EFFECTS OF COMMUNICATION MODE AND POLLING ON COOPERATION IN A COMMONS DILEMMA

A Thesis

by

KRISTEN MICHELLE WATROUS

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

August 2004

Major Subject: Psychology

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Approved as to style and content by:

Charles D. Samuelson (Chair of Committee)	Mindy E. Bergman (Member)
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ABSTRACT

Effects of Communication Mode and Polling on Cooperation in a Commons Dilemma.

(August 2004)

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This study examined the effects of communication mode, both face-to-face (FTF) and computer-mediated communication (CMC), and polling on cooperation in a commons dilemma. Sixty-seven six-person groups used FISH, a computer program that uses a fishing metaphor to simulate a commons dilemma. Next, groups had a 10-minute discussion period, either FTF or via CMC, in which they devised a strategy for the second FISH session. Groups were randomly assigned to one of four conditions: FTF, no-poll CMC, end-poll CMC, and two-poll CMC. The polls allowed members to determine others' intended behavior, thus enhancing perceived consensus. Finally, groups used the FISH program again. Results indicated that experimental condition influenced consensus, with end-poll CMC groups reaching consensus most often, followed by FTF, two-poll CMC, and no-poll CMC groups. However, groups did not differ across experimental condition on resource pool sustainability or group profit. FTF groups were more satisfied with group performance than no-poll CMC groups, and two-poll CMC and FTF groups had similar levels of satisfaction. The strategy the group decided to implement in the second FISH session had a significant effect on group profit but not resource pool sustainability. Thus, the harvest strategy implemented by the group may have been a stronger predictor of performance than experimental condition.

DEDICATION

I would like to dedicate this thesis to my fiancé, Luis Rodriguez. I want to thank him for his assistance in achieving this success. He has supported me throughout my entire academic career, both undergraduate and graduate. He has been my strongest supporter, believing in me whenever I doubt myself, encouraging me whenever I feel discouraged, motivating me whenever I feel like failure is imminent. He has taught me to continue when I feel like quitting and he refuses to let me fail. I cannot express in words how much his faith, love, and support have meant to me. Without him, I never would have reached this goal.

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INTRODUCTION

Social dilemmas, including both two-person prisoner's dilemmas and n-person games, have been a topic of psychological research since the mid-1950s (Sally, 1995). There are two defining characteristics of a social dilemma: (1) each individual receives a greater reward for a defecting choice rather than a cooperating choice, regardless of the choices of others in his or her group; and (2) universal cooperation yields a higher reward to all members than universal defection (Dawes, 1980). In short, an individual's decision to maximize his or her short-term interests leads to an outcome that is less beneficial than a cooperative decision would be (Ostrom, 1998). Real-world examples of social dilemmas include individuals' willingness to conserve water in a drought, their contribution to public television, and their decision to carpool to work rather than drive alone.

Resource dilemmas (e.g., commons dilemmas) are a subtype of social dilemmas. In a resource dilemma, group members have access to a shared resource that they are vying for. The size of the resource pool is not constant. Additionally, the pool can replenish itself. However, there is usually a restriction in place regarding the maximum size of the pool. Individuals benefit by harvesting as much of the resource as possible. Thus, each individual finds that overuse of the resource results in immediate gain, but eventually such use will lead to a depletion of the pool (Messick & Brewer, 1983). Real-world examples of resource dilemmas include electricity and fossil fuel shortages, declining whale and lobster populations (Kramer & Brewer, 1986), and a lack of fresh

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water and clean air (Kramer & Brewer, 1986; Samuelson, Messick, Wilke, & Rutte, 1986).

Communication and Cooperation in Social Dilemmas

Past research indicates that face-to-face communication increases cooperation in social dilemmas (Bornstein, Rapoport, Kerpel, & Katz, 1989; Bouas & Komorita, 1996; Chen, 1996; Chen & Komorita, 1994; Dawes, 1980; Dawes, McTavish, & Shaklee, 1977; Dawes & Orbell, 1981; Kerr & Kaufman-Gilliland, 1994; Messick & Brewer, 1983; Orbell, van de Kragt, & Dawes, 1988; Ostrom, 1998; Sally, 1995). Allowing groups to discuss the dilemma increases the likelihood of individual members making cooperative choices rather than defecting ones (Bouas & Komorita, 1996; Dawes et al., 1977; Messick & Brewer, 1983).

Several explanations for the effect of communication on cooperation have been proposed in the literature. Messick and Brewer (1983) discuss four ways by which communication can increase the likelihood that group members will make cooperative choices. First, discussing the dilemma gives group members information about others' intended choices, which leads to the establishment of group norms favoring cooperation. Second, a period of discussion may allow group members to indicate that they are committed to making a cooperative choice, which builds trust and an expectation of cooperation between members, thus decreasing the individual risk associated with cooperation. Third, social values may enter into the discussion, which allow members to make moral arguments in favor of cooperation, thus persuading others to make cooperative choices. Finally, the discussion may create a sense of group identity among

group members, causing them to shift their attention away from their own self-interest toward the group interest, resulting in cooperative action.

Throughout the social dilemma literature, two of these explanations have received the most attention: (1) group identity (Dawes van de Kragt, & Orbell, 1990; Kerr & Kaufman-Gilliland, 1994; Messick & Brewer, 1983; Orbell et al., 1988; van de Kragt, Dawes, Orbell, Braver, & Wilson, 1986), and (2) commitment-making (Bouas & Komorita, 1996; Chen, 1996; Chen & Komorita, 1994; Dawes et al., 1990; Kerr & Kaufman-Gilliland, 1994; Orbell et al., 1988). Each of these will be discussed further in turn.

Group Identity

Individuals are constantly associated with groups. They begin to feel attracted and attached to members of their own groups and describe their groups in positive terms, such as trustworthy, honest, and cooperative (Brewer, 1979; Brewer & Silver, 1978; Kramer & Brewer, 1984; Messick & Brewer, 1983). When people begin to differentiate between groups, they develop in-group preferences and out-group biases. In-groups are groups to which an individual belongs; out-groups are other groups of which an individual is not a member. Associations with groups create group identities, which lead to in-group biases (Brewer, 1979; Messick & Brewer, 1983). Research indicates that the creation of an in-group bias is more strongly related to an increased attraction to the in-group rather than to an increased dislike for the out-group (Brewer, 1979). In fact, it has been found that the presence of strong similarities among group members can enhance individuals' attraction to their group, even if there is no definitive out-group against

which they can compare themselves (Brewer, 1979). Group-level identities serve to differentiate individuals based on the groups to which they belong. Individuals learn to identify and define themselves and others by their location in a system of social categorizations and group memberships (Turner, 1975).

The formation of a group identity reduces the psychological distance between group members (Messick & Brewer, 1983). Grouping individuals together within a common social boundary lessens the social distance between group members, making it less likely that they will distinguish between their own and others' welfare (Kramer & Brewer, 1984). As such, whether or not individuals act cooperatively in the context of a social dilemma may depend on whether they view themselves as autonomous individuals or as members of an aggregate (Kramer & Brewer, 1984). Thus, because of their salient group identity, individuals act in the best interest of the collective unit by restricting their use of a common resource (Kramer & Brewer, 1984). Furthermore, they expect their fellow group members to reciprocate by also acting cooperatively (Bornstein et al., 1989; Brewer, 1979; Kramer & Brewer, 1986; Messick & Brewer, 1983).

The research literature offers some support for the group identity hypothesis. Some researchers are strong advocates of this position. For example, Dawes et al. (1990) stated, "our experiments have led us to conclude that cooperation rates can be radically affected by one factor in particular, which is independent of the consequences for the choosing individual. That factor is group identity." (p. 99). Indeed, there are results that support this claim. van de Kragt et al. (1986) examined a variable they called "group regardingness" (synonymous with a sense of group identity) and found

that it is sufficient and necessary for successful group performance on a social dilemma task. Bornstein et al. (1989) found that within-group discussion enhanced group identity, thus promoting cooperation. Brewer and Kramer (1986) found that participants involved in a commons dilemma demonstrated increased self-restraint under conditions of group identity as compared to conditions of individual identity. Kramer and Brewer (1984, 1986) found that individuals with a heightened sense of group identity are more likely to cooperate and demonstrate individual restraint.

Other studies have concluded that group identity interacts with promises to cooperate to affect group cooperation (Dawes et al., 1990; Orbell et al., 1988). Group promises were found to be effective in increasing cooperation only in instances of universal promising (i.e., instances in which all members of a group make a promise to cooperate) (Orbell et al., 1988). Additionally, universal promising fostered group identity, which led to enhanced cooperation among group members (Dawes et al., 1990; Orbell et al., 1988).

Commitment Making

A second reason for the effect of communication on cooperation in social dilemmas involves commitment making. The commitment hypothesis states that communication provides the opportunity for group members to make and extract promises to cooperate (Kerr & Kaufman-Gilliland, 1994; Orbell et al., 1988). Past research has differentiated between two versions of the commitment hypothesis: (1) universal consensus and (2) perceived consensus. Both versions of the commitment hypothesis have been used to explain discussion's effect on cooperation. Universal

consensus requires that all members of a group make a promise to cooperate (Orbell et al., 1988). Perceived consensus is a more lenient version of commitment making, as it does not require all members to agree. Instead, it is a generalized impression that the majority, rather than all group members will cooperate (Bouas & Komorita, 1996). Orbell et al. (1988) found that commitments were effective only if all group members promised to cooperate. In contrast, Bouas and Komorita (1996) suggest that universal consensus may not be necessary to increase cooperation. They suggest that perceived consensus might be sufficient to induce cooperation. These researchers proposed that perceived consensus might be an important factor in social dilemmas because it reduces the risk associated with making a cooperative choice. Indeed, perceived consensus suggests that group discussions are able to increase cooperation because they allow participants to develop the expectation that their fellow group members will cooperate. Thus, they are willing to cooperate as well.

Another area of debate in the commitment making literature concerns whether or not stating individual commitments to cooperate should be mandatory. Dawes et al. (1977) included a condition in their study in which participants engaged in relevant communication and took a roll call vote at the end of the group discussion. They found that participants in this condition did not reach greater levels of cooperation than participants in an unstructured, relevant communication condition, even though every participant in the roll call vote condition stated that he or she intended to cooperate. The only reasonable thing for participants to do in this situation was to promise to cooperate, no matter what they truly intend to do (Dawes et al., 1977). However, the mandatory

nature of the vote process could have negatively affected the likelihood of members honoring their commitments.

A final area of research in commitment making concerns the bindingness of pledges. Chen (1996) and Chen and Komorita (1994) investigated different levels of the bindingness of pledges. They defined a pledge as "an informal poll of group members regarding their intention or preference on an investment/contribution decision" (Chen, 1996). A "nonbinding" pledge occurs when a participant is asked to make a pledge; however, when the time comes to make a decision, he or she is not required to follow through on that pledge. When an individual makes a "binding" pledge, he or she is expected to honor it during the decision making stage of the dilemma. Finally, a "somewhat binding" pledge occurs when individuals are informed that some degree of commitment is involved in their pledge. It has been suggested that nonbinding pledges do not elicit more cooperation than control conditions that do not allow any communication. However, when pledges are described as "somewhat binding," cooperation is enhanced (Chen & Komorita, 1994). Chen (1996) and Chen and Komorita (1994) found that pledges to cooperate create a two-stage dilemma: the first stage of making the pledge, and the second stage of actually following through with the pledge. Furthermore, they found that group-based pledges (i.e., those that require all group members to contribute equally to a common good) increased cooperation above and beyond individual-based pledges (i.e., those that do not require equal contributions).

Summary

Whereas most research has offered support for either the group identity or the commitment hypothesis, some researchers have suggested that both may be effective at increasing cooperation in social dilemmas. For instance, Bouas and Komorita (1996) found that group identity alone was insufficient to evoke cooperation. They suggest that perceived consensus is one of the essential factors in enhancing cooperation. However, they do note the possibility that both group identity and perceived consensus are needed to evoke cooperation among group members. Also, although Kerr and Kaufman-Gilliland (1994) and Orbell et al. (1988) favor different explanations for discussion's effect, both acknowledge partial support for each of the two alternate hypotheses.

Rationale for Present Study

There are several reasons for studying computer-mediated communication (CMC) in social dilemmas. First, a search of the extant literature on communication in social dilemmas indicated that only face-to-face (FTF) communication has been examined. It is important, however, to examine not only FTF communication, but also CMC within the context of social dilemmas because CMC is quickly becoming a common means of communication in organizational and academic settings (Kiesler, Siegel, & McGuire, 1984; Straus & McGrath, 1994; Walther, 1993). Second, the majority of CMC studies have used decision-making tasks in which individuals must make decisions on issues that do not have an identifiably correct answer (Hollingshead & McGrath, 1995). In a recent review of the literature on CMC, Hollingshead and McGrath (1995) found that only one of fifty studies examined used a mixed-motive task,

such as a social dilemma or negotiation task. The present study can thus add to the literature by using a mixed-motive task. Third, CMC allows people to communicate remotely in space and time and may therefore be more practical than FTF communication. Thus, the study of social dilemmas within the context of CMC could have an applied value in the management of resource conflicts. Finally, the comparison of FTF and CMC allows researchers to manipulate directly the communication processes that occur in groups. The current study can facilitate theory development by identifying the type of communication processes that promote cooperation in social dilemmas.

Face-to-Face Communication vs. Computer-Mediated Communication

CMC can be defined as "any communication patterns mediated through the computer" (Metz, 1994, p. 32), either synchronous or asynchronous. The Internet, the World Wide Web, Lotus Notes, electronic mail, computer conferencing, and group decision support systems (GDSS) are all examples of CMC methods (Scott, 1999). Furthermore, more advanced CMC packages (e.g., GDSS) offer tools for generating ideas, setting agendas, or attaining group consensus (Hollingshead & McGrath, 1995).

Past research has examined the differences between FTF and CMC and found several factors that vary across these two communication modes. First, groups using CMC usually take longer than FTF groups to complete similar tasks (Straus & McGrath, 1994). CMC involves the simultaneous entry of ideas, while FTF usually proceeds in a sequential fashion (Straus & McGrath, 1994). Thus, the flow of a computer-mediated discussion can be more difficult to follow than that of a FTF discussion because, with simultaneous entry, the temporal sequence of messages is often disrupted. Moreover,

simultaneous entry of ideas leads to a great amount of information that participants must process at once (Straus & McGrath, 1994). Compared to FTF, CMC also has been found to be more task-oriented (Walther, 1996), to have more instances of "flaming," or rude, offensive, uninhibited behavior (Hollingshead & McGrath, 1995; Kiesler, et al., 1984; Matheson, 1991; Straus & McGrath, 1994; Walther, 1996), and to have lower levels of other-awareness (Matheson, 1991).

Levels of group consensus consistently have been found to be lower in CMC groups than in FTF groups. CMC groups have been found to make fewer statements of agreement than FTF groups (Walther, 1996). However, when CMC groups do reach consensus, the levels are higher than those found in FTF groups (Hollingshead & McGrath, 1995). This finding could be due to the fact that CMC groups might not know whether or not an argument or idea is understood and accepted by fellow group members (Adrianson & Hjelmquist, 1999). Writing down ideas and strategies can increase group members' commitments to them (Poole, Shannon, & Desanctis, 1992). Also, the implementation of a voting tool can increase group consensus (Scott, 1999; Walther, 1996) and enhance the group's ability to manage conflict (Sambamurthy & Poole, 1992). However, Poole, Holmes, and Desanctis (1991) reported that the use of Software Aided Meeting Management (SAMM) resulted in the greater use of voting tools, but this use had a negative effect because group members used the tool to end the discussion.

CMC also lacks the paraverbal and nonverbal cues of FTF such as tone of voice, facial expressions, and body language (Adrianson & Hjelmquist, 1999; Hollingshead & McGrath, 1995; Walther, 1993; Walther, 1996). This feature can cause CMC to be

viewed as a less personal mode of communication, which can decrease group identity (Walther, 1996). However, the impersonal nature of CMC can also create equal participation among group members and cause participants to devote more time to work and less time to personal discussion. The use of CMC also makes the use of turn taking associated with FTF communication unnecessary (Walther, 1996).

Regarding participation, individuals in CMC groups were found to have lower levels of participation than FTF groups in a laboratory setting but equal or higher levels of participation than FTF groups in an organizational setting (Scott, 1999). However, other researchers have found that although overall levels of participation may be lower in CMC than FTF, individuals may participate more equally in CMC than FTF groups (Hollingshead & McGrath, 1995, Straus & McGrath, 1994). Thus, while more total interaction may occur in FTF groups, the distribution of participation among members is more equal in CMC groups. Postmes, Spears, and Lea (1998) and Straus and McGrath (1994) argue that this equalization of participation may be due to increased anonymity in CMC groups as compared to FTF groups.

Empirical studies are equivocal with respect to satisfaction with the communication medium. Whereas some research indicates that CMC produces equal or greater levels of satisfaction than FTF communication (Scott, 1999), in other cases FTF groups had higher levels of satisfaction than CMC groups (Hollingshead & McGrath, 1995, Straus & McGrath, 1994). Research thus indicates that neither FTF nor CMC is unequivocally better for communication; rather, depending on the variable of interest, each communication mode is sometimes better and sometimes worse than the other.

Task Type in CMC

The types of tasks completed by CMC groups included in empirical studies, while having the potential to vary greatly, in reality are quite similar throughout the extant literature. McGrath (1984) presented a Circumplex Model that proposed that group task types can be divided into four quadrants of a circumplex. The first quadrant, "generate," involves the generation of ideas and plans, and can be further subdivided into creativity tasks and planning tasks. The second quadrant, "choose," consists of choosing a correct answer or preferred solution to a problem. This quadrant is comprised of the two subcategories intellective tasks and decision-making tasks. Intellective tasks are problems that have correct, identifiable solutions; decision-making tasks deal with problems that do not have correct answers. In the third quadrant, "negotiate," conflicting viewpoints or interests must be resolved. Two subcategories for this quadrant are cognitive-conflict tasks (i.e., conflicts of differing viewpoints) and mixed-motive tasks (i.e., conflicts of interest between members). In the final quadrant, "execute," group members are in direct competition with either an opponent or with a standard for performance. The "execute" quadrant is comprised of contests (or competitive tasks), in which group members must resolve conflicts of power, and performances (or psychomotor tasks), in which group members execute performance tasks.

Hollingshead and McGrath (1995) summarized 50 studies that used computer-assisted groups. Several of the 50 studies used more than one task type, resulting in a total of 69 tasks used across the studies. Hollingshead and McGrath (1995) found that

the majority (31 studies) used decision-making tasks in which groups decided on issues that did not have explicitly stated correct answers. Seventeen of the studies used creativity tasks, eight used planning tasks, seven used intellective tasks, one used a cognitive-conflict task, one used a mixed-motive task, and four used tasks that were not described in the review. None of the 50 studies reviewed used competitive tasks or performance tasks. Thus, it is obvious that although many task types exist for use in CMC studies, some are rarely implemented in empirical research. Furthermore, the tasks used most often in experimental studies are judgment, consensus, or brainstorming tasks.

Straus and McGrath (1994) conducted a study in which CMC and FTF groups worked on one of three tasks: (1) an idea-generation task, which involved brainstorming for ideas to improve the quality of the environment; (2) an intellective task, which involved solving a complex logic problem; and (3) a consensus task, which involved deciding on a punishment for a student and his teaching assistant who violated a school policy. They hypothesized that the performance and satisfaction of groups on tasks that required greater teamwork would be enhanced by FTF communication because it allows the transfer of more social context cues than CMC. The researchers found that, although there were few differences between CMC and FTF groups in terms of the quality of their work, FTF groups were more productive on all three of the tasks than CMC groups. Moreover, the differences between FTF and CMC groups were larger for the task that required more teamwork or member interdependence (i.e., the consensus task). Poole et al. (1991) conducted a study using a conflict management task to test a model that

states that group interaction processes (e.g., the manner in which the group uses a GDSS) will mediate the effect of the GDSS on the process and on the outcome of the conflict. The researchers proposed that it is not the GDSS itself that affects the group's interaction. Instead, it is the way in which the group uses the components of the GDSS that is important. Adaptive Structuration Theory (DeSanctis & Poole, 1994) proposes that information and communication technologies exert an influence on group processes according to the manner in which groups use them. Any groupware system is comprised of a set of structures or features. Groups tend to use certain features and neglect others; thus, they vary in terms of the amount of the system's features they use and in whether they use them properly or improperly. It is these differences that will affect the outcome of the conflict.

Poole et al. (1991) proposed seven ways that a GDSS might exert positive or negative influences on a group's ability to manage conflict. It is important to note that the researchers did not propose that these effects occur automatically but rather that they are dependent upon both the specific GDSS that is being used and the situation in which it is used. First, the exploration of alternatives should positively influence the conflict outcome, as the consideration of a diverse set of alternatives increases the chance of finding a creative solution that the group can implement. Second, having a clear set of roles and procedures to follow should enable the group to become organized with regard to its task, thus reducing tension and positively affecting the conflict outcome. Third, the availability of a voting tool could affect the conflict outcome either positively (e.g., when group members use it to bring conflict to the forefront in a discussion) or

negatively (e.g., when group members use it to end the discussion). Fourth, certain features of a GDSS, such as the ability to input and display information, can positively affect conflict by de-emphasizing personal relations, which helps to diffuse conflicts and allow group members to remain focused on their task. Fifth, a GDSS can elicit equal participation from group members; this can have a positive (e.g., by ensuring that group members will have a stronger sense of ownership if they reach consensus) or negative (e.g., by making the task more time-consuming) effect on the conflict outcome. Sixth, the reliance on written information that is created in a GDSS should affect the conflict outcome negatively. Research has indicated that individuals are more likely to maintain an opinion or idea when it is written than when it is spoken (Johansen, Vallee, & Spangler, 1979), thereby increasing the likelihood of conflict within the group. Finally, it was proposed that the use of a GDSS will foster affective expressions, which will lead group members to focus on issues that divide rather than unite them, less on the task, and more on personal issues, which will negatively affect the conflict outcome.

In the Poole et al. (1991) study, forty groups consisting of either three or four persons were assigned to three conditions. In the first type of group, called SAMM groups, participants used a GDSS entitled the Software Aided Meeting Management system. The second type of group, labeled manual groups, did not use any technology; rather, they were given paper and pencil versions of the features found in SAMM. Finally, the baseline groups were given no support. The groups completed the Foundation Task, a budget allocation task in which members must decide how to divide $500,000 among six projects. This task falls into the category of mixed-motive tasks on

McGrath's (1984) circumplex model. The interactions of the group members were coded to measure the outcomes, which were conflict level, conflict management behaviors, consensus among group members, and change in consensus.

Poole et al.'s (1991) results supported their proposed model, overall. First, they found that the GDSS groups implemented the voting tool more often than groups in the other conditions. However, the use of the voting tool negatively influenced the conflict outcome, as it was frequently used to end the discussion. In addition, it was found that GDSS groups de-emphasized personal relations, which had a positive effect on conflict management. As expected, GDSS groups relied more on written information than manual groups. Whereas participants in all three conditions generally responded neutrally to written media, GDSS groups responded more negatively to it than groups in the other two conditions. Moreover, GDSS groups engaged in less exploration of alternatives than groups in the other conditions. As expected, GDSS groups expressed more affective responses than other groups. Contrary to past research, however, it was positive affect rather than negative; thus it positively affected conflict management. Finally, the overall balance of the influence of GDSS seemed to be negative, indicating that GDSS groups possibly did not handle conflict as productively as the manual and baseline groups. Thus, Poole et al. (1991) concluded that it was not the GDSS itself that affected conflict management, but rather how the groups used the GDSS that mediated the impact of the system on conflict management.

Computer-Mediated Communication in Social Dilemmas

The present study was intended to serve as a replication and extension of a study conducted by El-Shinnawy, Samuelson, Poole, Vinze, and Baker (2004). In this study, the researchers examined the effect of CMC as compared to FTF communication in the context of a resource dilemma. El-Shinnawy et al. (2004) were interested in determining whether or not CMC could produce comparable effects on cooperation as compared to FTF. Specifically, they used FACILITATE.COM™, a web-based communication system. This program is considered an "electronic white board," in which group members can post ideas and respond to others' ideas. The comments are shown hierarchically. As such, the screen contains different comment areas and an individual's comment is placed under a heading that represents a certain content area. FACILITATE.COM™ does not organize comments automatically. Instead, it allows individuals to structure their own discussion.

It was expected that the negative effects of CMC would outweigh the positive. First, El-Shinnawy et al. (2004) predicted that CMC groups would reach lower outcome levels (lower economic profits and lower levels of resource sustainability) than FTF groups. Second, they hypothesized that CMC groups would have lower levels of group identity than groups who communicated FTF because they would be communicating via a medium that offers a slower rate of communication and information poor channels. Finally, they expected that CMC groups would make fewer statements of commitment to cooperate than FTF groups. The parallel entry of ideas that occurs in

FACILITATE.COM™ makes the ability to coordinate group members to reach consensus more difficult.

To test these hypotheses, El-Shinnawy et al. (2004) randomly assigned 41 7- to 9-person groups to either an FTF or CMC condition. Group members used FISH (Gifford & Wells, 1991), a computer fishing task that simulates a real-world commons dilemma. Initially, participants interacted via the FISH program. They then were allowed a 10-minute discussion period in which FTF groups communicated around a table, while CMC groups communicated via FACILITATE.COM™. Finally, they had a second session with FISH.

The researchers found support for their hypotheses. First, CMC groups earned lower economic profits and achieved lower levels of sustainability than FTF groups. Second, CMC groups reported lower levels of group identity than FTF groups. Finally, CMC groups made fewer commitments to a consensus harvest strategy than FTF groups. Thus, it does appear that, overall, the negative effects of CMC outweighed its positive effects.

Present Study

El-Shinnawy et al. (2004) found that FTF groups performed better on the task overall than CMC groups. However, the question of why the CMC groups performed less well remains unanswered. The current study attempts to answer this question by focusing on the communication process. El-Shinnawy et al. (2004) found that FTF groups made more commitments than CMC groups. The higher incidence of commitment making in FTF groups may have led to higher levels of cooperation, thus

resulting in increased performance. While FTF discussion may have promoted commitment making, the use of FACILITATE.COM™ may have inhibited such a process in CMC groups. The present study addresses this issue by adding the use of a polling procedure to the computer program. Thus, a manipulation was added to some CMC groups that gave them the same opportunity to make commitments to one another that occurs naturally in FTF groups.

The present study uses a methodology similar to that of El-Shinnawy et al. (2004), in that all groups will follow a three-step procedure: (1) they will interact via the FISH program, (2) they will have a 10-minute discussion period, and (3) they will interact via the FISH program again. A four-condition design was used. An FTF condition without the use of an explicit polling procedure served as the control group. Three different CMC conditions were used. The first was a CMC condition without explicit polling instructions (no-poll CMC). The second was a CMC condition that was required to poll group members about the strategy they would use at the end of their 10-minute discussion (end-poll CMC). The last condition was a CMC condition in which group members were required to take a poll both midway through the discussion and at the end (two-poll CMC). The structure of CMC may not naturally induce voluntary, spontaneous commitment making. However, if a feature is implemented in the context of CMC that mandates polling of group members' strategies for the second FISH session, the format of CMC will more closely resemble that of FTF discussion in which group members question others' strategies or ask for commitments to a certain strategy.

As such, it was expected that the implementation of the polling procedure would enhance the performance and satisfaction of the CMC groups who had access to it.

Based on the research discussed above, five hypotheses regarding the impact of CMC on group processes in resource dilemmas can be advanced. First, FTF groups should outperform no-poll CMC groups, replicating the results of El-Shinnawy et al.'s (2004) study. Without mandatory polling, the negative effects of CMC discussed previously should outweigh its benefits. Thus,

H1a. FTF groups will outperform no-poll CMC groups in terms of economic profits and resource pool sustainability.

H1b. FTF groups will be more satisfied than no-poll CMC groups.

Furthermore, it is expected that end-poll CMC groups would outperform no-poll CMC groups. The mere act of writing down ideas and strategies can increase individuals' commitments to them. Although this can have a negative effect, such that putting ideas in writing can make individuals' positions inflexible (Poole et al., 1992), this research will focus on the positive aspect; writing down ideas can increase their salience and thus cause individuals to follow through with them. The end-poll will allow group members to determine others' intended behavior in the upcoming FISH session. This information should have enhanced the groups' perceived consensus (Bouas & Komorita, 1996) to a harvest strategy and increase their cooperation. Thus,

H2a. End-poll CMC groups will outperform no-poll CMC groups in terms of economic profits and resource pool sustainability.

H2b. End-poll CMC groups will be more satisfied than no-poll CMC groups.

Whereas polling should increase the performance and satisfaction of end-poll CMC groups relative to no-poll CMC groups, it is expected that FTF groups will have higher levels of performance and satisfaction than end-poll CMC groups. When group members are allowed only one chance to make commitments to one another, they might commit to different strategies. For example, one individual might voice a commitment to catch five fish per season, while another may state his or her intentions to catch fifteen fish per season. Thus, whereas participants in the end-poll condition might perform better and exhibit greater satisfaction with the task than no-poll CMC groups because they are given an opportunity to determine other group members' intentions, they might also enter into the second FISH session with less certainty than FTF groups about how others will act. In contrast, during the FTF discussion, participants may have several opportunities to gauge how their fellow group members would act in the second FISH session. Thus,

H3a. FTF groups will outperform end-poll CMC groups in terms of economic profits and resource pool sustainability.

H3b. FTF groups will be more satisfied than end-poll CMC groups.

Past research has indicated that voting tools can negatively affect conflict management because they can be used to end discussions before consensus has been reached (Poole et al., 1991). This effect should be negated in the two-poll CMC groups. The first poll should serve as a method to determine the group members' standing in terms of fishing strategies, not as a way to table or end the discussion. Rather, it should be viewed as a starting point in the search for consensus. The two-poll CMC condition

offers an opportunity to reach higher levels of perceived consensus (Bouas & Komorita, 1996). The greater availability of information in the two-poll CMC condition should enhance perceived consensus, which should have a positive effect on cooperation. Therefore,

H4a. Two-poll CMC groups will outperform both end-poll and no-poll CMC groups in terms of economic profits and resource pool sustainability.

