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Initial identity level and cooperation in face-to-face and computer-mediated contexts

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Initial Identity Level and Cooperation in Face-to-Face and Computer-Mediated Contexts

by

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Dedication

I dedicate this work to my father and mother, James and Rose Lineberry, for being terrific parents and supporting me in my career. I also dedicate this to my wonderful wife Katy, who gives me strength and joy – both good things to have when working on a thesis!

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ABSTRACT

Organizations today are increasingly encouraging employees to engage in pro-social behaviors at work, though this effort may be hindered by the increasing reliance on computers to mediate workplace interpersonal interactions. While much research has been directed at computer-mediated teams performing highly interdependent tasks, there is a need to examine the effect of computer mediation on individual vs. collective identification and cooperation for employees in less overtly interdependent tasks. This study examined the role of group members' conscious and non-conscious identity level in the relationship between physical context and cooperation with a work group. 50 groups of 4 participants each worked in either a face-to-face or computer-mediated workspace to complete puzzles. The study hypotheses were tested using mediated hierarchical modeling. Unexpectedly, computer mediation was related to higher levels of cooperation and was unrelated to participants' identity level. An interaction between prior ability and cooperation was found, with more capable group members cooperating more, but only in the computer-mediated context. Implications for research and practice on the role of computer technology at work are discussed.

Chapter One

Introduction

Cooperation at work has been a major focus of research in the last two decades, referring to desirable employee behaviors such as sharing relevant information among colleagues or sacrificing time to help a co-worker with a heavy workload (e.g. Williams & Anderson, 1991; Motowidlo & Van Scotter, 1994; Brief & Motowidlo, 1986). Many organizations seek to encourage cooperation among employees, and supervisors consider it when making performance ratings (Werner, 1994; Borman, White, & Dorsey, 1995; Allen & Rush, 1998).

Organizations today are also taking advantage of dramatic advances in computer technology to connect physically dispersed employees. E-mail has replaced the phone or face-to-face interaction for many communications, workers are increasingly taking advantage of technology to do their work in remote locations, and organizations are using electronic knowledge management systems to promote information sharing among employees (Olson & Olson, 2003; WorldatWork, 2007; Majchrzak, Wagner, & Yates, 2006). However, reconciling the effort to encourage cooperation with the increasing reliance on computer-mediated communication has not been easy (Olson & Olson, 2000). While considerable research has been devoted to how computer mediation affects cohesion and performance in highly interdependent teams (for a review, see Driskell,

Radtke, & Salas, 2003), studies are needed that examine these relationships on work tasks where independence or cooperation are at the discretion of the group member.

The present study was designed to examine the interplay between physical context, group members' identification with the group, and their cooperation in a laboratory setting. Groups of four participants were randomly assigned to work at either a round table or at individual computer workstations with collaboration software. All participants trained on the experimental task, which involved solving crossword puzzles. They completed implicit and explicit measures of their state identity level after having spent time in their assigned context, to assess whether individual or collective concepts were more accessible in memory. The number of answers they gave to other group members during the experimental task was used to measure cooperation. Using a hierarchical modeling approach, I tested the hypothesis that identity level mediates the relationship between context and cooperation (see Figure 1, Appendix A).

By studying cooperation in this way, it is possible to examine the effect of physical context on people's identification with a group at its earliest stage, in a situation that does not strongly demand cooperation. Research has already established that group members often consider computer-mediated communications confusing and dissatisfying after the fact (e.g., Thompson & Coovert, 2003). My research question is instead, what effect does the physical context have on whether people consider themselves part of a group and intend to cooperate in the first place, given the choice to do so? The answer to that question can lead us to new ways of addressing potential adverse effects of computer mediation on cooperation. Rather than focusing only on increasing the bandwidth of

communications, it may prove fruitful to find ways to improve awareness of group membership in computer-mediated contexts.

