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Face-to-face versus computer-mediated communication: An investigation of multiple outcomes across task-types

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FACE-TO-FACE VERSUS COMPUTER-MEDIATED COMMUNICATION: AN INVESTIGATION OF MULTIPLE OUTCOMES ACROSS TASK-TYPES

A Thesis

Presented to the

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by

Anton James Villado

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ABSTRACT

A novel approach was used to investigate differences between groups using computer-mediated and face-to-face communication. In a laboratory setting, three-person groups completed three survival themed tasks. The tasks were related in that the output of a preliminary task became the input of subsequent task. The two methods of communication were compared through a profile analysis on measures of performance and multiple measures of satisfaction. Computer-mediated groups were consistently less satisfied than face-to-face groups across tasks. Contradictory to predictions, satisfaction increased in computer-mediated groups as the tasks required more coordination effort,. No performance differences were found. The results are promising in terms of revisiting the use of computer-mediated communication in organizational work-groups. Implications and limitations are discussed.

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And finally, I wish to thank those individuals who served in this project as participants. You have all helped me to reach my goals, and you have contributed to science. I thank you all.

DEDICATION

To my parents. It is because of their undying support that I continue to pursue all that I may.

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CHAPTER ONE

INTRODUCTION

Communication is undoubtedly a vital component of any organizational function (Katz & Kahn, 1978). Computer-mediated communication, for example is just one medium that has transformed communication within organizations and work groups. Today, work groups can collaborate at the speed of light, using video, audio, and text while on opposite sides of the world, all through the use of personal computers. As technology continues to revolutionize the way in which we communicate, understanding the affects of different communication mediums becomes increasingly important.

Organizations continually strive to enhance interaction, productivity, quality and learning by introducing new and innovative communication mediums (Carey & Kacmar, 2000). Organizations have recognized that computer-mediated communication has had behavioral and operational effects, but has often failed to bring about the desired changes (Carey & Kacmar, 2000). It is not surprising to find research investigating the various issues that could affect the utility of one communication method over another. The degree of information transmitted,

types of task, group size, type of industry and familiarity with the medium are all factors that have been investigated as having an effect on outcomes such as performance and satisfaction (Barkhi, Jacob, & Pirkul, 1999; Benbasat, & Lim, 1993; Carey, & Kacmar, 2000; Fjermestad, & Hiltz, 1999; Kiesler, & Sproull 1992; Zigurs, & Buckland, 1998). Although there are some contradictory findings, current theories suggest different mediums are appropriate for different tasks, environments and experience (Barge, & Hirokawa, 1989; Hollingshead, McGrath, & O'Connor, 1993; McGrath, 1991; Whitworth, Gallupe, & McQueen, 2000; Zigurs, & Buckland, 1998). While this research may demonstrate the optimal use for each form of communication, it is seemingly useless for organizations that may be forced to use only one or two different forms of communication for a variety of tasks. Often, it may not be feasible to select a specific medium for every task in the organization.

Purpose of the Study

Investigation of the performance and satisfaction of computer-mediated groups is vital to our understanding of how these groups function and the means necessary to achieve desired results. Despite various attempts at

understanding performance and satisfaction outcomes of computer-mediated groups, numerous factors or combinations of certain factors have yet to be tested (Benbasat, & Lim, 1993; Carey, & Kacmar, 2000; Fjermestad, & Hiltz, 1999; Ocker, & Yaverbaum, 1999; Straus, 1999; Zigurs, & Buckland, 1998). Moreover, the majority of research has examined only a few outcomes, typically with only one or two different tasks (Straus, 1999). Accurately predicting the outcomes of computer-mediated groups still eludes researchers. It is the goal of this research to advance the literature of this field by providing an empirical investigation of outcomes associated with groups that are using computer-mediated communication. Investigation of several task-types and communication methods, using various outcomes will enhance our understanding of how a particular communication medium affects certain tasks. To accomplish this goal, the influences of task-type and communication medium on performance and four measures of satisfaction will be assessed in groups completing tasks designed to elicit increasing levels of coordination effort.

CHAPTER TWO

LITERATURE REVIEW

Communication Medium

Technological advances in communication mediums have brought about an increased number of advantages and disadvantages (Benbasat, & Lim, 1993; Boiney, 1998; Lam, & Schaubroeck, 2000; Weisband, 1992). For example, electronic mail (e-mail) may offer a cheap and simple way to communicate at lightning speeds, yet it is difficult to convey complicated or abstract ideas using this medium. Alternately, video conferencing is a medium in which complicated and abstract ideas may be easily understood, but it involves complex and expensive hardware, and requires a greater degree of coordination to manage. Add to these two mediums the more traditional forms of communication, such as face-to-face communication, communication via telephone and written communication, and we can see that the selection of an appropriate communication medium involves the consideration and understanding of many elements.

To better understand how groups use computer-mediated communication, the literature has seen several theories put forth by researchers (Barge, & Hirokawa, 1989; Hollingshead, McGrath, & O'Connor, 1993; Whitworth, Gallupe, & McQueen, 2000; Zigurs, & Buckland, 1998). Although these theories have undergone limited and occasionally no empirical testing, they do offer a starting point (Straus, 1999). One particular theory that has received attention in the literature is that presented by McGrath and Hollingshead (1993). McGrath and Hollingshead (1993) present a theory of group communication based on task-media fit. These two components interact to produce a model from which group communication systems can be created to enhance group performance and satisfaction (McGrath and Hollingshead 1993).

Communication medium is an important component of task-media fit (Hollingshead, McGrath, & O'Connor, 1993; McGrath, & Hollingshead, 1993). On the most basic level, communication can be thought of as the simple exchange of ideas between members. Today, groups can exchange ideas using a variety of communication mediums. Task-media fit first focuses on the different qualities each communication method offers (McGrath, & Hollingshead, 1993). First,

communication can be synchronous (where information can be sent and received at the same time), or asynchronous (information is limited to either only sending or only receiving at any one time). Face-to-face communication is a synchronous form of communication. While speaking to someone face-to-face, a person is sending information while at the same time receiving information, typically in the form of non-verbal cues. These nonverbal cues can be as simple as body language, but they allow the receiver to send complex information without interrupting the sender. Asynchronous communication does not allow individuals to send and receive information at the same time. E-mail is a good example of asynchronous communication. A sender types out and then transmits an e-mail message without knowing if the receiver will understand the information, is interested in the information or even if the message is received.

Communication can also be described in terms of the amount of information transmitted (Allen & Griffeth, 1997; Barge, & Hirokawa, 1989; Daft, & Lengal, 1986; Daft, Lengal, & Trevino, 1987; McGrath, & Hollingshead, 1993). Whether via e-mail or face-to-face, the amount of information within a message can vary. This variation in information content is referred to as communication

richness (Daft, & Lengal, 1986). Face-to-face communication is an example of a rich communication medium. In a face-to-face setting, information is transmitted through verbal expression. In addition to the verbal communication, information is also sent through non-verbal channels. These channels of communication manifest themselves in various forms, such as body language, voice inflection and other non-verbal cues.

The difference between rich and lean channels of communication can be seen when comparing face-to-face communication with communication via e-mail. The majority of researchers in this field typically consider e-mail a lean method of communication, although some have expressed opposition to such classification (Lee, 1994). E-mail lacks the ability to transmit additional channels of communication that other methods, such as face-to-face communication offer. The number of additional channels that an e-mail lacks is obvious when we consider the difference between denotation and connotation. Denotation refers to the literal meaning of the idea. "It was an exciting night," can mean just that, the person believed the evening to be thrilling or stimulating. However, consider the same statement in the following context, "Last night I finished

washing all of the dishes. It was an exciting night." The connotation, which includes the information transmitted beyond the literal denotations, infers that it was by no means an exciting night. In fact, the person most likely had a dull evening, inferring the opposite of the literal meaning. To the extent that a communication medium can transmit information across multiple channels, a communication medium is said to be rich (Allen, Griffeth, 1997; Barge, & Hirokawa, 1989; Daft, & Lengal, 1986; Daft, Lengal, & Trevino, 1986; McGrath, & Hollingshead, 1993).

With the emergence of e-mail, Internet relay chat and instant messaging, innovative forms of non-verbal communication have materialized. These take the form in the popular collection of emoticons often used in electronic communication. Emoticons have managed to enhance communication through an electronic medium in such a way that connotations which were once difficult to express without an awkwardly direct reference can now be transmitted with a simple punctuation combination (e.g. :) to represent absurdity or sarcasm or :(to represent discontent or unhappiness).

Intriguing as these expressions may be, communication by means other than face-to-face communication should not

be thought of as equivalent in number of channels or richness. This poses a problem to groups that choose a communication method other than direct, face-to-face communication. Groups communicating via telephone, for example, have the ability to transmit information beyond the direct message, using techniques such as voice inflection. Visual cues, however, such as body language are not possible when using a strictly auditory medium and therefore, this medium offers fewer channels of communication than face-to-face communication. Fewer channels of communication are also a characteristic of e-mail. E-mail does not have ability to send information through body language, nor the ability to transmit information via voice inflection.

This linear pattern of information loss increases as the medium loses transmission channels (Daft, Lengal, & Trevino, 1987). By closely examining the extent to which a particular medium can transmit information, a hierarchy of communication medium may be established (Daft, & Lengal, 1986; Daft, Lengal, & Trevino, 1987). At the top of the hierarchy resides face-to-face communication, rich with information in that auditory, visual and other nonverbal cues can be used as a means of communication. As the

different channels are pealed away, the communication medium is less and less capable of supporting multiple channels, until there are but a few channels left, as in electronic mail, void of auditory and non-verbal cues.

While it may be easy to assume that more information will lead to increasingly effective group communication, research has found otherwise (Benbasat, & Lim, 1993; Farmer, & Hyatt, 1994; Fjermestad, & Hiltz, 1999; Hedlund, Ilgen, & Hollenbeck, 1998; McGrath, & Hollingshead, 1993; Straus, 1999; Whitworth, Gallupe, & McQueen, 2000; Zigurs, & Buckland, 1998). Additional information may enhance effectiveness (Nagasundaram, & Dennis, 1993). However, it may also become a hindrance to group processes by overloading the receiver with unnecessary information (Barge & Hirokawa, 1989; Daft & Lengal, 1986; Hollingshead, McGrath & O'Connor, 1993). When the additional information is of no use and yet still being processed, multiple channels of communication begin to work against the group. By providing more information than is necessary, a communication medium can be described as causing an information overload (Allen, Griffeth, 1997; Daft, & Lengal, 1986; Daft, Lengal, & Trevino, 1987). While the literature supports the concept of information overload,

further exploration of communication richness has demonstrated the task itself can have an influence on the effectiveness of communication.

Task-Type

Researchers have demonstrated that the type of task can also have an effect on performance and group satisfaction (Benbasat, & Lim, 1993; Carey, & Kacmar, 2000; Farmer, & Hyatt, 1994; Hollingshead, McGrath, & O'Connor, 1993; Wood, 1986). Depending on the type of task, groups using computer-mediated-communication may perform better or worse than groups communicating face-to-face. Attempting to clarify the various tasks groups face in a work-related context, McGrath (1984) classified tasks into categories based on two dimensions, the level of collaboration or conflict generated and the degree to which the task requires behavioral or cognitive action. The Task Circumplex divides tasks into four basic quadrants, generate, choose, negotiate and execute. Although McGrath (1984) divides these quadrants into further components, the four basic quadrants provide an adequate categorization of task-types.

The first Quadrant (I) of the Task Circumplex (see Figure 1), generate, categorizes task that are the starting point of most groups (McGrath, 1984). This quadrant represents the earliest collaboration a group experiences. Specifically, generate tasks involve the planning and idea-generating stages of group projects. Groups decide how they will tackle a problem. Ideas are brought to the table in an effort to offer as many solutions to the problem or paths to the goal as possible. We often see the use of brainstorming in this quadrant of task categorization. A group is presented with a problem or goal, and then attempts to generate as many ideas as possible; the primary concern of the group facing this task being the generation of numerous and unique ideas, not necessarily viable solutions or paths (Connolly, Routhieaux, & Schneider, 1993; Nagasundaram, & Dennis, 1993). Idea-generating tasks benefit from almost all contributions of group members. Group performance in this stage is often measured by how many unique ideas are generated. After this stage, groups are left with multiple solutions or paths at which time they proceed to Quadrant II.

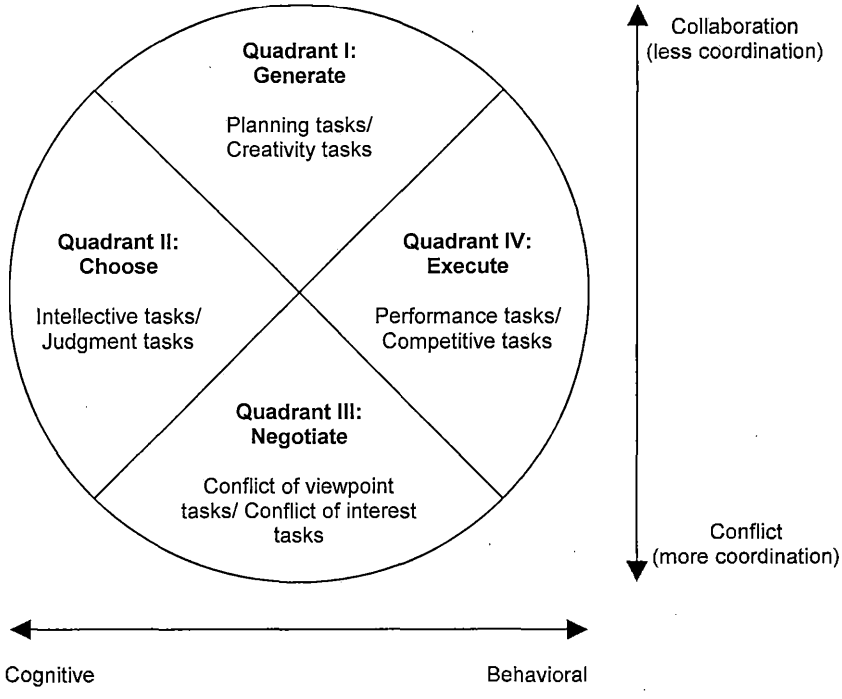

Figure 1. McGrath's Task Circumplex. Adapted from McGrath, J. E. (1984). *Groups: Interaction and performance*. Englewood Cliffs, NJ: Prentice-Hall.

In Quadrant II (choose), groups face the challenge of eliminating solutions from those generated in the first step. Choosing is done by either selecting the correct answer, or by selecting the best answer, whichever is applicable. Groups must individually contribute ideas and

opinions related to selecting the best or correct answer. As one might expect, the level of coordination required is somewhat more than that required in Quadrant I. Where in Quadrant I, group members need not attend to the ideas being offered by other member, choosing a solution or path requires that each member attend to the other members concerns and thoughts. Coordination that was unnecessary in Quadrant I is required when groups must choose a best or correct answer. After this task is completed, groups are then left to negotiate the final choice.

Quadrant III tasks require negotiation. For these tasks, groups must negotiate a final decision. Negotiation occurs because more than one of the answers serves as a possible solution, and opposing viewpoints or conflicts of interest exist. These opposing viewpoints or conflicts of interest require even more coordination than the tasks of Quadrant I or Quadrant II. Because competing viewpoints or conflicts of interest make different solutions more appealing to individual group members, they must coordinate their efforts so that a final solution can be negotiated. The conflicts of each member must be understood and dealt with if a final solution is to be selected. Negotiation tasks are interdependent on member participation and

require some of the highest levels of coordination in order to be successful (McGrath, 1984).

At the conclusion of the Task Circumplex, a group must put into action their decision. Quadrant IV of the Task Circumplex involves the execution of the decision. This stage is relatively straightforward; a group decision is made by the previous stage and therefore, a group must put into action its decision. Coordination and interdependence are not as critical as they were in the negotiation task; there is no disagreement on the solution or path to the goal at this point because the solution has been generated, ideas narrowed, and the final solution negotiated. The group need only act on its decision.

The Task Circumplex provides a visual representation of various types of tasks and of the requirements (coordination and interdependence) associated with each type. Integrating the type of communication medium and the types of tasks presented in the Task Circumplex, Hollingshead, McGrath, & O'Connor, (1993) proposed that group performance and satisfaction could be predicted using a Task-Media Fit model of communication.

The Task-Media Fit model suggests that different mediums are appropriate for different tasks (Hollingshead,

McGrath, & O'Connor, 1993). While groups need not progress through all four quadrants of the Circumplex, specific communication mediums could be selected based on the coordination and interdependence requirements of each task. For idea generating tasks, groups would benefit from communication methods that are less rich, allowing greater opportunity for each member to submit ideas without the unnecessary clutter associated with rich methods of communication (Benbasat, & Lim, 1993; Boiney, 1998; Carey, & Kacmar, 2000; Farmer, & Hyatt, 1994; Hollingshead, McGrath, & O'Connor, 1993; Nagasundaram, & Dennis, 1993; Straus, 1999). For example, group members could contribute ideas via e-mail. Unlike face-to-face communication, members do not have to wait their turn in order to share an idea when using e-mail. Perhaps more repetitive solutions might be offered, yet the possibility of more unique ideas being presented appears to negate the redundancy. Numerous studies have found that when comparing face-to-face groups to computer-mediated groups on idea-generating tasks, computer-mediated groups produce more unique ideas and are generally more satisfied with the process and the outcome (Benbasat, & Lim, 1993; Carey, & Kacmar, 2000; Hollingshead, McGrath, & O'Connor, 1993; Straus, 1999).

Idea-generating tasks require little coordination or interdependence, and therefore benefit by using a communication medium that lacks additional, unnecessary, and sometimes detrimental channels of communication. However, as a group moves from idea-generating tasks, through choosing tasks, to a negotiation task, the need for coordination and information increases (Hollingshead, McGrath, & O'Connor, 1993; McGrath, & Hollingshead, 1993). As groups require additional coordination, group members begin to benefit from the added information transmitted by richer forms of communication.

Implications for these findings are clear; groups should increase the richness of communication in relation to their movement from idea generating tasks to negotiating tasks. Perhaps collaborating via e-mail is the best solution in the preliminary phases of a group project, while relying on face-to-face communication, such as group meetings best serves the group as the project nears completion.

Although group performance and satisfaction literature has compared face-to-face groups and computer-mediated groups, there has been only limited support for the Task-Media Fit model (Benbasat, & Lim, 1993; Fjermestad, &

Hiltz, 1999; Zigurs, & Buckland, 1998). In fact, much of the literature provides us with conflicting results(Mennecke, Valacich, & Wheeler, 2000, Ocker, & Yaverbaum, 1999). In some cases, groups using computer-mediated communication out perform groups using face-to-face communication during idea-generating tasks (Benbasat, & Lim, 1993; Fjermestad, & Hiltz, 1999; Zigurs, & Buckland, 1998). Further studies have gone to show that groups using face-to-face communication and computer-mediated communication are equivalent in many ways (Ocker, & Yaverbaum, 1999). Sometimes there is an interaction of communication-type by task-type on several outcomes, while other studies fail to demonstrate an interaction. These findings suggest a dismal future for computer-mediated communication. If groups cannot meet the performance and satisfaction levels attained with traditional methods of communication, then the utility of incorporating computer-mediated communication is drastically reduced. Computer-mediated group communication must be understood in a manner such that we are able to construct computer-mediated groups to achieve, at minimum, the equivalent performance and satisfaction seen in face-to-face groups.

Cognitive Processes

Despite the seemingly obvious goal of attaining equivalent performance and satisfaction from both computer-mediated and face-to-face groups, much of the research has identified the differences and deficiencies computer-mediated communication has over groups using face-to-face communication, but repeatedly ignores the similarities and steps to achieve equivalency. Understanding group communication needs, and the cognitive function of communication in groups is a prerequisite to achieving equivalent or superior performance from computer-mediated communication as compared to face-to-face communication (Whitworth, Gallupe, & McQueen, 2000).

In answer to this need for understanding the cognitive processes of group communication, Whitworth, Gallupe and McQueen (2000) proposed the Cognitive Three-Process Model of Computer-Mediated Group Interaction (C3P). Their model focuses on the cognitive process associated with group interaction and takes the perspective of the individual operating within the group. An individual within the group would look at their environment in three distinct ways, a task, other individuals and the group. Group interactions are thus divided into three basic components, resolving

task information, relating to others and representing the group. Each of these processes is an important component of group interaction and serves to fill a cognitive function of group membership.

Resolving task information is the cognitive process of interpreting and communicating information about the task. In this process, individuals receive, decode and interpret factual, informative information about the task (Whitworth, Gallupe, & McQueen, 2000). Information is used to determine possible resolutions (or decide that the task has no resolution), with decisions being based on information stemming from informed, factual sources. The influence of others and the influence of the group as a whole are not a factor in this process because information related to logical argument and rationalization is the only information considered. Simply stated, this process is concerned with factual information exchange.

Relating to others, on the other hand, is not an isolated factual information exchange. Rather, Whitworth, Gallupe, & McQueen, (2000) describe this process as dealing with the interaction between an individual and others within the group. Relational information allows individuals to form common bonds, and adds predictability to

interactions individuals in the group have with one another. It is this process where friendships and adversaries are formed and maintained within the group. Relationships allow individuals to experience an intimacy with one another, thus exchanging affect. This is influential in that factual information may be or may not be internalized by the receiver; depending on the trust that individual has in the sender. Relationships and therefore influence from other individuals within the group are maintained using this process.

Whereas individual relationships are the primary concern of relating to others, normative group pressure is the primary influence in the process of representing the group. Social structure is formed and maintained by this process (Whitworth, Gallupe, & McQueen, 2000). Individuals within the group are governed by group norms and group values transmitted through this process. This process is not rational (resolving task information) or emotional (relating to others) but normative in nature, and operates from the basis of conformity.

The focus on an individual's cognitions about the group is primarily how this model differs from those past. This cognitive difference can be seen by comparing the C3P

model to the Task-Media Fit model proposed by (Hollingshead, McGrath, & O'Connor (1993). McGrath's (1984) Task Circumplex relies on tasks having a physical basis. Therefore, the Task-Media Fit model relies on tasks concrete enough that different individuals, in different groups must all perceive a particular task in a similar way. However, this conception of the task is what differentiates the two theories (Whitworth, Gallupe, & McQueen, 2000). The C3P model recognizes that the whole premise of task difficulty relies on individual perceptions (Whitworth, Gallupe, & McQueen, 2000). These perceptions are likely to (and do) differ. One person might see the task as that of choosing whereas others view the task as negotiation. The individual's perceptions of the task offer us a greater understanding of the functions of communications than does the actual task.

Whitworth, Gallupe and McQueen (2000) contend that group interactions can be broken into the three processes of C3P and by using these three processes as a foundation, communication mediums can be created that allow a group to cognitively function as a group. By providing a means to communicate at all three levels, properly designed and configured computer-mediated communication systems are no

longer a limiting factor, but simply another form of communication available to a group. It is because previous designs of computer-mediated communication have ignored one or all of the cognitive processes, subsequently limiting the cognitions of group members.

The environment for group cognition must be set prior to the group function (Whitworth, Gallupe, & McQueen, 2000). An important factor in accomplishing this goal is the creation of the environment in which the group will function. Applying the recommendations of the C3P model, three different channels of communication are important if we expect computer-mediated and face-to-face groups to function equivocally.

While this model may present us with some interesting insights, it has not been demonstrated empirically. Only in hindsight does this model offer us an understanding of group communication. Moreover, post hoc reflection does not offer the support necessary for this model utilized in an organizational setting. Despite a lack of empirical testing, the C3P model does offer some interesting avenues of exploration. Specifically, the C3P model suggests that multiple outcomes are important.

Hypotheses

In an attempt to enhance our understanding of computer-mediated communication in a group environment, the findings of Task-Media Fit research will be investigated using multiple outcomes, many of which are suggested by the C3P model. The Task-Media Fit model suggests differences in satisfaction and performance due to coordination effort and media fit (McGrath, & Hollingshead, 1993). In this experiment, three tasks were selected, Idea-generation, Choose and Negotiation. These specific tasks were chosen because they represent an increase in coordination effort, often experienced throughout the life of a group project. While idea-generating tasks require less coordination, choose and negotiation tasks require substantially more coordination, thus representing the natural increase seen in workgroups. To investigate the media fit, two forms of communication were selected, face-to-face and computer mediated. These two forms of communication were selected because they offered the ability to transmit substantially different channels of communication. Face-to-face communication is classified as a rich medium of communication, while computer-mediated communication is limited in its ability to transmit multiple channels of

information, and is therefore considered a leaner communication medium. Computer-mediated communication was also chosen because it is the most likely replacement for face-to-face group meetings given today's technology. Communication through computers is substantially less expensive than conducting face-to-face meetings when considering global travel. Such technology is also made more cost-effective by relying on the Internet for a means of network transport.

Following from the research of Task-Media Fit, and the suggestions of the C3P model of Computer-Mediated Group Interaction, several predictions regarding outcomes are possible. Specifically, groups using computer-mediated communication will report higher satisfaction than groups communicating face-to-face when completing a task that requires minimal coordination effort. Further, this difference will be reversed for groups working to complete the Choose task, such that groups communicating face-to-face will report higher satisfaction than groups communicating via computers. This difference will continue for groups working to complete a negotiation task. Groups using face-to-face communication will report a higher

satisfaction than groups using computer-mediated communication.

These satisfaction trends are expected to be linear. Groups communicating face-to-face are expected to demonstrate positive linear satisfaction trends on various satisfaction measures (satisfaction with the decision process, satisfaction with the solution, satisfaction with the group, and satisfaction with the communication medium). Satisfaction in groups communicating face-to-face will increase as they move from the Idea-generation task, to the Choose task and finally to the Negotiation task (increasingly more coordination). Computer mediated groups are also expected to demonstrate a linear trend between satisfaction and task-type. However, it is expected that computer mediated groups will experience a decrease in satisfaction as they move from the Idea-generation task, to the Choose task and finally to the Negotiation task.

Performance outcomes will also be affected by communication medium. Groups completing the idea-generating task will exhibit higher performance outcomes when communicating via computers than when communicating face-to-face. This difference is expected to be different when groups are working to complete the Choose task. When

completing the Choose task, face-to-face groups are expected to out perform computer-mediated groups. This difference is expected remain the same when groups are negotiating. Groups completing the Negotiation task will exhibit higher performance outcomes using face-to-face communication than when communicating via computers. These hypotheses are given below.

H1: There will be a significant mean difference (levels test) between groups using computer mediated communication versus groups using face-to-face communication on a linear combination of satisfaction measures (satisfaction with the decision process, satisfaction with the solution, satisfaction with the group, and satisfaction with the communication medium) across tasks (Idea-generation, Choose, and Negotiation).

H2: There will be an interaction (deviation from parallelism) of task-type by communication medium (computer-mediated versus face-to-face) on a linear combination of satisfaction measures (satisfaction with the decision process, satisfaction with the solution, satisfaction with the group, and satisfaction with the communication medium).

H3: Computer mediated groups will exhibit a linear trend across the three tasks (Idea-generation, Choose, and Negotiation) for each of the four satisfaction measures (satisfaction with the decision process, satisfaction with the solution, satisfaction with the group, and satisfaction with the communication medium). As groups progress through the tasks, mean satisfaction ratings will decrease on each of the four satisfaction measures as the need for coordination increases.

H4: Face-to-face groups will exhibit a linear trend across the three tasks (Idea-generation, Choose, and Negotiation) for each of the four satisfaction measures (satisfaction with the decision process, satisfaction with the solution, satisfaction with the group, and satisfaction with the communication medium). As groups progress through the tasks, mean satisfaction ratings will increase on each of the four satisfaction measures as the need for coordination increases.

H5: There will be a significant mean difference (levels test) between groups using computer-mediated communication versus groups using face-to-face communication when performance is averaged across tasks (Idea-generation, Choose, and Negotiation).

H6: There will be an interaction (deviation from parallelism) of task-type (Idea-generation, Choose, and Negotiation) by communication medium (computer-mediated versus face-to-face) on the measures of performance (number of unique ideas, number of essential items chosen, and number of essential items negotiated).

H7: Computer mediated groups will exhibit a linear trend across the three tasks (Idea-generation, Choose, and Negotiation) on the measures of performance (number of unique ideas, number of essential items chosen, and number of essential items negotiated). As groups progress through the tasks, performance will decrease as the need for coordination increases.

H8: Face-to-face groups will exhibit a linear trend across the three tasks (Idea-generation, Choose and Negotiation) on the measures of performance (number of unique ideas, number of essential items chosen and number of essential items negotiated). As groups progress through the tasks, performance will increase as the need for coordination increases.

CHAPTER THREE

METHODOLOGY

Methods

Participants

Participants were recruited from the student population of California State University, San Bernardino (CSUSB). A total of 180 students (121 women and 59 men, mean age = 25.69 years), enrolled in various undergraduate and graduate psychology courses, were solicited to participate in the experiment.

Demographically, participants assigned to computer-mediated communication (CMC) groups were similar to those participants assigned to face-to-face communication (FTFC) groups on all but four variables at $\alpha = .10$ (see Table 1 and 2). Participants in the two communication conditions differed on the demographic variables of age (CMC mean age in years = 26.66, FTFC mean age in years = 24.74), hours spent using a PC during the day (CMC mean hours spent using a PC per day = 3.21, FTFC mean hours spent using a PC per day = 2.29), perceived NetMeeting® competence after the study and class standing (see Table 2 for frequency counts). The difference between participants in either

Table 1

Analyses of Scale Demographic Variables

Communication medium	*n*	*M*	*t*	*df*	*p*
		Age			
Computer	88	26.66	1.81[a]	159.76	.07
Face-to-face	90	24.74			
		Years of PC experience			
Computer	88	6.77	-0.25	175	.80
Face-to-face	89	6.92			
		Hours spent using a PC daily			
Computer	90	3.21	2.23[a]	147.17	.03
Face-to-face	90	2.29			

Note. [a]Equality of error variances not assumed.

communication condition on NetMeeting® competence after the study was expected and demonstrated that the participants in the CMC had learned how to use the software throughout the study. These four differences in demographics were not thought to have posed a problem to the study and were not addressed further.

Table 2

Analyses of Nominal Demographic Variables

	Communication medium				
	Computer *n*	Face-to-face *n*	χ^2	*df*	*p*
		Gender			
Male	34	25	2.04	1	.153
Female	56	65			
		Ethnicity			
Asian	9	12	5.00	4	.287
Black	8	2			
Caucasian	44	44			
Hispanic	24	29			
Other	5	3			
		Class standing			
Freshman	7	1	16.10	4	.003
Sophomore	6	4			
Junior	23	46			
Senior	41	34			
Graduate	12	5			
		PC competence			
Novice	2	1	1.64	3	.651
Still leanrning	15	13			
Average	47	55			
Advanced	26	21			
Expert	0	0			
		NetMeeting® competence before tasks			
Never used	46	41	3.59	5	.610
Novice	4	5			
Still leanrning	12	16			
Average	22	26			
Advanced	5	2			
Expert	1	0			
		NetMeeting® competence after tasks			
Never used	0	40	57.42	5	< .001
Novice	8	6			
Still leanrning	22	16			
Average	43	26			
Advanced	13	2			
Expert	3	0			

The sample size necessary for this investigation was determined using a power analysis for the specific analysis employed, as prescribed by Cohen (1992). Cohen suggests that 50 participants per cell would have been necessary to achieve experimental power of .90, while yielding the ability to detect a medium effect size (ω^2 = .25) (Cohen, 1992). With groups consisting of three participants, two cells containing 50 groups would require 100 groups of three participants (300 participants). However, a slightly lower number of participants were obtained for the sample since the primary statistical analysis was conducted at the group level. Group level means and standard deviations have often been found to be more stable than means and standard deviations at the individual level. Therefore, the number of participants sought was reduced from 50 groups to 30 groups (90 participants per cell); thus reducing the necessary sample size from 300 to 180 participants.

Extra credit was offered to students for their voluntary participation in the experiment. All of the participants were treated in accordance with the "Ethical Principles of Psychologists and Code of Conduct" (American Psychological Association, 1992).

Design

A 2 x 3, mixed (between/within) design was utilized to test the hypotheses. Two independent variables were manipulated, communication medium and task-type. The independent variable of communication medium, with two levels (face-to-face communication versus computer-mediated communication) constituted the between-subjects variable. Task-type was the second independent variable, with three levels (Idea-generation, Choose and Negotiation) and thus served as the within-subjects variable. Utilization of three task-types measured by a within-subjects approach was an important and novel component of this research. Previous investigations have primarily examined between-subject differences using several independent and unrelated tasks. In this design, within-subjects variance was examined over a series of related tasks. The tasks were designed to require an increase in coordination effort as groups moved from one task to the next. Various levels of coordination effort, measured in a within-subjects approach were chosen to reflect the natural progression of group-based projects seen in organizations. In this design, each group completed three separate tasks, an Idea-generating task, a Choose task, and a Negotiation task. Although each group

experienced the three task-types, groups completed the tasks using only one method of communication, either face-to-face communication or computer-mediated communication. A design where groups completed all three tasks together was specifically sought so that we would further understand the relationship of communication medium across task-types on various outcomes.

Apparatus

To facilitate computer-mediated communication, Microsoft NetMeeting® (a widely available conferencing application) was used. Participants in the computer-mediated communication condition collaborated through an IBM® compatible personal computer using Microsoft® NetMeeting® in a Microsoft® Windows® 98 Second Edition environment. Two of the collaborative functions of Microsoft® NetMeeting® (whiteboard and real-time chat) were available to computer-mediated groups.

Measures

To test the hypotheses, both satisfaction and performance outcomes were assessed. Four separate measures were used to assess satisfaction; satisfaction with the process, satisfaction with the solution, satisfaction with the group, and satisfaction with the communication medium

(see Appendix A for complete measures). The satisfaction with the decision process and satisfaction with the solution measures were modified versions of measures presented by Green and Tabert (1980). Slight modification of the measures was necessary to maintain consistent scales across the various measures of satisfaction. The slight modifications were not substantial enough to suspect changes in meaning or interpretation of the items.

The two additional satisfaction measures, satisfaction with the group, and satisfaction with the communication medium were created for the purposes of this research. Items on the satisfaction with the group measure were written to address several group processes suggested by the C3P model of group communication (Whitworth, Gallupe, & McQueen, 2000). Group unity was assessed with three questions.

I felt a sense of unity with my group members.
I felt that I was part of the group.
The group was able to work as a unit.

The perception of agreement was assessed with one question.

There was agreement among the members of the group.

Enjoyment of working with the group was assessed with the following question.

I enjoyed working with the others in the group.

Finally, general satisfaction with the group was also assessed.

I felt satisfied with my group.

Items on the satisfaction with the communication method measure were written to address several processes of communication also suggested by Whitworth, Gallupe, & McQueen's (2000) C3P model of group communication. The participants' ability to transmit messages was assessed with three items.

> The group understood my inputs as they were intended.
> I was not able to clearly express my ideas using this particular communication method.
> The communication method allowed me to understand the ideas of other group members.

In addition, the participants' ability to determine when messages were not understood was also assessed.

> I could determine when the members of my group did not understand my intended messages.
> Group members could tell when I did not understand their messages.

Participants' comfort with the communication medium was assessed with the following item.

> I felt comfortable expressing my ideas using this communication method.

The appropriateness of the communication medium was assessed with the following two items.

The communication method was appropriate for this task.
The communication method did not hinder my group's progress.

Finally, a general satisfaction with the communication medium item was included in the satisfaction with the communication medium scale.

I felt satisfied using this communication medium.

To evaluate the internal consistency of the scales, reliability estimates were evaluated for each of the four satisfaction scales. The four satisfaction scales were all found to have a high magnitude of internal consistency using Chronbach's alpha estimate of reliability. Averaging the reliability estimate of each scale across the three tasks, the group satisfaction measure (mean α = .94), process satisfaction measure (mean α = .93), solution satisfaction measure (mean α = .83), and the satisfaction with the communication medium measure (mean α = .82) were all found to have high internal consistency.

Consistent with previous research, performance was measured differently for each task-type. For the idea-generating task, the number of unique ideas generated was evaluated. Alternatively, the performance of groups completing the Choose task and the Negotiation task was

evaluated by assessing the value of items remaining. The value of the items was determined by assigning a value to each item selected. Using the United States Army's Field Manual (1992), a list of items essential for survival was created (see Table 3). Items that were selected by each group in the Choose task were compared to items on the essential items. Matching items from the Choose task and the essential items list were assigned a score of one. The performance of a group on the Choose task could range between 0 (no essential items packed into the three bags) and 15 (15 essential items packed into the three bags). To rate the performance of groups on the Negotiation task, the number of essential items remaining after eliminating one bag was used. The value of this measure ranged between 0 (no essential items in the two bags remaining) and 10 (10 essential items in the two bags remaining).

It is important to note that unlike performance on the idea generation task, performance on the Choose task had a direct effect on the Negotiation task since the score for the Negotiation task was limited by the score obtained on the Choose task. For example, a group might have generated 75 ideas while working on the idea generation task. During the Choose task, that same group may have chosen to pack 8

Table 3

Essential Survival Items

Hunting	First-aid	Containers
fishing line/sting	sutures	condoms
fish hooks	surgical blade	plastic bag
fish lures	oxytetracycline	needle/thread
fish net	antibiotics	bowl
	lip balm	pot
Tools	needle/thread	pan
wire	purification tablets	jug
knife		canteen
machette	**Fire**	bottle
survival book	lighter	bucket
	matches	pale
Shelter	magnifying glass	
solar blanket	flint	
tarp	candle	

Note: Adapted from the United States Army Field Manual.

items that appeared on the essential items list, earning a score of 8 for the Choose task (3 essential items in bag 1, 3 essential items in bag 2 and 2 essential items in bag 3). In a situation such as this, the performance rating on the Negotiation task that had a theoretical range of 0 through 10 is restricted to a range of 0 through 6, since the two highest valued bags (bag 1 and bag 2) could only attain a

score of 6. Although this situation might be viewed as problematic to some, it is important to recognize the similarity an obstacle such as this has to an actual workgroup. Imagine a group working to complete a single project. Although several different stages may define the project, ultimately, the final measure of performance would depend on the cumulative performance of each stage. Since this type of cumulative performance is also paralleled in real-world workgroups, it was not expected to pose a significant problem to the interpretation of the results; moreover, the similarity of this design to a real world work group was chosen so that it would provide a more comprehensive view of groups than has been seen in previous research. Again, once determined, all three performance measures (number of unique ideas, number of essential items chosen and number of essential items negotiated) were standardized to facilitate comparison across task-types.

To assess the manipulation of the independent variables, a measure of perceived level of coordination effort required was used. Participants were asked to indicate which task they thought required the most coordination effort and which task they thought required the least coordination effort. Participants were expected

to rate the Negotiation task as requiring most coordination effort and the Idea-generation task as requiring the least.

Demographics (age, sex, race, class standing, years of experience with personal computers, expertise of personal computers, hours of personal computer use per day, familiarity with the software, and expertise with the software) were collected to report descriptive statistics for the sample (see Appendix A for complete measures).

Tasks

The tasks that groups completed were similar in their theme of survival. A similar theme across tasks was sought for two reasons. First, a related theme across tasks might provide a closer simulation of actual group tasks. In the workplace, output from a preliminary task often becomes the input for a subsequent task. It is unlikely that a group might generate ideas about a problem, and then go on to choose an appropriate solution for an entirely unrelated problem. The second reason a consistent theme was sought was to elicit a sense of involvement with the task. The theme of survival was the topic of a popular reality-based television program, and thus offered a task theme that participants might find interesting and familiar. In this

investigation, every group completed three separate tasks. The three tasks are described below.

Idea-Generation Task. Idea-generation tasks vary in their restrictions and complexity. To provide the groups with a task that required minimal coordination, groups generated a list of items that would aid in their survival on a desert island. Participants worked together in groups of three to construct such a list. The only restrictions during this task were that participants were not allowed to list electronic devices or communication devices as possible items. Items such as two-way radios, cellular phones or any other electronic or communication device would hinder the necessity of the subsequent tasks by providing the group with a means to increase their chance of rescue. Further, each item alone had to be able to fit in a typical travel bag (defined as a bag with the dimensions: 1.5' x 1.5' x 3'). Finally, the groups were instructed to generate ideas for a period of five minutes. Other than those restrictions, groups were instructed to consider any item; the goal being that the items would somehow aid their survival on an island.

Choose Task. Choose tasks can be broken down into two distinct categories, choose correct or choose best. In a

choose correct situation, the group must choose a demonstrably correct answer. A group working to complete a choose best task must also make some sort of choice; however, because there is no demonstrably correct answer, the group must choose the answer they reason most appropriate. The sole difference between these two tasks is that a choose correct task has a correct answer that may be demonstrated, and a choose best task does not (McGrath, 1984). The choose task employed in this research required participants to use their best judgment to select the most necessary survival items generated in a previous task, and was therefore a choose best task.

In this investigation, participants completing the Choose task worked from the list of survival items they generated in the previous task. They worked together to sort 15 of the survival items they listed in the previous task into three clusters. The purpose of this task was to sort the items so that they could be packed into three separate travel bags. Each bag, they were told, could hold five items. Groups were asked to sort the items so that if one bag were lost, it would not detrimentally affect the survival of the group. Participants worked together to choose the 15 items they thought would best help them

survive and then sort the items so that they were evenly divided into three bags.

Negotiation Task. Negotiation tasks require increased coordination because of the mixed motives in arriving at a decision (McGrath, 1984). These tasks often have multiple solutions that each benefit the group but vary in their benefit to individual members.

In order to facilitate group negotiation, participants were instructed to work with the product of the previous task. The three bags of survival items were distributed randomly among the three participants so that each participant had an inventory of five survival items. Each participant generally had different items in their inventory, yet the overall value of inventories remained similar because of the previous task's (Choose task) instructions to create equally valued bags. Participants were introduced to the Negotiation task by being asked to imagine they were competing for a one million dollar prize. The group would then negotiate to consensus which bag should be discarded if they were only able to take two of the three bags to a deserted island. The prize was to be awarded to each of the two individuals whose bags remained on the island. All three individuals would remain on the

island, and therefore, each individual would benefit from choosing to keep two bags with the most useful items. However, since the person whose bag was left behind could not be awarded the prize, participants would be required to negotiate for their particular bag. The group was reminded to consider the survival utility of the items left behind and the items that were to remain as well as the cash prize if their bag was chosen. Therefore, the group had to decide on a group level goal while also trying to promote their own personal goal.