H4b. Two-poll CMC groups will be more satisfied than both end-poll and no-poll CMC groups.

The performance of two-poll CMC groups should equal that of FTF groups. FTF groups have been found to make more statements of commitment than CMC groups, independent of any experimentally imposed structure. Furthermore, FTF groups have been found to outperform CMC groups (El-Shinnawy et al., 2004). It may be the general format of FTF communication that lends itself to such instances of commitment making, which in turn enhances cooperation and increases performance. The two-poll procedure will assist group members in gaining consensus on a strategy for performance in the second FISH session, thereby making the format of CMC more similar to that of FTF discussion. Thus,

H5a. Two-poll CMC groups' level of performance will equal that of FTF control groups in terms of economic profits and resource pool sustainability.

H5b. Two-poll CMC groups and FTF groups will have equal levels of satisfaction.

METHOD

Participants

Participants were 402 undergraduate students at Texas A&M University, recruited from the subject pool of Introductory Psychology classes. Students in Introductory Psychology had to participate in experimental sessions due to a course requirement; however they were allowed to choose which experiments they participated in. As such, their participation in this particular study was voluntary and assisted them in the fulfillment of this course requirement. Participants were assigned to one of 67 six-person groups. Groups were randomly assigned to each of the four experimental conditions. There were 14 FTF groups, 19 no-poll CMC groups, 18 end-poll CMC groups, and 16 two-poll CMC groups. The sample was 54.5% female with an average age of 18.5. The groups had an average of 3.27 female members.

Communication Mode

Two communication modes were used in this study: computer-mediated communication (CMC) and face-to-face communication (FTF). The participants in the CMC groups used Microsoft NetMeeting™, a commercially available software package that offers computer conferencing over the Internet. This program engages participants in discussion through the use of a text-based chat program. This feature allows participants to conduct real-time, synchronous text discussions. The messages appear in a window, similar to instant messages. Participants can read and respond to comments made by other participants in this window.

FTF groups were provided paper and pencils to note ideas and suggestions, or make calculations. These sessions were videotaped.

Experimental Task

A computer program entitled FISH was used for the experimental task. Participants used the FISH program twice during the experimental session; once before and once after the group discussion period. The FISH program (Gifford & Wells, 1991) uses a fishing metaphor to simulate a "real-life" commons dilemma. The participants act as fishermen who operate fishing boats. The fishers leave port, cast lines, and catch fish, and return to port. Fish are shown to spawn between fishing seasons at a predetermined rate. Furthermore, FISH displays graphically the exact number of available fish on the screen. Thus, when an individual catches a fish, the number of fish displayed on the screen decreases. Also, when the fish spawn between seasons, the number of fish displayed graphically on the screen increases. A fishing season ends either upon the return of all fishers to port or if no fish remain in the ocean. FISH is economically realistic, as fishers must pay certain costs to operate their boats and earn a fixed amount for each fish caught. Participants also can view information regarding both their own and others' harvest amounts, the number of available fish, profits, and costs. Group members participate in the "real-time" FISH simulation for a series of fishing seasons.

Experimenters can manipulate 24 parameters in the FISH program. The present study used parameters identical to those of El-Shinnawy et al. (2004). First, the number of seasons was set to five for the first session and ten for the second session. However, to avoid end-game strategies, participants were not informed in advance about the

number of seasons. Second, the probability of catching a fish was set to 1.0, such that each time a fisher cast, he or she caught a fish. Participants could catch as many fish as they wanted in the FISH task, provided that there were fish in the pool. Third, the time taken to catch a fish, or the fish interval, was set to 10 seconds, so that once a participant cast his or her line, it took 10 seconds to actually catch a fish. Fourth, the initial and maximum pool size in both sessions was 100 fish. Fifth, the spawning rate was set to 1.5. Thus, if 10 fish remained when all participants returned to the port at the end of a season, 15 fish were available for catch during the following season. Although participants were informed that the pool would never exceed its original size of 100 fish, they were not informed about the spawning rate. Finally, income and cost parameters were set such that $10.00 was earned for each fish caught, and fishers paid a fixed cost of $15.00 to leave port and $1.00 per minute while fishing. Thus, total profit was equal to the number of fish caught multiplied by $10.00 per fish minus the $15.00 fixed cost and $1.00 per minute spent fishing. The amount of time spent fishing can vary greatly, as individual fishers decide when to leave and return to port.

Polling Manipulation

Groups in two of the four conditions were required to engage in polling. The FTF groups were not required to engage in polling. Furthermore, the CMC groups were divided into three conditions: no-poll, end-poll, and two-poll. The no-poll CMC groups were not required to engage in polling. The end-poll CMC groups were required to take a poll following the conclusion of their 10-minute discussion session. They were given additional time after the discussion to conduct the poll. The two-poll CMC groups were

required to take a poll both at the 5-minute midway point and at the end of the 10-minute discussion period. These groups also were allowed extra time to conduct each poll. Participants were informed at the conclusion of the first FISH session whether or not they were to engage in polling, and if so, when that polling would occur. At the appropriate time, the experimenter informed the participants that it was time to take a poll electronically, via the NetMeeting™ software.

Procedure

Upon arrival at the laboratory, participants signed an informed consent form and completed a pre-experimental questionnaire. This questionnaire contained questions regarding their past experiences with computers, group work, and other basic demographic information. Additionally, participants completed a personality inventory at this time. They were then seated at separate workstations in the computer lab. The participants were able to see their own screen, but they were seated such that they were not able to view the screens of other group members.

Next, participants were informed about the general nature of the experimental task. They were informed that they would be working simultaneously with other participants on a resource management task. They also were told that they would have an opportunity later in the session to discuss the task with the other group members, but that they should not discuss the task until this specified discussion period was announced.

At this point, CMC groups received general instructions on how to use NetMeeting™. The computer program was described to participants as a text-based chat

program. They were informed that group members were able to enter original comments and respond to previously presented comments. The experimenter reviewed basic instructions on the use of the communication program through the use of handouts, which were read aloud. Also, participants were directed to enter a message into the program. All participants were assigned a letter (A, B, C, D, etc.) based on their seating assignment that served as their identifiers in the discussions. Finally, participants were instructed that all communication during the experimental session would occur via NetMeeting™.

Next, participants in all conditions received more specific information about the FISH task. The experimenter informed participants that each member would be in command of a fishing boat and that each would be responsible for deciding how many fish to catch from a common fishery available to the entire group. Participants were given detailed instructions regarding the proper use of the FISH program via their computer screens. They also were given a summary sheet to keep at their workstations to use as a reference during the experimental task. The experimenter read aloud the instructions on the summary sheet to ensure that all participants fully understood the task. The experimenter explained all of the information fields on the FISH display screen, including season, fishing time, number of casts, fish caught, fish remaining, income, expenses, profit, and other fishers' harvest activity. The experimenter pointed out that the maximum size of the fish pool was 100 fish. Also, she stated that if all of the available fish were caught, then the fishing session would end. Finally, the experimenter used examples to explain the concept of "spawning" to the participants, but

did not inform them of the spawning rate. Participants were informed that the fish could spawn only when all fishers returned to the port after each season, assuming that there were still fish remaining in the pool. The experimenter then answered any questions from the participants at this time.

Participants then were informed that the FISH task would end either when no fish remained in the pool or when a randomly determined number of fishing seasons was completed. In reality, the FISH session would end when the pool was depleted or when five seasons had passed. Participants also were informed that the objective of the FISH task was to maximize individual profit. They were informed that there were a number of different ways to accomplish this goal and that finding the most effective fishing strategy was the purpose of FISH. At this point, participants were informed that there were financial outcomes based on the decisions they made in the experiment. They were told that one group would be selected at random in a lottery that would be held at the end of the data collection. Participants were told that groups would receive one lottery ticket for each $100 of profit earned by the group. Thus, greater group profit equaled a greater chance of winning in the lottery. Participants also were informed that the exact amount to be paid in the lottery would be determined by individual profit, such that for every $20.00 of individual profit earned, participants would receive $1.00 of actual profit. Thus, the economic incentives for both group and individual profit captured the mixed-motive conflict of a social dilemma.

Participants in all conditions completed a practice round of FISH. They were instructed by the experimenter to begin the FISH task, leave port, catch three fish, and

return to port. They were then able to see the fish spawn. Also, they were able to view information about their fishing results and the results for the other fishers in their group. Once the 20-second fish spawning period ended, participants were instructed to fish again. This time, they were instructed to catch four fish and then return to port. Finally, participants were able to see the fish spawn and were given information about their own and their fellow group members' fishing results.

Once participants demonstrated a basic understanding of the FISH task, they were instructed to begin the first FISH session. They were informed that there would be an initial limit of 100 fish in the pool. The groups fished for up to five seasons or until the pool was depleted, whichever occurred first. Following each season, they were given feedback about their personal catch totals, income, expenses, and profit, and that of their fellow group members. Participants were assigned an identification number by which the experimenter could examine their FISH behavior and by which other group members would receive information about them. The data gathered during this first session of FISH was used as baseline group performance information. It was recorded on a flipchart and used during the group discussions.

Next, all participants participated in a 10-minute group discussion. FTF groups were escorted to a separate room where they sat around a table to discuss strategies for the next fishing session. They were told that participants in previous sessions have often found it useful to discuss the FISH task. They were told that they had 10 minutes to discuss the FISH task in preparation for the second FISH session. They were told that they were not allowed to discuss "side payments" to other group members following the

experimental session or make physical threats. They were told that, once the discussion ended, they would begin the second FISH session and no further communication would be permitted. Finally, while the experimenter was not present in the room to monitor their discussions, they were instructed that the discussion would be videotaped. The experimenter monitored the group discussions from the control room via the video camera.

CMC groups remained at their workstations and communicated via NetMeeting™. They were given the same verbal instructions as FTF groups with the exception that they were told that all communication between group members must be conducted via the computer. Participants were assigned letter identifications for use during their discussions. Thus, their comments were identified by a letter, but the letters used to identify participants in the CMC discussions were not related to their user numbers in the FISH task; thus, other group members did not know which participant was associated with which letter.

At this time, the end-poll and two-poll CMC groups were informed that they would be engaging in polling during the discussion session, and they were told that the poll was mandatory. The purpose of the polling procedure was to gather information regarding group members' intentions for the second FISH session (i.e., harvest strategies). The experimenter alerted the groups electronically via NetMeeting™ when it was time to take the poll, at the five-minute point for the two-poll groups and at the ten-minute point for the two-poll and end-poll groups. All group members were asked to respond to the question, "How many fish do you intend to catch per season in the next

fishing session?" via the NetMeeting™ chat window. The participants answered the poll in alphabetical order according to the letter that identified them in the NetMeeting™ program.

Following the completion of the discussion period, FTF groups were escorted back to their original workstations to begin the second FISH session. All groups were directed to review the instructions, focusing on the final summary sheet. They were told that the pool size was reset to 100 fish, while all other parameters were kept constant, except for the number of seasons, which was chosen randomly by the computer. In reality, the number of seasons was set to 10. The participants then were instructed to begin the FISH session and continue until either the pool was depleted to zero or until the computer instructed them to stop.

Upon completion of the second FISH session, participants completed a post-experimental questionnaire. This questionnaire helped to control end-game strategies, as the end of the second FISH session was not the end of the experimental session. Participants were unaware of the post-experimental questionnaire until after the second FISH session ended. As such, those participants who were trying to create end-game strategies based on the amount of time remaining in the experimental session likely overestimated the amount of time to be spent in the second FISH session; thus, if any end-game strategies were used, they were likely to be used later rather than earlier in the second FISH session. At this time, participants' individual and total group profits for the second session were posted on a flipchart. Following the completion of the experimental session, participants were debriefed about the purpose of the experiment. They also

were given course credit at this time. Finally, upon completion of data collection, the groups who won the lottery were informed and arrangements were made for them to collect the money.

Measures

Pre-experimental questionnaire. The pre-experimental questionnaire contained demographic information, including age, gender, college major, and GPA (see Appendix A). Additionally, questions regarding past experiences and comfort level with computers, typing skills, and experience with group work were included. Finally, participants completed the Big Five Inventory (John, Donahue, & Kentle, 1991), a personality inventory, at this time.

FISH dependent measures. Group performance was assessed through measures recorded by the FISH program. The level of analysis was the group. Six measures of group performance were used, including (1) the number of seasons completed prior to pool depletion, (2) total number of fish caught, (3) total expenses, (4) total profit, (5) pool size in the final season, and (6) total number of fish replenished to the pool.

Post-experimental questionnaire. This questionnaire contained several sets of items. First, individuals were asked about their perceptions of the quality and inclusiveness of the group's discussion. Second, participants were asked about their motivations for catching fish and their attributions for the group's performance and the harvesting behavior of other group members in the second session. Third, all CMC group members were asked questions designed to assess their reactions to the NetMeeting™ communication system. Finally, members of the end-poll and two-poll

CMC groups were asked about their perceptions and opinions about the polling procedure used in the group discussion. Post-experimental questionnaires for each condition are presented in Appendixes B, C, D, and E.

A three-item satisfaction scale was included in the post-experimental questionnaire. The three items were: (1) "How satisfied are you with the group's performance in using the fishery resource pool in the second fishing session?", (2) "How satisfied are you with your own profit total in the second fishing session?", and (3) How satisfied are you with the profit differences among group members in the second fishing session?" This scale was accompanied by a seven-point Likert-type scale ranging from not satisfied to very satisfied. Scale reliability was assessed by calculating coefficient alpha (Cronbach, 1951). The reliability estimate was .74.

The Group Identification Scale (Hinkle, Taylor, Fox-Cardamone, & Crook, 1989) was used to assess group identity. This scale was created for use in a laboratory setting with ad hoc groups. It contains 10 items divided into three subscales: (1) emotional or affective aspects of group membership, (2) opposition between individual needs and group dynamics, and (3) cognitive aspects of group identity. Statements such as "I identify with this group", "I think this group worked well together", and "I feel strong ties to the group" are rated by participants on a nine-point scale ranging from strongly disagree to strongly agree.

Group Discussion Transcripts

The group discussion videotapes and the computer conferencing transcripts were coded by two raters for two variables: (1) strategy and (2) consensus. Strategy was

defined as the total number of fish the group planned to catch during the second FISH session. This variable was coded for all groups across all four conditions. For the two polling conditions, the number recorded for strategy was the total number of fish indicated in the group's response to the poll. FTF and no-poll CMC groups often devised a strategy during their discussions. When possible, the strategy variable was coded for these groups according to the total number of fish the group discussed catching in the second FISH session. When no strategy was obvious from the transcripts, the strategy variable was coded as missing data. Consensus was defined as whether or not the group reached consensus on their strategy. This was coded as a dichotomous variable, with 1 indicating complete consensus around a strategy and 0 indicating a lack of total consensus.