Group Perception

A brief clarification of what groups this study pertains to is in order, as groups can vary greatly in terms of how they are perceived, what purposes they serve, and how they function. This study is aimed broadly at groups at work, including formally established teams as well as informal collectives such as coworkers who work in the same office. An important first question is whether employees perceive such hypothetical groups as groups, or if they perceive them as arbitrary collections of independent individuals.

Research suggests that people hold stereotypes about four classes of groups: *intimacy groups*, such as one's family; *task groups*, e.g. a group of coworkers or a baseball team; *social categories*, such as national or ethnic groups; and *loose associations*, e.g. the audience at a movie (Lickel, Hamilton, Wieczorkowska, Lewis, Sherman, & Uhles, 2000). Task groups – the focus of this study – are generally perceived as being small and interdependent, with a short lifespan and relative ease of entry into the group and exit from the group. Groups differ in terms of how closely bonded they are perceived to be, referred to as each group's "entitativity" (Campbell, 1958). Task groups are generally perceived as highly entitative. Lickel et al. (2000) found that people in the United States perceived task groups as significantly more entitative than social categories and loose associations, but significantly less entitative than intimacy groups. In a second sample using Polish respondents, task groups and intimacy groups were not significantly different, and were both rated as more entitative than social categories and loose associations.

Entitativity perceptions can be influenced by chronic perceiver differences, contextual factors, and properties of the group being perceived. Perceiver differences include constructs such as collectivism and need for closure, both of which may predispose a person to perceive groups as being entitative. An example of a contextual factor is the proximity of group members to one another, such that a person would likely perceive three people huddled around a desk as more entitative than three people walking at a distance from each other on a street. Finally, group properties such as role differentiation, similarity, and common fate can influence entitativity perceptions. In a traditional business organization, contextual elements and group properties generally support perceptions of entitativity: workers are collocated in an office building (proximity), adhere to a formal or informal dress code (similarity), work within a hierarchy (role differentiation), and rely on the success of the group for their continued profitable employment (common fate). Thus, it is not too surprising that people consider task groups highly entitative.

In industrial/organizational psychology research, a special kind of task group where members function interdependently is referred to as a "team;" the term "work group" refers generally to collections of people at work regardless of whether they must coordinate to complete their taskwork (Hackman, 1990; Brannick & Prince, 1997). This distinction helps draw attention to the rich variety of work groups; however, it should not be assumed that all teams are in constant cooperation, nor that non-"team" work groups never cooperate. Interdependence is a matter of degree, and in most teams, members act independently for at least part of their taskwork. Tesluk, Mathieu, Zaccaro, and Marks (1997) outline four basic workflow arrangements typical of teams. In *pooled*

interdependence, team performance is simply the sum of individual team members' performance, as might be the case with a team of data entry employees. In *sequential interdependence,* employees work independently on tasks that are "passed" from one employee to another in a single direction. For instance, one person may audit invoices, after which another person makes payment on those invoices. In *reciprocal interdependence,* team members pass taskwork in multiple directions, such as when an instructor and a graphic designer collaborate to create instructional materials. Finally, in *intensive* workflow arrangements, teamwork is highly interdependent and orchestrated, as with a surgical team.

Note that in all but the intensive team workflow arrangement, the actual taskwork is often conducted independently, with cooperation occurring intermittently. Team members must move back and forth between independent and collective work modes, and must recognize when each mode is appropriate based on their current progress on the task. Conversely, even if a work group completes its tasks independently and thus does not qualify as a "team," this does not mean they cannot share information and assist one another from time to time. For instance, an employee might take time out of their day to contribute a lesson they learned to their organization's internal knowledge management system or “wiki”, helping anyone in the company to whom that knowledge is relevant, then and in the future. Since cooperation can occur under many group configurations, the term "work group" in this study refers broadly to any group completing a task in which the group members have some discretion to either do work independently or to assist one another.

Group Identification

It seems that work groups are perceived as real entities in organizations, but the question remains as to when people consider themselves a part of such groups. Research suggests that people do not have singular, consistent selves. Instead, we sample from a variety of selves based on the situation we are in a given moment, a phenomenon called the *working self-concept* (Markus & Wurf, 1987). Complimentary to the notion that employees must switch between independent and collective work modes during group tasks, one way in which the working self-concept differs from moment to moment is in whether a person thinks of themselves as an independent entity or as part of a group.

Triandis (1989) refers to the existence of private, public, and collective selves, all of which are present in individuals but may differ in their complexity and relative frequency of activation. Similarly, Brewer and colleagues have pointed to three levels of identity, one of which is salient at any given moment: individual, relational, and collective (Brewer & Gardner, 1996; Sedikides & Brewer, 2001). At an individual identity level, the self is construed to include only the person perceiving their self. At the relational or collective identity level, some other person or persons are included in one's self-construal, shifting the self from "I" to "we" (Taylor & Dube, 1986). The distinction between the relational and collective identity level is in whether the self includes one significant other or multiple others. For the purposes of this study, I considered individual vs. collective identity; while dyadic interactions at work are no doubt important, the behavior of interest here is generalized group cooperation.

The individual-collective distinction has been demonstrated in laboratory studies using priming manipulations. Trafimow, Triandis, & Goto (1991) found that priming

either an independent or collective identity led participants to retrieve more self-cognitions consistent with the identity level that had been primed, suggesting that independent and collective self-concepts are organized separately in memory. Priming an independent identity is also associated with placing greater weight on personal attitudes, while activation of collective identity is associated with increased attention to group norms in determining behavior (Ybarra & Trafimow, 1998), one possible mechanism for how identification with a group leads to increased cooperation.

Another mechanism by which collective identity relates to cooperation is through self-esteem enhancement (Tyler & Blader, 2001). The authors of the aforementioned study found that employees who felt their organization held high status, and that they held high status within that organization, were more likely to identify themselves with the organization. In turn, identification was related to cooperation at work. Interestingly, instrumental motives such as earning a high salary did not predict interpersonal cooperation. This is contrary to what would be predicted under a social exchange theory perspective on group behavior (Thibaut & Kelley, 1959), which emphasizes the role of obtaining desired resources. Tyler & Blader's (2001) results suggest that cooperation is better understood through the framework of social identity theory (Tajfel & Turner, 2001), which states that individuals use groups to define their selves and are motivated to enhance their self-concept by advancing group goals (or to leave the group, if group membership is detrimental to their self-concept).

In summary, employees generally perceive work groups as real entities based on their own perceptual tendencies, context clues, and aspects of the groups themselves. At any given moment, employees may identify themselves with a work group or maintain an

identity separate from the group. Identification with the group leads to intra-group cooperation via internalization of group norms and values and commitment to group goals. However, all but the most intensive group workflow arrangements include times of solitary effort, such that group members must be able to switch back and forth from independent and cooperative work modes, or sustain a cooperative identity even while the group is not immediately salient. One important issue in understanding cooperation, then, is how the physical context that a work group operates within affects group perception, identification, and cooperation.

Cooperation and Context

In one sense, developments in electronic communications technology have been a boon to cooperation at work. E-mail has become a common medium for work group cooperation, along with similar text-based electronic media such as blogs or knowledge management systems. E-mail may be used to share information, provide constructive criticism on a colleague's work, or provide encouragement, for instance. An employee who finds an effective solution for a certain problem may post their discovery to an internal knowledge management system, for later access by employees facing similar problems. Since text-based electronic communications can be distributed widely, at minimal expense, and are readily archived and searchable, they represent a powerful medium for group cooperation (Thompson & Coovert, 2006).

For spontaneous cooperation of the kind mentioned above to take place, employees must perceive the group and its goals in order to recognize opportunities to cooperate. They must also identify with the group to exert optimal effort towards cooperation. However, there is reason to believe that the context in which electronic

communication takes place is inhibitive of group perception and identification. For one, computer-mediated contexts usually contain cues that are consistent with independent work and inconsistent with cooperative work. While computers have become more user-friendly in their design and functionality over time, they still have many machine-like characteristics. The same QWERTY keyboard used in 19th-century typewriters is still the primary input mode, and the point-and-click mouse is essentially an extension of the user's hand into a representation of a machine, with buttons to click and displays to monitor (Guastello, 2006, p. 170). Generally, the computer is on a desk at which the operator sits, with their foveal view occupied by the computer screen. Typical workstations are designed with only one user in mind; it is rare to find a computer workstation with multiple keyboards attached to it for collaborative input, for example. Most of the functional features of computer workstations are thus more similar to independent work at a machine than with interactive work with other people.

It is also possible that employees' typical use of computers shapes their associations with them. Among respondents in the most recent U.S. Census Bureau study on computer use in America, those using computers at work most frequently reported using the Internet and e-mail (75%), word processing software (68%), and spreadsheet software (64%) (Day, Janus, & Davis, 2005). While use of e-mail constitutes a form of interpersonal interaction, it seems unlikely that this always represents group identification and cooperation; indeed, people often use e-mail when they want to avoid social contact (Markus, 1994). The rest of the most frequently reported activities are essentially independent endeavors. It seems possible then that many people would associate computers more with independent work than with cooperative work.

Computer programs can indicate the availability of another person, such as when a person's name or picture is displayed in an instant messaging application. However, the "social presence" of that person is usually not as salient as during a face-to-face encounter, due to the failure of the computer medium to convey all sensory aspects of that person's presence (Short, Williams, & Christie, 1976; Daft & Lengel, 1984). Studies have found that participants in computer-mediated discussions report greater psychological distance between one another (Citera, 1998) and engage more frequently in uninhibited behavior, such as making inflammatory remarks (Siegel, Dubrovsky, Kiesler, & McGuire, 1986). Even when videoconferencing is available, people tend to interact less than when they are face-to-face (Fish, Kraut, & Chalfonte, 1990). The lack of perception of individuals through computer mediation interferes with the perception of groups and identification with the group. To sum up, it seems that the typical computer workstation is functionally designed for independent work, is most often used for independent work, and is often deficient in conveying social presence when there is an opportunity to cooperate.

Contrast the typical computer workstation with its opposite, the project room (Covi, Olson, & Rocco, 1998). In such a room, group members work in close proximity, sharing a conference room to complete their tasks. Olson & Olson (2000) identified ten characteristics of such face-to-face interaction that support cooperation, such as having personal information about group members and having a shared local context. Being able to see group members in close proximity supports the perception of group entitativity, as does the similarity that results from sharing context, e.g. all group members are working in the same time zone, with the same weather outside, etc. Certainly this is not to imply

that people who share a conference room and common work will always consider themselves a group; for example, demographic heterogeneity has been found to be related to less cooperative norms among work groups, although this relationship faded as groups continued to work together (Chatman & Flynn, 2001). However, a great deal of research has shown that face-to-face encounters are related to cooperation in social dilemmas (Kiesler & Cummings, 2002), suggesting that overall, face-to-face interaction tends to lead to more identification with group members.

Based on the aforementioned review of the literature, the following are hypothesized:

Hypothesis 1. Physical context is related to cooperation, with cooperation being greater in a face-to-face context than in a computer-mediated context.

Hypothesis 2. Physical context is related to identity level, such that:

(a) independent identity is more accessible in a computer-mediated context, and

(b) collective identity is more accessible in a face-to-face context.

Hypothesis 3. Identity level is related to cooperation, such that

(a) independent identity is associated with less cooperation, and

(b) collective identity is associated with more cooperation.

Hypothesis 4. Identity level mediates the effect of physical context on cooperation.

Actor and Partner Effects

To test the study hypotheses, a hierarchical modeling approach is required, as participants' cooperative behavior is likely to be consequentially dependent on the group

to which they are assigned. For example, belonging to a group whose members are relatively high on collective identity level may elicit cooperation. It is critical to consider such dependence of observations in order to obtain accurate estimates of error variance (Kenny, Mannetti, Pierro, Livi, & Kashy, 2002). As noted in Kenny et al. (2002), while it is important to model the effect of group membership in small group research, it is often the case that the group effect of interest is best conceived of as an effect of the average standing of all other group members on a particular variable, excluding oneself. However, the typical two-level hierarchical modeling approach treats person-level variables as deviations from the group mean, which includes one's own standing on the variable. To model the group effect properly, the actor-partner interdependence model approach to multilevel modeling (Kashy & Kenny, 2000; Campbell & Kashy, 2002) can be used to separately model effects at the level of individuals (or "actors") and at the level of the group minus the actor (or "partners"). While I expected similar relationships at both levels, consistent with the hypothesized relationships above, modeling them separately is more appropriate given the nature of the interaction between the individual and the group and allows for the relationships to vary in strength (and possibly direction, though that is not hypothesized).

Hypothesis 5. The identity level of one's partners is related to cooperation, such that

(a) people whose partners have more accessible individual identities will cooperate less, and

(b) people whose partners have more accessible collective identities will cooperate more.

Automatic Processing and Identity

While completing tasks at computer workstations, employees are generally faced with conflicting cues about what appropriate behavior is along the independent-collective continuum. Assignment to a work group would certainly suggest cooperative behavior, and when asked if they belong to a group, employees may rationalize their group membership based on such assignments. However, the functional nature of the computer and the lack of visibility of group members may make independent cognitions and behaviors more accessible to memory, outside of the group members' awareness. When employees experience an overt change in their workspace layout or the content of their work, the effect of the physical context may be readily apparent to them. For example, in nuclear power plant control rooms, the switch from analog to computer-based controls and displays has also meant a shift from an open workspace arrangement to cockpit-style workstations that tend to isolate operators from one another and impair interaction (O'Hara & Roth, 2006). Such an overt shift may make the effects of the technology quite apparent to employees. However, in many cases it is possible that the effects of work contexts are not so readily apparent, particularly when changes occur over time and effects occur outside of conscious awareness. To more fully understand the role of the physical contexts in group processes, it is necessary to consider such non-conscious effects these contexts may have.

Although people are often uncomfortable with the assertion that their thoughts and actions are influenced outside of conscious control, the relevance of automatic processing to the field of psychology is increasingly evident (Bargh & Chartrand, 1999). Numerous researchers have asserted that social behavior is determined by two separate

information-processing modes: one characterized by conscious and purposeful processing, the other characterized by rapid, automatic processing based on prior associations (for a review of dual-process theories, see Chaiken & Trope, 1999). Neuropsychological research demonstrating the mediating role of the hippocampus in quickly creating new associations, and its non-operation in more gradual learning processes, suggests that the dual-mode distinction is grounded in basic neuropsychological processes (Smith & DeCoster, 2000).

These two processing modes function in different ways. The *deliberative* processing mode involves evaluation of the truth of an associative proposition (e.g. "when it is cold, one should wear more clothes" = TRUE) and triggers behavior through intentions (e.g. "I'm going to put on a coat"). The *automatic* mode involves no such evaluation or overt intention, instead triggering behavior through spreading activation between the object of perception and the behavioral schemata associated with that perception (Strack & Deutsch, 2004). Having a salient independent identity at the level of deliberative processing reflects conscious awareness of group membership (e.g. "I am part of this group" = FALSE). At the level of automatic processing, no such conscious awareness is implied; rather, independence-oriented thoughts and behavioral schemata are simply more accessible to retrieval.

For a number of reasons, the automatic processing mode is a major source of influence on behavior. Automatic processing is constantly engaged and does not tax mental energy, while deliberative processing can be disengaged or disrupted and requires a considerable amount of mental energy (Strack & Deutsch, 2004). The deliberative system monitors the automatic system, but this monitoring is often lax (Kahneman, 2003).

Additionally, even when the deliberative mode is engaged, the associations to be evaluated are retrieved from the automatic system, meaning that associations activated in the automatic mode can bias reflective processing (Strack & Deutsch, 2004). In situations of non-optimal arousal, such as when office workers are completing routine tasks at their computer, automatic processes have a particularly strong influence on thoughts and behavior (Baumeister & