectively compensate for impediments and at least equal face-to-face groups in terms of performance scores. Given the complex nature of the task in the present study and the fact that the groups have to produce a finished document in only four sessions, performance will be assessed once -- i.e., at the end of the exercise -- rather than repeatedly throughout the experiment.

The hypothesis concerning the effects of treatment on task performance is as follows:

**H7: Distributed groups will perform at least as well as face-to-face groups.**

### 5.6 Summary

This chapter began with a discussion of the fundamental rationale underlying the hypotheses which this study tests. Adaptive structuration theory provides the theoretical underpinning for the hypotheses developed later in the chapter. AST suggests that structures evolve as people alter them to better suit context specific requirements. Some structures are more mutable than others and are expected to change more readily than relatively rigid structures. Because the particular relational structures examined in this study are presumed to be generally more flexible than the socio-technical structures, they are expected to exhibit change sooner than the technical structures.

For purposes of this study, the primary causal variable is meeting environment which exhibits three levels -- face-to-face, distributed synchronous and distributed asynchronous. The primary dependent variables focused on
behavioral and socio-technical structures. The output variable of interest was performance. Finally, hypotheses were presented relative to expected patterns of change in relational and socio-technical structures and performance.
CHAPTER VI - RESEARCH METHODOLOGY

This chapter describes the implementation of the experiment. There are several general types of research design which could have been employed in the study, for example a case study or a field experiment. However, because there are few organizations in this locale using systems to support asynchronous group work, this study used a laboratory experimental design. While such a design limits the external validity of the results, it permits much greater control over several extraneous variables thus increasing the internal validity of the study.

The designs of the two pilots studies are described in the next section. The lessons learned from the pilots and the changes indicated by those lessons with respect to the main study are also discussed. Thus, the pilots served primarily as a testing arena for the study design. Finally, the design of the main experiment is presented in light of the information gathered during the pilot studies.

6.1 Pilot Studies

Two pilot studies were conducted to validate the task and check the effectiveness of the experimental procedures. A sample of 32 participants (eight groups) was used in both pilots. All experimental procedures were identical to those proposed for the main study except that the groups in the first pilot met for three sessions rather than four. Exit interview data from the first pilot indicated that the participants felt the task was relatively complex and difficult and that adding a fourth session would offer the groups a more reasonable amount of time
to complete the task. This adjustment was made in the design of the second pilot where post-session interviews ascertained that a limit of four sessions -- though some subjects wanted more -- was reasonable. Thus, the main study used four one hour sessions as well. A discussion of the preliminary results from the first pilot are presented in Appendix K.

6.1.1 Time

Time is an important variable in any study of group behavior (McGrath, 1988). In the spirit of AST, the current study treated time as both a resource and a constraint. On one hand, time is the resource by which groups are able to perform their task while exploring methodologies and adapting actions and structures. Thus, the first pilot study allowed groups three sessions to realize their development. On the other hand, time is a constraint in that all groups find themselves limited in the amount of time they are able to devote to any single task. Groups in the first pilot study were strictly held to their three one hour time limits in order to ensure comparability across environments.

6.1.2 Task

A major objective in the pilot studies was to validate the task. Remarks from participants in the first pilot indicated that the case background included too much detail and material and did not help to clarify the requirements. Both the background and requirements were rewritten and shortened with the result that
participants in the second pilot felt the material was sufficiently relevant and meaningful.

6.1.3 Procedures

The procedures used in the main study were refined in the first and second pilot studies. Training was more efficient in the main study as a result of working out bugs in the pilots and improving the script. Other procedures were also improved. For example, in the pilot, sessions were scheduled on the hour with one session directly following the previous session. However, at times, when the experimenter was elsewhere starting another group, participants were not able to start promptly. Thus the main study incorporated a 15 minute slack period between sessions to allow the experimenter to get everyone started on time.

6.1.4 Questionnaires

Post-session questionnaires were identical in both pilot studies and all had been validated in previous studies. For the most part, reliability tests confirmed the validity of the scales in the pilot studies. Therefore, the instruments were used without alteration in the main study.

6.2 Main Study Research Design

The study utilized a repeated observations longitudinal design capturing data from each of four one hour group meetings over a four week period. Such a design helped increase the generalizability of the results relative to results
obtained from single meeting studies which have predominated EMS research to date.

A single factor design was used with three levels. The factor manipulated was meeting mode and the levels were:

1) face-to-face with EMS,
2) distributed-synchronous with EMS and
3) distributed-asynchronous with EMS.

Participants were randomly assigned to groups and groups were randomly assigned to meeting environments and all groups worked on the same task.

6.2.1 Treatments

All groups were required to write their document within a co-authoring tool of the EMS. The EMS was a networked, distributed EMS designed by Ventana Corporation and called GroupLink. Subjects were trained on and used only the GroupWriter tool for all activities pertaining to the task. The activities included reaching agreement on an appropriate procedure for the process and the subsequent development of the orientation document. See Appendices C, D, E and F for specific procedural instructions.

All groups were trained to use two features of the group writing tool for any necessary communication. The first was an "annotation" feature which permitted users to embed comments in sections of the document without disrupting the flow of the document. Once entered in the document, annotations were only visible as a number (representing the sequential number of the annotation) enclosed in double chevrons (e.g., <<1>> ) at the point in the text.
where the author of the comment entered it. Participants were instructed that when they saw such a marking they could "open" and read the entire annotation.

The second method of communication was via a section of the document which was restricted to the posting of messages and was labeled accordingly. Participants were taught to enter any comments directly related to a portion of the text as an annotation at the relevant point. All other comments were to be placed in the "communication" section of the document. Participants were also instructed to avoid discussing the exercise outside of the scheduled session times.

The experimenter was present during all sessions for technical advice and to preserve procedural integrity (e.g., preventing dispersed participants from interacting face-to-face, etc.).

**a) Face to Face EMS**

Members of face-to-face groups met at the same time in the Electronic Meeting Room at the University of Hawaii's College of Business Administration. Terminals in this room were organized in groups of three abreast in three sides of a square. The four participants were arranged so that two sat in one row and immediately adjacent and at a right angle to them sat the other two. Every participant was in full view of the other group members. All face-to-face groups were instructed that:

i) they were to produce the document using the system,

ii) they could make any comments using the application’s annotation feature or communication section of the document as instructed and
iii) teammates could talk freely among themselves.

**b) Synchronous EMS**

Groups in the distributed-synchronous condition met at the same time but in four different rooms containing networked PCs throughout the Business Administration building. No single group member was allowed to start a session before the others arrived and were ready to begin. The experimenter made sure there was no face-to-face interaction between members during meeting times. In the distributed synchronous and asynchronous treatments, participants were required to communicate via the two EMS features described above, i.e., through use of annotations and the announcements and communications sections of the document; they had no other interaction channels available.

**c) Asynchronous EMS**

Asynchronous group members were not allowed to meet simultaneously. Instead, they logged onto the system and "attended" the meeting at times when other members were not at their computers. All other procedures were the same as described above.

**6.2.2 Experimental Procedures**

**a) Subjects**

The design used 33 groups of junior and senior Business and Travel Industry Management students. The total subject pool was initially 128; due to a
work schedule change, one participant had to drop out after the first session. The remaining 127 participants completed the study. The exercise was a course assignment for about half of the subjects and an extra credit project for the remainder.

Monetary prizes were awarded to the top six teams based on their output as evaluated by the expert judges, many of whom were Business College instructors. First place prize was $160 for the group, second prize was $100, third - $80, fourth - $60, fifth - $40 and sixth place prize was $20. In order to try equalize motivation across environments, all participants were informed that since there were three conditions, the two top scoring groups in each condition would receive cash awards.

b) Task

Much of the EMS research has been concerned with GDSSs (e.g., Jarvenpaa et al., 1988; Zigurs et al., 1988; Connolly et al. 1990; Jessup et al., 1990; Chidambaram and Bostrom, 1993) and typically report on decision making or intellective tasks. Some CMC studies have also looked at decision making tasks (e.g., Hiltz et al., 1986; Siegel et al., 1986; Walther, 1992). However, Panko (1992) argues that less than 25% of the meetings that real groups engage in, consist primarily of decision making.

Some EMS studies investigated the general process of communication in a less structured context (e.g., Kiesler et al., 1984; Sproull and Kiesler, 1986; Kraut et al. 1987-88; Rice and Love, 1987). The contexts within which some of these
projects studied interaction, e.g., capturing data from ongoing BBSs, were generally not focused on a specific task and tended to be rather unstructured. Thus, the generalizability of results from these earlier studies to organizational settings where tasks are frequently more structured is questionable.

In light of these limitations, the current study used a complex project development task which required groups to generate, assess, select and develop ideas relevant to and then create a policy manual. According to McGrath’s Task Circumplex (McGrath, 1984), the task used here would be considered a type 1 planning task. The nature of the task is different from decision specific tasks and is representative of many organizational situations.

Every participant received background information pertaining to a fictitious international consulting organization (Appendix B) of which they were to consider themselves members. Along with the background data, subjects were given instructions describing the objectives of the task (Appendix C). Specifically, they were asked to create ideas and explain their implementation within each of six pre-titled segments of a policy document. The purpose of the policy manual was to introduce newly hired managers to the organizational culture and to the standards of practice employed throughout the organization.

Appendix D contains directions regarding the specific deliverables each group was encouraged to try to achieve at the end of each session; requirements for the first three sessions were presented as guidelines rather than measurable goals. Subjects were informed that deliverables for the final session would be evaluated against a specific set of criteria. Instructions pertaining to logging onto the system, basics about the technology, session protocol and directions for communicating
were also given to each participant (Appendix E). All of these documents, except the Task (Appendix C), were distributed to each participant during their training session as a take-home packet. A copy of all of the instructions was also provided at each terminal for each session in case anyone forgot to bring their packet.

c) Training

Training consisted of a one-hour session for all subjects. Although initial plans were to have each experimental group trained as a whole, scheduling problems prevented that and training sessions were randomly formed. Participants were trained to log on, enter the document and perform simple text editing functions including typing, cutting, pasting, copying and deleting. They were also taught how to create and read annotations and to use the communication section for posting comments. A script was followed for all training sessions to ensure comparability across sessions. The experimenter and one assistant (the manager of the Electronic Meeting Room facility) conducted all training sessions following the script precisely.

d) Prior Training

If subjects in the study had prior training with respect to collaborative writing in a technology supported context, they might be more comfortable working in a collaborative writing group than participants would be who had no prior training. Additionally, performance could be expected to differ between previously trained and non-trained groups. Therefore, a post-experiment follow up survey was conducted on a random sample of 25 participants. The objective of
the survey was to determine whether any systematic differences existed between treatments in terms of prior training in EMS-supported collaborative writing.

All of the subjects queried -- either through chance meetings or telephone solicitations -- were asked whether they had previously been exposed to any sort of training program in group writing, either with or without the aid of technology. None of the respondents had ever received any instruction in collaborative writing before this exercise. Thus, prior training was not a factor in group development or performance in this study.

e) Questionnaires

The instruments (Appendices, G, H and I) were identical to the ones used in the two pilot studies and follow-up reliability tests were performed on each of them in the main study. The results generally indicated reasonable levels of reliability for all measures and are reported with the statistical analyses of the individual variables in Chapter VII.

6.2.3 Evaluation of Performance

Performance was evaluated using the quality of the final document produced. The evaluations were performed by a panel of eleven judges who were all expert in teaching and evaluating documents. Moreover, most of the judges had extensive experience with organizational issues.

Judges were provided evaluation forms to assess each major segment of the final document (see appendix J). Evaluation criteria included creativity of
ideas presented, the tone used, practicality and comprehensiveness of the document in dealing with the issues explained in the case. Higher scores indicate better performance relative to the specific criteria applied. Each judge evaluated nine documents independently of other judges' opinions and each document was evaluated by three judges. Further, the identities of the documents' authors or the treatments from which they derived were unknown to all judges.

6.3 Summary

This chapter presented a detailed discussion of the research methodology employed in this study. The pilot studies were discussed with particular attention to the roles they played in facilitating refinement of the research design for the main study. Following that, the basic design was explained including descriptions of the treatments, the subjects, the task, training and performance evaluation. The next chapter details results from the statistical analyses performed on the data gathered during the main study.
CHAPTER VII - RESULTS OF STATISTICAL ANALYSES

This chapter presents the results of the statistical analyses used to test the hypotheses discussed in Chapter V. The chapter begins with descriptive statistics of the subjects' biographical and academic information. Subjects were randomly assigned to groups and groups were randomly assigned to treatments. Thus, randomization should have precluded systematic differences between treatments with respect to individual differences. One-way ANOVAs were conducted on the background information gathered in the pre-test questionnaires to ascertain homogeneity across treatments.

The hypotheses presented in Chapter V concerned three perspectives of structural relationships. The primary hypothesis for each structural variable examined over time predicted differences among the profiles. Secondary hypotheses predicted that significant differences would be detected among treatments in the initial sessions. Tertiary hypotheses predicted directional differences in the rate of increase (i.e., the slope) of the variables over time.

7.1 Descriptive Statistics

A total of 127 undergraduate subjects were enlisted for the study and randomly assigned to 33 groups. Groups were comprised of four members, although three groups (one face-to-face and two synchronous groups) started with only three members each and two other groups (one face-to-face and one asynchronous) finished the exercise with three members. Although some groups
experienced subject mortality (a natural occurrence in most organizations), no 
groups were entirely dropped from the analyses.

| Table 7.1: Manipulation Check Of Random Assignment Participants’ 
Biographical Information |
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor</td>
</tr>
<tr>
<td>Major:</td>
</tr>
<tr>
<td>Finance</td>
</tr>
<tr>
<td>Marketing</td>
</tr>
<tr>
<td>Management</td>
</tr>
<tr>
<td>MIS/Decision Sciences</td>
</tr>
<tr>
<td>Accounting</td>
</tr>
<tr>
<td>TIM</td>
</tr>
<tr>
<td>General Business</td>
</tr>
<tr>
<td>Human Resources</td>
</tr>
<tr>
<td>International Business</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>Average Age:</td>
</tr>
<tr>
<td>Sex:</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Work Experience:</td>
</tr>
<tr>
<td>Part Time (months)</td>
</tr>
<tr>
<td>Full Time (months)</td>
</tr>
<tr>
<td>GPA:</td>
</tr>
</tbody>
</table>

* Test values are F-values except where noted as $\chi^2$.

Each subject was given a pre-session questionnaire soliciting background 
academic and biographical information (see Appendix L for a copy of the pre-
session questionnaire). Questions concerned their age, academic major, grade 
point average (GPA), sex, class standing and part and full-time work experience. 
A person’s experience with and feelings towards working with groups and how 
outgoing they perceived themselves to be were also likely to impact outcomes; 
hence, these factors were measured as well. Perceived level of typing expertise
and feelings toward using a computer may be particularly relevant to computer-mediated interaction and were therefore also included as pre-test factors. Table 7.1 presents a summary of relevant descriptive statistics for individual biographical and academic characteristics.

As was expected following randomization of subject and group assignment, post-hoc one-way ANOVAs and chi-square frequency tests showed no significant differences among treatments with respect to the individual characteristics detailed in table 7.1.

### 7.2 Background Information

Factors other than those addressed in Table 7.1 may also impact an individual’s contribution to the group process (e.g., McGrath, 1984). Thus, the pre-session survey solicited participants’ perceptions with respect to the following background information:

i) the extent of prior experience with groups

ii) whether the subject liked working in groups

iii) whether the participant was outgoing in groups

iv) whether the subject liked using computers

v) level of typing ability

Data gathered along with results of the one-way ANOVAs are provided in Table 7.2.
Table 7.2: Manipulation Check Of Random Assignment Participants’ Background Information

<table>
<thead>
<tr>
<th>Issue</th>
<th>F-t-F</th>
<th>Sync</th>
<th>Async</th>
<th>F-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have a lot of experience working in groups.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>3.116</td>
<td>2.244</td>
<td>3.140</td>
<td>5.978</td>
<td>.003*</td>
</tr>
<tr>
<td>Std. dev.</td>
<td>1.546</td>
<td>1.067</td>
<td>1.373</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I like to work in groups.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>3.116</td>
<td>2.342</td>
<td>2.884</td>
<td>2.965</td>
<td>.055</td>
</tr>
<tr>
<td>Std. dev.</td>
<td>1.621</td>
<td>1.217</td>
<td>1.592</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I like using computers.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>2.977</td>
<td>2.293</td>
<td>2.535</td>
<td>1.954</td>
<td>.146</td>
</tr>
<tr>
<td>Std. dev.</td>
<td>1.883</td>
<td>1.537</td>
<td>1.369</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How well do you type?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>4.698</td>
<td>4.293</td>
<td>4.767</td>
<td>1.419</td>
<td>.246</td>
</tr>
<tr>
<td>Std. dev.</td>
<td>1.489</td>
<td>1.328</td>
<td>1.342</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* indicates significance at $\alpha = .05$

7.2.1 Previous Experience With Groups

In order to test for systematic differences among treatments, the pre-session questionnaire presented a question about the subject’s level of previous experience with groups. A response of 1 indicated a high level of experience while a 7 indicated very little experience in groups. Results displayed in Table 7.2 indicate that distributed synchronous groups reported more group experience than either face-to-face or asynchronous groups. However, an analysis of covariance (MANCOVA) including this term as a covariate produced statistical and significance values with respect to all dependent variables identical to those attained in the initial MANOVA. Thus, variability of group experience had no systematic impact on the dependent variables targeted in this study. This was not
surprising in light of the bi-level randomization of subjects to groups and groups to treatments.

7.2.2 Disposition Toward Working In Groups

A second question asked whether the participant liked working in groups. A score of 1 showed great affinity toward group interaction while a 7 indicated aversion to group activity. A positive prior disposition toward working in groups might lead to greater attraction to fellow teammates than exhibited by those with a negative predisposition. However, as shown in Table 7.2, subjects did not differ across treatments in their attitude about working in groups.

7.2.3 Computer Use and Typing Ability

Because participants were required to use the computer for writing the document, the pre-session questionnaire also checked participants’ attitudes toward computer use and perceived typing ability. The results in Table 7.2 show no differences among subjects in the different treatments with respect to their attitude toward the computer or their typing ability.

7.3 Tests of Hypotheses

Because the experimental design covered multiple sessions, the multivariate analysis of variance for repeated measures was used to determine whether treatments differed with respect to the dependent variables.
**Assumptions**

Two assumptions required for the MANOVA are normal distribution of means and equality of variances across treatment populations. In the current study, these were reasonable assumptions since the subjects were randomly assigned to groups and groups were randomly assigned to treatments.

**Test Used**

Pillai’s Trace (V statistic) was used for evaluating multivariate differences. Two concerns influence the choice of multivariate test criterion. The first is the ability of the test to detect effects and the other concerns the robustness of the test. Among the variety of tests most commonly used for multivariate analysis (e.g., Wilks’ lambda, Hotelling’s T-squared and Roy’s largest root), Pillai’s Trace is the most powerful and conservative. Moreover, the significance level based on Pillai’s trace is reasonably correct even when assumptions of normality and equality of variance across samples are violated.

The formula for Pillai’s test is:

\[ V = \sum_{i=1}^{s} \frac{1}{1 + \lambda_i} \]

where \( \lambda_i \) is the \( i \)th eigenvalue and \( s \) is the number of all non-zero eigenvalues.

**Discussion of Effects**

Although there is only one factor (treatment), the variables were all measured repeatedly over the four sessions. In this sense then, the MANOVA reports the effect of treatment over time. While time (i.e., the sessions) is not a factor, nonetheless, the MANOVA analyzes the dependent measures in the
different sessions as though one were dependent on the others. In effect, with repeated measures, time becomes a factor being tested for interacting with treatment, but only at one level -- i.e., the overall profile -- rather than at each of four (session) levels. These effects are reported here as profiles over time or treatment x variable. Such an analysis addresses the question: do the treatments differ when looking at the variable across all of the four different sessions? Thus, the vectors of session means for all groups in a treatment are compared to the vectors of means for the other treatments.

Another way of examining the source of effects is to collapse the vectors of group means within a session so that treatment differences are irrelevant. In this case, the comparison is of vectors of means only across sessions. The question being addressed by such an analysis is: ignoring treatment, are there differences between the vectors of means of (at least) any two sessions? Such effects are reported here as variable effects (where variable denotes the particular dependent variable being discussed).

**Unit of Analysis**

Data were aggregated -- as group means -- for all perceptual variables for several reasons. First, a review of EMS and small group research revealed that while some studies analyzed individual observations (e.g., Hiltz and Johnson, 1990; Kinney and Dennis, 1994) others -- especially those focused on group development issues -- used aggregate data (e.g., Chidambaram, 1989; Walther, 1992). Secondly, individuals' perceptions are likely to be dependent on behaviors
of others in the group. Thus, since individual data points are not independent, it is appropriate to pool them for testing. However, using aggregate data may obscure certain information, e.g., variability between individual scores. Therefore, the current study applied the same MANOVA tests to both the individual raw scores and aggregated data. Since results were identical using both methods, those obtained from the aggregated data are reported here.

**Missing Data**

Missing data presents another concern with respect to appropriate data analysis. When using aggregated data such as group means, missing individual level values are automatically imputed during aggregation. However, when analyzing individual data, the most conservative solution for missing values is to do nothing. The problem is that missing values destroy the balance of the design thus decreasing the degrees of freedom available and, consequently, the power of the test. Because data is a critical -- and usually scarce --resource, a more appealing solution is to estimate the missing values with the groups’ mean for the variable in question. Although other, less conservative, methods of estimating missing values do exist, since the purpose of testing individual level data was only as a means of cross-checking results obtained from aggregate data, the present study applied the most conservative approach. Further, the relative number of missing values was quite small (less than 1%) and, for the most part, was not systematic. Thus, missing values were treated as system missing and the case was dropped from the analysis listwise, i.e., the case was ignored for (only) that
variable when a missing value was detected. Given the absence of effects with both procedures (i.e., individual and aggregate data analysis) more complex imputation methods appeared unwarranted.

7.3.1 Hypotheses Related to Cohesion

**H1:** Cohesiveness will differ across treatments over time.

**H1a:** Cohesiveness will initially be greater in face-to-face groups than in distributed groups.

**H1b:** Over time, distributed groups will converge with face-to-face groups in cohesiveness.

Cohesion was measured by five items (a score of one being the lowest, five being the highest) based on the previously-validated Seashore’s Index of Cohesiveness (Seashore, 1954) with a Cronbach’s alpha of 0.82 in the present study. Cronbach’s alpha is one of several possible estimates which can be applied to assess the internal consistency of a factor. Factor reliability is derived from the squared multiple correlations (SMC) of the factor scores which are predicted from the scores of the observed variables. Tabachnick and Fidell (1983) argue that .70 is a high SMC indicating that the observed variables account for a substantial amount of the variance in the overall factor score. Table 7.3 presents treatment means for each of the sessions and Table 7.4 shows the statistical test results for the differences in cohesiveness.

With respect to the profiles of cohesiveness over time, Pillai’s statistic of 0.277 had an F-value of 1.551 which was not significant at the alpha = .05 level.
In other words, groups reported no significant differences among treatments in level of cohesiveness over time. Thus, hypothesis H1 was not supported.

Although treatment did not affect cohesion over time, cohesion by itself -- i.e., ignoring treatment -- did change over time as indicated in Table 7.4. That is, without regard to treatment, cohesion differed significantly between sessions one and four, i.e., over time. Pillai's statistic for the effect of cohesion over time (irrespective of treatment) was 0.507 with an F-value of 9.607 which was significant at the alpha = .05 level. The effect of time is central to the question concerning relative structural mutability discussed in Chapter II. Therefore, MANOVA results pertinent to variable effects minus treatment effects will be reported throughout the discussion in this chapter. The implications of the relationship between time and structural mutability will be more fully explored in the next chapter.

Figure 7.1 shows the profiles of the three environments with respect to cohesiveness across all four sessions. Group means, presented in Table 7.3 and graphically represented in Figure 7.3, suggest that, although the profiles did not differ significantly, the face-to-face groups scored higher than the distributed groups initially and maintained that advantage over time. All groups increased in cohesion as the task progressed.
Figure 7.1: Cohesiveness
A one-way ANOVA of the first session data reveals that treatments differed significantly in cohesiveness. First session differences are significant at the alpha = 0.05 level with an F-value of 12.203. Thus, hypothesis H1a, predicting that face-to-face groups would experience more cohesiveness initially, is supported, as indicated by the results presented in Table 7.5.

Results from Duncan's range test, performed concurrent with the one-way ANOVA in order to determine the precise location of effects, indicate that face-to-face groups reported more cohesion than either synchronous or asynchronous groups in the first session while distributed treatments did not differ between themselves. These findings support hypothesis H1a.

<table>
<thead>
<tr>
<th>Table 7.3: Cohesiveness Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>Face-to-face</td>
</tr>
<tr>
<td>Synchronous</td>
</tr>
<tr>
<td>Asynchronous</td>
</tr>
<tr>
<td>Grand Means</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 7.4: MANOVA Results for Cohesiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effect</td>
</tr>
<tr>
<td>-------------</td>
</tr>
<tr>
<td>Treatment by cohesion</td>
</tr>
<tr>
<td>Cohesion</td>
</tr>
</tbody>
</table>

* significant at \( \alpha = .05 \)
Furthermore, the means for the distributed groups tended to increase in sessions two through four. In the last three sessions, the differences between face-to-face and synchronous groups disappeared altogether. However, face-to-face groups continued to differ from asynchronous groups throughout. These results support hypothesis H1b since the differences in means between face-to-face and synchronous groups became non-significant in later sessions, thus indicating a greater rate of increase of cohesion in synchronous groups leading to convergence with respect to cohesion.

<table>
<thead>
<tr>
<th>Table 7.5: Treatment Differences By Session: Cohesiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

† Duncan’s range test - significantly different pairs at $\alpha = .05$

">" indicates "significantly greater than," otherwise equal

F = face-to-face, S = synchronous, A = asynchronous

* ANOVA significant at $\alpha = .05$

7.3.2 Hypotheses Related to Conflict Management

**H2:** Perceptions of conflict management will differ across treatments over time.

**H2a:** Perceived conflict management will initially be greater in distributed groups than in face-to-face groups.

**H2b:** Over time, distributed groups will experience a greater increase in perceived effective conflict management than face-to-face groups.
Means for perceived conflict management across all four sessions are presented in Table 7.6 and MANOVA results are shown in Table 7.7. The four items measuring conflict resulted in a Cronbach’s alpha of 0.56 in this study. As indicated, profiles were not significantly different among treatments over time at a significance level of $\alpha = .05$ (Pillai’s value = 0.152, F-value = 0.793 and P-value = .579). Hence, hypothesis H2 was not supported.

However, Table 7.7 shows that -- when collapsing mean scores across treatments into single vectors per session -- experienced conflict differed significantly over time at an alpha = .05 (Pillai’s value = 0.575, F-value = 12.611, P-value = .000). In other words, ignoring treatment differences, conflict management ability -- another relational structure -- did exhibit significant change when observed over the four sessions as expected.

As the Duncan’s range test results displayed in Table 7.8 show, face-to-face groups reported greater ability to handle conflict than asynchronous groups (though not significantly more than synchronous groups) in sessions one and two. Thus, hypothesis H2a was not supported. However, the differences between collocated and distributed groups disappear in sessions three and four, thereby supporting hypothesis H2b. Therefore, as time passed, distributed groups began to converge with face-to-face groups in ability to handle conflict. Figure 7.2 depicts this convergence graphically.
Table 7.6: Perceived Conflict Management Means

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face</td>
<td>4.977</td>
<td>5.159</td>
<td>5.273</td>
<td>5.568</td>
</tr>
<tr>
<td>Synchronous</td>
<td>4.727</td>
<td>5.000</td>
<td>5.273</td>
<td>5.273</td>
</tr>
<tr>
<td>Asynchronous</td>
<td>4.455</td>
<td>4.682</td>
<td>5.045</td>
<td>5.364</td>
</tr>
<tr>
<td>Grand Means</td>
<td>4.720</td>
<td>4.497</td>
<td>5.197</td>
<td>5.402</td>
</tr>
</tbody>
</table>

Table 7.7: MANOVA Perceived Conflict Management

<table>
<thead>
<tr>
<th>Effect</th>
<th>Test Name</th>
<th>Value</th>
<th>F-value</th>
<th>Hyp. df</th>
<th>Error df</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment by conflict</td>
<td>Pillai’s</td>
<td>0.152</td>
<td>0.793</td>
<td>6</td>
<td>58</td>
<td>.579</td>
</tr>
<tr>
<td>Conflict</td>
<td>Pillai’s</td>
<td>0.575</td>
<td>12.611*</td>
<td>3</td>
<td>28</td>
<td>.000</td>
</tr>
</tbody>
</table>

* significant at $\alpha = .05$

Table 7.8: Treatment Differences By Session: Ability to Manage Conflict

<table>
<thead>
<tr>
<th>Session</th>
<th>Effect †</th>
<th>Hyp. df</th>
<th>Error df</th>
<th>F-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F&gt;A</td>
<td>2</td>
<td>30</td>
<td>3.422*</td>
<td>.046</td>
</tr>
<tr>
<td>2</td>
<td>F&gt;A</td>
<td>2</td>
<td>30</td>
<td>3.035</td>
<td>.063</td>
</tr>
<tr>
<td>3</td>
<td>None</td>
<td>2</td>
<td>30</td>
<td>.608</td>
<td>.551</td>
</tr>
<tr>
<td>4</td>
<td>None</td>
<td>2</td>
<td>30</td>
<td>.904</td>
<td>.416</td>
</tr>
</tbody>
</table>

† Duncan’s range test - significantly different pairs at $\alpha = .05$

* ANOVA significant at $\alpha = .05$
Figure 7.2: Ability to Manage Conflict
7.3.3 Hypotheses Related to Satisfaction With Group Process

**H3:** Satisfaction with the group process will differ across treatments over time.

**H3a:** Satisfaction with the group process will initially be *greater* in distributed groups than in face-to-face groups.

**H3b:** Over time, distributed groups will converge with face-to-face groups in satisfaction with group processes.

Another relational structure examined in this study concerned satisfaction with the group process. Significant factors of the group process included leadership, coordination, task focus and feelings about whether members were analytical in their approach to the solution. A factor analysis revealed that those characteristics all loaded onto a super-ordinate factor, i.e., satisfaction with group processes. The scale consisted of seven items which were scored from one (lowest) to seven (highest) and had a Cronbach’s alpha of 0.82.

The hypotheses argued that face-to-face groups would be more distracted by non-task issues at the start while distributed environments would participants to focus on the task and perhaps away from relational issues. However, over time distributed groups would discover interaction channels which would lead to greater social interaction resulting in distractions and, therefore, less satisfaction with the process.

The means are presented in Table 7.9 and the MANOVA results in Table 7.10. Pillai’s statistic for process satisfaction over time was 0.110 with an F-value of 0.561 which is not significant at the .05 alpha level (P-value = .760). No
effects of treatment over time were observed meaning the profiles did not differ significantly among treatments. Thus, over time, satisfaction with the process did not differ across environments and hypothesis H3 was not supported.

However, the existence of satisfaction effects over time for all treatments combined (Pillai’s value = 0.495, F-value = 9.133, P-value = .000) implies that satisfaction changed significantly for all groups during the course of the exercise. The means presented in Table 7.9 suggest that, similar to the pattern exhibited with cohesiveness and conflict management, satisfaction continued to increase from session to session.

Hypothesis H3a was also not supported. As shown in Table 7.11, no significant differences were reported in the first session (F-value = 1.115, P-value = .341). Thus, contrary to what was expected, distributed groups were not any more task focused than face-to-face groups in the first session. In fact, satisfaction means were essentially the same across treatments throughout the study. Hence, while satisfaction with the process did increase for all groups over time, the rate of increase did not differ as a function of differences among meeting environments.

Figure 7.3 depicts the profiles of the treatments. The results of the range tests and the graph suggest that all groups, regardless of environment, developed similarly in attitude toward process satisfaction as the sessions progressed. Thus, hypothesis H3b was not supported by the data.
Table 7.9: Satisfaction With Group Process Means

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face</td>
<td>4.818</td>
<td>4.935</td>
<td>5.273</td>
<td>5.494</td>
</tr>
<tr>
<td>Synchronous</td>
<td>4.636</td>
<td>5.026</td>
<td>5.091</td>
<td>5.494</td>
</tr>
<tr>
<td>Asynchronous</td>
<td>4.506</td>
<td>4.896</td>
<td>5.091</td>
<td>5.325</td>
</tr>
<tr>
<td>Grand Means</td>
<td>4.654</td>
<td>4.952</td>
<td>5.152</td>
<td>5.437</td>
</tr>
</tbody>
</table>

Table 7.10: MANOVA Results For Process Satisfaction

<table>
<thead>
<tr>
<th>Effect</th>
<th>Test Name</th>
<th>Value</th>
<th>F-value</th>
<th>Hyp. df</th>
<th>Error df</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment by satisfaction</td>
<td>Pillai's</td>
<td>0.110</td>
<td>0.561</td>
<td>6</td>
<td>58</td>
<td>.760</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Pillai's</td>
<td>0.495</td>
<td>9.133*</td>
<td>3</td>
<td>28</td>
<td>.000</td>
</tr>
</tbody>
</table>

* significant at $\alpha = .05$

Table 7.11: Treatment Differences By Session: Group Process Satisfaction

<table>
<thead>
<tr>
<th>Session</th>
<th>Effect †</th>
<th>Hyp. df</th>
<th>Error df</th>
<th>F-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>None</td>
<td>2</td>
<td>30</td>
<td>1.115</td>
<td>.341</td>
</tr>
<tr>
<td>2</td>
<td>None</td>
<td>2</td>
<td>30</td>
<td>.131</td>
<td>.877</td>
</tr>
<tr>
<td>3</td>
<td>None</td>
<td>2</td>
<td>30</td>
<td>.437</td>
<td>.650</td>
</tr>
<tr>
<td>4</td>
<td>None</td>
<td>2</td>
<td>30</td>
<td>.267</td>
<td>.768</td>
</tr>
</tbody>
</table>

† Duncan’s range test - significantly different pairs at $\alpha = .05$
Figure 7.3: Process Satisfaction
7.3.4 Hypotheses Related to Social Presence

**H4:** Perceived social presence will differ across treatments over time.

**H4a:** Perceived social presence will initially be greater in face-to-face groups than in distributed groups.

**H4b:** Over time, distributed groups will converge with face-to-face groups in perceived social presence.

Social presence was the first of three socio-technical structures examined and was expected to follow development patterns similar to those predicted for relational structures with a caveat; specifically, changes in perceived social presence -- in fact changes in all of the socio-technical structures examined in this study -- would likely occur at a slower rate than changes in relational variables because socio-technical structures were expected to be less mutable than relational structures. The reliability of the seven item social presence scale was 0.86 (Cronbach's alpha) in this study.

Tables 7.12 and 7.13 display reported means (low score = one, high score = seven) and MANOVA results respectively. The MANOVA results (Pillai's trace = 0.056, F-value = 0.276, P-value = 0.946) were non-significant at alpha = .05, indicating no differences over time with regard to social presence. Thus, profiles of social presence did not differ across treatments over the four sessions and hypothesis H4 was not supported. Moreover, irrespective of treatment, participants' perceptions of social presence did change significantly over time.
Table 7.14 shows that face-to-face groups felt their environments conveyed greater levels of social presence than did groups in either of the distributed conditions during the first session. The F-value was 54.591 which was significant at alpha = .05. These findings support hypothesis H4a.

### Table 7.12: Social Presence Means

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face</td>
<td>4.818</td>
<td>4.727</td>
<td>4.753</td>
<td>4.498</td>
</tr>
<tr>
<td>Synchronous</td>
<td>3.597</td>
<td>3.597</td>
<td>3.597</td>
<td>3.610</td>
</tr>
<tr>
<td>Asynchronous</td>
<td>3.221</td>
<td>3.286</td>
<td>3.325</td>
<td>3.468</td>
</tr>
<tr>
<td>Grand Means</td>
<td>3.879</td>
<td>3.870</td>
<td>3.892</td>
<td>4.009</td>
</tr>
</tbody>
</table>

### Table 7.13: MANOVA Results For Social Presence

<table>
<thead>
<tr>
<th>Effect</th>
<th>Test Name</th>
<th>Value</th>
<th>F-value</th>
<th>Hyp. df</th>
<th>Error df</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment by social presence</td>
<td>Pillai's</td>
<td>0.056</td>
<td>0.277</td>
<td>6</td>
<td>58</td>
<td>.946</td>
</tr>
<tr>
<td>Social presence</td>
<td>Pillai's</td>
<td>0.082</td>
<td>0.831</td>
<td>3</td>
<td>28</td>
<td>.488</td>
</tr>
</tbody>
</table>

### Table 7.14: Treatment Differences By Session: Social Presence

<table>
<thead>
<tr>
<th>Session</th>
<th>Effect †</th>
<th>Hyp. df</th>
<th>Error df</th>
<th>F-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F&gt;&gt;S&gt;A</td>
<td>2</td>
<td>30</td>
<td>54.591*</td>
<td>.000</td>
</tr>
<tr>
<td>2</td>
<td>F&gt;S,A</td>
<td>2</td>
<td>30</td>
<td>24.318*</td>
<td>.000</td>
</tr>
<tr>
<td>3</td>
<td>F&gt;S,A</td>
<td>2</td>
<td>30</td>
<td>18.828*</td>
<td>.000</td>
</tr>
<tr>
<td>4</td>
<td>F&gt;S,A</td>
<td>2</td>
<td>30</td>
<td>20.477*</td>
<td>.000</td>
</tr>
</tbody>
</table>

† Duncan’s range test - significantly different pairs at \( \alpha = .05 \)

* significant at \( \alpha = .05 \)

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Figure 7.4: Social Presence
As the graph in Figure 7.4 and the results displayed in Table 7.14 attest, face-to-face groups continued to report greater social presence than did distributed groups throughout all four sessions. Duncan’s range test showed no significant tendency for the conditions to converge. Thus, hypothesis H4b was not supported. That is, counter to expectations, the distributed groups did not experience a greater change from session to session than did face-to-face groups with regard to perceived social presence.

7.3.5 Hypotheses Related to Communication Effectiveness

H5: Perceived communication effectiveness will differ across treatments over time.

H5a: Perceived communication effectiveness will initially be greater in face-to-face groups than in distributed groups.

H5b: Over time, distributed groups will converge with face-to-face groups in perceptions of communication effectiveness.

A scale consisting of eight items with one being low and seven being high measured perceived communication effectiveness of the environment; the scale had a Cronbach’s alpha of 0.90 in the present study. Means are presented in Table 7.15 and the MANOVA results are shown in Table 7.16.

As shown in Table 7.16, the Pillai’s value for treatment over time effects was 0.060 with an approximate F-value = 0.30 which was not significant at alpha = .05. Thus, when observed over the four sessions, environment did not significantly impact communication effectiveness. Therefore, hypothesis H5 --
predicting differences in the profiles across environments -- was not supported. Nor did the level of communication effectiveness change significantly over time when collapsing treatment means into one vector per session.

Table 7.17 indicates that communication effectiveness means in the first session were significantly different (i.e., F-value = 10.793 was significant at alpha = .05). Thus, face-to-face groups reported more communication effectiveness in the first session than distributed groups; these results supported hypothesis H5a.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face</td>
<td>5.261</td>
<td>5.284</td>
<td>5.273</td>
<td>5.466</td>
</tr>
<tr>
<td>Synchronous</td>
<td>4.591</td>
<td>4.625</td>
<td>4.750</td>
<td>5.023</td>
</tr>
<tr>
<td>Asynchronous</td>
<td>4.352</td>
<td>4.443</td>
<td>4.318</td>
<td>4.500</td>
</tr>
<tr>
<td>Grand Means</td>
<td>4.735</td>
<td>4.784</td>
<td>4.780</td>
<td>4.996</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effect</th>
<th>Test Name</th>
<th>Value</th>
<th>F-value</th>
<th>Hyp. df</th>
<th>Error df</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment by communication effectiveness</td>
<td>Pillai's</td>
<td>0.060</td>
<td>0.300</td>
<td>6</td>
<td>58</td>
<td>.935</td>
</tr>
<tr>
<td>Communication effectiveness</td>
<td>Pillai's</td>
<td>0.202</td>
<td>2.363</td>
<td>3</td>
<td>28</td>
<td>.093</td>
</tr>
</tbody>
</table>
Figure 7.5: Communication Effectiveness
Table 7.17: Treatment Differences By Session: Communication Effectiveness

<table>
<thead>
<tr>
<th>Session</th>
<th>Effect</th>
<th>Hyp. df</th>
<th>Error df</th>
<th>F-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F&gt;S,A</td>
<td>2</td>
<td>30</td>
<td>10.793*</td>
<td>.000</td>
</tr>
<tr>
<td>2</td>
<td>F&gt;S,A</td>
<td>2</td>
<td>30</td>
<td>5.491*</td>
<td>.009</td>
</tr>
<tr>
<td>3</td>
<td>F&gt;S,A</td>
<td>2</td>
<td>30</td>
<td>8.258*</td>
<td>.001</td>
</tr>
<tr>
<td>4</td>
<td>F&gt;A</td>
<td>2</td>
<td>30</td>
<td>4.473*</td>
<td>.020</td>
</tr>
</tbody>
</table>

* Duncan’s range test - significantly different pairs at $\alpha = .05$

* significant at $\alpha = .05$

Figure 7.5 graphically represents the profiles of the three environments showing that, over time, synchronous groups began to converge with face-to-face groups in their perceptions of communication effectiveness. In the final session, face-to-face and synchronous groups did not differ. However, perceived communication effectiveness in asynchronous groups failed to converge with face-to-face groups and hypothesis H5b was only partially supported.

### 7.3.6 Hypotheses Related to Communication Interface

**H6:** Perceptions of the communication interface will differ across treatments over time.

**H6a:** Perceptions of the communication interface will initially be greater in face-to-face groups than in distributed groups.

**H6b:** Over time, distributed groups will converge with face-to-face groups in perceptions of the communication interface.

Communication interface refers to issues such as perceived simplicity and ease of use of an environment relevant to group interaction. This scale consisted
of four items using a seven point semantic differential scale with lower scores indicating negative attributes and higher scores denoting positive characteristics.

The construct had a Cronbach’s alpha level of 0.80.

Table 7.18 shows the means being relatively clustered within treatments with a slight tendency to increase over time. MANOVA results displayed in Table 7.19 indicate that treatment means did not differ significantly over time (Pillai’s = 0.073, F = 0.367, P = .897). Hence, hypothesis H6 was not supported.

Table 7.18: Communication Interface Means

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face</td>
<td>5.091</td>
<td>5.114</td>
<td>5.000</td>
<td>5.341</td>
</tr>
<tr>
<td>Synchronous</td>
<td>4.250</td>
<td>4.205</td>
<td>4.364</td>
<td>4.477</td>
</tr>
<tr>
<td>Asynchronous</td>
<td>4.386</td>
<td>4.341</td>
<td>4.159</td>
<td>4.500</td>
</tr>
<tr>
<td>Grand Means</td>
<td>4.576</td>
<td>4.553</td>
<td>4.508</td>
<td>4.773</td>
</tr>
</tbody>
</table>

Table 7.19: MANOVA Results For Communication Interface

<table>
<thead>
<tr>
<th>Effect</th>
<th>Test Name</th>
<th>Value</th>
<th>F-value</th>
<th>Hyp. df</th>
<th>Error df</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment by communication interface</td>
<td>Pillai’s</td>
<td>0.073</td>
<td>0.367</td>
<td>6</td>
<td>58</td>
<td>.897</td>
</tr>
<tr>
<td>Communication interface</td>
<td>Pillai’s</td>
<td>0.141</td>
<td>1.534</td>
<td>3</td>
<td>28</td>
<td>.228</td>
</tr>
</tbody>
</table>
Figure 7.6: Communication Interface
On the other hand, hypothesis H6a was supported as indicated by the existence of differences during the first session shown in Table 7.20. Specifically, face-to-face groups reported their communication interface was significantly better than distributed groups in the first session.

As Table 7.20 and Figure 7.6 show, however, face-to-face groups preferred the communication interface throughout the entire exercise. Duncan’s test results indicate that in every session face-to-face groups were more satisfied with their communication interface than were distributed groups. This was not expected and hypothesis H6b was not supported.

<table>
<thead>
<tr>
<th>Session</th>
<th>Effect</th>
<th>Hyp. df</th>
<th>Error df</th>
<th>F-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F&gt;S,A</td>
<td>2</td>
<td>30</td>
<td>4.774*</td>
<td>.016</td>
</tr>
<tr>
<td>2</td>
<td>F&gt;S,A</td>
<td>2</td>
<td>30</td>
<td>6.718*</td>
<td>.004</td>
</tr>
<tr>
<td>3</td>
<td>F&gt;S,A</td>
<td>2</td>
<td>30</td>
<td>4.140*</td>
<td>.026</td>
</tr>
<tr>
<td>4</td>
<td>F&gt;S,A</td>
<td>2</td>
<td>30</td>
<td>3.235</td>
<td>.054</td>
</tr>
</tbody>
</table>

* Duncan’s range test - significantly different pairs at $\alpha = .05$
* significant at $\alpha = .05$

7.3.7 Hypothesis Related to Performance

**H7:** Distributed groups will perform at least as well as face-to-face groups.

Table 7.21 shows the evaluation means for each treatment along with the one-way ANOVA and Duncan’s range test results. Evaluations consisted of the
average of 25 items scored for each document by three different judges. The scoring range for each item was one (lowest) to five (highest) with respect to factors such as creativity, practicality, tone, and comprehensiveness of the document.

<table>
<thead>
<tr>
<th>Means</th>
<th>Effect</th>
<th>Hyp. df</th>
<th>Error df</th>
<th>F-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>3.098</td>
<td>S&gt;A,F</td>
<td>2</td>
<td>96</td>
<td>8.282*</td>
</tr>
<tr>
<td>A</td>
<td>2.718</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>2.424</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

† Duncan's range test - significantly different pairs at \( \alpha = .05 \)

* ANOVA results significant at \( \alpha = .05 \)

The spirit of the argument inherent in H7 was that, although the distributed environments would exhibit less potential initially, over time adaptive structuration would enable distributed groups to perform as well as collocated groups. Results indicate that face-to-face scores did not average higher than distributed scores and, therefore, hypothesis H7 was supported. In fact and rather surprisingly, the synchronous groups scored significantly higher than groups in both other conditions and asynchronous groups tended to score higher -- though not significantly higher -- than face-to-face groups. Thus, with respect to performance, advantages which collocated groups may have experienced early in the process, if any, did not pertain over time.

### 7.4 Summary

Hypotheses arguing that face-to-face groups would report greater levels than distributed groups with respect to the individual structures in the first session
were supported. Thus, cohesion, social presence, communication effectiveness and communication interface were all greater initially in the face-to-face than in the distributed environments. With respect to predictions that distributed groups would converge with collocated groups along all dimensions, three of the six hypotheses were supported. Perceptions of cohesiveness, conflict management and communication effectiveness among distributed groups converged with those of face-to-face groups over time as expected by AST.

Finally, the hypothesis that performance would be at least as good in distributed groups as in face-to-face groups was supported. Beyond what was expected, synchronous groups went so far as to outperform both face-to-face and asynchronous groups, while collocated groups did no better than asynchronous ones. The next chapter discusses these results and examines their implications for practice and research.
CHAPTER VIII - DISCUSSION AND CONCLUSIONS

This chapter discusses the results from the statistical analyses presented in Chapter VII. Results relevant to the seven dependent variables -- cohesiveness, conflict management, process satisfaction, social presence, communication effectiveness and communication interface -- and performance are considered in detail. Also discussed are the implications of these results for EMS research and use. Following that, findings relevant to structural mutability are discussed along with their implications for technology appropriation in organizations. The chapter also presents some assumptions and limitations of the current study and addresses issues related to future research. Finally, the chapter highlights the contributions and summarizes the conclusions of this study.

8.1 Discussion of Relational Structures

In this section, the discussion focuses on the three relational structural variables, cohesion, conflict management and process satisfaction. The relationship of structural mutability to group development is also explored with particular concern for the importance of time in the appropriation of environmental structures.

Chapter II introduced the argument that structures vary in their degree of mutability, relative to each other. Moreover, structures will exhibit change, in part, as a function of their relative mutability. Two principles with regard to mutability were implied in the discussion in Chapter V as the concept of structural
mutability was developed further for purposes of this study. First, those structures which are more mutable ought to be susceptible to change (i.e., appropriation) sooner than less mutable ones. Second, more mutable structures also ought to change to a greater degree than less mutable structures.

Specifically, of the six proposed structures (see Figure 2.1), three were behavioral (i.e., cohesion, conflict management and process satisfaction) and concerned interpersonal interaction while the other three were socio-technical (i.e., social presence, communication effectiveness and communication interface) and pertained to perceptions of the external environment. The relational structures examined in this study were anticipated to exhibit greater mutability, i.e., change sooner and to a greater degree, than socio-technical structures.

Post-hoc analysis of the statistical results justifies this expectation. Evidence supporting this position is reviewed within the context of each of the specific variable discussions and then integrated at the end of the results discussion section.

8.1.1 Cohesiveness

The hypothesis related to cohesiveness was not supported indicating that, overall, groups did not differ across treatments in their profiles of cohesiveness over time. There are several possible explanations for this result.

One explanation may be that, because the experiment occurred over four sessions, the profiles may not tell the whole story. That is, although profiles may
not differ, results from other tests may be helpful in explaining specific aspects of behavior patterns.

Results from session-by-session ANOVAs indicate that face-to-face groups report greater cohesiveness than groups in both distributed conditions after the first session, continuing to report more than asynchronous groups through all four meetings. Differences between face-to-face and synchronous groups in cohesiveness disappear after the first session. Thus, as predicted, cohesion in synchronous groups showed a linear increase relative to the quadratic pattern experienced by face-to-face groups.

Taken together, these results suggest that, while environments differed structurally in communication capacity, the distributed groups were nonetheless able to achieve increased cohesiveness. Furthermore, as time progressed they were able to reduce the differences between themselves and face-to-face groups with respect to cohesion development. Thus, while profiles may not differ, patterns of change suggest that differences between environments do indeed exist and should be examined further.

Stage theories of group development offer one way of explaining the failure to find differences between profiles in this study. Some theorists argue that structural factors develop in stages which are fixed in some temporally sequential order (e.g., Fisher and Ellis, 1990). Stage models of group development -- as well as "cyclic" models -- are deterministic in that they describe phases which all groups pass through, regardless of other environmental
characteristics (e.g., task, group composition, etc.). Thus, following a stage model approach, cohesion could be expected to emerge in some predictable pattern regardless of treatment, as happened in the current study. However, stage models are overly simplistic and have difficulty accounting for instances of non-sequential development (Poole, 1983). Thus, deterministic theories are inadequate to explain phenomena such as the decrease of cohesion in face-to-face groups during the second session at the same time that the distributed treatments experienced linear increases in cohesiveness.

Adaptive structuration theory offers another, perhaps more tenable, explanation because it allows for emergent adaptation by groups to contextual structures. What were initially significant differences, may have become less significant after the first session because synchronous groups learned to interact via the distributed technology in ways which counteracted environmental limitations. As expected -- given their relatively less interactive environment -- asynchronous groups exhibited a similar pattern, but at a slower rate. Time constraints may have prevented asynchronous groups from converging with face-to-face groups in cohesiveness. Exploration would be a heuristic process occurring gradually -- session by session. Such a process may take longer than four one hour sessions to change significantly. In other words, the asynchronous environment may have been so constraining that participants needed more than four sessions to discover methods which would enable them to compensate for the structural barriers they faced.
Moreover, face-to-face groups did not plateau in cohesiveness after the first session. In fact, after a drop in the second session, they experienced increasing cohesion through sessions three and four. This pattern was contrary to what was expected in light of theory and relational development patterns exhibited by face-to-face groups in Walther’s (1992) study.

Perhaps face-to-face groups, like distributed groups, needed more time to develop than was allotted. This may have been because they also had to spend time learning to use the EMS (all groups were required to use the EMS for the writing of the document) which would have reduced their time available for cohesion building. In fact, one face-to-face group engaged in almost no verbal interaction until the final session (post session interviews revealed that several members of this group actually wanted to interact verbally from the start but felt inhibited since their initial perceptions led them to believe that others in the group did not want to talk). Several other face-to-face groups also appeared at times to be largely focused on the technology, though not to the total exclusion of verbal discussion. Such behavior is understandable since the task was primarily a writing task. If this explanation is correct, future studies might not expect cohesiveness to plateau until after several sessions. Nevertheless, if environments do differ, cohesion building and any subsequent plateauing would still be expected to occur earlier in face-to-face groups than in distributed groups.

Another possible explanation for profile similarities may be that there are no differences between meeting environments in their capacities to exchange
messages. However, the environments clearly differed in channel capacity -- at least the face-to-face setting differed from the distributed environments -- since visual cues were available in one setting but not in the others. Therefore, the conclusion that the environments do not differ is difficult to reconcile with reality.

Alternatively, communication capacity may not be correlated with cohesiveness. This conclusion is also problematic since communication is very important to cohesion building (e.g., Fisher and Ellis, 1990) and the environments differ in communication capacity as argued above.

Another possible explanation is that, although development of cohesion is dependent on communication, it is not sensitive to the differences of channel capacity exhibited by the environments studied here. In other words, cohesiveness can develop equally well in environments which differ greatly in communication capacity. But, results from the one-way ANOVAs suggest that differences do indeed exist between environments when cohesiveness is examined session by session as discussed above.

In conclusion, though profiles of cohesion development did not differ significantly over time between face-to-face and distributed groups, patterns of effects did occur within sessions suggesting that cohesiveness evolved differently. As predicted, face-to-face groups developed more cohesiveness sooner than distributed groups. Moreover, as suggested by AST, synchronous groups did appear to overcome development shortfalls which they experienced early in the exercise. Asynchronous groups also exhibited the pattern of development
anticipated, though not to the extent expected. Most importantly, cohesiveness as a structure appeared to change and evolve in patterns predicted by structuration theory.

8.1.2 Conflict Management

Focusing on social aspects of interaction, rather than task based issues, can lead to dysfunctional conflict (see a review of relevant findings in Witteman, 1991). This study expected that distributed groups would experience less personal interaction and more equal participation resulting in less conflict initially, relative to face-to-face groups. Contrary to what was expected, however, profiles did not differ significantly among treatments. Also unexpectedly, face-to-face groups reported greater ability to handle conflict than asynchronous groups -- though no better than synchronous groups -- in the first two sessions. Thus, neither hypothesis H2 nor hypothesis H2a was supported.

On the other hand, ability to handle conflict among asynchronous groups increased over time at a greater rate than in face-to-face groups. Therefore, groups converged across treatments in conflict management and hypothesis H2b was partially supported. These results offer tentative support for the primary premise advanced in this study; that adaptive structuration occurs as distributed groups explore alternatives for improving structural conditions.

Given their potential for a greater level of interpersonal focus and interaction, the fact that face-to-face groups exhibited less conflict initially than distributed groups is somewhat puzzling. This is even more surprising since
Chidambaram (1989) found that EMS supported groups reported less conflict overall and in Miranda and Bostrom (1993) EMS supported groups experienced less interpersonal conflict. An explanation for the disparity of results may be that in the two earlier studies, the groups were either EMS supported or not, but all were face-to-face. Thus, the differences between treatments may have been specifically due to the supported groups having something to focus them on task issues (i.e., the EMS) while the non-supported groups had no such focusing mechanism available. In the present study, even the face-to-face groups had a system which could be used to focus them on issues and away from personalities. Therefore, in a sense the face-to-face groups may have had the best of both worlds initially; they had the EMS to focus on when interaction was not necessary and could also use face-to-face interaction to iron out issues as they arose. Whereas, even though they improved in later sessions, the distributed groups had less interaction capacity to deal with issues (either task or interpersonal) in the earlier sessions.

Thus, by the end, face-to-face interaction may well have become a source of conflict as predicted, since those groups became unable to manage conflict any more effectively than distributed groups as time passed. The results further suggest that distributed groups may be able to adapt their structures for the purpose of managing conflict.
8.1.3 Satisfaction With Group Processes

Profiles over time of satisfaction with group processes did not differ between treatments. With respect to level of satisfaction with group processes, the environments did not differ after the first session nor did they differ after any of the sessions. Unlike cohesiveness and conflict management, groups reported similar levels of process satisfaction for each session regardless of environment. Moreover, rates of satisfaction increase did not differ significantly across treatments over time.

These results are puzzling in the face of the arguments presented in Chapter V with respect to structural differences of interaction -- especially regarding anonymity -- imposed by the environments. The point made earlier was that face-to-face groups are likely to encounter situations where some members dominate the process through the use of non-verbal symbols and signals (e.g., Kiesler et al, 1984), leading to lower satisfaction with group processes relative to distributed groups. On the other hand, distributed groups can be expected to experience more democratic procedures as a result of the anonymous nature of EMS mediated interaction.

AST, however, suggests that distributed participants will appropriate the system in ways which allow them to communicate cues which convey status, power or dominance. Thus, in this study, distributed groups were expected to experience increasing dissatisfaction with the process as anonymity and equality eroded.
One possible explanation for the failure to observe differences relates to the argument presented in Chapter V which presumes that a major determinant of satisfaction is participatory equality. On the contrary, inequality may be beneficial or even preferred in some cases. For example, when a person exhibits expertise essential to some aspect of the task, others may welcome the assumption of leadership by that individual. Thus, while equality of participation may lead to a larger number of alternatives being explored (e.g., Chidambaram, 1989) or a greater procedure oriented focus rather than an issue oriented one (e.g., Watson, 1988), these factors may not correlate highly with process satisfaction.

Moreover, equality may not have resulted in process satisfaction in the present study because anonymity allowed more critical evaluation of members' contributions, perhaps leading to dissatisfaction with the process by those being criticized. Other factors which are also considered important to effective groups and, therefore important to satisfaction with the process are critical examination of members' contributions and validity checking of members' assumptions (Fisher and Ellis, 1990) as well as goal directedness and issue amplification. These issues were included in the process satisfaction construct used in this study. Thus, weighting participatory equality so heavily in the theoretical argument may have obscured the potential for effects from other phenomena.

Another possible explanation for why groups did not differ may be that none of the participants in either environment felt sufficiently motivated to pressure or dominate fellow team members in any way. All participants were told
in advance that they would be awarded course credit just for participating and showing up for all meetings. Beyond that, cash prizes were the only external incentives. These cash prizes may have provided little stimulation to perform. Thus, motivation may not have been great enough to lead anyone to dominate the process. In order to clarify this potential issue in future studies, level of motivation to perform should be assessed and perhaps manipulated.

Perhaps differences in initial expectations resulted in lack of perceived differences. For example, if those entering the exercise in distributed groups had very low expectations for satisfaction initially, then even minimal performance might have produced satisfaction equal to face-to-face scores. However, unless initial expectations are measured -- and they were not measured in this study -- comparison of the scores is problematic. In future studies, expectation should be assessed at the outset to make results more comparable.

On the other hand, satisfaction with group processes did increase significantly over time for all groups. Thus, another important relational structure evolved over time as predicted. Hence, as with cohesion, satisfaction development does not occur in some functionally deterministic pattern, e.g., increasing satisfaction is necessary to facilitate performance. Such an argument, Poole (1983) maintains, is descriptive but not explanatory and Turner (1991) discounts it as fatally teleological. Rather, satisfaction develops according to how participants explore their contexts in efforts to cope with their particular structural constraints.
Thus, all groups, regardless of environment, are expected to pursue satisfaction enhancement to some extent. However, structural differences should result in differential rates of progress with respect to process satisfaction. The important point here is that change did occur in this relational structure over time as expected and as it did with cohesiveness and conflict. Future studies need to explore further the specific mechanism by which change occurs.