RESULTS

All analyses were conducted at the group level. Two of the FISH performance measures—end-pool size and number of seasons—were group-level variables, such that all members of a group had the same value for these variables. Intraclass correlations (ICCs) were computed to determine whether it was appropriate to aggregate the FISH profit and satisfaction measures to the group level. ICCs estimate the extent to which scores from members within a group are more similar than scores from members across different groups (Kashy & Kenny, 2000). Results indicated that it was appropriate to aggregate both the FISH profit data ($r = .71$, $p < .0002$) and the satisfaction data ($r = .22$, $p < .0002$) to the group level. Nested ANOVAs were then conducted to analyze the data from these dependent variables. Nested ANOVAs are used when participants are nested within groups and the group is important to the purpose of the study (Keppel, 1991). In nested designs, participants are nested within groups and groups are nested within conditions. Thus, participants' scores on the dependent variables are not independent; rather, the independence occurs at the group level.

Several times during data collection, a software error occurred in the FISH program, causing it to terminate prematurely and lose data. Due to these missing observations, the number of groups per condition varied from 13 to 19 across analyses on several dependent variables.

Manipulation Checks

An independent samples chi-square test was performed to determine if experimental condition had a significant effect on the consensus reached by participants

during the group discussion. In the total sample, 61% (*N*=40) of the 66 groups reached consensus[1]. More specifically, Table 1 indicates that end-poll CMC groups (*M* = .83) reached consensus most often, followed closely by FTF groups (*M* = .77) and two-poll CMC groups (*M* = .56), with no-poll CMC groups (*M* = .32) reaching consensus least often, $\chi^2(3, N = 66) = 12.18$, $p = .0068$. Thus, it appears that experimental condition did exert a significant effect on the likelihood of consensus being achieved by the conclusion of the group discussion period. It is notable that the introduction of a *single* poll produced a higher rate of consensus than either two polls or no poll. The rate of consensus for the end-poll CMC groups exceeded that of the FTF groups, although the primary source of the significant chi-square effect appears to be the contrast between the end-poll CMC groups and the no-poll CMC groups.

Session 1 FISH Performance Data

Group performance data collected by the FISH program in the first session (i.e., baseline) was analyzed via several one-way ANOVAs to ensure that there were no pre-existing differences across conditions on the FISH performance measures prior to the experimental manipulation (i.e., group discussion session). Results indicated that number of seasons in the first FISH session did not differ by assigned experimental condition at baseline, $F(3, 63) = .44$, $p = .72$ ($d = .17$, observed power = .18), which is to be expected as participants had not yet experienced the experimental manipulation. Moreover, end-pool size did not differ by condition at baseline, $F(3, 63) = .22$, $p = .88$ (*d*

[1] Consensus was dichotomized (1=complete consensus, 0=lack of consensus). One FTF group's videotape failed to record the audio; thus, for this analysis, *N*=66.

= .12, observed power = .10). Finally, a nested ANOVA revealed that total group-level profit did not differ by condition at baseline, $F(3, 63) = 1.21$, $p = .31$ ($d = .28$, observed power = .45). Table 2 presents the means and standard deviations for all FISH performance measures from Session 1. Thus, as expected, there is no evidence of pre-existing differences between experimental groups on the FISH dependent measures. These results rule out the possibility of a selection threat to the internal validity of this experiment (Cook & Campbell, 1979).

Table 1

Proportion of Groups Reaching Consensus by Condition

	Consensus		
Condition	No	Yes	Total
FTF	.23 (3)	.77 (10)	.20 (13)
CMC no-poll	.68 (13)	.32 (6)	.29 (19)
CMC end-poll	.17 (3)	.83 (15)	.27 (18)
CMC two-poll	.47 (7)	.56 (9)	.24 (16)
Total	.39 (26)	.61 (40)	

Note. The number of groups is given in parentheses.

Table 2

Means and Standard Deviations for FISH Session 1 Performance Measures by Condition

Condition	N	Mean	Standard Deviation
		Number of Seasons	
FTF	14	3.57	1.65
CMC no-poll	19	4.16	1.50
CMC end-poll	18	4.06	1.47
CMC two-poll	16	3.94	1.44
		End-Pool Size	
FTF	14	6.14	8.36
CMC no-poll	19	4.95	7.10
CMC end-poll	18	6.72	9.96
CMC two-poll	16	4.69	8.54
		Profit (in dollars)	
FTF	14	962.88	121.24
CMC no-poll	19	885.31	149.43
CMC end-poll	18	937.05	108.78
CMC two-poll	16	918.66	92.32

Tests of Hypotheses

Hypotheses 1a, 2a, 3a, 4a, and 5a. The dependent variables for these hypotheses were the resource pool sustainability and economic profit of groups across conditions. Resource pool sustainability was operationalized as the number of seasons and end-pool size variables, while economic profit was operationalized as the group's total profit earned in the second FISH session[2]. Specifically, it was expected that: 1) FTF groups would outperform no-poll CMC groups in economic profit and resource pool sustainability, 2) end-pool CMC groups would outperform no-poll CMC groups in economic profit and resource pool sustainability, 3) FTF groups would outperform end-poll CMC groups in economic profit and resource pool sustainability, 4) two-poll CMC groups would outperform both end-poll and no-poll CMC groups in economic profit and resource pool sustainability, and 5) two-poll CMC groups would have equal levels of performance compared to FTF groups on economic profit and resource pool sustainability.

A series of one-way ANOVAs was conducted to test these hypotheses. First, univariate ANOVAs were performed on the two resource pool sustainability dependent measures, end-pool size and number of seasons. These analyses found that experimental condition did not influence either end-pool size, $F(3, 62) = .72$, $p = .54$ ($d = 22$, observed power = .28), or number of seasons, $F(3, 61) = 1.05$, $p = .38$ ($d = .26$, observed power = .38). Second, a one-way nested ANOVA was conducted to examine differences in total

[2] El-Shinnawy et al. (2004) used factor analysis to determine that a two-factor model (economic profit, resource pool sustainability) provided the best fit for the FISH dependent variables.

group profit as a function of experimental condition. No significant effect for condition was obtained, $F(3, 62) = 1.48$, $p = .23$ ($d = .31$, observed power = .53). Means and standard deviations associated with these analyses are presented in Table 3.

Thus, Hypotheses 1a, 2a, 3a, and 4a were not supported. However, the absence of a significant difference between conditions on end-pool size, number of seasons, and group profit can be interpreted as consistent with Hypothesis 5a. Two-poll CMC groups' performance on these dependent measures was not significantly different from FTF groups.

Hypotheses 1b, 2b, 3b, 4b, and 5b. The dependent variable for these hypotheses was the three-item satisfaction scale that measured the groups' satisfaction with group performance and group profit in FISH Session 2. A pattern of results similar to that associated with the resource pool sustainability and economic profit hypotheses was predicted. It was hypothesized that: 1) FTF groups would be more satisfied than no-poll CMC groups, 2) end-pool CMC groups would be more satisfied than no-poll CMC groups, 3) FTF groups would be more satisfied than end-poll CMC groups, 4) two-poll CMC groups would be more satisfied than both end-poll and no-poll CMC groups, and 5) two-poll CMC groups would have levels of satisfaction equal to that of FTF groups.

Table 3

Means and Standard Deviations for FISH Session 2 Performance Measures by Condition

Condition	N	Mean	Standard Deviation
		Number of Seasons	
FTF	14	7.86	2.74
CMC no-poll	19	6.89	3.28
CMC end-poll	17	8.59	2.27
CMC two-poll	15	7.53	3.18
		End-Pool Size	
FTF	14	14.64	20.30
CMC no-poll	19	9.63	17.77
CMC end-poll	17	11.53	17.22
CMC two-poll	16	5.81	11.38
		Profit (in dollars)	
FTF	14	1388.73	394.81
CMC no-poll	19	1289.77	428.78
CMC end-poll	17	1557.17	645.83
CMC two-poll	16	1248.75	221.82

A one-way nested ANOVA was conducted to examine differences in group satisfaction as a function of experimental condition. A marginally significant effect for condition was obtained, $F(3, 60) = 2.19$, $p = .10$ ($d = .38$, observed power = .70). Means and standard deviations for satisfaction are presented in Table 4. It is important to note that the specific questions in the satisfaction scale vary, with one item concerning group performance, one concerning individual profit, and one concerning profit differences among group members. Because of the differences in item content and to more closely explore the marginally significant effect, individual nested ANOVAs were conducted on each of the three items in the scale.

Table 4

Means and Standard Deviations for Satisfaction Measure by Condition

Condition	N	Mean	Standard Deviation
FTF	14	88.93	15.69
CMC no-poll	18	77.72	16.99
CMC end-poll	17	85.06	15.31
CMC two-poll	15	80.93	10.91

A series of one-way nested ANOVAs was conducted. First, a significant experimental effect was found in the groups' responses to the first item in the scale, "How satisfied are you with the group's performance in using the fishery resource pool in the second fishing session?", $F(3, 60) = 2.93$, $p = .04$ ($d = .44$, observed power = .83). Means and standard deviations are presented in Table 5. Examination of the standard deviations across conditions suggests that the ANOVA may have violated the homogeneity of variance assumption. Consequently, Levine's test was conducted. A marginally significant effect was found, $F(3, 60) = 2.62$, $p = .06$ ($d = .42$, observed power = .79), indicating that this result should be interpreted with caution. A post-hoc Duncan test indicated that FTF groups were significantly more satisfied with group performance than no-poll CMC groups; however, all other between-group comparisons were not significantly different. Next, two nested ANOVAs were performed on the second and third items in the satisfaction scale (i.e., "How satisfied are you with your own profit total in the second fishing session?", and "How satisfied are you with the profit differences among group members in the second fishing session?"). These analyses found that experimental condition did not affect either satisfaction with individual profit, $F(3, 60) = .36$, $p = .78$ ($d = .15$, observed power = .14), or satisfaction with profit differences, $F(3, 60) = 1.80$, $p = .16$ ($d = .35$, observed power = .62). Table 5 lists means and standard deviations for these items.

The pattern of results revealed by the nested ANOVAs on the satisfaction scale items offers partial support for Hypothesis 1b: FTF groups were more satisfied with group performance than no-poll CMC groups. Furthermore, the lack of significant

differences for the individual profit and profit differences items, along with the nonsignificant effect for two-poll CMC and FTF groups on the group performance item, is consistent with Hypothesis 5b. Two-poll CMC groups and FTF groups did not differ with regard to their satisfaction with group profit, individual profit, or profit differences. Finally, Hypotheses 2b, 3b, and 4b were not supported.

Ancillary Analyses

Further analyses were conducted to investigate the lack of significant differences between experimental conditions on the FISH Session 2 performance measures. One issue of concern was the high variance observed within conditions on the total group profit measure. This unanticipated finding indicated that groups within the same experimental condition were performing at quite different levels in terms of total group profit on the FISH task. This pattern of variability on the dependent measure could be a sign that some variable, other than the experimental manipulation, was driving groups' performance in terms of economic profit.

Table 5

Means and Standard Deviations for Individual Satisfaction Items by Condition

Condition	N	Mean	Standard Deviation
Item 1: Group Performance			
FTF	14	30.79	5.47
CMC no-poll	18	24.83	8.06
CMC end-poll	17	29.29	5.49
CMC two-poll	15	27.13	4.31
Item 2: Individual Profit			
FTF	14	30.36	6.61
CMC no-poll	18	28.56	4.62
CMC end-poll	17	29.71	4.41
CMC two-poll	15	29.53	4.34
Item 3: Profit Differences			
FTF	14	29.14	5.39
CMC no-poll	18	25.22	6.58
CMC end-poll	17	27.29	5.87
CMC two-poll	15	25.00	6.58

One prime candidate for this "uncontrolled" variable was the specific group harvest strategy (for FISH Session 2) developed by each group during the discussion period. During the coding of the transcripts from the group discussions, it became apparent that groups differed substantially, both within and across conditions, in the group-level fishing strategies devised for the second FISH session. It was also clear from an informal content analysis of these transcripts that group harvest strategy is a critical aspect of the FISH task; if groups decide to implement a poor strategy (e.g., each participant catches 10 fish per season), detrimental effects will occur rapidly to the fishery stock.

The FISH program consists of 19 parameters that can be controlled by the experimenter (Gifford & Wells, 1991). Two of these parameters allow the experimenter to set the size of the fish pool and the replenishment rate. Gifford and Hine (1997) state that, "… perfect sustainability occurs when the exact amount of the resource is taken on each trial that allows the resource to fully regenerate itself between trials, but this far from perfectly describes the actions of individual harvesters" (p. 173). In the present study, the maximum size of the fishery stock was set to 100 fish and the replenishment rate was set at 1.5. As such, to maintain the fishery stock at its maximum of 100 fish, each group needed to harvest no more than 33 fish per season. Thus, with six-person groups, the optimal sustainable strategy in the present study was for each group member to catch 5 fish per season. However, the group discussion transcripts revealed that, while group members may have reached consensus on a group harvest strategy, and possibly cooperated in executing this group strategy, this consensus may have been

around a group strategy that resulted in rapid overharvesting of the fishery stock available to the group.

To test this idea, a series of one-way ANCOVAs with experimental condition as the independent variable and group harvest strategy[3] as the covariate was conducted on total group profit, end-pool size, and number of seasons from FISH Session 2. First, experimental condition did not affect total group profit after controlling for group harvest strategy, $F(3, 60) = 1.20$, $p = .32$. However, group harvest strategy did indeed have a significant independent effect on total group profit, $t(1) = -2.17$, $p = .03$ ($\beta = -8.01$). Thus, this significant ANCOVA result confirms our speculation that a significant portion of the variance in groups' performance (i.e., total group profit in FISH Session 2) within experimental conditions was being driven by heterogeneity in group harvest strategy. Second, after the statistical adjustment for group harvest strategy, experimental condition still did not influence number of seasons $F(3, 59) = .95$, $p = .42$. Further, results indicated that group harvest strategy did not have a direct effect on number of seasons $t(1) = -.52$, $p = .60$ ($\beta = -.01$). Finally, experimental condition also did not affect end-pool size $F(3, 60) = .76$, $p = .52$, even after controlling for group harvest strategy, nor did group strategy influence end-pool size directly $t(1) = .28$, $p = .78$ ($\beta = .04$).

[3] Strategy was defined as the total number of fish the group planned to catch during the second FISH session. Refer to Method for more information about this variable.

DISCUSSION AND SUMMARY

The results of this study did not find significant differences across experimental conditions on measures of economic profits and resource pool sustainability, thus Hypotheses 1a-4a were not supported. However, the lack of significant differences offers support for Hypothesis 5a. Specifically, two-poll CMC and FTF groups had equal levels of performance on economic profit and resource pool sustainability. In fact, these results indicated that groups in all experimental conditions performed similarly on measures of economic profit and resource pool sustainability. Indeed, one purpose of the present study was to examine CMC in the context of social dilemmas in order to discover ways to make CMC comparable to FTF communication in these situations. The results on economic profit and resource pool sustainability are encouraging in that they suggest that these two forms of communication may not be so distinct.

The results of the analyses on the satisfaction index were less clear. First, marginally significant differences were found across experimental conditions on the satisfaction scale; thus Hypotheses 1b-4b were not supported. The absence of clear, significant differences across experimental conditions on this measure is consistent with Hypothesis 5b, however. Two-poll CMC and FTF groups did have equal levels of satisfaction. Next, when the scale was decomposed into its individual items and analyses were performed comparing experimental condition and group responses to each item, the results indicated that FTF groups were more satisfied with group performance than no-poll CMC groups, thus supporting Hypothesis 1b. As such, the satisfaction analyses supported Hypothesis 1b and 5b.

The extant literature is equivocal regarding satisfaction levels across CMC and FTF groups. As noted previously, some research indicates that CMC groups are more satisfied than FTF groups (Scott, 1999). In contrast, other researchers have found that FTF groups are more satisfied than CMC groups (Hollingshead & McGrath, 1995; Straus & McGrath, 1994). The results of the present study were somewhat mixed, indicating that FTF groups were more satisfied with group performance in FISH than no-poll CMC groups. However, because I found only one significant difference out of several, it is possible that this result is due to chance. Additionally, two-poll CMC groups were as satisfied as FTF groups on the other two satisfaction questions included in the scale.

A secondary objective of the present study was to replicate results for FTF and no-poll CMC groups obtained in an earlier study by El-Shinnawy et al. (2004). El-Shinnawy et al. (2004) found that no-poll CMC groups earned lower economic profit and performed significantly worse on resource pool sustainability than FTF groups. In contrast, the results of the present study indicated no significant differences on these FISH performance measures for the same two experimental conditions tested in El-Shinnawy et al.'s (2004) study.

One possible explanation for this lack of replication across studies focuses on the group communication software. El-Shinnawy et al. (2004) used FACILITATE.COM™, which may be described as an "electronic white board." The structure of this web-based group support tool may have been unfamiliar to many of their participants, as it does not organize comments automatically, but rather allows users to structure their own

discussion by placing comments under content area headings. As such, the entire discussion is not viewable at once on the screen, which makes the format more rigid and cumbersome to use. The parallel entry of comments under specific headers in FACILITATE.COM™ creates a threaded discussion, which may have made the ability of group members to coordinate and reach consensus around a strategy difficult. In contrast, the present study used Microsoft NetMeeting™, a text-based chat program that is very similar to instant messaging programs. NetMeeting™ is a flexible, easy-to-use program that allows participants to engage in real-time, synchronous text discussion. The format of NetMeeting™ was likely more familiar to the participants in the present study, who were 18-24 year old college students—a cohort more likely to be comfortable with instant messaging and chat rooms. This obvious difference in the communication software across the two studies may be responsible, at least in part, for the disparity in the FISH performance results. Participants in the present study had to spend less time learning to use and becoming comfortable with NetMeeting™ than the web-based group conferencing software used in El-Shinnawy et al's (2004) study. The ease with which participants in the present study were able to communicate may have allowed CMC groups to have group discussions more comparable in quality to the FTF groups' discussions. Thus, the present results suggest that there is an important human-computer interface issue in groupware design that needs to be addressed in future research to better understand these group performance differences on complex mixed-motive tasks.

A second possible explanation for lack of replication of El Shinnawy et al. (2004) regards floor and ceiling effects. For example, it is possible that the no-poll CMC groups in the present study performed better overall compared to the CMC groups in the original El Shinnawy et al. (2004) study, thus indicating a ceiling effect. Alternatively, it is also a possibility that the FTF groups in the present study performed worse overall compared to the FTF groups in El Shinnawy et al. (2004), thus indicating a floor effect. To test for this possibility, independent samples t-tests were conducted on the three FISH performance measures (i.e., profit, end-pool size, number of seasons) between El Shinnawy et al.'s (2004) data and data from the present study. Regarding profit in FTF groups, results indicated that groups in the present study (M = 1388.79, SD = 394.81) had significantly higher profit levels than groups in El Shinnawy et al.'s (2004) sample (M = 1153.46, SD = 506.64), $t(13, 15) = 2.30$, $p < .05$. Before conducting the t-test for profit in CMC groups, Hartley's F_{max} test was conducted to test for homogeneity of variance. Results indicated that variances across samples were significantly different, $F_{max} = 23.23$, $p < .01$. In accordance with Keppel's (1991) suggestion, a more stringent significance level (i.e., $p < .02$) was adopted in this analysis. Results of an independent samples t-test examining differences in profit in no-poll CMC groups across the two studies indicated that the present study's groups (M = 1289.77, SD = 428.78) had significantly higher profit levels than groups in El Shinnawy et al.'s (2004) sample (M = 841.74, SD = 71.24), $t(18, 14) = 3.88$, $p < .02$. The results of these analyses indicate that a ceiling effect was present, as no-poll CMC groups in the present study performed better overall than CMC groups in El Shinnawy et al.'s (2004) study. One reason for

this difference lies in the software utilized in the different studies. As discussed previously, the present study used NetMeeting™, which was easier to use than FACILITATE.COM™, which was used by El-Shinnawy et al. (2004).

Results of independent samples t-tests conducted to determine the presence of floor and ceiling effects in the number of seasons and end-pool size measures were not significant. Thus, number of seasons in FTF groups in the present study (M =7.86, SD =2.74) did not differ significantly from number of seasons in FTF groups in the El-Shinnawy (2004) study (M = 9.31, SD = 1.89), $t(13, 15) = -1.65$, $p > .05$. Nor did number of seasons in no-poll CMC groups in the present study (M = 6.89, SD = 3.28) differ significantly from number of seasons in CMC groups in the El-Shinnawy et al. (2004) study (M = 6.13, SD = 3.71), $t(18, 14) = .61$, $p > .05$. Additionally, end-pool size in FTF groups in the present study (M =14.64, SD =20.30) did not differ significantly from end-pool size in FTF groups in the El-Shinnawy (2004) study (M = 21.44, SD = 23.34), $t(13, 15) = -.82$, $p > .05$. Before conducting an independent samples t-test to test for differences across studies in end-pool size in CMC groups, Hartley's F_{max} test again was conducted to test for homogeneity of variance. Results indicated that variances in end-pool size in CMC groups were significantly different, $F_{max} = 3.32$, $p < .01$. Therefore, Keppel's (1991) suggestion to adopt a more stringent significance level (i.e., $p < .02$) was adopted in this analysis. However, end-pool size in no-poll CMC groups in the present study (M = 9.63, SD = 17.77) did not differ significantly from number of seasons in CMC groups in the El-Shinnawy et al. (2004) study (M = 5.07, SD = 9.75), $t(18, 14) = .87$, $p > .02$. Thus, floor and ceiling effects were not responsible for the

present study's lack of replication of El-Shinnawy et al.'s (2004) results on the number of seasons or end-pool size measures.

The chi-square test determined that condition had a significant effect on the frequency of consensus reached by participants. Indeed, end-poll CMC groups reached consensus more often than FTF groups, followed by two-poll CMC groups, with no-poll CMC groups reaching unanimous agreement least often. This finding is consistent with past literature that indicates that the use of a voting tool can increase consensus in CMC groups (Scott, 1999; Walther, 1996). Further, the finding that end-poll CMC groups reached consensus more frequently than two-poll CMC groups is consistent with Poole et al.'s (1991) assertion that voting tools can negatively affect conflict management when they are used to end a discussion. It was originally believed that the two-poll condition was necessary to give groups an opportunity to take a baseline poll and still be allowed time to discuss the poll results before the discussion period ended. However, examination of the CMC transcripts indicates that the first poll taken by the two-poll CMC groups might have been used to table the discussion; it was common for groups to decide quickly on a group harvest strategy before the first poll, then use the remaining discussion time for informal, off-task personal conversation, ending with an identical poll at the end of the 10-minute period. Thus, the two-poll condition might have failed to meet its intended purpose—to foster consensus among group members about the need for cooperative behavior in managing the fishery stocks.

One puzzle is why the effects of experimental condition on group consensus around a harvest strategy were not reflected in the FISH group performance measures. There

are two possible reasons why this pattern of results occurred. First, the experimental manipulation of communication mode might not have been a strong enough influence, relative to other factors that constrain or facilitate group performance in FISH. For example, the harvest strategy implemented by the group may have been a stronger predictor of performance than condition. The ANCOVA results confirmed this independent relationship between group harvest strategy and total group profit; group harvest strategy was significantly related to group profit while experimental condition was not. The polling procedure was designed to make it easier for group members to make commitments to cooperate to each other. However, even with perfect consensus, groups could have converged on and executed a poor group harvest strategy, thus decreasing group performance on FISH relative to groups who were unable to reach consensus.

Second, the poll might have been too restrictive or it might have asked the wrong question. The question asked during the polling procedure was: "How many fish do you intend to catch per season in the next fishing session?" The purpose of this study was to examine the impact of various polling protocols on commitment making in CMC groups confronted with a resource dilemma. However, the question asked during the poll does not *directly* inquire about participants' intentions to make a commitment to cooperate with fellow group members. Indeed, the results might have differed if participants were instructed to spend the discussion period devising a strategy for the second FISH session and if the polling question asked, "Will you cooperate with fellow group members on the chosen strategy?"

Limitations

There were several limitations in the present study. First, the small sample size did not allow for sufficient power to detect differences between conditions. Observed power for the analyses using nested designs was greater than it was for the analyses that did not use nested designs. The highest value found for observed power (.70) was associated with the nested ANOVA testing experimental condition and the satisfaction scale. Even this value is below the recommended .80 benchmark (Cohen, 1969). While a larger sample might have increased power to a level sufficient to detect differences across experimental conditions, the issue of low power due to small sample sizes is endemic to small group research. Second, small effect sizes (d = .12-.38) were obtained in most of the statistical analyses. Detecting such small effects is difficult, if not impossible, with the relatively low level of statistical power in this study. Third, as indicated in Table 3, there was high variance within conditions on the group profit measure, indicating the presence of significant group-to-group variability in performance. High variance within experimental conditions creates a substantial "noise" factor, making it difficult to detect a small effect size even if one was present. This uncontrolled source of variability could be related to the effect that group harvest strategy had on FISH group performance. Further, it may explain, at least partially, the lack of support for Hypotheses 1a-4a. Finally, the instructions given to participants to maximize profit may have added noise to the results. Participants were instructed to maximize profit only; however, analyses were conducted on the number of seasons groups were able to sustain the pool and the end-pool size in addition to profit. The strategies that participants could implement to

reach these goals might be different than the strategies used to maximize profit. If participants were instructed to be mindful of these other FISH performance measures, the results may have been affected.

Although there were several limitations to the present study, the finding that CMC and FTF groups did not differ significantly across profit and resource pool sustainability has important implications. The results of the present study indicate that consensus might not be as important as group strategy. The FISH task used in this study fits generally into McGrath's (1984) circumplex model in the mixed-motive task sector of the "negotiate" quadrant. As such, the task involves resolving conflicts of interest among group members. The conflict in the FISH task revolves around the way in which the group members should use the common-pool resource. Resolution of this conflict arises when group members settle on a strategy to implement in the second FISH session. Successful performance in the FISH task does not automatically occur when group members reach consensus around a strategy. Indeed, group members must devise a strategy that will maintain the fishery stocks successfully. Thus, the impact of group harvest strategy might outweigh the impact of consensus on this particular group task.

Future Research

Future research should focus on the communication software used by CMC groups. Specifically, "user-friendly" programs, such as NetMeeting™, should be compared directly to more structured programs, such as FACILITATE.COM. Such experimental comparisons could resolve definitely whether the lack of significant experimental effects

on group performance in the present study was actually caused by the group communication program.

A second issue for future research is the impact of group strategy on performance on the FISH task. Participants in the present study devised a number of different strategies during the group discussion period. Some groups decided that each member should catch a certain number of fish per season, while others chose to catch a certain percentage of the fish pool, and still others used an "each participant for him/herself" strategy. The effect of group strategy on performance could be tested through the use of a computer simulation study. The FISH program could be run using various strategies in a Monte-Carlo fashion. The FISH performance measures taken at the end of the fishing session would indicate which strategy was optimal.

In conclusion, the present study integrates two distinct areas of small group research dealing with social dilemmas and computer-mediated communication (CMC). Heavy reliance on the Internet and e-mail communication in our society at large and organizations of all types makes the study of CMC timely and of considerable practical value. Further, as social dilemmas continue to cross international boundaries (e.g., disputes over fishing rights in international waters), CMC tools may have a place in the effective management of such resource conflicts, as they allow communication to occur remotely in "real-time" across time and space. This study's results suggest the possibility that CMC, at least under some circumstances, may substitute for FTF discussion, particularly when such opportunities for direct personal contact are infeasible or cost prohibitive.

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APPENDIX A

PRE-EXPERIMENTAL QUESTIONNAIRE

Date:_____

Please fill in the information requested below. Your responses to these questions will be kept confidential at all times and will not in any way affect your grade for this course.

ID Number:_____ Name:_____

Age:_____ Sex:_____ Instructor:_____

1. What is your major?_____

2. Are you participating in this experiment for credit as part of the class?_____
   If yes, which class?_____

3. Have you participated in a decision-making experiment before? ___ Yes ___ No
   If you answered yes: When? _____

   Where?_____

4. Have you taken any classes or attended any workshops related to meeting in groups? _____ Yes _____ No

   If you answered *yes*, please insert the following information:

   a. Name of Class/Workshop: _____
      Where you attended the class: _____
      When you attended the class: _____

   b. Name of Class/Workshop: _____
      Where you attended the class: _____
      When you attended the class: _____

5. Please estimate the total number of group projects you have participated in during your university career (1, 2, 3, 4, etc.):_____

6. What is your cumulative grade point average? _____

7. What is your level of experience in working in groups in general (circle one)?

1	2	3	4	5
Very Low	*Low*	*Medium*	*High*	*Very High*

8. What is your level of experience in making actual decisions in a group (circle one)?

1	2	3	4	5
Very Low	*Low*	*Medium*	*High*	*Very High*

9. If you have participated in group work before (a task force, group project, committee, etc.), *in general*, how satisfied were you with the group experience (circle one)?

1	2	3	4	5
Very Dissatisfied	*Dissatisfied*	*Neutral*	*Satisfied*	*Very Satisfied*

10. *In general*, when a decision has to be made, individuals make better quality decisions than groups (circle one).

1	2	3	4	5
Strongly Agree	*Agree*	*Neutral*	*Disagree*	*Strongly Disagree*

11. What is the total amount of time *in months* that you have been employed full-time? (excluding part-time work)? _____ Hours

12. Approximately how many hours of a typical week do you *currently* spend in meetings (where a "meeting" refers to two or more people working together for a business, school, or other organizational purpose)? _____ Hours

13. How well do you type (circle one)?

    a. Hunt and peck
    b. Rough or casual typing
    c. Good typing (30 wpm error free)
    d. Excellent typing (50 wpm error free or better)

14. How comfortable do you feel working with computer terminals or computer technology in general?

1	2	3	4	5
Very Comfortable	*Comfortable*	*Neutral*	*Uncomfortable*	*Very Uncomfortable*

15. Have you ever used a computer-based decision support system before?
_____ Yes _____ No

If you answered *yes*, please insert the following information:
Name of the system: _____
Where you used the system: _____
When you used the system: _____

16. How comfortable do you feel using Windows computer software?

1	2	3	4	5
Very Comfortable	*Comfortable*	*Neutral*	*Uncomfortable*	*Very Uncomfortable*

17. How often do you use the following types of communication tools? Indicate the number of times per week (0 - 7) that you use or access each.

_____ Electronic Mail
_____ UseNet Discussion Groups
_____ MUDs or Multi-User Dimensions; other Internet multi-user games
_____ World Wide Web
_____ IRC Chat

18. Have you ever been a member of a committee that makes decisions about resource allocation in schools? _____ Yes _____ No

If you answered *yes*, please insert the following information:
Name of the Committee: _____
Name of the Committee's parent organization: _____
When did you serve on the Committee?: _____

Directions: Here are a number of characteristics that may or may not describe you. For example, do you agree that you are someone who is talkative? Please write in the number which best indicates the extent to which you agree or disagree with each statement listed below. Use the following scale:

1----------2----------3----------4----------5
| | |
Strongly Disagree Neutral Strongly Agree

I see myself as someone who…

1. _____ Is talkative.
2. _____ Tends to find fault with others.
3. _____ Does a thorough job.
4. _____ Is depressed, blue.
5. _____ Is original, comes up with new ideas.
6. _____ Is reserved.
7. _____ Is helpful and unselfish with others.
8. _____ Can be somewhat careless.
9. _____ Is relaxed, handles stress well.
10. _____ Is curious about many different things.
11. _____ Is full of energy.
12. _____ Starts quarrels with others.
13. _____ Is a reliable worker.
14. _____ Can be tense.
15. _____ Is ingenious, a deep thinker.
16. _____ Generates a lot of enthusiasm.
17. _____ Has a forgiving nature.
18. _____ Tends to be disorganized.
19. _____ Worries a lot.
20. _____ Has an active imagination.
21. _____ Tends to be quiet.
22. _____ Is generally trusting.
23. _____ Tends to be lazy.
24. _____ Is emotionally stable, not easily upset.
25. _____ I inventive.
26. _____ Has an assertive personality.
27. _____ Can be cold and aloof.
28. _____ Perseveres until the task is finished.
29. _____ Can be moody.
30. _____ Values artistic, aesthetic experiences.
31. _____ Is sometimes shy, inhibited.
32. _____ Is considerate and kind to almost everyone.
33. _____ Does things efficiently.
34. _____ Remains calm in tense situations.
35. _____ Prefers work that is routine.
36. _____ Is outgoing, sociable.
37. _____ Is sometimes rude to others.
38. _____ Makes plans and follows through with them.
39. _____ Gets nervous easily.
40. _____ Likes to reflect, play with ideas.
41. _____ Has few artistic interests.
42. _____ Likes to cooperate with others.
43. _____ Is easily distracted.
44. _____ Is sophisticated in art, music, or literature.

APPENDIX B

POST-EXPERIMENTAL QUESTIONNAIRE: FTF CONDITION

FISH User ID: _____

Date: _____

The following questions ask you about the session you have just completed.

Please circle the number (from 1 to 7) that best represents your position along the scale for each question. All questions about the fishing session refer to the SECOND fishing session, the one held after your discussion.

1. Do you think the group harvested too many, too few, or about the right number of fish from the resource pool during the second fishing session?

   Too few 1-----2-----3-----4-----5-----6-----7 Too many

2. How satisfied are you with the group's performance in using the fishery resource pool in the second fishing session?

   Not at all satisfied 1-----2-----3-----4-----5-----6-----7 Very satisfied

3. How satisfied are you with your own profit total in the second fishing session?

   Not at all satisfied 1-----2-----3-----4-----5-----6-----7 Very satisfied

4. How satisfied are you with the profit differences among group members in the second fishing session?

   Not at all satisfied 1-----2-----3-----4-----5-----6-----7 Very satisfied

5. How fair do you find the profit differences among group members in the second fishing session?

   Not at all fair 1-----2-----3-----4-----5-----6-----7 Very fair

6. How typical was your group's behavior compared to other groups that might use FISH?

   Not at all typical 1-----2-----3-----4-----5-----6-----7 Very typical

7. To what extent did you understand the replenishment process (i.e., spawning) in FISH?

   Not at all 1-----2-----3-----4-----5-----6-----7 Very much

8. To what extent could you predict the spawning rate (replenishment of fish stocks) following each of the seasons in the second fishing session?

   Not at all predictable 1-----2-----3-----4-----5-----6-----7 Very predictable

9. To what extent did you feel uncertain about the spawning rate (replenishment of fish stocks) following each of the seasons in the second fishing session?

   Not at all uncertain 1-----2-----3-----4-----5-----6-----7 Very uncertain

10. To what extent did you think of your own interests when making your fish harvest decisions in the second fishing session?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

11. To what extent did you feel other group members knew which boat was yours during the second fishing session?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

12. To what extent did you think of the entire group's interests when making your fish harvest decisions in the second fishing session?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

13. To what extent did you feel people knew what boat was yours during the discussion period between fishing sessions?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

14. How helpful was the discussion period in improving the use of the fishery stock?

    Not at all helpful 1-----2-----3-----4------5------6-----7 Very helpful

15. To what extent do you think that the group's use of the fishery stock was caused by the fish harvests of the other group members?

    Not at all due to others' harvests 1-----2-----3-----4-----5-----6-----7Very much due to others' harvests

16. To what extent do you think that the group's use of the fishery stock was caused by the uncertainty regarding the spawning rate after each season?

    Not at all due to rate uncertainty 1-----2-----3-----4-----5-----6-----7 Very much due to rate uncertainty

17. To what extent do you think that the group's use of the fishery stock was influenced by your behavior?

    Not at all due to my behavior 1-----2-----3-----4-----5-----6-----7 Very much due to my behavior

18. To what extent were you concerned for the group's well-being when making your fish harvest decisions during the second fishing session?

    Not at all concerned with group 1-----2-----3-----4-----5-----6-----7 Very much concerned with group

19. To what extent did you think it was important to sustain the fishery stock for as long as possible during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

20. To what extent was it important to harvest as many fish as possible for yourself during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

21. To what extent was it important to you to harvest more fish than other members harvested during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

22. To what extent did you feel responsible for the welfare (individual profit level) of the other members of your group during the second fishing session?

    Not at all responsible 1-----2-----3-----4-----5-----6-----7 Very responsible

23. What is your perception of the extent to which **other members** were concerned for the group's well-being when making their fish harvest decisions during the second fishing session?

    Not at all concerned with group 1-----2-----3-----4-----5-----6-----7 Very much concerned with group

24. What is your perception of the extent to which **other members** thought it was important to sustain the fishery stock for as long as possible during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

25. What is your perception of the extent to which **other members** thought it was important to harvest as many fish as possible for themselves during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

26. What is your perception of the extent to which **other members** thought it was important to harvest more fish than you harvested during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

27. What is your perception of the extent to which **other members** thought it was important to take the welfare of the group into consideration when deciding how many fish to harvest during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

28. What is your perception of the extent to which **other members** felt responsible for the welfare (individual profit level) of the other members of the group during the second fishing session?

    Not at all responsible 1-----2-----3-----4-----5-----6-----7 Very responsible

29. When making your fishing decisions during the first fishing session, to what extent did you believe that you would be interacting with the other group members following the session?

    Not at all likely to interact 1-----2-----3-----4-----5-----6-----7 Very likely to interact

30. To what extent do you want to have further contact with the members of your group following the second fishing session?

    No desire for future contact 1-----2-----3-----4-----5-----6-----7 Very much desire future contact

31. How much did you enjoy playing FISH?

    Did not enjoy at all 1-----2-----3-----4-----5-----6-----7 Enjoyed very much

32. How involving was FISH?

    Not at all involving 1-----2-----3-----4-----5-----6-----7 Very involving

33. To what extent did you understand the group's task in FISH?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

34. To what extent did FISH put you in a situation similar to the dilemmas faced by actual fishing boats?

    Not at all similar 1-----2-----3-----4-----5-----6-----7 Very similar

We are interested in your opinions about the group discussion. For each of the following statements, please indicate your opinion by circling the appropriate number.

1. The overall quality of our discussion was:

   Poor 1-----2-----3-----4-----5-----6-----7-----8-----9 Good

2. The discussion, on the whole, was:

   Ineffective 1-----2-----3-----4-----5-----6-----7-----8-----9 Effective

3. The outcome of the discussion was:

   Unsatisfactory 1-----2-----3-----4-----5-----6-----7-----8-----9 Satisfactory

4. The discussion was:

   Incompetently executed 1-----2-----3-----4------5------6-----7-----8-----9 Competently executed

5. The issues explored in the discussion were:

   Trivial 1-----2-----3-----4-----5-----6-----7-----8-----9 Substantial

6. The manner in which the participants examined issues was:

   Not constructive 1-----2-----3-----4-----5-----6-----7-----8-----9 Constructive

7. The participants initiated discussions on:

   Irrelevant issues 1-----2-----3-----4-----5-----6-----7-----8-----9 Relevant issues

8. Participation in discussion was:

   Unevenly distributed 1-----2-----3-----4-----5-----6-----7-----8-----9 Evenly distributed

9. I felt frustrated and tense about others' behavior during the discussion.

   1----------2----------3----------4----------5----------6
   Strongly Disagree Somewhat Somewhat Agree Strongly
   Disagree Disagree Agree Agree

10. One or two members strongly influenced the outcome of the discussion.

    1----------2----------3----------4----------5----------6
    Strongly Disagree Somewhat Somewhat Agree Strongly
    Disagree Disagree Agree Agree

11. My opinions or suggestions were rejected by other group members.

    1----------2----------3----------4----------5----------6
    Strongly Disagree Somewhat Somewhat Agree Strongly
    Disagree Disagree Agree Agree

12. The group's discussion process was efficient.

    1----------2----------3----------4----------5----------6
    Strongly Disagree Somewhat Somewhat Agree Strongly
    Disagree Disagree Agree Agree

13. The group's discussion was fair.

    1----------2----------3----------4----------5----------6
    Strongly Disagree Somewhat Somewhat Agree Strongly
    Disagree Disagree Agree Agree

14. My group weighed all the potential effects of all possible options or solutions carefully during its discussion.

    1----------2----------3----------4----------5----------6
    Strongly Disagree Somewhat Somewhat Agree Strongly
    Disagree Disagree Agree Agree

15. My group carefully considered possible negative consequences of options or solutions during its discussion.

    1----------2----------3----------4----------5----------6
    Strongly Disagree Somewhat Somewhat Agree Strongly
    Disagree Disagree Agree Agree

16. During the discussion, this group thoroughly diagnosed the problems it faced.

    1----------2----------3----------4----------5----------6
    Strongly Disagree Somewhat Somewhat Agree Strongly
    Disagree Disagree Agree Agree

17. In my group's discussion, key issues were neglected or not fully considered.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

18. My group carefully considered questions and issues even whey they ran counter to the general consensus.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

19. When new, relevant information came up during the discussion, we considered it carefully.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

20. The group experimented with alternative answers during the discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

21. This group was highly imaginative during the discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

22. This group encouraged the participation of members.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

23. My group invited input from all members.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

24. The group seriously considered the ideas and opinions of members who did not agree with the majority.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

25. My group encouraged members to speak up and express their ideas and opinions during the discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree | Disagree | Somewhat Disagree | Somewhat Agree | Agree | Strongly Agree

26. This group was efficient during its discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree | Disagree | Somewhat Disagree | Somewhat Agree | Agree | Strongly Agree

27. The group discussion was a slow and cumbersome process.

1----------2----------3----------4----------5----------6
Strongly Disagree | Disagree | Somewhat Disagree | Somewhat Agree | Agree | Strongly Agree

28. I identify with this group.

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

29. I am glad to belong to this group.

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

30. I feel held back by this group

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

31. I think this group worked well together.

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

32. I do not fit in well with the other members of this group.

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

33. I do not consider the group to be important.

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

34. I see myself as an important part of this group.

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

35. I feel uneasy with the members of this group.

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

36. I feel strong ties to this group.

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

APPENDIX C

POST-EXPERIMENTAL QUESTIONNAIRE: CMC CONDITION

FISH User ID: _____

Date: _____

The following questions ask you about the session you have just completed.

Please circle the number (from 1 to 7) that best represents your position along the scale for each question. All questions about the fishing session refer to the SECOND fishing session, the one held after your discussion.

1. Do you think the group harvested too many, too few, or about the right number of fish from the resource pool during the second fishing session?

   Too few 1-----2-----3-----4-----5-----6-----7 Too many

2. How satisfied are you with the group's performance in using the fishery resource pool in the second fishing session?

   Not at all satisfied 1-----2-----3-----4-----5-----6-----7 Very satisfied

3. How satisfied are you with your own profit total in the second fishing session?

   Not at all satisfied 1-----2-----3-----4-----5-----6-----7 Very satisfied

4. How satisfied are you with the profit differences among group members in the second fishing session?

   Not at all satisfied 1-----2-----3-----4-----5-----6-----7 Very satisfied

5. How fair do you find the profit differences among group members in the second fishing session?

   Not at all fair 1-----2-----3-----4-----5-----6-----7 Very fair

6. How typical was your group's behavior compared to other groups that might use FISH?

   Not at all typical 1-----2-----3-----4-----5-----6-----7 Very typical

7. To what extent did you understand the replenishment process (i.e., spawning) in FISH?

   Not at all 1-----2-----3-----4-----5-----6-----7 Very much

8. To what extent could you predict the spawning rate (replenishment of fish stocks) following each of the seasons in the second fishing session?

   Not at all predictable 1-----2-----3-----4-----5-----6-----7 Very predictable

9. To what extent did you feel uncertain about the spawning rate (replenishment of fish stocks) following each of the seasons in the second fishing session?

   Not at all uncertain 1-----2-----3-----4-----5-----6-----7 Very uncertain

10. To what extent did you think of your own interests when making your fish harvest decisions in the second fishing session?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

11. To what extent did you feel other group members knew which boat was yours during the second fishing session?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

12. To what extent did you think of the entire group's interests when making your fish harvest decisions in the second fishing session?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

13. To what extent did you feel people knew what boat was yours during the discussion period between fishing sessions?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

14. How helpful was the discussion period in improving the use of the fishery stock?

    Not at all helpful 1-----2-----3-----4------5------6-----7 Very helpful

15. To what extent do you think that the group's use of the fishery stock was caused by the fish harvests of the other group members?

    Not at all due to others' harvests 1-----2-----3-----4-----5-----6-----7 Very much due to others' harvests

16. To what extent do you think that the group's use of the fishery stock was caused by the uncertainty regarding the spawning rate after each season?

    Not at all due to rate uncertainty 1-----2-----3-----4-----5-----6-----7 Very much due to rate uncertainty

17. To what extent do you think that the group's use of the fishery stock was influenced by your behavior?

    Not at all due to my behavior 1-----2-----3-----4-----5-----6-----7 Very much due to my behavior

18. To what extent were you concerned for the group's well-being when making your fish harvest decisions during the second fishing session?

    Not at all concerned with group 1-----2-----3-----4-----5-----6-----7 Very much concerned with group

19. To what extent did you think it was important to sustain the fishery stock for as long as possible during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

20. To what extent was it important to harvest as many fish as possible for yourself during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

21. To what extent was it important to you to harvest more fish than other members harvested during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

22. To what extent did you feel responsible for the welfare (individual profit level) of the other members of your group during the second fishing session?

    Not at all responsible 1-----2-----3-----4-----5-----6-----7 Very responsible

23. What is your perception of the extent to which **other members** were concerned for the group's well-being when making their fish harvest decisions during the second fishing session?