Procedure

Upon arrival at the laboratory, the participants were informed that the purpose of the research project was to understand how groups work together to complete a task. Introduction to the general procedures of the experiment followed:

> You will be completing three tasks as a group. This project will begin with an introduction to the first task. Then, you will work as a group to complete the task. You should work as accurately and as quickly as you can. After five minutes has passed, I will stop your group and you will complete a short survey. I will then introduce the second task, after which you will begin to complete that task. Again, you should work as accurately and as quickly as you can. When you are finished with the second task, you will complete another short survey. You may notice that the survey you are to complete at the end of each task is the same throughout the tasks. It's okay that you notice

this. The questions are the same questions in the same order asking the same things. However, I would like you to answer the each of the questions only considering the task you have just completed. Please answer the questions in regards to your feelings about that task only. After you complete the survey a second time, I will introduce you to the third and final task. Again, work as accurately and as quickly as you can. When you are finished with the final task, you will complete the last part of the survey. Once you are finished with the last portion of the survey, the experiment is over and you will receive extra credit for your participation.

After the brief procedural review, participants were randomly assigned to a group of three. Once the participants had been assigned to a group, the groups were then assigned to one of the two communication conditions (computer-mediated or face-to-face). Groups were then lead to either the computer-mediated communication or face-to-face communication experimental site.

Computer-Mediated Communication. Participants working in computer-mediated groups were lead to the computer laboratory. During a brief instruction period, the researcher familiarized the participants with the computer and software by demonstrating how to use the whiteboard and chat features of the software. After the computer and software demonstration, participants were read the instructions for the Idea-generation task (see Appendix B for complete instructions) and a handout detailing the

basic instructions of the first task was distributed (see Appendix C for handouts). Once participants were introduced to the task, they were then lead to their individual computer workstations. The computer workstations were located in a single room, situated in cubical like areas such that participants could not communicate with their fellow group members by any means other than through their computer. Participants were not be able to see one another, and were instructed not to speak or make any sounds during the completion of the task. Each workstation was labeled with a color (red, blue, orange, brown, yellow, or blue), which represented the participant while working on the tasks. Once participants were situated at a workstation, they were logged onto a session of Microsoft® NetMeeting®. After logging onto a session of NetMeeting®, a message was sent to all members of the group to insure that the participants could send and receive messages. The message read as follows:

> The chat window will be used to start and stop the group during this experiment. Everyone, please type, "Hello" to show that you are able to read and send messages from your computer.

Once each participant had properly replied to the message, a second message was sent to the group signaling the start of the Idea-generation task:

> You have five minutes to complete the first task. You may begin now.

After five minutes had passed from the start of the task, a message was sent to all participants asking them to stop working and to begin completing the first part of the survey:

> Your five minutes has ended. Please stop working on this task, and complete the first four pages of the survey.

Once the participants completed the survey, consisting of the four measures of satisfaction, the researcher read the instructions and gave participants a handout detailing the basic instructions of the Choose task. After the instructions, participants were reminded that they would be allowed to work on the task as long as they wished and that they must all agree with the final decision of the group. To indicate that all of the group members agreed, participants were asked to type, "Done," signaling agreement to the decision of the group. Once participants were familiar with the task, a message was sent to all

participants asking them to begin working on the Choose task:

> Once you have completed the second task, and everyone agrees, please type, "Done" to indicate that you have finished. You may begin the second task now.

After each of the participants signaled their agreement by typing "Done," they were asked to complete the second section of the survey, again consisting of four measures of satisfaction. After participants had completed the survey, they were then read the instructions for the Negotiation task and given a handout detailing the basic instructions of that task. After the instructions, participants were again reminded that they would be allowed to work on the task as long as they wished and that they must all agree with the final decision of the group. Participants were asked to type "Done," when they had reached a unanimous decision for the Negotiation task. After the instruction, a message was sent to all participants asking them to begin working on the Negotiation task:

> Again, once you have completed the third task, and everyone agrees, please type, "Done" to indicate that you have finished. You may begin the third task now.

When all three members indicated agreement by typing, "Done," they were asked to complete the remainder of the

survey consisting of the four measures of satisfaction, the manipulation check and demographics. Upon completion of the survey, participants were debriefed, given extra-credit and thanked for their participation.

Face-To-Face Communication. Face-to-face groups experienced the same general procedure as the computer-mediated groups, except that they completed their task while in the presence of one another and without the use of a computer. After being assigned to the face-to-face communication condition, participants in face-to-face groups were lead into the computer laboratory. The same cubicles used in the computer-mediated condition were used for face-to-face groups, with all three members of the face-to-face groups occupying the same cubical. Unlike participants completing tasks in the computer-mediated condition, face-to-face group members were not allowed to use the computer during any of the three tasks. Participants were introduced the Idea-generation task and a handout detailing the basic instructions of the first task was distributed. Face-to-face condition groups were also provided with several sheets of blank paper. Once participants were familiarized with the Idea-generation task, they were reminded of the five-minute time limit and

were asked to begin working on the first task. After five minutes had passed from the start of the task, were asked to stop working and to begin completing the first section of the survey, consisting of the four measures of satisfaction. After completing the first section of the survey, participants were then read the instructions for the Choose task and a handout detailing the basic instructions of the second task was distributed. Once familiar with the second task, participants were reminded that there was no time limit and that they must all agree on the final decision before indicating that they had completed the second task. To indicate they were all in agreement and done with the second task, groups were asked to send one member outside of the cubical and inform the researcher that they had completed the second task. Once all group members understood the procedure for the second task, participants were asked to begin working on the task. Once the group indicated that they had reached a unanimous decision, their time was recorded and they were then asked to complete the second part of the survey, again consisting of four measures of satisfaction. After completing the second part of the survey, participants were introduced to the Negotiation task and a handout detailing the basic

instructions of the third task was distributed. Once familiar with the final task, participants were reminded that there was no time limit and that they must all agree on the final decision before indicating that they had completed the third task. To indicate they were all in agreement and done with the second task, groups would again, send one member to inform the researcher that they had completed the task. Once all group members understood the procedure for the final task, participants were asked to begin working on the task. When the group indicated that they had reached a unanimous decision, their time was recorded and they were asked to complete the last part of the survey, consisting of the four measures of satisfaction, the manipulation check and demographics. Upon completion of the survey, participants were debriefed, given extra-credit and thanked for their participation.

CHAPTER FOUR

RESULTS

Results

A two-way mixed (between/within) doubly multivariate analysis of variance (MANOVA), with planned comparisons was performed on four dependent variables: satisfaction with the process, satisfaction with the solution, satisfaction with the group, and satisfaction with the communication medium (four separate satisfaction measures). Communication medium (Computer-Mediated versus Face-To-Face) served as the between-subjects independent variable. Task-type (Idea Generation, Choose, and Negotiation) served as the within-subjects independent variable treated multivariately.

Due to the different nature of the tasks, measures of performance differed for each task. Because of these differences, performance was assessed in a second analysis. A profile analysis, followed by planned comparisons was performed on three standardized performance measures: number of unique ideas, number of essential items chosen, and number of essential items negotiated. The grouping variable was communication medium, either computer-mediated or face-to-face.

Prior to the main analyses of the satisfaction and performance measures, SPSS FREQUENCIES was used to evaluate the assumptions of doubly multivariate analysis of variance in addition to the assumptions of profile analysis as prescribed by Tabachnick, & Fidell (2001). A total of 180 participants completed the tasks, while working in groups of three. Upon examination of each participant's responses, none of the variables contained values outside of the expected range. Data were missing from the demographics of six participants. Two participants (both in the CMC condition) failed to report their age, one participant (CMC condition) failed to report class standing, and three participants (two in the CMC condition) failed to report their years of experience with personal computers. The data collected from these participants was retained in all of the analyses.

Two measures were used to assess the manipulation of coordination effort associated with each task. Participants in both communication conditions viewed the Idea-generation task as requiring the least amount of coordination (CMC mode = Idea-generation task, FTFC mode = Idea-generation task). Based on the manipulation check, 71 participants (78.9%) in the CMC condition and 59 participants (65.6%) in

the FTFC condition chose the Idea-generation task as the task that required the least coordination effort. Participants in both communication conditions also agreed on which task required the most coordination effort (CMC mode = Choose task, FTFC mode = Choose task). For the task that required the most coordination effort, 53 participants (58.9%) using CMC, 55 and participants (61.1%) using FTFC selected the Choose task as the task requiring the most coordination effort.

Despite the implementation of three tasks that were created to produce a perception of increasing coordination, the manipulation check clearly indicates that the participants viewed the tasks differently. Participants were expected to view the Idea-generation task as that which required the least coordination effort, while the Negotiation task was expected to be viewed as the task that required the most coordination. Clearly, the manipulation of perceived required coordination effort failed. Despite participants perceiving the Choose task as requiring the most coordination, the tasks still provide a glimpse of groups working on tasks similar to those that real-world work groups might be expected to complete. The failure of

the manipulation should be recognized while considering the results and findings of this research project.

Evaluation of Statistical Assumptions

Measures of Satisfaction. Satisfaction data was collected at the individual level; therefore, intra-class correlations were calculated to justify group-level analysis of the satisfaction measures (see Table 4). Using an alpha level of .25 to evaluate the significance of the intra-class correlations, as suggested by Kenny and LaVoie (1985), within group variance was smaller than between group variance suggesting a group level effect for all variables except satisfaction with the solution for the Negotiation task.

Upon reflection, the inconsistent participant responses on the measure of satisfaction with the solution should have been expected given the circumstances of the Negotiation task. It was during the third and final task (Negotiation task) where participants were eliminated from further completion for the hypothetical one million dollar prize. The sole participant whose inventory was not selected in the Negotiation task would most likely not be satisfied with the solution, and therefore it should have been expected that this variable would not reflect a group

Table 4

Intra-Class Correlations of Satisfaction Measures Across Task-Types (N = 60)

Satisfaction scale	F^a	Intra-class r	r	η^2	p
		Idea-generation task			
Group	2.72	.37	.63	.57	< .001
Process	2.68	.36	.63	.57	< .001
Solution	2.08	.27	.52	.51	< .001
Communication	3.38	.44	.70	.63	< .001
		Choose task			
Group	1.60	.17	.37	.44	.016
Process	2.62	.35	.62	.56	< .001
Solution	1.42	.12	.30	.41	.054
Communication	1.93	.24	.48	.49	.001
		Negotiation task			
Group	1.48	.14	.33	.42	.035
Process	1.65	.18	.40	.45	.011
Solution	1.07	.02	.07	.35	.369
Communication	1.65	.18	.39	.45	.011

Note. [a]Degrees of freedom for F = (59,120).

level effect. Despite the inconsistent responses of the group members on the Negotiation task's measure of solution satisfaction, the data was aggregated to meet the assumption of independence of error variance. All further

evaluations of assumptions were performed at the group-level.

Sample sizes were equal for both communication conditions (n = 30 for CMC; n = 30 for FTFC). Multivariate normality was assumed as the number of groups per cell (n = 30) was not exceeded by the number of dependent measures (DVs = 12), thus achieving a case to variable ratio of 2.5:1. No univariate or multivariate outliers were detected at α = .001 (z = 3.29). For the analysis of satisfaction, the assumption of homogeneity of variance-covariance matrices was assumed since the sample sizes for each condition were identical (n = 30 for CMC; n = 30 for FTFC). Further, the largest to smallest variance ratio for either communication condition was less than 10:1 (CMC = 2.803:1, FTFC = 3.532:1), indicating homogeneity of variance. The determinate of the variance-covariance matrix for the omnibus analysis of satisfaction assured the absence of statistical multicolliniearity and singularity (log-determinant = -1.837). SPSS MANOVA completed the main analysis, providing further support for the absence of multicolliniearity and singularity.

Measures of Performance. For the analysis of performance, multivariate normality was assumed since the

number of groups per cell (n = 30) was not exceeded by the number of dependent measures for the analysis (DVs = 3), thus achieving a case to variable ratio of 10:1. No univariate or multivariate outliers were detected at α = .001 (z = 3.29). The homogeneity of variance-covariance matrices and homogeneity of variance for the analysis of performance was ensured by the standardization of the performance variables. Standardization of the performance measures also addressed the correlation between the measures of performance, (p = .27); moreover, the absence of statistical multicolliniearity and singularity was confirmed since SPSS MANOVA completed the analysis.

Analyses of Satisfaction

Analysis of the satisfaction measures was conducted using SPSS MANOVA. Hypotheses 1 through 4 were evaluated using a doubly multivariate design as previously described. An alpha level of .05 was used for all statistical tests unless otherwise noted.

Using Wilks' criterion, significant differences were found between computer-mediated groups and groups using face-to-face communication on a linear combination of the four satisfaction measures when averaged across the three task-types (see Table 5 for estimated marginal means,

Table 5

Estimated Marginal Means, Standard Errors and Observed *F* Values for Satisfaction Measures by Communication Medium

	Communication medium			
Satisfaction	Computer	Face-to-face	Univarate *F*	Stepdown *F*
Group				
M	7.40	8.64	76.668**	76.668**
SE	.10	.10	(1,58)	(1,58)
Process				
	6.72	8.24	80.429**	5.855*
	.12	.12	(1,58)	(1,57)
Solution				
	7.34	8.52	45.743**	.190
	.10	.10	(1,58)	(1,56)
Communication Medium				
	6.50	6.51	82.363**	6.733*
	.12	.12	(1,58)	(1,55)

Note. Degrees of freedom for *F* values are indicated in parentheses.
* $p < .05$, ** $p < .01$.

standard errors and observed *F* values), $\lambda = .347$, $F(4,55) = 25.899$, $p > .001$, $\eta^2 = .653$. This difference supported the first hypothesis,

> H1: There will be a significant mean difference (levels test) between groups using computer mediated communication versus groups using face-to-face communication on a linear combination of satisfaction measures (satisfaction with the group, satisfaction

with the decision process, satisfaction with the solution, and satisfaction with the communication medium) across tasks (Idea-generation, Choose, and Negotiation).

Additionally, univariate and stepdown *F*-tests comparing CMC and FTFC groups on the four measures of satisfaction were examined for significance. As indicated in Table 5, univariate analyses revealed that CMC and FTFC groups differed on each of the four measures of satisfaction across the three tasks. For the stepdown analyses, the measures of satisfaction were entered in the order in which they were presented to participants, group satisfaction, process satisfaction, solution satisfaction and finally communication medium satisfaction. Results of the stepdown analyses indicated that the addition of the solution satisfaction measure did not significantly contribute to the variance accounted for by the group satisfaction and process satisfaction measures.

The profiles of the four satisfaction measures, shown in Figures 2, 3, 4, and 5, deviated significantly from parallelism, thus indicating an interaction of task-type by communication medium on a linear combination of satisfaction measures (see Table 6 for means and standard deviations and Table 7 for pooled within-cell

correlations), $\lambda = .563$, $F(8,51) = 4.945$, $p > .001$, partial $\eta^2 = .437$. This significant interaction of task-type by communication medium on a linear combination of satisfaction measures supported the prediction of second hypothesis,

> H2: There will be an interaction (deviation from parallelism) of task-type by Communication medium (computer-mediated versus face-to-face) on a linear combination of satisfaction measures (satisfaction with the decision process, satisfaction with the solution, satisfaction with the group, and satisfaction with the communication medium).

To further clarify the effect of task-type and Communication Medium on the four measures of satisfaction, planned comparisons (trend analyses) were conducted on each of the satisfaction measures separately for computer-mediated and face-to-face groups. SPSS GLM was used to perform the trend analyses.

Hypothesis 3 predicted linear trends on all four measures of satisfaction for computer-mediated groups,

> H3: Computer-mediated groups will exhibit a linear trend across the three tasks (Idea-generation, Choose, and Negotiation) for each of the four satisfaction measures (satisfaction with the decision process, satisfaction with the solution, satisfaction with the group, and satisfaction with the communication medium). As groups progress through the tasks, mean satisfaction ratings will decrease on each of the four satisfaction measures as the need for coordination increases.

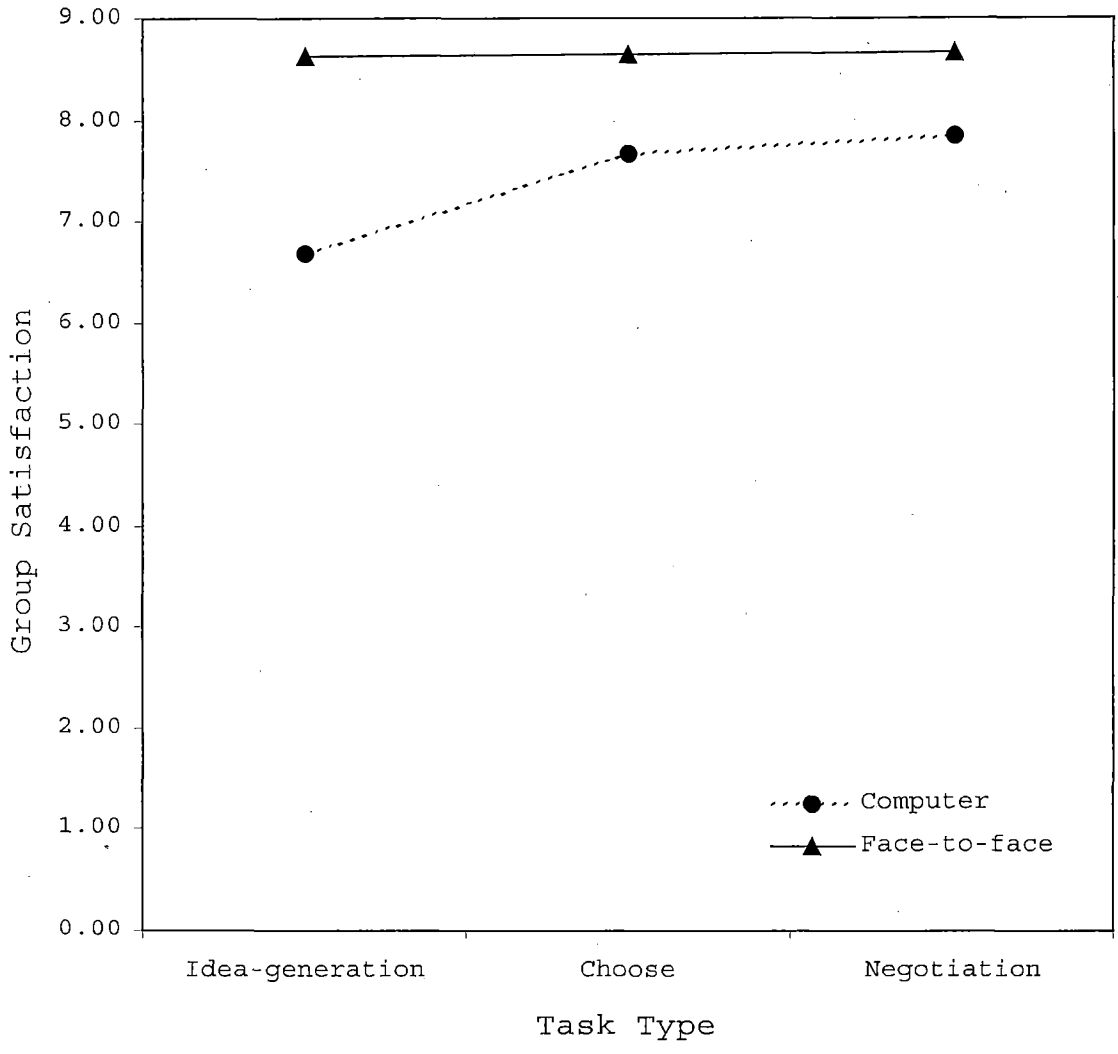

Figure 2. Profile of group satisfaction for computer-mediated and face-to-face groups.

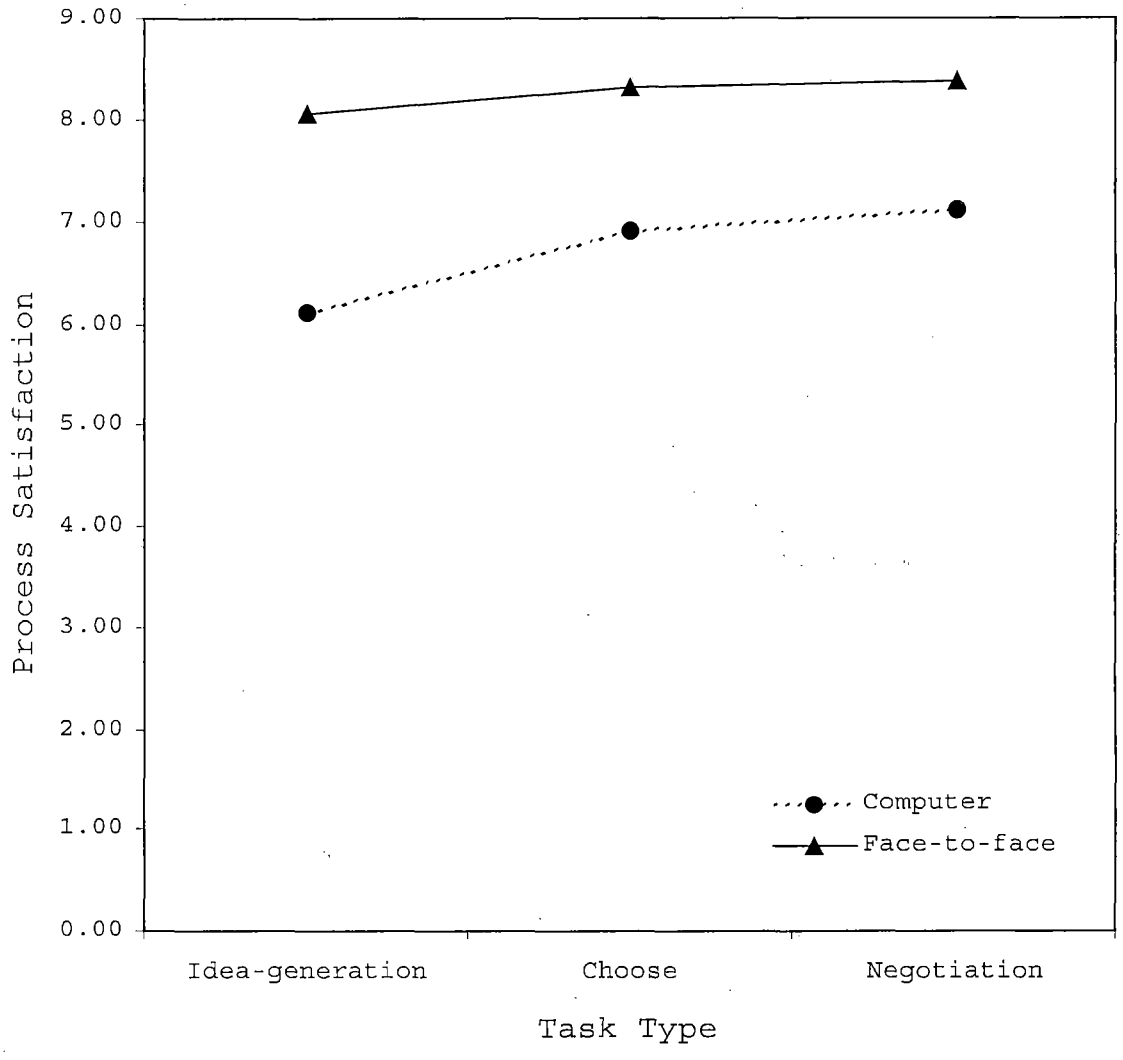

Figure 3. Profile of process satisfaction for computer-mediated and face-to-face groups.

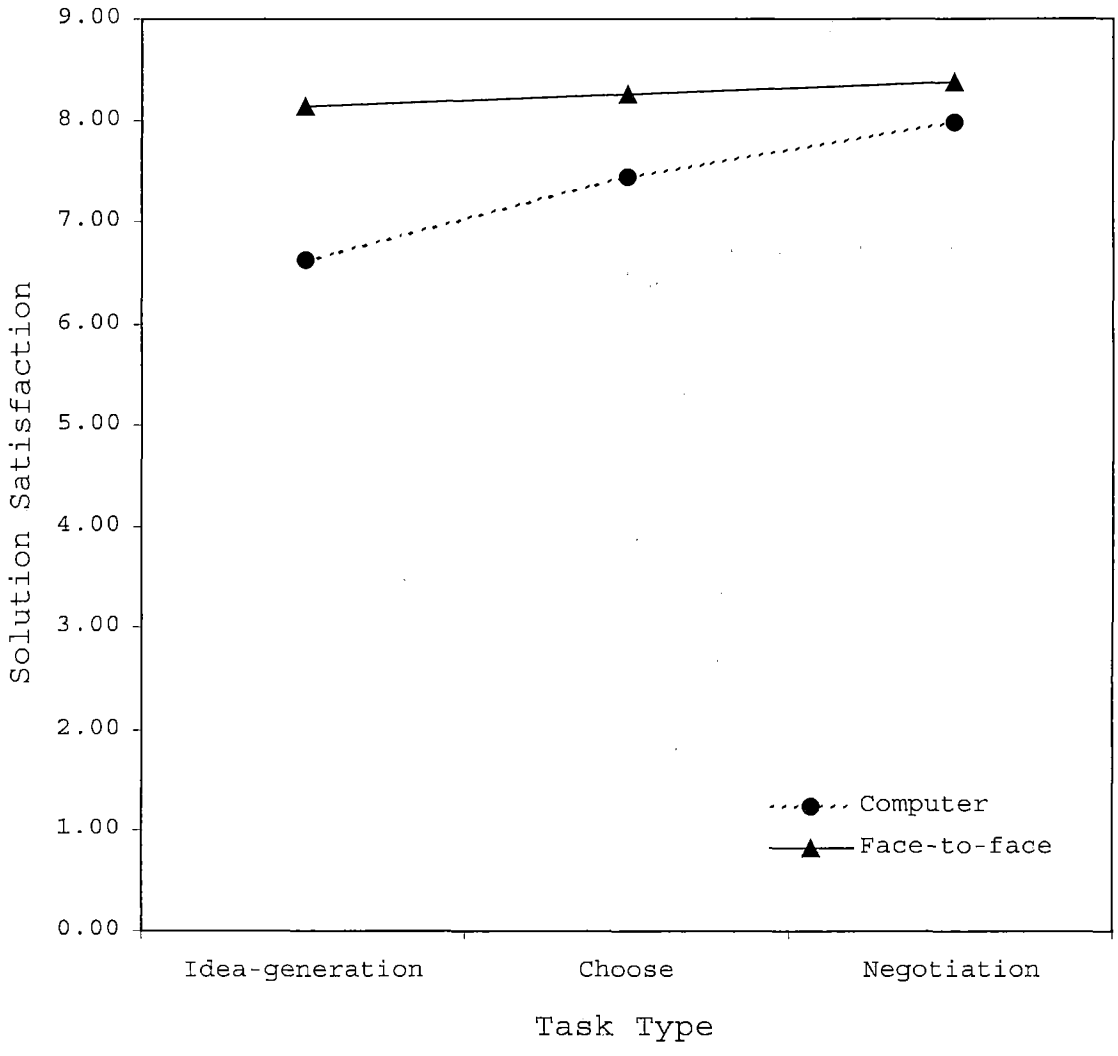

Figure 4. Profile of solution satisfaction for computer-mediated and face-to-face groups.

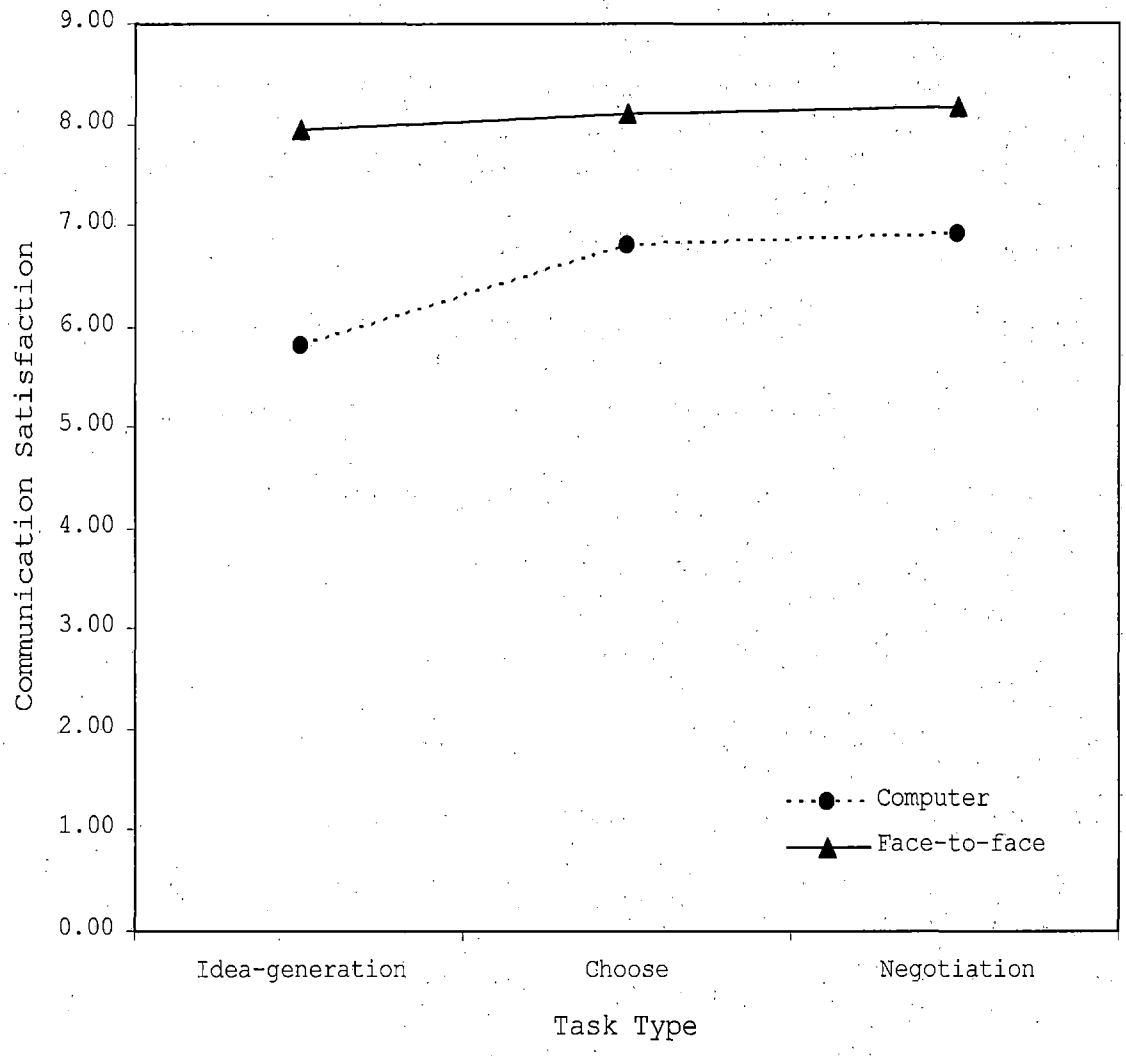

Figure 5. Profile of satisfaction with the communication medium for computer-mediated and face-to-face groups.

Table 6

Means and Standard Deviations of Four Measures of Satisfaction by Communication Medium Across Tasks

Communication medium		Task type		
		Idea-generation	Choose	Negotiation
		Group satisfaction		
Computer				
	M	6.69	7.67	7.84
	SD	1.99	1.60	1.40
Face-to-face				
	M	8.61	8.65	8.66
	SD	0.61	0.58	0.74
		Process satisfaction		
Computer				
	M	6.12	6.92	7.11
	SD	1.66	1.63	1.55
Face-to-face				
	M	8.05	8.31	8.37
	SD	1.10	0.94	1.08
		Solution satisfaction		
Computer				
	M	6.62	7.44	7.98
	SD	1.58	1.53	1.33
Face-to-face				
	M	8.14	8.24	8.38
	SD	0.83	0.70	0.98
		Communication medium satisfaction		
Computer				
	M	5.81	6.80	6.91
	SD	1.72	1.63	1.67
Face-to-face				
	M	7.95	8.10	8.18
	SD	0.84	0.80	0.83

Table 7

Pooled Within-Cell Correlations for the Measures of Satisfaction

Satisfaction Measure	Group	Process	Solution	Communication
Group	(.950)			
Process	.737	(1.141)		
Solution	.621	.601	(.899)	
Communication	.500	.594	.502	(1.159)

Note. Standard deviations are indicated in parantheses.

Computer-mediated groups demonstrated significant linear trends for all four measures of satisfaction (group satisfaction, $F(1,29) = 19.35$, $p < .001$, partial $\eta^2 = .400$; process satisfaction, $F(1,29) = 20.31$, $p < .001$, partial $\eta^2 = .412$; solution satisfaction, $F(1,29) = 51.39$, $p < .001$, partial $\eta^2 = .639$; communication satisfaction, $F(1,29) = 36.70$, $p < .001$, partial $\eta^2 = .559$). As CMC groups progressed from task 1 to task 2 and finally to task 3, group satisfaction, process satisfaction, solution satisfaction and communication satisfaction increased. Communication satisfaction was the only measure that

demonstrated a quadratic trend, (group satisfaction, $F(1,29) = 5.30$, $p = .029$; process satisfaction, $F(1,29) = 3.24$, $p = .082$; solution satisfaction, $F(1,29) = .63$, $p = .433$; communication satisfaction, $F(1,29) = 12.09$, $p = .002$, partial $\eta^2 = .294$). Although linear and quadratic trends were present in the profile of communication satisfaction, describing the profiles as linear is most appropriate. As can be seen in Figures 2, 3, 4, and 5, the profiles of the satisfaction measures for CMC groups follow a linear pattern. However, the measures do indicate a drop in satisfaction for CMC groups as groups moved from the Choose task to the Negotiation task. This slight drop is indicated in the significance of the quadratic trend.

Linear trends were predicted in hypothesis 3; yet, the observed direction of the trends ran counter to the direction predicted. The observed trends indicate that all four types of satisfaction increased as groups progressed from task 1 to task 3 (see Table 6 for means and standard deviations).

> H4: Face-to-face groups will exhibit a linear trend across the three tasks (Idea-generation, Choose, and Negotiation) for each of the four satisfaction measures (satisfaction with the decision process, satisfaction with the solution, satisfaction with the group, and satisfaction with the communication medium). As groups progress through the tasks, mean

satisfaction ratings will increase on each of the four satisfaction measures as the need for coordination increases.

The satisfaction trends demonstrated by face-to-face groups were not significantly linear for any of the measures of satisfaction (group satisfaction, $F(1,29) = .36$, $p = .555$; process satisfaction, $F(1,29) = 6.22$, $p = .019$; solution satisfaction, $F(1,29) = 4.97$, $p = .034$; communication satisfaction, $F(1,29) = 5.00$, p .033). None of the four measures of satisfaction for FTFC groups followed a quadratic trend, (group satisfaction, $F(1,29) = .052$, $p = .822$; process satisfaction, $F(1,29) = 1.32$, $p = .261$; solution satisfaction, $F(1,29) = .040$, $p = .843$; communication satisfaction, $F(1,29) = 2.68$, $p = .608$).

Analyses of Performance

A second analysis, using SPSS MANOVA, was necessary to evaluate the hypotheses regarding the performance of groups (hypotheses 5 through 8).

No significant mean differences were found between computer-mediated and face-to-face groups when performance measures were compared across the three task-types, $\lambda = 1.00$, $F(2,57)$ .001, $p = 1.00$. Therefore, hypothesis 5 was not supported,

H5: There will be a significant mean difference (levels test) between groups using computer-mediated communication versus groups using face-to-face communication when performance is averaged across tasks (Idea-generation, Choose, and Negotiation).

The profiles of the performance measures were examined for parallelism to assess hypothesis 6,

H6: There will be an interaction (deviation from parallelism) of task-type (Idea-generation, Choose, and Negotiation) by Communication type (computer-mediated versus face-to-face) on the measures of performance (number of unique ideas, number of essential items chosen, and number of essential items negotiated).

The profiles of the performance measures, shown in Figure 6, did not significantly deviate from parallelism, $\lambda = .975$, $F(2,57) = .744$, $p = .48$ (see Table 8 for standardized mean values).

SPSS GLM was used to assess hypotheses 7 and 8. Planned comparisons (trend analyses) were conducted on the measures of performance for both computer-mediated and face-to-face groups. Hypothesis 7 predicted a linear trend of performance for computer-mediated groups,

H7: Computer mediated groups will exhibit a linear trend across the three tasks (Idea-generation, Choose, and Negotiation) on the measures of performance (number of unique ideas, number of essential items chosen, and number of essential items negotiated). As groups progress through the tasks, performance will decrease as the need for coordination increases.

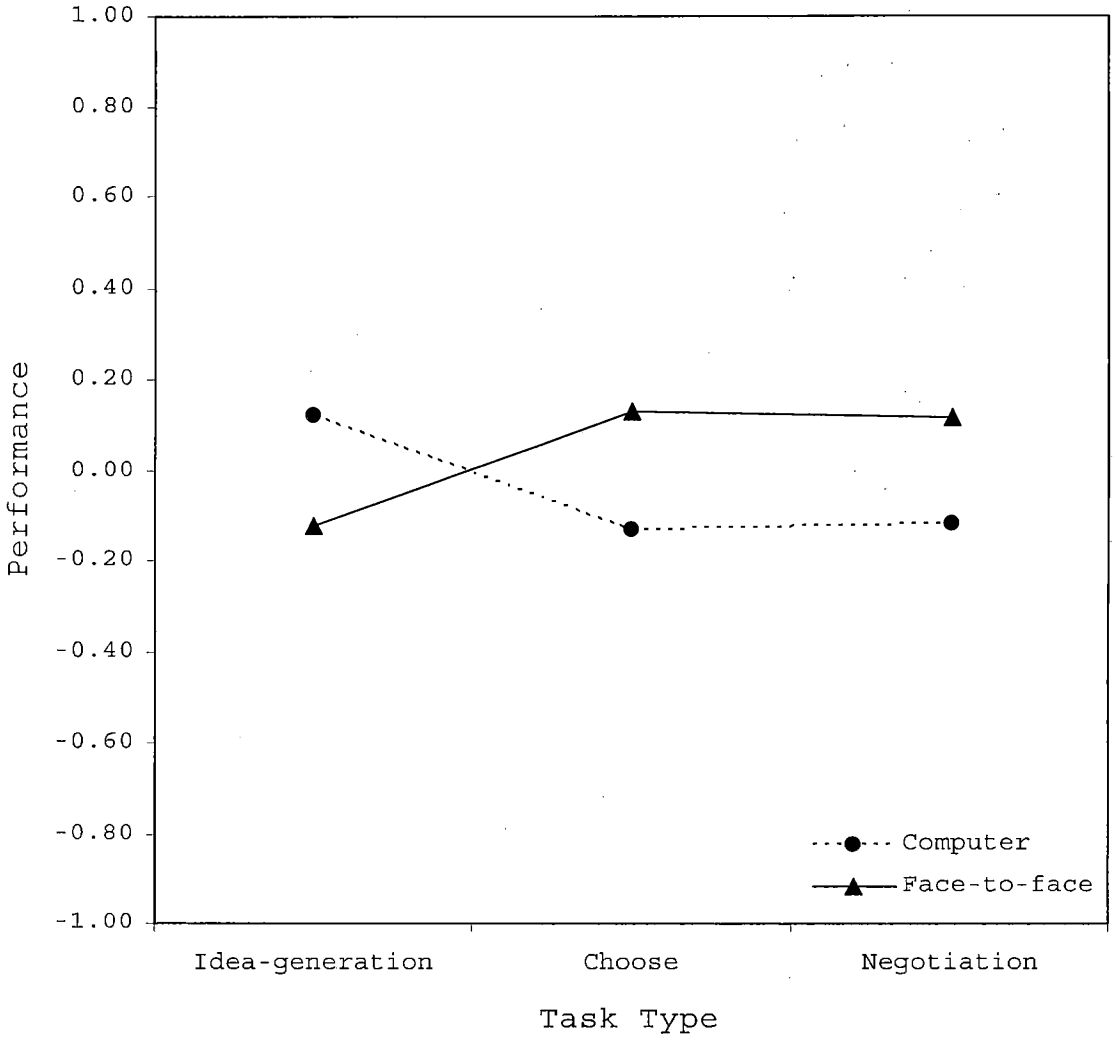

Figure 6. Profile of performance for computer-mediated and face-to-face groups.

Table 8

Mean and Standardized Mean Values for Three Measures of Performance by Communication Medium Across Tasks

Communication medium		Performance type: Number of unique ideas	Number of essential items chosen	Number of essential items negotiated
Computer				
	Mean	41.27	4.67	3.33
	Standardized Mean	1.21E-01	-1.30E-01	-1.19E-01
Face-to-face				
	Mean	37.80	5.20	3.70
	Standardized Mean	-1.21E-01	1.30E-01	1.19E-01

Computer-mediated groups did not demonstrate a linear trend of performance, $F(1,29) < .001$, $p = 1.00$, nor a quadratic trend of performance, $F(1,29) < .001$, $p = 1.00$.

Linear and quadratic trend analyses were also performed on the measures of performance for face-to-face groups to assess Hypothesis 8,

> H8: Face-to-face groups will exhibit a linear trend across the three tasks (Idea-generation, Choose and Negotiation) on the measures of performance (number of unique ideas, number of essential items chosen and number of essential items negotiated). As groups progress through the tasks, performance will increase as the need for coordination increases.

The performance trends demonstrated by face-to-face groups were not significantly linear, $F(1,29) < .001$, $p = 1.00$, nor quadratic, $F(1,29) < .001$, $p = 1.00$.

Post hoc analyses were run on the measures of performance to further describe the data. SPSS T-TEST was used to conduct independent sample t-tests between CMC and FTFC groups on the individual performance measures. Three separate analyses were used to compare the two conditions (CMC versus FTFC) on the standardized performance measures, number of unique ideas, number of essential items chosen and the number of essential items negotiated. Experimentwise $\alpha = .05$ was achieved by setting α for all three separate t-tests at .016.

Three t-tests revealed no significant differences between CMC and FTFC groups on the number of unique ideas generated, $t(58) = .938$, $p = .352$, number of essential items chosen, $t(53.421) = -1.00$, $p = .320$, or the number of essential items negotiated, $t(54.657) = -.917$, $p = .363$.

Although no predictions were made regarding the time groups would take to complete the three tasks, post hoc analyses were conducted on measures of time to assist in the interpretation of the results. Time data was not available for the Idea-generation task since all groups

were given 5 minutes to complete the task. Two t-tests were conducted on the amount of time taken to complete the Choose task, and the time taken to complete the Negotiation task. An alpha level of .05 was used for these two analyses. Significant mean differences were found between CMC and FTFC groups on the amount of time taken to complete the Choose task, $t(40.803) = 4.922$, $p < .001$, $\eta^2 = .295$. CMC groups (mean = 16.69 minutes) took longer to complete the Choose task than FTFC groups (mean = 7.10 minutes). CMC groups also differed significantly from FTFC groups on the mean number of minutes taken to complete the Negotiation task, $t(36.862) = 5.721$, $p < .001$, $\eta^2 = .361$. CMC groups took longer (mean = 7.53 minutes) than FTFC groups (mean = 2.81 minutes) to complete the Negotiation task.

CHAPTER FIVE

DISCUSSION, LIMITATIONS AND IMPLICATIONS

Discussion

The purpose of this study was to examine the effects of task-type and communication medium on multiple group outcomes. Organizations have sought the effective use of computer-mediated communication with failing results. Understanding the intricacies of CMC with respect to outcomes, specifically satisfaction and performance outcomes is vital to our understanding of CMC and the implementation of CMC in organizational settings.

To further our understanding of CMC, performance and four measures of satisfaction (decision process satisfaction, solution satisfaction, group satisfaction, and communication medium satisfaction) were assessed as groups completed a series of related tasks while communicating through a computer or in a face-to-face setting. The series of tasks were designed so that coordination effort would increase as groups completed each of the tasks. An Idea-generation task (list items), a Choose task (separate the items into equal groups) and a Negotiation task (select the best two groups of items) were

employed as the tasks and were hoped to be perceived by participants as having increasing coordination requirements. However, upon analysis of the manipulation checks, the groups did not perceive the tasks as expected. Groups ranked the tasks in the order of complexity from least to most as Idea-generation (task 1), Negotiation (task 3), and Choose (task 2). Despite this disruption in the manipulation, the tasks were still somewhat effective in that they did require groups to list, choose and negotiate a solution, although the coordination effort associated with them was not perceived as expected.

Only limited support was found for the hypotheses addressing satisfaction (H1, H2, H3, and H4). FTFC groups were more satisfied on all four measures of satisfaction (decision process satisfaction, solution satisfaction, group satisfaction, and communication medium satisfaction) than their CMC counterparts, thus supporting the first hypothesis. Further analysis also demonstrated an interaction of task-type by communication medium on the four satisfaction measures, supporting hypothesis 2. As seen in figures 2, 3, 4, and 5, the profiles of satisfaction measures differ for each communication condition as the groups progressed through the tasks.

The four satisfaction measures completed by CMC groups also demonstrated linear trends, partially supporting hypothesis 3. However, contrary to hypothesis 3, all four satisfaction types increased rather than decreased as CMC groups completed the three tasks. It was expected that FTFC groups would be better equipped to deal with the communication demands of the Choose task and Negotiation task than CMC groups, consistent with the findings of previous investigations of task-media fit (Benbasat, & Lim, 1993; Carey, & Kacmar, 2000; Farmer, & Hyatt, 1994; Hollingshead, McGrath, & O'Connor, 1993; Wood, 1986). Therefore, while satisfaction of FTFC groups was expected to be low during the first task of the project, the ability of FTFC to transmit the necessary information would yield gradually increasing satisfaction levels as FTFC groups completed the second and third tasks. Likewise, the inability of CMC groups to transmit the necessary information during the Choose and Negotiation tasks as compared to the Idea-generation task should have yielded a gradual decrease in satisfaction as CMC groups completed the tasks. Although CMC groups reported less overall satisfaction than FTFC groups, the satisfaction of CMC groups increased as they moved through each subsequent task

(see Table 6 for means and standard deviations). Moreover, FTFC groups reported generally consistent levels of satisfaction across task-types (see table 6 for means and standard deviations). The unchanging satisfaction of FTFC groups ran counter to the direction predicted by hypothesis 3, demonstrating no linear trend.

No support was found for the hypotheses addressing the performance of the groups (hypotheses 5, 6, 7, and 8). CMC and FTFC groups did not differ on the measures of performance. No interaction and no linear or quadratic trends of performance measures were found for either CMC or FTFC groups. Although no differences were found in the measures of performance for which the hypotheses addressed, post hoc analyses revealed differences in the time it took groups to complete both the Choose and the Negotiation tasks. CMC groups took approximately twice as long to reach a consensus on both the Choose and the Negotiation tasks than did FTFC groups.

Interestingly, the four separate satisfaction measures were generally parallel for each group. The relatively identical satisfaction trends within the two groups might seem as though multiple measures provide little utility; however, this is not true. Multiple measures are important

to this research in that had the satisfaction measures differed within a group, it would have indicated that something other than task-type or communication medium was affecting the outcomes. According to the C3P model of CMC, various channels of communication must be present in a particular communication medium if that medium is expected to provide a means of effective group communication (Whitworth, Gallupe, & McQueen, 2000). The various measures of satisfaction were employed in this research to assess the participants' perception of the various channels suggested by the C3P model. Had participants felt one or more of those channels was lacking, the satisfaction measures used would not have remained parallel across the tasks. The relative similarity of satisfaction types reported by groups within the two communication conditions merely demonstrates that the groups perceived the communication method as capable of transmitting the necessary information.

While only partial support was found for the hypotheses regarding satisfaction and no support was found for those addressing performance, the results suggest a promising future for CMC. Based on previous investigations of CMC, the hypotheses predicted that CMC was best suited

for idea-generation tasks, while FTFC was appropriate for the more complicated and information dependent Choose and Negotiation tasks (Benbasat, & Lim, 1993; Carey, & Kacmar, 2000; Farmer, & Hyatt, 1994; Hollingshead, McGrath, & O'Connor, 1993; Wood, 1986). Following such predictions, one would expect CMC groups to outperform FTFC groups while completing an idea-generation task and report higher levels of various satisfaction types during such a task. Likewise, this relationship should be reversed during the Choose and Negotiation tasks, with FTFC groups outperforming and reporting higher satisfaction levels than CMC groups. However, this was not the case. No differences were observed in terms of performance and FTFC groups reported being more satisfied on all four measures of satisfaction across all three tasks. This is promising for CMC in that previous studies have discounted the use of CMC as it has always shown a decline in satisfaction and performance beyond idea-generation tasks (Hollingshead, McGrath, & O'Connor, 1993; McGrath, & Hollingshead, 1993). In this investigation though, the reported satisfaction of CMC groups increased rather than decreased. This phenomenon becomes even more intriguing when recognizing that the satisfaction of CMC groups increased even though CMC groups

were learning to use the communication medium. Groups in both communication conditions reported similar competence with the NetMeeting® software prior to the study (both communication conditions reported a mode value which indicated they had never used the software prior to the study). However, the two groups did differ in their competence with the NetMeeting® software after the study (FTF groups reported a mode value which indicated they had never used the software while CMC groups reported a mode value equivalent to being advanced users). This difference clearly indicates that CMC groups had learned to use the software during the experiment.

The effect of familiarity is an important point to note, as Hollingshead, McGrath, & O'Connor demonstrated (1993). Consistent with their investigations, the satisfaction of computer-mediated groups in this experiment increased as familiarity with the communication medium also increased. In their research, experience with the medium played more of a role than did the type of task. Just as they had found, familiarity was key to predicting satisfaction in this experiment. Groups who were unfamiliar with the software and the medium were less satisfied during the first task. Once they had learned the basic functions

of the software, they reported an increase in satisfaction, contrary to the predictions of Task-Media Fit.

As contradictory as these results appear to those predicted by the Task-Media Fit model, there is utility in the foundation of the theory. Where Task-Media Fit is lacking, the C3P model contributes by highlighting the importance of the group members' cognitions. The perception that members can communicate factual information and group identity while fostering interpersonal relationships is important in the satisfaction that group members will experience with a particular method. Interestingly enough, focusing on the perception or cognitions of group members allows for a dynamic description of communication medium. For example, CMC might be perceived by one group as not being able to transmit anything beyond factual information, while another group perceives CMC capable of transmitting all necessary messages. Where the first group may succumb to the predictions of Task-Media Fit and be unable to transmit the information necessary, the second group would likely experience no inability to exchange information and be able to complete a complex task requiring high coordination.

In this research, groups demonstrated lower satisfaction levels in the first task (Idea-generation) than those seen in the third task (Negotiation). The majority of participants also reported that they had never used or where still learning how to use the conferencing software, CMC groups reported spending, on average, 3.2 hours a day using a PC and rated themselves mostly as being of average competence with a PC. Apparently, CMC groups were capable of communicating effectively using a PC. The parallel increase in all four measures of satisfaction demonstrates this; CMC groups were satisfied with their group, process, solution and the communication medium. Such a pattern suggests that the groups perceived the communication medium as capable of supporting their information needs on all levels deemed necessary by the C3P model of CMC. The ability of CMC groups to effectively communicate using such a medium would explain the results obtained in this study. Both FTFC and CMC groups found their communication medium to be effective. While satisfaction of FTFC groups remained constant, CMC groups began with lower satisfaction levels, and increased to nearly equivalent satisfaction levels, an opposite direction than that predicted.

It is likely that the low satisfaction levels reported by CMC groups in the earliest task were not the result of a poor communication medium as Task-Media Fit may suggest, but to the fact that CMC groups, unlike FTFC groups, had to learn how and when to implement the features of the software in order to complete the task. Informal observations revealed that most of the communication during the first few seconds of the Idea-generation task was focused on what features of the software would be best suited for the task, rather than on the task itself. For example, many groups began the Idea-generation task with comments such as, "Let's use the chat window and just type items there," or, "Everyone type on the whiteboard so we can see all of [the items] at once." Familiarity with the software became evident during the Choose and Negotiation task. Many groups actually felt comfortable enough with the software to draw squares and sometimes even draw bags to organize the items. While contrary to the predictions of hypotheses 3 and 4, implementation of CMC seems feasible even in situations where the demand for communication is high, provided groups are familiar and comfortable using the software.

Limitations

Participants

The sample plays a critical role in the ability to generalize the results. Clearly, groups composed of university students are not the type of groups implications are aimed to address. Conducting this research using employees from actual work-groups would have been optimal, but highly impractical. Therefore, based on the ease of sampling and the likelihood that these participants would enter an organizational setting at some point, university students were sampled.

Unfortunately, the assignment of participants did not create balanced groups in terms of their daily PC usage. Participant's in the CMC condition reported using a computer nearly an hour longer than participants in the FTFC condition. It is important to remember the relative ease of which these participants may have learned the software. Had the distribution of participants been swapped, the increase in satisfaction may not have been as drastic, further affecting the interaction witnessed between the two communication conditions.

Setting

While the sterile environment provided by a laboratory setting may reduce the number of confounding variables, the loss of realism is an unavoidable concern. In this study, groups completed the tasks in an artificial laboratory setting. Undoubtedly, employees in an organizational work-group would experience different environmental factors than groups in this study. Although the additional environmental factors experienced in an organizational setting may have influenced the outcomes, the factors under investigation in this study were communication medium and task-type. To study these variables with clarity, it was necessary to conduct this experiment within the controlled conditions of a laboratory. It would be a natural and beneficial step to conduct further analyses in the field.

In addition to the artificial conditions of the laboratory, it was also necessary to artificially assign colors to the workstations used by CMC groups. As participants in these groups sent messages, the chat log identified each sender by spelling out the color of the workstation from which the message originated. When a person typed a message, it was preceded by the color identifying that workstation. Participants working in this

condition did not use their names to identify each other, as this would have required typing their name in every time a message was sent. This color system of identification was different from FTFC groups who were able to identify each other using their names. This limitation may have introduced a bias of which the effects are not able to be determined. Whether using colors aided or hindered CMC groups is unknown, and therefore, presents a limitation to the study.

Tasks

Like the artificial laboratory setting, the tasks themselves were artificial and required participants to imagine scenarios they were unlikely to experience (stranded on a desert island and competing for a large cash prize on such an island). Although the tasks were created to parallel the coordination requirements of tasks as described by McGrath's Task Circumplex (1984), the coordination effort required by each task was not perceived as planned. Again, participants were expected to view the Idea-generation task as that which required the least coordination effort, while the Negotiation task was expected to be viewed as the task that required the most coordination. The failure of the manipulation should be

recognized while considering the inability to find linear trends in many of the satisfaction and performance variables.

Rather than focusing on organizational issues, the tasks were also designed to elicit interest and involvement throughout the experiment. This was achieved as participants could be heard enthusiastically debating the appropriateness of certain items even after being debriefed. Further, the manipulation, although not eliciting the desired perceptions of performance, did provide groups with tasks that built upon one another, much like those completed by real-world work-groups.

Implications

CMC is a viable communication medium of work-groups. The results of this investigation demonstrate that groups using CMC can attain high levels of various types of satisfaction (group, process, solution and communication medium) even during communication intensive tasks. Although this is contrary to the predictions of the Task-Media Fit model, the C3P model of CMC adds to the theory by highlighting the importance of group member cognitions. Integration of the two perspectives is necessary if proper

implementation of CMC is desired. The key is to take advantage of capabilities of a particular group. Certainly, using CMC to completely replace FTFC would have negative results for a group who is not familiar with, or not comfortable using such a medium. However, as computers become a larger part of everyday life, computer-mediated communication may become a more viable and effective communication medium of work groups. As seen in this investigation, university students demonstrated an ability to communicate effectively while working on a group project in a lab setting. Organizations should be ready to take advantage of this ever-advancing resource. Employees who are competent and familiar with communicating through computers could be a vital component to organizational work groups. It may be these employees that are the key to unlocking those positive experiences that have eluded researchers and organizations thus far.

APPENDIX A

MEASURES

Informed Consent

The study in which you are about to participate is designed to investigate the effects of communication medium on groups completing a series of tasks. This study is being conducted by Anton J. Villado, under the supervision of Dr. Janelle Gilbert, Associate Professor of Psychology, in partial fulfillment of degree requirements. This study has been approved by the Psychology Department Human Participants Review Board, California State University, San Bernardino. The University requires that you give your consent before participating in a research study.

This study will take place in a laboratory setting. You will work with others to complete a series of tasks. These tasks may be completed via computer. It will take approximately 1 hour to complete the study. During the study, you will work on three separate tasks. After each task, you will be asked to answer several questions regarding your feelings while working on the task. You will also be asked to complete a few demographic questions at the completion of the study. Please be assured that any information you provide will remain completely anonymous. At no time will your responses be identifiable. All data will be reported in group form only. At the study's conclusion during the summer of 2001, you may receive a report of the results.

The foreseeable risks to you while participating in this study are minimal, and you may terminate your participation without penalty at any time. At conclusion of the experiment, you will receive a slip worth 4-units of participation credit. At the instructor's discretion, you may receive extra credit toward a course grade for your participation in this experiment. Please understand that your participation in this research is voluntary and you are free to withdraw at any time during this study without penalty. You may also remove any identifying data at any time during this study. If you have any questions about the study, or if you would like a report of the results, please contact Anton J. Villado or Dr. Janelle Gilbert at (909) 880-XXXX.

By placing a mark in the space provided below, I acknowledge that I have been informed of, and understand, the nature and purpose of this study and that I freely consent to participate. By this mark, I further acknowledge that I am at least 18 years of age.

Give your consent to participate by making a check or 'X' mark here: ____

Today's date is: _____

The questions in this section ask about your feelings concerning the group as a whole. Read the following statements and then circle the number that best indicates your level of agreement or disagreement using the scale below. Please, only consider how you felt about ***the group as a whole during this task only*** when responding to the following statements.

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Somewhat Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6	7	8	9

I felt that I was part of the group.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I enjoyed working with the others in the group.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I felt a sense of unity with my group members.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

There was agreement among the members of the group.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The group was able to work as a unit.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I felt satisfied with my group.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The questions in this section ask about your feelings concerning the process by which your group approached the task. Read the following statements and then circle the number that best indicates your level of agreement or disagreement using the scale below. Please, only consider how you felt about ***the approach your group used for this task only*** when responding to the following statements.

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Somewhat Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6	7	8	9

I would describe my group's problem solving process as efficient.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I would describe my group's problem solving process as uncoordinated.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I would describe my group's problem solving process as fair.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I would describe my group's problem solving process as confusing.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I would describe my group's problem solving process as satisfying.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The questions in this section ask about your feelings concerning the solution your group offered. Read the following statements and then circle the number that best indicates your level of agreement or disagreement using the scale below. Please, only consider how you felt about ***the solution your group determined for this task only*** when responding to the following statements.

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Somewhat Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6	7	8	9

I am satisfied with the quality of the group's decision.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The final solution reflects my inputs.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I feel committed to the group's solution.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I am confident that the group's decision is correct.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I feel personally responsible for the correctness of the group's decision.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The questions in this section ask about your feelings concerning the communication method used to complete the task. Read the following statements and then circle the number that best indicates your level of agreement or disagreement using the scale below. Please, only consider how you felt about ***the method of communication for this task only*** when responding to the following statements.

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Somewhat Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6	7	8	9

The group understood my inputs as they were intended.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I could determine when the members of my group did not understand my intended messages.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I was not able to clearly express my ideas using this particular communication method.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The communication method allowed me to understand the ideas of other group members.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

Group members could tell when I did not understand their messages.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The communication method did not hinder my group's progress.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The communication method was appropriate for this task.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

STOP

The questions in this section ask about your feelings concerning the group as a whole. Read the following statements and then circle the number that best indicates your level of agreement or disagreement using the scale below. Please, only consider how you felt about ***the group as a whole during this task only*** when responding to the following statements.

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Somewhat Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6	7	8	9

I felt that I was part of the group.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I enjoyed working with the others in the group.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I felt a sense of unity with my group members.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

There was agreement among the members of the group.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The group was able to work as a unit.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I felt satisfied with my group.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The questions in this section ask about your feelings concerning the process by which your group approached the task. Read the following statements and then circle the number that best indicates your level of agreement or disagreement using the scale below. Please, only consider how you felt about ***the approach your group used for this task only*** when responding to the following statements.

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Somewhat Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6	7	8	9

I would describe my group's problem solving process as efficient.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I would describe my group's problem solving process as uncoordinated.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I would describe my group's problem solving process as fair.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I would describe my group's problem solving process as confusing.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I would describe my group's problem solving process as satisfying.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The questions in this section ask about your feelings concerning the solution your group offered. Read the following statements and then circle the number that best indicates your level of agreement or disagreement using the scale below. Please, only consider how you felt about ***the solution your group determined for this task only*** when responding to the following statements.

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Somewhat Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6	7	8	9

I am satisfied with the quality of the group's decision.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The final solution reflects my inputs.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I feel committed to the group's solution.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I am confident that the group's decision is correct.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I feel personally responsible for the correctness of the group's decision.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The questions in this section ask about your feelings concerning the communication method used to complete the task. Read the following statements and then circle the number that best indicates your level of agreement or disagreement using the scale below. Please, only consider how you felt about ***the method of communication for this task only*** when responding to the following statements.

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Somewhat Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6	7	8	9

The group understood my inputs as they were intended.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I could determine when the members of my group did not understand my intended messages.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I was not able to clearly express my ideas using this particular communication method.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The communication method allowed me to understand the ideas of other group members.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

Group members could tell when I did not understand their messages.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The communication method did not hinder my group's progress.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The communication method was appropriate for this task.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

STOP

The questions in this section ask about your feelings concerning the group as a whole. Read the following statements and then circle the number that best indicates your level of agreement or disagreement using the scale below. Please, only consider how you felt about ***the group as a whole during this task only*** when responding to the following statements.

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Somewhat Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6	7	8	9

I felt that I was part of the group.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I enjoyed working with the others in the group.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I felt a sense of unity with my group members.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

There was agreement among the members of the group.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The group was able to work as a unit.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I felt satisfied with my group.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The questions in this section ask about your feelings concerning the process by which your group approached the task. Read the following statements and then circle the number that best indicates your level of agreement or disagreement using the scale below. Please, only consider how you felt about ***the approach your group used for this task only*** when responding to the following statements.

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Somewhat Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6	7	8	9

I would describe my group's problem solving process as efficient.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I would describe my group's problem solving process as uncoordinated.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I would describe my group's problem solving process as fair.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I would describe my group's problem solving process as confusing.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I would describe my group's problem solving process as satisfying.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The questions in this section ask about your feelings concerning the solution your group offered. Read the following statements and then circle the number that best indicates your level of agreement or disagreement using the scale below. Please, only consider how you felt about ***the solution your group determined for this task only*** when responding to the following statements.

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Somewhat Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6	7	8	9

I am satisfied with the quality of the group's decision.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The final solution reflects my inputs.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I feel committed to the group's solution.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I am confident that the group's decision is correct.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I feel personally responsible for the correctness of the group's decision.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The questions in this section ask about your feelings concerning the communication method used to complete the task. Read the following statements and then circle the number that best indicates your level of agreement or disagreement using the scale below. Please, only consider how you felt about ***the method of communication for this task only*** when responding to the following statements.

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Somewhat Agree	Moderately Agree	Strongly Agree
1	2	3	4	5	6	7	8	9

The group understood my inputs as they were intended.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I could determine when the members of my group did not understand my intended messages.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

I was not able to clearly express my ideas using this particular communication method.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The communication method allowed me to understand the ideas of other group members.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

Group members could tell when I did not understand their messages.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The communication method did not hinder my group's progress.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

The communication method was appropriate for this task.

1----------2----------3----------4----------5----------6----------7----------8----------9
Strongly Disagree Strongly Agree

Please answer each of the general information questions below. Remember, your responses will remain completely anonymous. Thank you for your honesty.

Age (years): _____

Gender (please check only one)

☐ Male ☐ Female

Ethnicity (please check only one)

☐ Asian ☐ Black ☐ Caucasian ☐ Hispanic ☐ Other

Class Standing (please check only one)

☐ Freshman ☐ Sophomore ☐ Junior ☐ Senior ☐ Graduate

Years of experience with personal computers: _____

How many hours a day, on average do you spend using a personal computer? _____

How would you describe your competence with personal computers?

☐ Novice ☐ Still Learning ☐ Average ☐ Advanced ☐ Expert

How would you describe your competence with Microsoft® NetMeeting® software **prior to** the experiment?

☐ Never Used ☐ Novice ☐ Still Learning ☐ Average ☐ Advanced ☐ Expert

How would you describe your competence with Microsoft® NetMeeting® software **after** the experiment?

☐ Never Used ☐ Novice ☐ Still Learning ☐ Average ☐ Advanced ☐ Expert

The task that required the **most** coordination effort was the:

☐ Task 1 (list items) ☐ Task 2 (separate items) ☐ Task 3 (pick bags to keep)

The task that required the **least** coordination effort was the:

☐ Task 1 (list items) ☐ Task 2 (separate items) ☐ Task 3 (pick bags to keep)

Debriefing Statement

Thank you for your participation in this study. The purpose of this study was to understand the effects of communication mediums and task-types on multiple outcomes. While all participants completed the same three tasks, some groups did so while communicating face-to-face and some groups completed the tasks using computer-mediated communication. It was expected that the different communication types would be better for different tasks. These differences were assessed using various measures of your satisfaction and several performance measures. It is hoped that this research will be able to assist in the design, development and implementation of computer-mediated communication systems.

If your participation in this study has raised any issues for you and you feel you need someone to talk to, please contact the California State University, San Bernardino Counseling Center at (909) 880-5040. The Psychology Department Human Participant Review Board, California State University, San Bernardino has approved this research. This research was conducted by Anton J. Villado, and supervised by Dr. Janelle Gilbert. If you have any questions or concerns regarding your participation, or if you would like a copy of the results (available summer, 2001), you may contact Anton J. Villado or Dr. Janelle Gilbert at (909) 880-5587.

APPENDIX B

TASK INSTRUCTIONS

Idea-generation task

For this task, you will need to think about items that would help you survive on a desert island. Other than food or water, many items might be useful. As a group, you will try to think of as many items that would help you survive. Think of anything, the more outrageous the better. There are only a few conditions you must follow.

First, any idea is a good idea. The object of this task is to think of as many things as possible. They can be crazy, silly or wild, the more ideas the better.

Second, you may not criticize an idea. Since you will be trying to think of as many ideas as possible, all ideas are good ideas.

Third, these are things you would need to help you survive on an island. These should not be things to aid in your rescue. You may not list any communication devices or any electronic devices. Cellular phones, two-way radios and hairdryers are not allowed.

Fourth, items must be listed individually. Do not list a 'survival pack' or 'survival kit.' You may only list individual items. (give example of loaded gun: "For example, you might list a loaded gun. Now, that's fine if you think a loaded gun is going to help you survive somehow. However, a loaded gun is really two items, a gun and the ammunition. Instead of listing a loaded gun, you'd do better if you listed a gun and ammunition, since that would give you two items and the more items the better.") (give example of survival pack: "Also, your group might list something like a survival pack. Again, the more ideas the better. Listing a survival pack is one item versus listing all of the items you might expect to be in such a pack. Rather than just listing the pack, list the items you think might be in a survival pack. That way you get more items and you fellow group members know what is and isn't in the kit.")

Fifth, the items must be able to fit in a typical travel bag. Imagine the bag is 1.5' by 1.5' by 3' in size. Each item must be able to fit in the bag. Don't worry if all the items together would fit, just make sure that any one item would be able to fit in the bag. Remember, the more ideas the better. Wild ideas are okay, and encouraged. (give example of baseball size item; a baseball will fit a yacht will not fit)

To complete the task, think of as many items as possible. Keep thinking of items until the time has expired. When your time is up, your group will provide me with a record of the ideas you generated.
When your time is up, I will save a copy of the ideas you generated. Work as fast as you can while being as thorough as you can. Unless there are any questions, you may begin now.

Choose task

Now that you have thought of items to help you survive on an island, the next task will be to sort the items. Imagine you are packing three bags of survival gear. Each bag can hold five items. You want to include the best items you listed in these three bags. Be careful to consider how useful the items are. You don't want to pack the best items into one bag in case that bag was somehow lost.

Work together to separate the items into three bags. In order for you to complete this task, you must all agree on the final solution. When you have all reached an agreement as to which bag has what item, one member will provide me with the final decision of the group. The final decision must be a list that shows what five items are in each of the three bags. Work as fast as you can while being as accurate as you can. Unless there are any questions, you may begin now.

You may only use items your group listed in the previous task.
Stay focused on the task. This task can be the most time consuming task if you loose sight of the goal.

Negotiation task

From your previous two tasks, you have made a list of items to help you survive on a desert island. After that, you separated the items into three bags. The final task that you have to complete uses the three bags your group created. Each of you will be given one of the three bags your group created. Each bag is relatively the same, since you tried not to pack the best items into one bag.

Your task will be like that of the television show Survivor, except for a couple of differences. For this task, imagine you and your group are going to be taken to a desert island. You and your fellow group members must do your best to survive on the island with no resources but those in the bags. Just as in the show, assume you will be competing for a large cash prize; in this case one million dollars. You may only take two of the three bags to the island with you. That means your group must try to decide whose bag would best serve the group once stranded on the island. Unfortunately, the person whose bag is left behind may not win the prize. To win the grand prize, your bag must be on the island. In short, if your bag is eliminated, you remain on the island, but your bag does not. Again, you must all agree on the final decision. If you cannot reach a decision, no one can win the prize. You must do your best to work out a decision where everyone is happy. When you are finished, you should be able to provide me with a list that shows which two bags were chosen, and which bag was left behind. This will include any agreements made among members during this task. Work as fast as you can while being as accurate as you can. Unless there are any questions, you may begin now.

APPENDIX C

TASK HANDOUTS

List Survival Items

- You have 5 minutes to complete this task.
- You may approach this task any way you see fit.
- List as many items as possible.
- Any idea is a good idea.
- Items must fit in a travel bag, about 1.5 feet by 1.5 feet by 3 feet.
- Each item alone must fit in the travel bag.

- Do not include items to help you be rescued.
- Do not include any electrically powered items.
- Do not list communication items. (radio, cellular phone, etc.)
- Do not list 'kits' or 'packs.' Only list items individually.

Think of as many items as possible. When your time has expired, you should be able to provide the researcher with a list of items your group generated. The task is complete once the 5 minutes has expired.

Separate Items

- You may approach this task any way you see fit.
- Separate the items into 3 bags.
- Each bag can hold 5 items.
- You may only include items from the previous task.
- Each bag should be equal in importance.
- Everyone must agree on the final solution.

Everyone must agree on the final solution. Once the items have been separated into the 3 bags of 5 items, and everyone agrees on that solution, one person should provide the researcher with the solution. The solution must indicate what items are in each bag. The task is complete once the solution has been turned in.

Pick Bags to Keep

- You may approach this task any way you see fit.
- Imagine you are competing for a $1,000,000 prize.
- Group members each have one bag assigned to them.
- Select two bags to keep and one bag to leave behind.
- Group members who do not have a bag on the island cannot win the grand prize cash award but remain on the island.
- Everyone must agree on the final decision.

Everyone must agree on the final decision. Once the group has agreed which bags to keep and which bag to leave behind, one person should provide the researcher with the final decision. This must include any deals or compromises made to reach an agreement. The task is complete once the final decision has been turned in.

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