8.2 Discussion of Socio-technical Structures

This section explores the results gathered with respect to the socio-technical variables. In support of the premise that structures vary in their mutability, the data indicate that change did not occur with these structures until the final session. On the other hand, the relational structures exhibited change much sooner. Thus, structures may differ inherently with respect to their adaptability.

8.2.1 Social Presence

While profile patterns over time did not differ among treatments, treatments did exhibit different levels of perceived social presence. Face-to-face groups reported significantly greater social presence than distributed groups in all four sessions. Because the trend was relatively flat for all treatments, the differences remained constant through the study thus explaining lack of profile differences. Taken together, these results indicate that the environments differed in social presence. Moreover, none of the environments exhibited a significant shift in social presence as time progressed.
One explanation for these results may be that the environments possess different properties with respect to social presence and, further, the structural differences may be unalterable under any circumstances. This is the position taken by social presence (e.g., Short et al., 1976) and media richness (Daft and Lengel, 1986) theorists. However, studies show that, while the environments may differ, they are nonetheless able to accommodate varying levels of socio-emotional content (e.g., Rice and Love, 1987; Walther, 1993) indicating a flexibility in media capacity not accounted for by those arguing from a technologically deterministic persuasion, e.g., social presence theory.

Alternatively, whether the environments do or do not differ in social presence, the structuration process may be likely to exhibit patterns and rates of change which differ relative to the structural context. Thus, direction and rate of appropriation of a structure will probably depend on a combination of factors including the structure's relative mutability, the task, the time available to complete the task and the participants' motivation to perform.

Several of these factors may have been responsible for the absence of change in this study. First, as argued in Chapter II, structural characteristics vary with respect to their mutability. Moreover, socio-technical structures are anticipated to be less flexible than relational structures. Thus, social presence can be expected to be less susceptible to adaptation than, for example, cohesion. If this point is valid, cohesiveness and process satisfaction should exhibit change.
before social presence or any of the socio-technical structures examined here; this is precisely what occurred in the present study.

Second, time is a major consideration associated with group development and activity (e.g., Gersick, 1988, 1991; McGrath, 1990). In the present case, four sessions may have provided too few opportunities for groups to discover novel ways of interacting within the constraints they faced. This possibility interacting with the relative inflexibility of the structure may have combined to prevent the early occurrence of any substantive appropriation.

8.2.2 Communication Effectiveness

Results indicate that, with respect to perceived communication effectiveness of the environment, the mean profiles exhibited by groups from the three treatments were not significantly different. A possible explanation for this is that the environments did not differ in their capacity to facilitate effective communication. To properly assess such a position, however, it is necessary to identify what effective communication is. For example, effective communication requires timely exchange and meaningful clarification (e.g., McGrath, 1984; Fisher and Ellis, 1990). Therefore, effective communication includes factors like speed, truthfulness and meaningfulness of interaction among others. Certainly, the environments appear to differ in their relative capacity to promote those communication characteristics which facilitate effective interaction. For example, distributed synchronous interaction is faster -- i.e., quicker feedback -- than asynchronous but both are slower than face-to-face communication. While
asynchronous interaction may often allow the time required for composing more thoughtful and better articulated responses, in this study the time limitations probably minimized the potential for such benefits. Therefore, in the context of the present study, face-to-face interaction was expected to be more effective than distributed interaction.

In fact, differences between environments were reported in all sessions, substantiating the preceding argument. Once again, even though the profiles did not vary as much as expected, the structure underlying the profiles appeared complex and warranted follow up analyses. In the first session, face-to-face groups reported that their environment facilitated more perceived effective communication than was reported in either distributed condition. Moreover, these significant differences continued through sessions two and three. Even in the final session, face-to-face groups reported more perceived effective communication than asynchronous groups, although, by then synchronous groups had begun to report increased communication effectiveness. Thus, while profiles did not differ, differences existed on a session by session basis.

Further, synchronous groups began to converge with face-to-face groups in communication effectiveness. Asynchronous groups also reported increased -- though not significantly more -- effectiveness in the final session. Together, these results indicate that environments did differ but the distributed groups, especially synchronous groups, exhibited a tendency to report improved communication effectiveness over time.
A possible explanation for this is that the synchronous groups experienced a technology learning curve phenomenon. Thus, as they became more familiar with the EMS, participants perceived it to be more effective. While this argument has some appeal, several points deserve attention. First, the technology was rather simple. It was essentially a word processing type of tool and all subjects were somewhat familiar with word processing. Secondly, randomization should have precluded the existence of any systematic effects due to learning differences.

Another reason for the session-by-session differences observed may be that the face-to-face environments are superior to distributed environments with respect to communication effectiveness. However, as AST predicts, synchronous groups, while initially experiencing barriers to effective interaction, may have discovered ways to overcome such impediments. That is, as time passed, they adapted aspects of the environment (e.g., EMS functions) to better suit their situation, gradually increasing communication effectiveness.

The fact that asynchronous groups were unable to narrow the gap significantly may be explained by the same factors which influenced social presence. Specifically, time and motivation to perform may both have been limited relative to the task used. Once again, the immutability of the structure may have limited its potential for change. Groups may need to interact with an EMS over longer periods before being able to invent new ways to use a technology, i.e., “re-invention” may require a long term investment in time. Of course, greater motivation might shorten the structuration period. Thus, the
saying “necessity is the mother of invention” may be particularly applicable in the context of adaptive structuration.

8.2.3 Communication Interface

Results indicate that perceptions of communication interface did not differ over time among the treatments. Moreover, there was no indication of any convergence among treatments in perceptions of their communication interface as time passed.

One reason for this may be that there was no need for any of the groups to seek improvement in the interface because it was satisfactory for all from the start. This explanation, however, is unlikely because there are significant differences among treatments when tested session-wise. That is, in every session face-to-face groups reported significantly more satisfaction with the interface. Hence, perceptions clearly indicated that the distributed groups perceived some shortcomings in their communication interface relative to the feelings expressed by face-to-face groups. Further, the mid range scoring by distributed groups (i.e., approximately four on a seven point scale) combined with the increase in the final session for both distributed treatments, support the contention that the interface needed improvement.

Another possible interpretation may be that the results were, in large part, due to the nature of the structure. Ease of use -- along with other dimensions of the computer-user interface -- has long been considered an important factor influencing satisfaction with and use of a technology (e.g., Bailey and Pearson,
The problem is, technology interfaces, may be among the most steadfast and least flexible of the structures a group contends with in an EMS environment. This is because many elements of the interface (e.g., system response time, software, etc.) function at levels completely hidden and removed from user control. Thus, the user has no opportunity to manipulate these aspects of the system. Because many characteristics associated with the interface are "hardwired" into the EMS, overcoming problems resulting from these characteristics is likely to require technology redesign. Therefore, adapting technological structures may be more difficult than altering other aspects of the environment. The failure to observe interaction effects in this study may be due to the immutability of this socio-technical structure. That is, the difficulty to appropriate the system was so great that no one could accomplish much adaptation within the time frame permitted.

A fact worth noting is that, for all three treatments, the means in the final session were higher than in the first session. This delayed upturn in satisfaction with the communication interface -- across all treatments -- reflects the immutability of the structure. In other words, if the technical aspects of this structure do make it difficult to alter, then no change would be expected for any groups until later in the exercise. That is precisely what occurred. Significantly, the potential for change began to appear in the final session, suggesting structuration may be delayed in some cases.
Also interesting was the fact that even the face-to-face groups reported more appreciation for their interface in the final session than in earlier sessions. Did structuration take place with these groups as well? Final session means indicate the possibility. If so, why and how? Perhaps, as time passed, the face-to-face groups began feel to more pressure to write and less need to interact. As requirements for effective interaction decreased, constraints of the interface would have become less significant resulting in greater satisfaction.

Another possible reason is that, toward the end, when the writing became more essential and the face-to-face groups focused more on the system, they became more comfortable with it as a channel for interaction. They may have even discovered that the system was useful for making relatively short or simple comments rather than verbally disrupting the writing process.

In fact, participants in all treatments ought to eventually begin experimenting with the manipulation of structures toward the goal of improving performance or making the task easier, etc. The point this study makes is that structuration is more likely to occur (i.e., sooner and to a greater degree) when existing structures are more problematic, e.g., impediments inherent to distributed interaction relative to face-to-face interaction. Thus, what was somewhat surprising was the initiation of structuration in the face-to-face groups concurrently with that in distributed groups. The occurrence was even more unexpected in light of the apparent superiority of the face-to-face communication interface, implied by the fact that face-to-face scores -- along all structural
dimensions -- were consistently higher than distributed scores in this study. Hence, it may be that structuration takes place as much a matter of opportunity as of necessity.

8.3 Structural Mutability

In the context of the present study, the relational structures were expected to be more mutable than the socio-technical structures as discussed in Chapter V. Post-hoc analyses were conducted to determine potential directions for more formal testing of the issues in the future. Evidence from this study supports the premise of structural mutability.

The results of the MANOVA tests for each variable suggest the existence of a differential trend between relational and socio-technical structures. Cohesiveness, conflict management and process satisfaction demonstrated differences across sessions. Conversely, none of the socio-technical variables displayed significant differences over time. These results indicate the potential for differences in capacity for change among structures.

The means of the three structural variables comprising each type were aggregated and are presented in Table 8.1. The absolute differences between means is not the primary concern as much as the relative differences over time. Note that the relational means tend to increase linearly over the four sessions while the socio-technical means follow a relatively flat line. These trends are depicted visually in Figure 8.1.
A post-hoc paired t-test indicates that the sets of means differ between relational and socio-technical factors (T value = 5.24, df = 3, one-tailed significance = .028). That is, the relational means were approximately equivalent to the socio-technical means in the first session but began to increase in the second session and continued to increase steadily over subsequent sessions. On the other hand, the profile of the socio-technical means remained relatively flat throughout. These results suggest the potential for differences in mutability across structural types.

<table>
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<th>Table 8.1: Means For Structural Variable Types</th>
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<td>Structural Type</td>
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<td>Relational</td>
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<td>Cohesiveness</td>
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<td>Conflict management</td>
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<td>Process satisfaction</td>
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<td>Socio-technical</td>
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<td>Social presence</td>
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<td>Communication effectiveness</td>
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While inherent mutability of a structure may be a determinant in how fast and much it can be adapted, other factors may also play a role in rate of structuration. For example, it seems likely that some structures are more essential to a process or task than others and may be expected to be manipulated more readily. This and other potential structural factors need to be explored more fully in future research.
Figure 8.1: Relative Structural Mutability
8.4 Discussion of Performance Results

The mean performance scores for synchronous groups were significantly higher than for face-to-face groups. Perceptions with respect to social presence, communication effectiveness and communication interface indicate that impediments to interaction did exist in the distributed conditions. Therefore, given the superior performance of groups in distributed environments, structuration may have occurred. Nonetheless, the fact that synchronous groups significantly outperformed face-to-face groups was rather surprising.

Possibly, the face-to-face groups were distracted from task issues by interpersonal issues, resulting in inferior performance. For example, conflict has been found to decrease in EMS mediated interactions compared to non-mediated interactions (e.g., Gallupe, 1985; Chidambaram, 1989; Bostrom and Miranda, 1993), perhaps because an EMS may help focus participants on task related issues. In the present study, even though they had to use the same EMS as distributed groups and despite a relative lack of conflict, face-to-face groups may have experienced more social interaction and less task focus resulting in lower performance.

Synchronous groups also significantly outperformed asynchronous groups in this study. This too is an interesting though understandable result since the feedback delays experienced in the asynchronous environment were time consuming and constraining relative to both other environments. Through structuration however, asynchronous groups should have been able to find ways to
enhance performance functions. An explanation for their failure to do as well as synchronous groups may be that the environment is so restrictive that more time was needed to overcome the problems. In fact, a considerable amount of coordination was necessary to generate and discuss ideas and then translate them into a readable and sensible document. Perhaps four sessions was inadequate for such a complex series of activities.

On the other hand, asynchronous groups did not perform better than face-to-face groups. One reason may be that the distractions of face-to-face interaction were no more severe than the limitations of delayed interaction. Given enough time however, asynchronous groups may have been able to make structural adjustments aimed at compensating for the lack of timely feedback. For example, in time, members' would come to be accepted as expert in different areas. Hence, certain functions might be more readily deferred to those recognized as experts than would happen in face-to-face groups where only dominant members get the opportunity to disclose such information. Establishing roles in this way might reduce the need for interaction. Consequently, in the long run distributed groups ought to be able to perform at least as well as -- and perhaps better than -- collocated groups. That is, technology may facilitate interaction when all that is required is distributed communication. Thus, face-to-face communication may need only take place when the complexities which come with it are essential -- not detrimental -- to the process.
8.5 Limitations

Different research methods present different problems. The present study employed a laboratory experimental methodology and, therefore, exhibits limitations common to such experimental investigations. Campbell and Stanley (1963) argue that research design problems generally fall into one of two categories: a) threats to internal validity and b) issues of external validity.

8.5.1 Threats To Internal Validity

Internal validity refers to the integrity of the research design which ensures that changes in the dependent variable were caused only by changes in the independent variable and not by some extraneous factors.

In the present study, the potential of individual differences to confound the results was minimized by randomized subject and treatment assignment and checked by testing. The potential for class schedule conflicts required the assignment of some participants to their treatment rather than being completely randomized. Hence, randomization was somewhat limited. Notwithstanding class scheduling constraints, by and large, assignment of subjects to groups and groups to treatments was random.

Other factors, e.g., group size, task, environment, technological tool, training, etc., were held constant across treatments. Thus, internal validity was ensured to the extent that confounding factors could be anticipated and mitigated.

Another potential limitation concerns control of interaction outside the experimental setting. While no formal control mechanism existed to prevent
external interaction, all subjects were asked not to discuss the exercise outside of the meeting sessions. Further, the groups were comprised of subjects from two different sources, the College of Business and the School of Travel Industry Management, thus reducing the opportunity for unscheduled interactions.

Trying to isolate and measure causes and effects relative to structural change -- the key objective in this study -- becomes more of a problem as the complexity of the system being studied increases. Motivation to perform is one factor which is likely to impact attitudes toward the situation but which is also difficult to control. For example, since some structural constraints, e.g., channel capacity, are difficult for participants to manipulate, compensation for such impediments may not occur under some circumstances. On the other hand, if the possibility of promotion is a factor, then the desire to increase cohesion, for instance, might be strong enough to initiate improvisation. Such experimentation may then lead to more cohesive interaction. Thus, the results and implications of this investigation need to be interpreted in light of the motivational context.

While not necessarily significant when taking objective measures, initial expectations may be important when observing perceptions. When a participant has low expectations for a technology to begin with, actual performance of the system may be perceived to be higher -- or lower -- relative to what was anticipated. Thus, as was mentioned when discussing the results, the failure to measure initial expectations in this study may make comparison of perceptions across treatments with respect to satisfaction, social presence, communication
effectiveness and communication interface less meaningful. This limitation can be mitigated in the future by gathering expectation data before the start of the exercise.