    Not at all concerned with group 1-----2-----3-----4-----5-----6-----7 Very much concerned with group

24. What is your perception of the extent to which **other members** thought it was important to sustain the fishery stock for as long as possible during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

25. What is your perception of the extent to which **other members** thought it was important to harvest as many fish as possible for themselves during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

26. What is your perception of the extent to which **other members** thought it was important to harvest more fish than you harvested during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

27. What is your perception of the extent to which **other members** thought it was important to take the welfare of the group into consideration when deciding how many fish to harvest during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

28. What is your perception of the extent to which **other members** felt responsible for the welfare (individual profit level) of the other members of the group during the second fishing session?

    Not at all responsible 1-----2-----3-----4-----5-----6-----7 Very responsible

29. When making your fishing decisions during the first fishing session, to what extent did you believe that you would be interacting with the other group members following the session?

    Not at all likely to interact 1-----2-----3-----4-----5-----6-----7 Very likely to interact

30. To what extent do you want to have further contact with the members of your group following the second fishing session?

    No desire for future contact 1-----2-----3-----4-----5-----6-----7 Very much desire future contact

31. How much did you enjoy playing FISH?

    Did not enjoy at all 1-----2-----3-----4-----5-----6-----7 Enjoyed very much

32. How involving was FISH?

    Not at all involving 1-----2-----3-----4-----5-----6-----7 Very involving

33. To what extent did you understand the group's task in FISH?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

34. To what extent did FISH put you in a situation similar to the dilemmas faced by actual fishing boats?

    Not at all similar 1-----2-----3-----4-----5-----6-----7 Very similar

This part of the questionnaire asks you for information about how you worked with Net Meeting. Indicate your choice by circling the appropriate number.

1. Using Net Meeting was fun.

1	2	3	4	5	6
Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree

2. Net Meeting was comfortable for me to use.

1	2	3	4	5	6
Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree

3. I enjoyed using Net Meeting.

1	2	3	4	5	6
Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree

4. While using Net Meeting, I had to be at my best.

1	2	3	4	5	6
Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree

5. If a group can't meet face-to-face, then using Net Meeting is the next best thing..

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

6. Net Meeting allowed me to relate to other members of my group in a satisfactory way.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

7. On the whole, I felt very comfortable with Net Meeting and would be willing to use it again.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

8. Net Meeting helped me to understand other group members, even though we weren't face-to-face.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

9. Net Meeting allowed my group to do most of the things that we could have done in a face-to-face meeting.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

10. While using Net Meeting, I felt challenged to do my best work.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

11. The Net Meeting interface was confusing.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

12. It was easy to follow the group discussion in Net Meeting.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

13. I could communicate effectively with the group using Net Meeting.

1----------2----------3----------4----------5----------6
Strongly Disagree | Disagree | Somewhat Disagree | Somewhat Agree | Agree | Strongly Agree

We are interested in your opinions about the group discussion. For each of the following statements, please indicate your opinion by circling the appropriate number.

1. The overall quality of our discussion was:

   Poor 1-----2-----3-----4-----5-----6-----7-----8-----9 Good

2. The discussion, on the whole, was:

   Ineffective 1-----2-----3-----4-----5-----6-----7-----8-----9 Effective

3. The outcome of the discussion was:

   Unsatisfactory 1-----2-----3-----4-----5-----6-----7-----8-----9 Satisfactory

4. The discussion was:

   Incompetently executed 1-----2-----3-----4------5------6-----7-----8-----9 Competently executed

5. The issues explored in the discussion were:

   Trivial 1-----2-----3-----4-----5-----6-----7-----8-----9 Substantial

6. The manner in which the participants examined issues was:

   Not constructive 1-----2-----3-----4-----5-----6-----7-----8-----9 Constructive

7. The participants initiated discussions on:

   Irrelevant issues 1-----2-----3-----4-----5-----6-----7-----8-----9 Relevant issues

8. Participation in discussion was:

   Unevenly distributed 1-----2-----3-----4-----5-----6-----7-----8-----9 Evenly distributed

9. I felt frustrated and tense about others' behavior during the discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree | Disagree | Somewhat Disagree | Somewhat Agree | Agree | Strongly Agree

10. One or two members strongly influenced the outcome of the discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

11. My opinions or suggestions were rejected by other group members.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

12. The group's discussion process was efficient.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

13. The group's discussion was fair.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

14. My group weighed all the potential effects of all possible options or solutions carefully during its discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

15. My group carefully considered possible negative consequences of options or solutions during its discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

16. During the discussion, this group thoroughly diagnosed the problems it faced.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

17. In my group's discussion, key issues were neglected or not fully considered.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

18. My group carefully considered questions and issues even whey they ran counter to the general consensus.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

19. When new, relevant information came up during the discussion, we considered it carefully.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

20. The group experimented with alternative answers during the discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

21. This group was highly imaginative during the discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

22. This group encouraged the participation of members.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

23. My group invited input from all members.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

24. The group seriously considered the ideas and opinions of members who did not agree with the majority.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

25. My group encouraged members to speak up and express their ideas and opinions during the discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

26. This group was efficient during its discussion.

1	2	3	4	5	6
Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree

27. The group discussion was a slow and cumbersome process.

1	2	3	4	5	6
Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree

28. I identify with this group.

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

29. I am glad to belong to this group.

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

30. I feel held back by this group

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

31. I think this group worked well together.

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

32. I do not fit in well with the other members of this group.

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

33. I do not consider the group to be important.

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

34. I see myself as an important part of this group.

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

35. I feel uneasy with the members of this group.

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

36. I feel strong ties to this group.

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

APPENDIX D

POST-EXPERIMENTAL QUESTIONNAIRE: END-POLL CMC CONDITION

FISH User ID: _____

Date: _____

The following questions ask you about the session you have just completed.

Please circle the number (from 1 to 7) that best represents your position along the scale for each question. All questions about the fishing session refer to the SECOND fishing session, the one held after your discussion.

1. Do you think the group harvested too many, too few, or about the right number of fish from the resource pool during the second fishing session?

   Too few 1-----2-----3-----4-----5-----6-----7 Too many

2. How satisfied are you with the group's performance in using the fishery resource pool in the second fishing session?

   Not at all satisfied 1-----2-----3-----4-----5-----6-----7 Very satisfied

3. How satisfied are you with your own profit total in the second fishing session?

   Not at all satisfied 1-----2-----3-----4-----5-----6-----7 Very satisfied

4. How satisfied are you with the profit differences among group members in the second fishing session?

   Not at all satisfied 1-----2-----3-----4-----5-----6-----7 Very satisfied

5. How fair do you find the profit differences among group members in the second fishing session?

   Not at all fair 1-----2-----3-----4-----5-----6-----7 Very fair

6. How typical was your group's behavior compared to other groups that might use FISH?

   Not at all typical 1-----2-----3-----4-----5-----6-----7 Very typical

7. To what extent did you understand the replenishment process (i.e., spawning) in FISH?

   Not at all 1-----2-----3-----4-----5-----6-----7 Very much

8. To what extent could you predict the spawning rate (replenishment of fish stocks) following each of the seasons in the second fishing session?

   Not at all predictable 1-----2-----3-----4-----5-----6-----7 Very predictable

9. To what extent did you feel uncertain about the spawning rate (replenishment of fish stocks) following each of the seasons in the second fishing session?

   Not at all uncertain 1-----2-----3-----4-----5-----6-----7 Very uncertain

10. To what extent did you think of your own interests when making your fish harvest decisions in the second fishing session?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

11. To what extent did you feel other group members knew which boat was yours during the second fishing session?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

12. To what extent did you think of the entire group's interests when making your fish harvest decisions in the second fishing session?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

13. To what extent did you feel people knew what boat was yours during the discussion period between fishing sessions?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

14. How helpful was the discussion period in improving the use of the fishery stock?

    Not at all helpful 1-----2-----3-----4------5------6-----7 Very helpful

15. To what extent do you think that the group's use of the fishery stock was caused by the fish harvests of the other group members?

    Not at all due to others' harvests 1-----2-----3-----4-----5-----6-----7 Very much due to others' harvests

16. To what extent do you think that the group's use of the fishery stock was caused by the uncertainty regarding the spawning rate after each season?

    Not at all due to rate uncertainty 1-----2-----3-----4-----5-----6-----7 Very much due to rate uncertainty

17. To what extent do you think that the group's use of the fishery stock was influenced by your behavior?

    Not at all due to my behavior 1-----2-----3-----4-----5-----6-----7 Very much due to my behavior

18. To what extent were you concerned for the group's well-being when making your fish harvest decisions during the second fishing session?

    Not at all concerned with group 1-----2-----3-----4-----5-----6-----7 Very much concerned with group

19. To what extent did you think it was important to sustain the fishery stock for as long as possible during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

20. To what extent was it important to harvest as many fish as possible for yourself during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

21. To what extent was it important to you to harvest more fish than other members harvested during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

22. To what extent did you feel responsible for the welfare (individual profit level) of the other members of your group during the second fishing session?

    Not at all responsible 1-----2-----3-----4-----5-----6-----7 Very responsible

23. What is your perception of the extent to which **other members** were concerned for the group's well-being when making their fish harvest decisions during the second fishing session?

    Not at all concerned with group 1-----2-----3-----4-----5-----6-----7 Very much concerned with group

24. What is your perception of the extent to which **other members** thought it was important to sustain the fishery stock for as long as possible during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

25. What is your perception of the extent to which **other members** thought it was important to harvest as many fish as possible for themselves during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

26. What is your perception of the extent to which **other members** thought it was important to harvest more fish than you harvested during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

27. What is your perception of the extent to which **other members** thought it was important to take the welfare of the group into consideration when deciding how many fish to harvest during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

28. What is your perception of the extent to which **other members** felt responsible for the welfare (individual profit level) of the other members of the group during the second fishing session?

    Not at all responsible 1-----2-----3-----4-----5-----6-----7 Very responsible

29. When making your fishing decisions during the first fishing session, to what extent did you believe that you would be interacting with the other group members following the session?

    Not at all likely to interact 1-----2-----3-----4-----5-----6-----7 Very likely to interact

30. To what extent do you want to have further contact with the members of your group following the second fishing session?

    No desire for future contact 1-----2-----3-----4-----5-----6-----7 Very much desire future contact

31. How much did you enjoy playing FISH?

    Did not enjoy at all 1-----2-----3-----4-----5-----6-----7 Enjoyed very much

32. How involving was FISH?

    Not at all involving 1-----2-----3-----4-----5-----6-----7 Very involving

33. To what extent did you understand the group's task in FISH?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

34. To what extent did FISH put you in a situation similar to the dilemmas faced by actual fishing boats?

    Not at all similar 1-----2-----3-----4-----5-----6-----7 Very similar

35. How satisfied were you with the outcome of the group's poll?

    Not at all satisfied 1-----2-----3-----4-----5-----6-----7 Very satisfied

36. How satisfied were you with your fellow group members' responses in the poll?

    Not at all satisfied 1-----2-----3-----4-----5-----6-----7 Very satisfied

37. How fair was the outcome of the poll?

    Not at all fair 1-----2-----3-----4-----5-----6-----7 Very fair

38. How helpful was the poll in reaching consensus among group members on a harvest strategy?

    Not at all helpful 1-----2-----3-----4------5------6-----7 Very helpful

39. How helpful was the poll in improving the group's management of the fishery stock?

    Not at all helpful 1-----2-----3-----4------5------6-----7 Very helpful

40. To what extent did you think about the group's interests when stating your response to the poll?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

41. To what extent did you think about your own profit total when stating your response to the poll?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

42. What is your perception of the extent to which **other members** were concerned for the group's well-being when declaring their intended harvest decisions in the poll?

    Not at all concerned with group 1-----2-----3-----4-----5-----6-----7 Very much concerned with group

43. The poll provided a useful structure to the NetMeeting discussion.

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

44. The poll enabled me to understand the intended actions of other group members for the second FISH session.

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

45. Overall, I felt the poll was a positive aspect of the NetMeeting discussion.

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

46. To what extent did you believe that your group reached consensus on a harvest strategy for the second FISH session?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

47. How committed were you to the harvest strategy that you stated during the poll?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

48. To what extend did you think that the **other group members** were committed to their declared harvest strategies during the poll?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

This part of the questionnaire asks you for information about how you worked with Net Meeting. Indicate your choice by circling the appropriate number.

1. Using Net Meeting was fun.

   1----------2----------3----------4----------5----------6
   Strongly Disagree | Disagree | Somewhat Disagree | Somewhat Agree | Agree | Strongly Agree

2. Net Meeting was comfortable for me to use.

   1----------2----------3----------4----------5----------6
   Strongly Disagree | Disagree | Somewhat Disagree | Somewhat Agree | Agree | Strongly Agree

3. I enjoyed using Net Meeting.

   1----------2----------3----------4----------5----------6
   Strongly Disagree | Disagree | Somewhat Disagree | Somewhat Agree | Agree | Strongly Agree

4. While using Net Meeting, I had to be at my best.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

5. If a group can't meet face-to-face, then using Net Meeting is the next best thing..

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

6. Net Meeting allowed me to relate to other members of my group in a satisfactory way.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

7. On the whole, I felt very comfortable with Net Meeting and would be willing to use it again.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

8. Net Meeting helped me to understand other group members, even though we weren't face-to-face.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

9. Net Meeting allowed my group to do most of the things that we could have done in a face-to-face meeting.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

10. While using Net Meeting, I felt challenged to do my best work.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

11. The Net Meeting interface was confusing.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

12. It was easy to follow the group discussion in Net Meeting.

1	2	3	4	5	6
Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree

13. I could communicate effectively with the group using Net Meeting.

1	2	3	4	5	6
Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree

We are interested in your opinions about the group discussion. For each of the following statements, please indicate your opinion by circling the appropriate number.

1. The overall quality of our discussion was:

   Poor 1-----2-----3-----4-----5-----6-----7-----8-----9 Good

2. The discussion, on the whole, was:

   Ineffective 1-----2-----3-----4-----5-----6-----7-----8-----9 Effective

3. The outcome of the discussion was:

   Unsatisfactory 1-----2-----3-----4-----5-----6-----7-----8-----9 Satisfactory

4. The discussion was:

   Incompetently executed 1-----2-----3-----4------5------6-----7-----8-----9 Competently executed

5. The issues explored in the discussion were:

   Trivial 1-----2-----3-----4-----5-----6-----7-----8-----9 Substantial

6. The manner in which the participants examined issues was:

   Not constructive 1-----2-----3-----4-----5-----6-----7-----8-----9 Constructive

7. The participants initiated discussions on:

   Irrelevant issues 1-----2-----3-----4-----5-----6-----7-----8-----9 Relevant issues

8. Participation in discussion was:

   Unevenly distributed 1-----2-----3-----4-----5-----6-----7-----8-----9 Evenly distributed

9. I felt frustrated and tense about others' behavior during the discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

10. One or two members strongly influenced the outcome of the discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

11. My opinions or suggestions were rejected by other group members.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

12. The group's discussion process was efficient.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

13. The group's discussion was fair.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

14. My group weighed all the potential effects of all possible options or solutions carefully during its discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

15. My group carefully considered possible negative consequences of options or solutions during its discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

16. During the discussion, this group thoroughly diagnosed the problems it faced.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

17. In my group's discussion, key issues were neglected or not fully considered.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Agree Strongly Agree

18. My group carefully considered questions and issues even whey they ran counter to the general consensus.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Agree Strongly Agree

19. When new, relevant information came up during the discussion, we considered it carefully.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Agree Strongly Agree

20. The group experimented with alternative answers during the discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Agree Strongly Agree

21. This group was highly imaginative during the discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Agree Strongly Agree

22. This group encouraged the participation of members.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Agree Strongly Agree

23. My group invited input from all members.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Agree Strongly Agree

24. The group seriously considered the ideas and opinions of members who did not agree with the majority.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Agree Strongly Agree

25. My group encouraged members to speak up and express their ideas and opinions during the discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree | Disagree | Somewhat Disagree | Somewhat Agree | Agree | Strongly Agree

26. This group was efficient during its discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree | Disagree | Somewhat Disagree | Somewhat Agree | Agree | Strongly Agree

27. The group discussion was a slow and cumbersome process.

1----------2----------3----------4----------5----------6
Strongly Disagree | Disagree | Somewhat Disagree | Somewhat Agree | Agree | Strongly Agree

28. I identify with this group.

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

29. I am glad to belong to this group.

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

30. I feel held back by this group

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

31. I think this group worked well together.

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

32. I do not fit in well with the other members of this group.

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

33. I do not consider the group to be important.

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

34. I see myself as an important part of this group.

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

35. I feel uneasy with the members of this group.

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

36. I feel strong ties to this group.

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

APPENDIX E

POST-EXPERIMENTAL QUESTIONNAIRE: TWO-POLL CMC CONDITION

FISH User ID: _____

Date: _____

The following questions ask you about the session you have just completed.

Please circle the number (from 1 to 7) that best represents your position along the scale for each question. All questions about the fishing session refer to the SECOND fishing session, the one held after your discussion.

1. Do you think the group harvested too many, too few, or about the right number of fish from the resource pool during the second fishing session?

   Too few 1-----2-----3-----4-----5-----6-----7 Too many

2. How satisfied are you with the group's performance in using the fishery resource pool in the second fishing session?

   Not at all satisfied 1-----2-----3-----4-----5-----6-----7 Very satisfied

3. How satisfied are you with your own profit total in the second fishing session?

   Not at all satisfied 1-----2-----3-----4-----5-----6-----7 Very satisfied

4. How satisfied are you with the profit differences among group members in the second fishing session?

   Not at all satisfied 1-----2-----3-----4-----5-----6-----7 Very satisfied

5. How fair do you find the profit differences among group members in the second fishing session?

   Not at all fair 1-----2-----3-----4-----5-----6-----7 Very fair

6. How typical was your group's behavior compared to other groups that might use FISH?

   Not at all typical 1-----2-----3-----4-----5-----6-----7 Very typical

7. To what extent did you understand the replenishment process (i.e., spawning) in FISH?

   Not at all 1-----2-----3-----4-----5-----6-----7 Very much

8. To what extent could you predict the spawning rate (replenishment of fish stocks) following each of the seasons in the second fishing session?

   Not at all predictable 1-----2-----3-----4-----5-----6-----7 Very predictable

9. To what extent did you feel uncertain about the spawning rate (replenishment of fish stocks) following each of the seasons in the second fishing session?

   Not at all uncertain 1-----2-----3-----4-----5-----6-----7 Very uncertain

10. To what extent did you think of your own interests when making your fish harvest decisions in the second fishing session?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

11. To what extent did you feel other group members knew which boat was yours during the second fishing session?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

12. To what extent did you think of the entire group's interests when making your fish harvest decisions in the second fishing session?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

13. To what extent did you feel people knew what boat was yours during the discussion period between fishing sessions?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

14. How helpful was the discussion period in improving the use of the fishery stock?

    Not at all helpful 1-----2-----3-----4------5------6-----7 Very helpful

15. To what extent do you think that the group's use of the fishery stock was caused by the fish harvests of the other group members?

    Not at all due to others' harvests 1-----2-----3-----4-----5-----6-----7 Very much due to others' harvests

16. To what extent do you think that the group's use of the fishery stock was caused by the uncertainty regarding the spawning rate after each season?

    Not at all due to rate uncertainty 1-----2-----3-----4-----5-----6-----7 Very much due to rate uncertainty

17. To what extent do you think that the group's use of the fishery stock was influenced by your behavior?

    Not at all due to my behavior 1-----2-----3-----4-----5-----6-----7 Very much due to my behavior

18. To what extent were you concerned for the group's well-being when making your fish harvest decisions during the second fishing session?

    Not at all concerned with group 1-----2-----3-----4-----5-----6-----7 Very much concerned with group

19. To what extent did you think it was important to sustain the fishery stock for as long as possible during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

20. To what extent was it important to harvest as many fish as possible for yourself during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

21. To what extent was it important to you to harvest more fish than other members harvested during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

22. To what extent did you feel responsible for the welfare (individual profit level) of the other members of your group during the second fishing session?

    Not at all responsible 1-----2-----3-----4-----5-----6-----7 Very responsible

23. What is your perception of the extent to which **other members** were concerned for the group's well-being when making their fish harvest decisions during the second fishing session?

    Not at all concerned with group 1-----2-----3-----4-----5-----6-----7 Very much concerned with group

24. What is your perception of the extent to which **other members** thought it was important to sustain the fishery stock for as long as possible during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

25. What is your perception of the extent to which **other members** thought it was important to harvest as many fish as possible for themselves during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

26. What is your perception of the extent to which **other members** thought it was important to harvest more fish than you harvested during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

27. What is your perception of the extent to which **other members** thought it was important to take the welfare of the group into consideration when deciding how many fish to harvest during the second fishing session?

    Not at all important 1-----2-----3-----4-----5-----6-----7 Very important

28. What is your perception of the extent to which **other members** felt responsible for the welfare (individual profit level) of the other members of the group during the second fishing session?

    Not at all responsible 1-----2-----3-----4-----5-----6-----7 Very responsible

29. When making your fishing decisions during the first fishing session, to what extent did you believe that you would be interacting with the other group members following the session?

    Not at all likely to interact 1-----2-----3-----4-----5-----6-----7 Very likely to interact

30. To what extent do you want to have further contact with the members of your group following the second fishing session?

    No desire for future contact 1-----2-----3-----4-----5-----6-----7 Very much desire future contact

31. How much did you enjoy playing FISH?

    Did not enjoy at all 1-----2-----3-----4-----5-----6-----7 Enjoyed very much

32. How involving was FISH?

    Not at all involving 1-----2-----3-----4-----5-----6-----7 Very involving

33. To what extent did you understand the group's task in FISH?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

34. To what extent did FISH put you in a situation similar to the dilemmas faced by actual fishing boats?

    Not at all similar 1-----2-----3-----4-----5-----6-----7 Very similar

35. How satisfied were you with the outcome of the group's first poll?

    Not at all satisfied 1-----2-----3-----4-----5-----6-----7 Very satisfied

36. How satisfied were you with the outcome of the group's second poll?

    Not at all satisfied 1-----2-----3-----4-----5-----6-----7 Very satisfied

37. How satisfied were you with your fellow group members' responses in the polls?

    Not at all satisfied 1-----2-----3-----4-----5-----6-----7 Very satisfied

38. How fair were the outcomes of the polls?

    Not at all fair 1-----2-----3-----4-----5-----6-----7 Very fair

39. How helpful were the polls in reaching consensus among group members on a harvest strategy?

    Not at all helpful 1-----2-----3-----4------5------6-----7 Very helpful

40. How helpful were the polls in improving the group's management of the fishery stock?

    Not at all helpful 1-----2-----3-----4------5------6-----7 Very helpful

41. To what extent did you think about the group's interests when stating your responses to the polls?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

42. To what extent did you think about your own profit total when stating your responses to the polls?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

43. What is your perception of the extent to which **other members** were concerned for the group's well-being when declaring their intended harvest decisions in the polls?

    Not at all concerned with group 1-----2-----3-----4-----5-----6-----7 Very much concerned with group

44. The polls provided a useful structure to the NetMeeting discussion.

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

45. The polls enabled me to understand the intended actions of other group members for the second FISH session.

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

46. Overall, I felt the polls were a positive aspect of the NetMeeting discussion.

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

47. To what extent did you believe that your group reached consensus on a harvest strategy for the second FISH session?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

48. How committed were you to the harvest strategies that you stated during the polls?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

49. To what extend did you think that the **other group members** were committed to their declared harvest strategies during the polls?

    Not at all 1-----2-----3-----4-----5-----6-----7 Very much

This part of the questionnaire asks you for information about how you worked with Net Meeting. Indicate your choice by circling the appropriate number.

1. Using Net Meeting was fun.

   1----------2----------3----------4----------5----------6
   Strongly Disagree | Disagree | Somewhat Disagree | Somewhat Agree | Agree | Strongly Agree

2. Net Meeting was comfortable for me to use.

   1----------2----------3----------4----------5----------6
   Strongly Disagree | Disagree | Somewhat Disagree | Somewhat Agree | Agree | Strongly Agree

3. I enjoyed using Net Meeting.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

4. While using Net Meeting, I had to be at my best.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

5. If a group can't meet face-to-face, then using Net Meeting is the next best thing..

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

6. Net Meeting allowed me to relate to other members of my group in a satisfactory way.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

7. On the whole, I felt very comfortable with Net Meeting and would be willing to use it again.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

8. Net Meeting helped me to understand other group members, even though we weren't face-to-face.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

9. Net Meeting allowed my group to do most of the things that we could have done in a face-to-face meeting.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

10. While using Net Meeting, I felt challenged to do my best work.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Somewhat Agree Strongly
Disagree Disagree Agree Agree

11. The Net Meeting interface was confusing.

1----------2----------3----------4----------5----------6
Strongly Disagree | Disagree | Somewhat Disagree | Somewhat Agree | Agree | Strongly Agree

12. It was easy to follow the group discussion in Net Meeting.

1----------2----------3----------4----------5----------6
Strongly Disagree | Disagree | Somewhat Disagree | Somewhat Agree | Agree | Strongly Agree

13. I could communicate effectively with the group using Net Meeting.

1----------2----------3----------4----------5----------6
Strongly Disagree | Disagree | Somewhat Disagree | Somewhat Agree | Agree | Strongly Agree

We are interested in your opinions about the group discussion. For each of the following statements, please indicate your opinion by circling the appropriate number.

1. The overall quality of our discussion was:

   Poor 1-----2-----3-----4-----5-----6-----7-----8-----9 Good

2. The discussion, on the whole, was:

   Ineffective 1-----2-----3-----4-----5-----6-----7-----8-----9 Effective

3. The outcome of the discussion was:

   Unsatisfactory 1-----2-----3-----4-----5-----6-----7-----8-----9 Satisfactory

4. The discussion was:

   Incompetently executed 1-----2-----3-----4------5------6-----7-----8-----9 Competently executed

5. The issues explored in the discussion were:

   Trivial 1-----2-----3-----4-----5-----6-----7-----8-----9 Substantial

6. The manner in which the participants examined issues was:

   Not constructive 1-----2-----3-----4-----5-----6-----7-----8-----9 Constructive

7. The participants initiated discussions on:

   Irrelevant issues 1-----2-----3-----4-----5-----6-----7-----8-----9 Relevant issues

8. Participation in discussion was:

   Unevenly distributed 1-----2-----3-----4-----5-----6-----7-----8-----9 Evenly distributed

9. I felt frustrated and tense about others' behavior during the discussion.

   1----------2----------3----------4----------5----------6
   Strongly Disagree Somewhat Somewhat Agree Strongly
   Disagree Disagree Agree Agree

10. One or two members strongly influenced the outcome of the discussion.

    1----------2----------3----------4----------5----------6
    Strongly Disagree Somewhat Somewhat Agree Strongly
    Disagree Disagree Agree Agree

11. My opinions or suggestions were rejected by other group members.

    1----------2----------3----------4----------5----------6
    Strongly Disagree Somewhat Somewhat Agree Strongly
    Disagree Disagree Agree Agree

12. The group's discussion process was efficient.

    1----------2----------3----------4----------5----------6
    Strongly Disagree Somewhat Somewhat Agree Strongly
    Disagree Disagree Agree Agree

13. The group's discussion was fair.

    1----------2----------3----------4----------5----------6
    Strongly Disagree Somewhat Somewhat Agree Strongly
    Disagree Disagree Agree Agree

14. My group weighed all the potential effects of all possible options or solutions carefully during its discussion.

    1----------2----------3----------4----------5----------6
    Strongly Disagree Somewhat Somewhat Agree Strongly
    Disagree Disagree Agree Agree

15. My group carefully considered possible negative consequences of options or solutions during its discussion.

    1----------2----------3----------4----------5----------6
    Strongly Disagree Somewhat Somewhat Agree Strongly
    Disagree Disagree Agree Agree

16. During the discussion, this group thoroughly diagnosed the problems it faced.

    1----------2----------3----------4----------5----------6
    Strongly Disagree Somewhat Somewhat Agree Strongly
    Disagree Disagree Agree Agree

17. In my group's discussion, key issues were neglected or not fully considered.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Agree Strongly Agree

18. My group carefully considered questions and issues even whey they ran counter to the general consensus.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Agree Strongly Agree

19. When new, relevant information came up during the discussion, we considered it carefully.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Agree Strongly Agree

20. The group experimented with alternative answers during the discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Agree Strongly Agree

21. This group was highly imaginative during the discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Agree Strongly Agree

22. This group encouraged the participation of members.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Agree Strongly Agree

23. My group invited input from all members.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Agree Strongly Agree

24. The group seriously considered the ideas and opinions of members who did not agree with the majority.

1----------2----------3----------4----------5----------6
Strongly Disagree Somewhat Disagree Somewhat Agree Agree Strongly Agree

25. My group encouraged members to speak up and express their ideas and opinions during the discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree | Disagree | Somewhat Disagree | Somewhat Agree | Agree | Strongly Agree

26. This group was efficient during its discussion.

1----------2----------3----------4----------5----------6
Strongly Disagree | Disagree | Somewhat Disagree | Somewhat Agree | Agree | Strongly Agree

27. The group discussion was a slow and cumbersome process.

1----------2----------3----------4----------5----------6
Strongly Disagree | Disagree | Somewhat Disagree | Somewhat Agree | Agree | Strongly Agree

28. I identify with this group.

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

29. I am glad to belong to this group.

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

30. I feel held back by this group

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

31. I think this group worked well together.

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

32. I do not fit in well with the other members of this group.

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

33. I do not consider the group to be important.

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

34. I see myself as an important part of this group.

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

35. I feel uneasy with the members of this group.

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

36. I feel strong ties to this group.

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

VITA

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Conference Presentations

Bergman, M. E., Watrous, K. M., & Gaulke, K. M. (April 2004). *Bilingualism in the workplace.* In K. T. Schneider (Chair), Emerging workplace diversity issues: Ethnicity, bilingualism, and workplace exclusion. Paper presented at the annual conference of the Society of Industrial and Organizational Psychology, Chicago, IL.

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