Two final issues potentially limiting internal validity relate to performance evaluation. Because of the large number of documents which had to be evaluated (i.e., 33), every effort was made to balance the requirement for reliable evaluations against the constraints of the availability of qualified judges. Interrater reliability would have been most effectively measured if every judge had evaluated all 33 documents. However, this would have placed an undue burden on the raters, requiring each judge to read in excess of 100 pages. Therefore, as discussed earlier, the eleven expert judges were each asked to rate nine documents with each document being rated exactly three times. The problem with such a design is that three evaluations per document constitutes too few cases to conduct a statistical interrater reliability analysis. Nonetheless, random assignment of documents to judges and the total number of evaluations (i.e., 99) provide reasonable assurance that the performance evaluation design was balanced and meaningful.

A second issue concerns the frequency of measuring performance. Since this experiment captured data concerning the other dependent measures over each of the four sessions and because the structuration process under investigation necessarily evolves over time, performance might also have been tracked over time. In this study, the unstructured nature of the writing task made periodic
measures quite difficult. Thus, performance was only measured one time, upon completion of the exercise, limiting the use of performance per se as an indicator of structuration. Results may be more illuminating of the structurational process if future designs attempt to capture performance measures over time.

8.5.2 Threats To External Validity

External validity refers to the extent to which results from the laboratory context are generalizable to organizational situations. Threats to generalizability lie along two dimension; a) *artifacts* induced by the experimental setting and b) the *realism* of the context (Fromkin and Streufert, 1976).

*a) Artifacts:*

Evaluation apprehension -- one of two primary artifactual possibilities -- refers to a tendency for the subject to feel the evaluation process is directed at her or him personally. If this situation exists, the subject may perform unnaturally. Fromkin and Streufert (1976) argue that this potential can be minimized by informing the subjects that the experimenter is interested in aggregated group responses rather than individual responses. This was done in the current study.

A second potential artifact derives from experimenter expectancy; this involves the subject acting in a way which corresponds to how she or he feels the experimenter expects them to act or perform. In the present study subjects were told that the experimenter had no pre-conceived notions of outcomes. The subjects were also told that the experimenter would not be evaluating the final
documents and that the papers would be reviewed only by a panel of independent judges in a blind review process.

\textit{b) Realism:}

The second type of limitation to external validity relates to realism. Fromkin and Streufert (1976) suggest that only a few variables need to represent organizational settings in order to depict organizational phenomena in general. Among the attributes they propose are task and size of workgroup. The task used in this study was employed earlier in two pilot studies wherein feedback indicated that the task was complex, relevant and realistic making it representative of organizational tasks. Because prior EMS research had primarily used groups of three and four, groups in this study were also comprised of four members each.

Another potential threat to external validity results from the use of student subjects as surrogates for organizational employees. Remus (1988) argues that this has especially been a problem with MIS studies where students are routinely used as substitutes for managerial decision makers as. This problem, however, was mitigated in the present study primarily because the task was not a decision making task; rather, it required participants to develop consensus on and write a policy type document. Such tasks frequently fall to non-managerial groups of employees in real organizations. Of course, such a solution means that results observed here may not be generalizable to a decision making setting.

The study assumed that four hours was sufficient to conduct the task. The same task was used in two pilot studies which only spanned three one hour
sessions. Post exercise interviews from these two studies indicated that participants felt three hours was insufficient for the task but that four hours would probably have been enough time. Thus, the fourth session was added for the main study.

The study also assumed that four sessions was enough time for groups to begin adapting structural factors to suit their needs -- i.e., for structuration to occur. Although few studies have specifically examined the structuration process, results from the pilot studies indicated that some process of change began occurring early in the exercise. However, the changes were minimal and it was expected that a fourth session would permit more structuration. In reality, structuration may be a very subtle and gradual process and may take longer than four sessions to manifest itself. Thus, the results here need to be examined in that light.

In spite of the limitations explained in this section, the present study is the first to investigate distributed group interaction over a period of time within the context of a collaborative writing task. Further, the two pilot studies and the main study combined involved approximately 200 participants meeting for 800 session hours in a controlled laboratory setting. The limitations of this study are generally the function of a controlled laboratory setting using a repeated measures research design. Precision -- resulting in better control and thus greater internal validity -- tends to lower external validity. Hence, results from this well controlled study may not be readily generalizable to other populations, environments and tasks.
Only further research and, specifically, validation of this experiment in other settings will make possible the generalization of these results.

8.6 Future Research

The results and lessons from this study have raised many issues which need to be considered in future research. For instance, results showed that change did occur over time, particularly with respect to perceived cohesiveness, conflict management and satisfaction with group processes. This indicates the real possibility that structuration took place. However, while integral and important to the development process, perceptions only tell part of the story. To further validate these results, aspects of the interaction process should be examined for evidence of adaptive appropriation. For example, content analysis can be performed on the communication patterns to test for structural differences across treatments. Observing different conversational structures emerging from different environments might provide a clearer picture of how adaptive structuration actually occurs.

Also, as argued in Chapter V, motivation may well be a critical determinant of the structuring process. Thus, future research ought to address this factor. For instance, groups meeting in organizational settings will probably be motivated differently than the groups used in this study. Therefore, organizational case studies could be used to investigate the effects of real world motivational factors on structuration.
This study raised the theoretical issue regarding the possibility that environmental structures exhibit different mutability characteristics. That is, some structures are likely to be more readily and more extensively altered than others. Evidence gathered in this study suggests that this, in fact, may be the case. However, the mutability typology presented here needs to be refined further. Many structures impact group interaction and are likely to exhibit a variety of characteristics which can influence their relative mutability and, thus, their structurational impact. Therefore, the structural mutability classification proposed here needs to be examined more closely from a theoretical perspective and then tested more extensively in other settings.

Also, as pointed out earlier, mutability may be only one of several factors which determine why and how structures are appropriated. For example, future studies need to look at issues like whether it is more critical to the group’s objectives for them to modify certain structures rather than others. To ensure appropriate interpretation of research results, a complete classification of structural characteristics needs to be developed.

Time is also a key factor influencing structuration. Groups in real organizations engaged in project development activities are likely to meet more than four times. Moreover, meetings in real organizations may not be limited to one hour session periods. Thus, in order to allow a more natural development environment, future studies should take place over longer periods of time and with more variable and longer individual session lengths than were possible in this...
study. Ideally, studies should be conducted in organizational settings which involve more typical time constraints.

As was pointed out earlier in this chapter, besides distributed groups, face-to-face groups may have also exhibited adaptive structuration. While this may not be surprising, it does raise the issue of why structuration occurs. The point made throughout this study was that problems coupled with motivations result in groups restructuring the environment in ways to solve the problems. However, opportunity may also be important in determining the nature of the structuration process. For example, some structures (e.g., complex technologies) may present numerous possibilities for applications which were initially not obvious or intended. These opportunities might be explored by more innovative groups regardless of motivation to perform. Future studies need to examine this issue in greater depth.

In some past studies performance was assessed by panels of experts. Group decisions were evaluated for quality without respect to any formal criteria. Thus, performance measures among judges were subjective and may not have been assessed against comparable standards. While evaluations must necessarily depend on the judge’s subjective opinions and are, therefore, likely to differ, steps can be taken to focus the experts on the same issues. The current study developed a list of criteria with scoring scales against which the experts were to evaluate each document's quality. This method provided some measure of comparability across evaluations with respect to the issues of concern in the assessment process.
While this method is more rigorous and more objective than many earlier evaluation methods, nonetheless, improvements are indicated. For example, the scoring sheets used semantic values such as “poor, average and excellent.” The scales might have been more precise if they had been numerical, e.g., one to five.

Finally, all of the process structures were assessed repeatedly over the four sessions. However, output may also be likely to exhibit changing characteristics as a function of the development of other factors. Therefore, future studies may be able to gain important information by also measuring performance as it develops. The potentially dynamic relationship between development and performance may be better examined thus providing a richer understanding of the structuration process.

8.7 Contributions of This Research

This study has extended current EMS research in several important ways. First, group interaction occurs over time and, unlike most previous EMS studies, this study examined development longitudinally. Second, the present study employed a task type which is similar to many organizational activities but which has been largely overlooked by EMS researchers. Moreover, whereas prior projects have often involved an array of systems and tools, this study tightly controlled for system or tool effects. With the hopes of establishing a synergistic foundation from which EMS research can proceed, the current study also integrated prior research from two disparate fields, i.e., CMC and GDSS.
This research has also contributed toward the development of a structurational model of group interaction in the context of electronically supported meetings. It is one of only a few studies to have empirically examined the process of structural development occurring during the meeting process. Several patterns of structural change were observed which support the theory and model advanced herein. Moreover, the study introduced and offered evidence for the concept that structures possess different potentials for mutability relative to each other and that structuration patterns may be correlated with these characteristics.

Finally, this study is the first to compare development characteristics in groups collaborating asynchronously with characteristics exhibited by face-to-face and synchronous groups. The next section provides a summary discussion of the specific conclusions and results of this study which demonstrate the contributions discussed above.

8.8 Summary and Conclusions

At the outset, this study argued that distributed interaction will become more prevalent as organizations continue to globalize and technology permits such interaction. However, in order for technology to facilitate -- rather than just permit -- group task activities, a better understanding of how groups develop and perform in these new environments is needed.

The premise underlying the work in this project was that while spatial and temporal distribution present opportunities, they also present impediments for
interaction. But, people can be creative in appropriating various environmental structures to overcome the problems. Adaptation of both relational and socio-technical structures is the process by which distributed groups can develop and enhance their performance.

Data gathered in this study and summarized in Table 8.1 suggest that such was the case. While none of the profiles differed significantly over time, perceptions reported on a session-by-session basis suggested that the environments did differ. Follow-up analyses indicated that, as predicted, face-to-face groups enjoyed greater cohesion, more social presence, more communication effectiveness and more satisfaction with their communication interface in the first session than did distributed groups. Those differences held over the next three sessions for the socio-technical structures but, as expected, distributed groups converged with face-to-face groups in cohesiveness and conflict management as time passed. Interestingly, groups reported similar attitudes toward process satisfaction in all sessions, increasing over time regardless of environment. With regard to the socio-technical structures, groups in all treatments reported an increase in the final session. Thus, relational variables consistently exhibited change over time and socio-technical structures did so only in the last session. These results combined suggest that structuration took place as expected, though not differentially across environments.
Table 8.2: Summary of Hypotheses Tests

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<td>H2b</td>
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<td>H7 Performance</td>
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* Indicates support for research hypothesis
** Indicates partial support

Another important finding in this study supported the premise of structural mutability. All three relational structures exhibited continuous change, increasing
from session to session. Moreover, none of the socio-technical variables displayed change until the final session. That is, social presence, communication effectiveness and communication interface remained relatively constant during earlier sessions when the relational variables were already exhibiting a transformation. These results indicate that some structures may be more susceptible to change than others. In this study, the relational structures evolved more readily than socio-technical structures. However, in order to become more fully aware of the structuration factors which impact groups, research needs to develop a clearer understanding of the differences between structures with respect to their various properties.

EMS researchers can benefit from this study because it points to the possible existence of the structuration process; though more needs to be done to reveal particular characteristics of the process. Managers in organizations can also benefit from this study since these results indicate that, even while participating in very different environments, groups can explore ways to adapt and perform. Moreover, EMS designers can profit from these findings since some structures -- especially socio-technical system structures -- are less malleable and present more difficult obstacles to group interaction. Thus, building systems which exhibit more flexible properties may provide better support for groups in challenging environments.
# APPENDIX A

Summary of EMS Studies Examining Group Development and Process Structures

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* EMS different from No EMS only in final two sessions. ** F2F met once. Asynch met over 2 weeks.
### BEHAVIORAL

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### TECHNICAL

- EMS vs No EMS except where specified otherwise in citation cell. Where Sync and/or Async are noted, comparisons are between F2F, Sync, and/or Async. A result of ">" indicates EMS (or other treatment) > No EMS (or other treatment) etc.
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All comparisons are EMS vs No EMS except where specified otherwise in citation cell. Where Sync and/or Async are noted, comparisons are between F2F, Sync, and/or Async. A result of "\( > \)" indicates EMS (or other treatment) > No EMS (or other treatment) etc.

* EMS different from No EMS only in final two sessions. ** F2F met once. Async met over 2 weeks.
Appendix B

Global Associates, Inc. (GAI)

Background

Global Associates, Inc. is a multinational consulting firm which specializes in helping large US firms establish their first international operation. Their consultants are experts in a variety of multinational business areas such as marketing, finance and international strategy.

Global Associates, however, is unique in the area of international consulting because of their expertise in cultural awareness training. A large number of Global Associates' clients are from the US. In the course of operations GAI has also established and maintained commercial and political connections in many Pacific Rim countries.

Consultants work in teams and all have considerable management education and experience. Teams are formed such that each member, in addition to their general background, also brings some specialized functional skills to the team. For example, if the team manager determines that a critical concern for the client will be the establishment of a marketing strategy appropriate for a specific market, then a consultant with the necessary marketing knowledge is assigned to that team. Similarly, if a situation exists requiring sophisticated financial expertise in a foreign country, the team manager will acquire a financial expert for the consulting team.

Cultural sensitivity: Mr. Robertson, the President and CEO firmly believes that GAI's competitive advantage is a result of its practice of hiring only those
consultants who demonstrate cultural sensitivity. All consultants are required to take a series of cultural awareness courses and follow up with periodic refreshers. Mr. Robertson feels that the failure of many US companies in countries such as Hong Kong, Japan, and Taiwan is primarily due to their failure to understand the customs and cultural practices of the countries in which they operate. To provide the necessary cultural expertise for all of their clients, GAI trains its consultants in various international customs and cultures.

**Integrity:** One of the major problems which foreign investment consulting firms face is a negative public image. Several cases have been publicized recently suggesting that the entire industry engages in unethical business practices. These alleged practices range from fraud to the use of payoffs to governments in foreign countries to get a "foot in the door" for their client.

In countries where it is traditionally "accepted" to do business in such a way, GAI seeks ethical solutions to the logistical and political problems which confront client firms. GAI has discovered that a better understanding of local cultural practices usually provides legal and ethical alternatives to improper practices.

**Fairness:** A central belief at Global Associates is that every customer has the right to be treated with respect and be given the service they want at a fair and reasonable price. GAI senior management will not compromise on this essential value. If a client does not feel they were treated fairly, Global Associates will do WHATEVER it takes to set things right with that client. Consequently, Global Associates enjoys an excellent reputation and is an industry leader in revenues.
The Problem: Because of the growing number of clients, Global Associates has stepped up hiring and training of consultants. More team managers must be hired to supervise the growing staff. Team managers must have excellent educational credentials and work references before they are considered for hire. In order to obtain managers with the necessary experience, GAI is forced to hire candidates from other firms whose objectives, standards, and overall corporate cultures are frequently very different from those at Global Associates.

Global's main concern in this context is that, entering team managers must be made aware of the importance of conducting business in accordance with the values and philosophy of the company.
Appendix C

Global Associates, Inc. (GAI)

The Task

Your team's task is to prepare an "orientation" type policy statement to be given to each new manager. This document should illustrate the culture at Global Associates (without repeating the information provided in this case) and explain the necessity for new managers to adopt the objectives, values, and attitudes which make Global Associates the industry leader it is. This document will be the most important part of a new manager's training at GAI.

Your team's orientation statement should spell out what is expected of the managers in terms of behavior, practice, and ethical standards for themselves and their subordinates and the importance of their role as representatives of Global Associates in helping GAI attain its objectives. The document should also address potential consequences for failure to adopt and demonstrate the corporate culture as outlined.

Section headings have already been established for the document. A listing of these sections and the information your team should develop in each area follow. Within these sections, be creative with your ideas and descriptions. The final document should not just be a listing of items; it should contain detailed descriptions of the points you are including.

1. Mission statement: the reason the organization exists, products and services offered, clientele served, nature and geographic marketing territory of the business.
2. Corporate values: an explanation of the values which you feel motivate and compel GAI in the conduct of their business.

3. Policies: statement of how the managers are expected to act so as to reflect GAI's mission and values.

4. Unacceptable behaviors: description of specific behaviors considered inappropriate relative to the stated mission and values.

5. Consequences for failure: explanation of the various consequences a manager can expect in the event of his or her failure to represent GAI in the manner the firm feels is appropriate.

6. Conclusion: brief summary of the GAI's basic objectives and how the company expects this document to aid the organization in realizing those goals.

Remember, your objective is to produce a statement which defines and describes in detail the values and standards you feel must be conveyed to new managers.
Appendix D

Requirements

Meeting requirements:

Your team will have approximately four hours in total to organize, outline, and prepare a final draft of the document. Each group will meet four times for a period of about one hour each time in order to accomplish this task.

Deliverables:

At the end of each meeting period, your group will be expected to complete the following:

1. During the first meeting, approximately 10 minutes will be used to read this requirements material. After reading this material, you should spend the next 30-40 minutes familiarizing yourself with the system. Log on and access the training session and play around until you feel comfortable with the functions. You may also want to go into the GAI task document and begin communicating with teammates. This communication might be just to get acquainted or you could begin organizing yourselves for the task. However, there is no need to begin the task now (you will be doing that in the next session). Just use this time to get comfortable and to get to know your teammates.

Finally, be sure to leave about 10-15 minutes at the end of the session to complete some important questionnaires.
2. In the second session you will need to begin generating ideas specifically about what might be included in each of the sections of the final document. Don't evaluate the ideas yet; you should express whatever ideas you feel may be relevant to the final document. Be as creative as possible within the categories provided to you. In the idea generation stage you should use key words or short phrases (e.g., honesty, enter Asian markets, etc.).

One approach might be to spend about 20 minutes generating ideas before you begin looking at other people's ideas and entering comments about them.

Again, be sure to allow about 10-15 minutes to answer some important questions.

3. During the third session your team will be concerned with further evaluating the ideas which were generated in the first and second sessions. You will need to come to agreement as a group on which of the ideas ought to be discarded and which should be included in the final document. **This means that the outcome of this session should reflect the ideas and opinions of the entire group, not just one person's thoughts.**

This third meeting should produce an outline of the final document. This outline should contain in short sentence form, most of the major points which will be covered in the final document. You may change the outline during the final session (e.g., more ideas discarded or new ideas introduced), but you should strive to make the outline as complete as possible during this stage.
Remember to leave 10-15 minutes to answer the questionnaires at the end of the third session also.

4. During the final session your team will fill in the outline with full sentences and whatever supporting discussion is necessary to effectively communicate the ideas to the reader. Thus, at the end of the fourth meeting each group should deliver a complete, well worded, and polished business document (outline or short phrase form is not acceptable).

Please leave enough time to answer the questionnaires as in previous sessions.

Your team’s output will be assessed at the end of each stage. However, the greatest emphasis in evaluation will be placed on the final document. The final document will be assessed for creativity, organization of ideas, comprehensiveness, readability, tone, and how well it accomplishes the objectives set forth in your instructions. Be as creative as possible in designing your document. The material included in these instructions is merely background information to give you a sense of some (but not all) of the issues which concern Global Associates. Do not just repeat the information included here in your document.

We are asking each of you in the group to assume the role of a person from a different department of the company. In some cases the agendas of these department heads contrast considerably. Therefore, you will need to communicate with your teammates to make sure the document reflects your objectives. Please do not discuss your role outside of the sessions.
The different segments of the document should not be dedicated to the concerns of just one member. Every section of the document should, instead, reflect a synthesis of the concerns of all team members about all the points contained in the document.
Appendix E

Instructions

GroupLink:

GroupLink is designed to allow you to generate ideas, evaluate the ideas, transform the ideas into an outline, and write a finished document as a group. There are many different tools in GroupLink. Due to time constraints we will only be able to teach you one tool. GroupWriter (GW) is a collaborative writing and editing tool which you will use for each of the four stages of your task.

When you first enter GW, you will notice that major headings or sections have been pre-established for the exercise. These section headings are your guideline concerning what specific material needs to be covered in the document. The headings reflect the "deliverables" discussed in the task part of the case.

Although GroupWriter is designed specifically for writing it can be used for idea generation and outlining. In the idea generation stage, you will need to enter ideas as separate lines of text within the section you are working on. For example, one of you will enter a document section such as the "Mission statement" and begin typing in issues which you feel ought to be included in that section. For readability, each idea should be separated from the preceding idea by a blank line.
Don't spend all your time in just one section. An appropriate strategy might be to enter a few ideas in a section, then close it and open another section and repeat the process.

The Sessions:

During the first session, after reading the task, you should concentrate only on getting comfortable with the system and trying to communicate with fellow teammates in order to get to know them and to organize the exercise. You will also need to leave about 10-15 minutes at the end of the hour for answering three brief questionnaires. **It is VERY IMPORTANT that you answer these questionnaires at the end of EACH of the three sessions.**

During your second session you should each be entering ideas which you feel should be included in your document. Spend the first part of the session generating ideas but leave enough time at the end of the session to look at ideas suggested by others and begin evaluating and commenting on them. **Once again, leave time at the end of the session to answer all the questionnaire.**

In the third stage you will continue commenting on and evaluating the ideas generated in the first session. At this time you may also agree to delete ideas or, perhaps, add new ones. During this session you should be, primarily, organizing and arranging the ideas into an outline of your final document. Don't forget to answer the questions.
During the final session you will be refining the outline into a complete document. Feel free to delete or add ideas in this stage also as long as you produce a business like document by the end of last session.

**Meeting arrangements:**

Some groups will conduct all of their meetings with all members present at the same time and will meet "face-to-face" using the Electronic Meeting Room. Those groups must use the system to do their work on but they will be able to talk freely among themselves.

Other groups will be meeting at the same time but using computers located in different rooms. Thus, during your meetings you will be sitting at your terminal at the same time that your teammates are sitting at theirs and you will all be able to share the same information on the "public" part of your computer screen. However, you will not be able to see or talk to the people you will be meeting with. This will probably feel quite different to you than meeting "face to face" with fellow team members. Please do your best to act as naturally as you can during the sessions; remember that the main objective for all of you is to write a document as a group.

The remainder of the groups will also conduct their sessions using computers located in different rooms. However, none of the group members will be sitting at the computer at the same time as you. This means that the first member scheduled will work on the task (e.g., enter ideas, or evaluate other's ideas, or write some of the document, depending on the task stage) and save their
work when the hour is done. When the second member is scheduled to work, that
person will enter the session which will retrieve the task (including the first
person's work) and they will continue with their own part of the assignment. After
all members have finished their first hour session, the second sessions will begin,
and so on until all members have finished four one hour sessions. All groups will
be allowed a total of four hours to complete the task.

Communication:

Group performance and effectiveness is related to communication between
members. Therefore, it is important that you use the computer system as you were
trained to communicate with fellow group members while working on this task.

Be sure to use the "announcements" and "communication" sections of
the document for communicating any thoughts you have which you feel don't
relate directly to the document contents (for example - "lets get going on this" or
"wow, this has been a rough day for me").

Use the "annotation" feature in the GroupWriting tool for communicating
to others any thing you have to say about the document (for example - "this is a
great idea," or "this sentence is too wordy"). It is important that you include your
id # at the end of each annotation you make.

Please do not communicate with group members about this task
outside of your scheduled sessions.
Logging onto the system:

If you are at the C:> prompt, type "net" to get to the "login" prompt. If you have a problem come and get me in room C-305 or call me at x68560.

If you are at the F:>, G>, or H> prompt you will need to type in "login emr/anonXX" where XX are the last two digits of the id number (without the group number) you were assigned for this exercise.

Example: F:LOGIN> login emr/anon57
Then you will be prompted for your password. Your password is the same as your login account number.

Example: F:> enter your password: anon57
After entering GroupLink you will be asked for an id again. Your id is the same as in your initial entry.

Example: GroupLink ID: anon57
Then GroupLink will ask you for your password. This time your password will be "anonymous".

Example: Enter your password: anonymous
where "anonymous" will show as: ********

This should take you to the opening GroupLink screen displaying the project and activity your team will be working on.
Appendix F

Role Assignments

Each role assignment began with the following statement in bold capital letters. "Please assume this role to the best of your ability and keep this perspective when stating your feelings to your teammates throughout the course of this exercise."

ROLE ASSIGNMENT 1.

You are head of the legal affairs department. Since GAI advises clients on procedures in many foreign countries, this is a large and influential department. This division is concerned with legal issues from several perspectives.

The legal implications of GAI's responsibility to its clients are enormous. For example, if GAI misinterprets a foreign policy or regulation they may be held financially responsible for a client's failure to comply. On the other hand, GAI needs to understand just how the laws are exercised and "used" when it comes to making their clients competitive.

There is often a difference between what is legal, what is morally right, and what makes the best business sense. Your job is to make sure company employees do what is legal; you leave the decisions about what is right or best up to others as long as they do what is legal.

During this exercise you will need to keep these issues in mind and communicate your thoughts concerning them to your teammates.
ROLE ASSIGNMENT 2.

As head of operations you are responsible for daily assignments, schedulings, and coordinating of consultants and managers to teams and teams with clients, etc. You have an excellent reputation for turning out productive consultants. They, like you, are no-nonsense types and know that the world is full of winners and losers. The winners are winners because they are flexible and act according to the situation. They see company rules as guidelines that sometimes need loosening. If you let the rules dictate your work style too strictly, you will be a loser.

Times are relatively hard and the pressure is on to increase business. Your job is to accommodate growth. The more pressure you apply to consultants to play it "by the book," the less they will be able to produce. You are well aware that they need a free hand to be good consultants and you plan to continue with your productive style of management.

During this exercise you will need to keep these issues in mind and communicate your thoughts concerning them to your teammates.

ROLE ASSIGNMENT 3.

You are head of the sales and marketing department. You are a hard driving and results oriented executive who knows the various "tricks of the trade." You came up through the ranks as a sales person and identify strongly with the problems and decisions your people are faced with in the field. Your primary goal is to get new business.
You feel that GAI can easily keep pace with demand by speeding up the hiring since top management is always pressing you and your staff to get new clients. Further, you know that the best sales people are the ones who do whatever it takes to get the job done. Therefore, screening out all except for the most ethically "pure" applicants is costly, time consuming, and, since it usually screens out the top producers, is not really in the best business interests of the company no matter what corporate policy dictates.

You feel that policies need to be more relaxed and flexible. This will support those sales people and consultants who understand how to "bend" with the customs of the country to get what is best for their client (as long as no one is breaking any major laws).

During this exercise you will need to keep these issues in mind and communicate your thoughts concerning them to your teammates.

ROLE ASSIGNMENT 4.

You are head of the human resources department. Your department is responsible for the recruiting and training of all personnel. The qualities GAI wants your department to look for in their managers makes the selection process extremely difficult. Human resources is always being pushed from the top to screen carefully and train extensively so as to maintain high standards of behavior for all employees, especially team managers.

However, these stringent screening and training rules slow the process and make it impossible for you and your department to provide the personnel required
by the sales and operations departments. You are being pressured by both of those departments to increase your output. The only way you can do that is by unofficially relaxing GAI's corporate standards and hiring people from other companies with lower criteria for ethical behavior.

During this exercise you will need to keep these issues in mind and communicate your thoughts concerning them to your teammates.
Appendix G

Post-Session Attitude Survey

1. The group carefully considered whether each alternative idea would make for a better quality decision.

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2. The group carefully checked the validity of members' opinions and assumptions.

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3. Premises for the group's strategy were not based on strong evidence.

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4. The most dominant member(s) influence on the group was:

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5. Do you feel that you are really a part of this work group?

   - Really a part of my work group.
   - Included in most ways.
   - Included in some ways, but not in others.
   - Don't feel I really belong too much.
   - Don't feel I belong at all.

6. If you had a chance to do the same kind of work in another student work group, how would you feel about moving to a different group?

   - Would want very much to stay where I am.
   - Would rather stay where I am than move.
   - Would make no difference to me.
   - Would rather move, than stay where I am.
   - Would want very much to move.
7. How does this group compare with other student groups on each of the following points?

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<th>Very much better</th>
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<th>About the same</th>
<th>Worse than most</th>
<th>Very much worse</th>
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A. The way people get along together □ □ □ □ □
B. The way people work together □ □ □ □ □
C. The way people help each other □ □ □ □ □

8. Ideas expressed in the discussion were **uncritically** examined.

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9. The functions of leadership in the discussion were poorly served.

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10. The participants tended to initiate discussion on irrelevant issues.

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11. The participants' contributions were well amplified.

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12. The participants **did not** deal with issues very systematically.

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13. Participation in the discussion was unevenly distributed.

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14. The behavior of the group was goal directed.

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15. Group members openly acknowledged and confronted conflict.

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16. There was constant bickering among the group.

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17. The group handled conflict effectively.

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18. One part of the group seemed to be working against the other parts.

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19. Did you find yourself wanting to say things that you didn't say?

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</tbody>
</table>

20. How satisfied were you with the outcome of this meeting?

<table>
<thead>
<tr>
<th>Very Satisfied</th>
<th>Undecided</th>
<th>Very Dissatisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>4</td>
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<td>6</td>
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<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

21. Conflict was limited to task-related issues and not to group members' personalities.

<table>
<thead>
<tr>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

22. Our discussions were:

- Dominated by one individual.
- Dominated by a coalition of two members.
- Democratic, with each of us having an equal say.
- Dominated by the facilitator.
### Appendix H

**Meeting Environment Communication Characteristics**

The scales below are designed to assess feelings and attitudes towards various meeting environments. Please consider the following communication characteristics of the *entire meeting environment* you used, and circle the point along the scale which you consider to be the most appropriate. Work rapidly; do not return to previously completed responses.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Constrained</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>2. Complex</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>3. Good</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>4. Inaccessible</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>5. Distorted</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>6. Impersonal</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>7. True</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>8. Pleasurable</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>9. Hot</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>10. Distant</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>11. Dehumanizing</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>12. Expressive</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>13. Difficult</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>14. Emotional</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>15. Meaningless</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>16. Slow</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>17. Successful</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>18. Insensitive</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>19. Interesting</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>20. Constricted</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Free</th>
<th>Simple</th>
<th>Bad</th>
<th>Accessible</th>
<th>Accurate</th>
<th>Personal</th>
<th>False</th>
<th>Painful</th>
<th>Cold</th>
<th>Close</th>
<th>Humanizing</th>
<th>Inexpressive</th>
<th>Easy</th>
<th>Unemotional</th>
<th>Meaningful</th>
<th>Fast</th>
<th>Unsuccessful</th>
<th>Sensitive</th>
<th>Boring</th>
<th>Spacious</th>
</tr>
</thead>
</table>
Appendix I

Environmental Effectiveness Survey

In answering the following questions please consider your impressions of the effectiveness of your meeting environment for communicating with your fellow teammates.

1. The manner in which my group is communicating in this meeting environment is productive.

<table>
<thead>
<tr>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

2. Communication in our group was hindered by our meeting environment.

<table>
<thead>
<tr>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

3. We are able to communicate effectively in this meeting environment.

<table>
<thead>
<tr>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

4. The meeting environment makes communicating with each other a frustrating process.

<table>
<thead>
<tr>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

5. The environment prevents us from communicating clearly.

<table>
<thead>
<tr>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

In answering the following questions, please consider your feelings about the effectiveness of the meeting environment TODAY compared to your feelings during the LAST session.

6. We are using the system differently to communicate with each other.

<table>
<thead>
<tr>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

7. We are using the system differently to work on the task.

<table>
<thead>
<tr>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

8. The meeting environment is more effective for communicating with each other.

<table>
<thead>
<tr>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

9. The meeting environment is more effective for working on the task.

<table>
<thead>
<tr>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
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</tbody>
</table>
## Judges Evaluation Form

**Global Associates Inc. Policy Orientation Document**

Please evaluate each segment of the document on each of the four criteria presented here. You do not need to total anything; just check the appropriate boxes and return the completed form to Kelly Burke.

**Group Number ____**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Poor</th>
<th>Avg.</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Mission Statement:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creativity of ideas presented.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Realism or practicality.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Comprehensiveness dealing with issues.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Positive tone.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td><strong>2. Corporate Values:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creativity of ideas presented.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Realism or practicality.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Comprehensiveness dealing with issues.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Positive tone.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td><strong>3. Policies:</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Creativity of ideas presented.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Realism or practicality.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Comprehensiveness dealing with issues.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Positive tone.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td></td>
<td>Poor</td>
<td>Avg.</td>
<td>Excellent</td>
</tr>
<tr>
<td>-------------------------</td>
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<td>------</td>
<td>-----------</td>
</tr>
<tr>
<td><strong>4. Inappropriate Behaviors:</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Creativity of ideas presented.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Realism or practicality.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Comprehensiveness dealing with issues.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Positive tone.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td><strong>5. Consequences for failure to follow policy:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creativity of ideas presented.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Realism or practicality.</td>
<td>□</td>
<td>□</td>
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</tr>
<tr>
<td>Comprehensiveness dealing with issues.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Positive tone.</td>
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<td>□</td>
<td>□</td>
</tr>
<tr>
<td><strong>6. Conclusion:</strong></td>
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<tr>
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<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Realism or practicality.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Comprehensiveness dealing with issues.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Positive tone.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td><strong>7. Overall Quality of Document</strong></td>
<td>□</td>
<td>□</td>
<td>□</td>
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</table>
Appendix K

Preliminary Results Of Pilot Study

A pilot study was conducted over a two week period in April, 1993. Thirty two subjects were randomly assigned to eight groups of four each which were randomly assigned to treatments. Two groups were assigned to the face-to-face condition and three groups each to the distributed (synchronous and asynchronous) condition. Participants were upper division undergraduates enrolled in a management class. Extra course credit was given to all who attended all three meetings and three cash prizes were awarded ($60, $40, and $20) based on expert evaluation of the final documents.

The objective of the pilot was to validate the task and experimental design. Additionally, data was gathered and analyzed from the questionnaires administered to each participant at the end of each of the three sessions.

Based on the responses during exit interviews some minor procedural alterations were proposed for the main study. A major change will be implemented in the number of sessions required. Most participants indicated that the three sessions were insufficient for the task. Thus, a fourth session will be added to the main study. Results show that all other procedures were appropriate.

In the pages that follow a preliminary analysis of the data gathered from the pilot is presented. Statistical results and graphs are provided to illustrate the data.
Results of Pilot

Time: An important consideration in the pilot was the number of sessions the groups should meet. The study intended to measure changes over time but it was not clear what length would be suitable given the complexity of the task. A significant result of the pilot was that participants felt overly pressured and constrained by the three session limit. Therefore, the main study will require groups to meet four times.

Task: The task was designed specifically for the study with the objective of requiring groups to surface ideas, reach consensus on which were appropriate to include in the policy document, and write the document in final form. This is a complex series of activities which represent real world requirements. Participant responses validated the complexity and relevance of the task.

Training: Training on an EMS is necessary since no participants had previously used one. Thus, the pilot served to refine training procedures in order to ensure comprehensiveness and parity of training across subjects.

Discussion of Results

Summary results from the MANOVA are presented in Table K-3. Where interaction effects pertained, follow-up one-way ANOVAs were performed to test for main effects. Those results are presented in Tables K-1 and K-2 and Figures K-1 and K-2.

H1: Cohesiveness will differ across treatments over time.
(Not supported)
Contrary to what we expected there were no differences in cohesion across meeting modes over time. The immediacy and hypothesized higher level of influence presumed to be present in a face-to-face meeting environment should have resulted in a greater degree of cohesion. Further, in conditions of decreased spatial and temporal proximity (i.e., asynchronous), we anticipated even less cohesion. However, this was not the case.

**H2: Leadership effectiveness will differ across treatments over time.**
(Supported)

We argued that functions of leadership are better served in environments which facilitate timely and productive exchange of information. Appropriate information exchange is fundamental to a shared understanding of process requirements and to notions of group togetherness.

<table>
<thead>
<tr>
<th>Table K-1: Leadership Effectiveness Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td>Face-to-Face</td>
</tr>
<tr>
<td>Synchronous</td>
</tr>
<tr>
<td>Asynchronous</td>
</tr>
</tbody>
</table>
As can be seen from the means (Table K-1 and Figure K-1), when we compare leadership effectiveness between treatments during each of the sessions, the differences generally support the hypothesis. In session one there were no significant differences between treatments possibly because there had been little time at that point for leadership to emerge in any of the conditions. In the second and third sessions the face-to-face groups reported greater leadership effectiveness than the asynchronous groups and in session two face-to-face groups also rated leadership better than the synchronous groups. This supports the contention that the meeting modality is a critical dimension influencing the leadership effectiveness in groups.

**H3: Coordination competence will differ across treatments over time.**
(Supported)

Coordination is a requirement in all group projects and the extent to which a group is well coordinated determines performance (Horton and Biolsi, 1992). The
pilot study found that there is an interaction effect of meeting mode and time on coordinative competence. See Table K-2 for the means and Figure K-2 for a graphical representation.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-Face</td>
<td>3.312</td>
<td>4.750</td>
<td>5.750</td>
</tr>
<tr>
<td>Synchronous</td>
<td>4.722</td>
<td>3.056</td>
<td>4.889</td>
</tr>
<tr>
<td>Asynchronous</td>
<td>4.167</td>
<td>3.917</td>
<td>4.458</td>
</tr>
</tbody>
</table>

In the first session, synchronous groups (unexpectedly) reported significantly better coordination than the face-to-face groups. However, by session two, (as predicted) the face-to-face groups began to show greater coordinative ability than the synchronous groups and again in session three exhibited significantly higher coordination competence than both synchronous and asynchronous conditions. The face-to-face environment was more immediate, more interactive, and exhibited greater communication capacity. This capacity afforded the groups the opportunity for the communication required for effective coordination.
**H4:** Perceived social presence will differ across treatments over time.
(Not Supported)

Counter to what is suggested by theories of social presence and media richness, there was no significant difference in perceived social presence between treatments over sessions. These results provide evidence that social presence may not be as dependent on media as has been assumed. In this study there were clearly differences in communication capacity between the collocated and the distributed conditions, yet the face-to-face groups reported their environment to be no more personal and engaging than did dispersed groups.

**H5:** Equality of participation will differ across treatments over time.
(Not Supported)

Previous studies indicated that EMSs offer group members anonymity (Jessup et al., 1988) and prevent conveyance of status messages. This helps "level
the playing field" sometimes leading to increased equality of participation (e.g., Siegel et al. 1986). The pilot study found no support for such a position.

**H6: Task performance will not differ across treatments.**  
(Supported)

Whether groups met in collocated or dispersed environments, there was no effect on the quality of the document produced relative to meeting mode. Thus, it may be that groups learn to adapt the environment to compensate for structural barriers which impede appropriate group development.

<table>
<thead>
<tr>
<th>Table K-3: Summary of Statistical Analyses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Variable</strong></td>
</tr>
<tr>
<td>---------------------------------</td>
</tr>
<tr>
<td>Cohesiveness</td>
</tr>
<tr>
<td>Leadership Effectiveness</td>
</tr>
<tr>
<td>Coordination Competence</td>
</tr>
<tr>
<td>Social Presence</td>
</tr>
<tr>
<td>Equality of Participation</td>
</tr>
<tr>
<td>Quality of Document #</td>
</tr>
</tbody>
</table>

* significant at alpha = .05

In conclusion, despite the small sample size, the results indicate some support for the effects hypothesized. The main study should corroborate these results. Further, the proposed sample size of 30 groups being observed repeatedly over four sessions should yield support for those hypotheses not supported in the pilot.

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Appendix L

Pre-Session Questionnaire

1. Academic Standing (circle one): Sophomore / Junior / Senior

2. Academic Major (check one):
   - Finance
   - Marketing
   - Management
   - MIS/Decision Sciences
   - Accounting
   - TIM
   - General Business
   - Human Resources Management
   - International Business
   - Other __________________________ Specify major

3. Cumulative G.P.A (out of 4.00): __________________

4. Age (in years): __________________

5. Sex (circle one): Male / Female

6. Part-time Work Experience (in months): __________________

7. Full-time Work Experience (in months): __________________

   For questions 8 - 12, circle one response that is the most appropriate.

8. I have a lot of experience working in groups:

<table>
<thead>
<tr>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. I like to work in groups:

<table>
<thead>
<tr>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
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<td>6</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

206
10. I am normally pretty outgoing in groups:

<table>
<thead>
<tr>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11. I like using computers:

<table>
<thead>
<tr>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12. How well do you type?

<table>
<thead>
<tr>
<th>Hunt &amp; Peck</th>
<th>Average</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td></td>
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</tr>
</tbody>
</table>

13. Please note the number of people in this group that you:

____ are close friends with.
____ know fairly well.
____ have talked with once or twice before.
____ recognize, but that's about all.
____ do not know at all.

14. I have talked previously with other participants about this experiment (circle one):

Yes / No

15. I am a citizen of (check one):

____ USA
____ United Kingdom
____ Germany
____ France
____ Japan
____ South Korea
____ Vietnam
____ Thailand
____ Philippines
____ People's Republic of China (PRC)
____ Republic of China (ROC - Taiwan)
____ Hong Kong
____ Macao
____ Singapore
____ Malaysia
____ Other

(Specify name of country)
16. My father's ethnic background is (check one):

___ Caucasian ___ Thai
___ Japanese ___ Filipino
___ Korean ___ Chinese
___ Vietnamese ___ Other ____________________________

(Specify ethnic background)

17. My mother's ethnic background is (check one):

___ Caucasian ___ Thai
___ Japanese ___ Filipino
___ Korean ___ Chinese
___ Vietnamese ___ Other ____________________________

(Specify ethnic background)

18. My first language i.e., my mother tongue, is (check one):

___ English ___ Vietnamese
___ Spanish ___ Thai
___ German ___ Filipino
___ Japanese ___ Chinese
___ Korean ___ Other ____________________________

(Specify first language)

19. In addition to English, I also know these languages (check all that apply):

___ French ___ Vietnamese
___ Spanish ___ Thai
___ German ___ Filipino
___ Japanese ___ Chinese
___ Korean ___ Other ____________________________

(Specify language)
20. I have lived in these countries for five years or more (check all that apply):

___ USA  ___ Philippines
___ United Kingdom  ___ People's Republic of China (PRC)
___ Germany  ___ Republic of China (ROC - Taiwan)
___ France  ___ Hong Kong
___ Japan  ___ Macao
___ South Korea  ___ Singapore
___ Vietnam  ___ Malaysia
___ Thailand  ___ Other

(Specify name of country)

21. Here in the US, I have lived in these states for five years or more
(check all that apply):

___ Alabama  ___ Alaska  ___ Arizona
___ Arkansas  ___ California  ___ Colorado
___ Connecticut  ___ Delaware  ___ District of Columbia
___ Florida  ___ Georgia  ___ Hawaii
___ Idaho  ___ Illinois  ___ Indiana
___ Iowa  ___ Kansas  ___ Kentucky
___ Louisiana  ___ Maine  ___ Maryland
___ Massachusetts  ___ Michigan  ___ Minnesota
___ Mississippi  ___ Missouri  ___ Montana
___ Nebraska  ___ Nevada  ___ New Hampshire
___ New Jersey  ___ New Mexico  ___ New York
___ North Carolina  ___ North Dakota  ___ Ohio
___ Oklahoma  ___ Oregon  ___ Pennsylvania
___ Rhode Island  ___ South Carolina  ___ South Dakota
___ Tennessee  ___ Texas  ___ Utah
___ Vermont  ___ Virginia  ___ Washington
___ West Virginia  ___ Wisconsin  ___ Wyoming
Appendix M

Agreement To Participate In

A Study of the Impact of Communication Media on Group Communication Processes

Principal investigator:
Kelly Burke

Home: 47-544 B. Melekula Rd.
Kaneohe, HI 96744
Ph: 239-4184

Office: College of Bus. Admin.
Bus. Admin. C-305
Ph: 956-8650

Project description: You will be voluntarily participating in a study which will be concerned with the effect of various types of electronic meeting systems on group communication processes. All participants will attend a one hour training session after which it is expected that you will meet with your assigned group three times for a period of about one hour each meeting over a period of two weeks. The objective for those meetings will be for your group to complete a writing task using the system you will be trained on.

You will be asked to complete several questionnaires pertaining to your demographic background information and learning and cognitive styles. You do not have to fill out these forms. Any information you do provide will be held strictly confidential. The results of the study may be published. This means that the data gathered from you may be published as combined data but individual information will not be made public.

Certification: I certify that I have been told of the possible risks involved in this project, that I have been given satisfactory answers to my inquiries concerning project procedures and other matters, and that I have been advised that I am free to withdraw my consent and to discontinue participation in the project or activity at any time without prejudice.

I herewith give my consent to participate in this project with the understanding that such consent does not waive any of my legal rights nor does it release the principal investigator or the institution or any employee or agent thereof from any liability for negligence.

If you cannot obtain satisfactory answers to your questions or have comments or complaints about your treatment in this study contact: Committee on Human Studies, University of Hawaii, 2540 Maile Way, Honolulu, HI 96822. Phone: 948-8658

__________________________________________
Signature of participant

Date: ________________________________
REFERENCES


Seashore, S.E., (1954) Group Cohesiveness in the Industrial Work Group, University of Michigan, Ann Arbor, MI.


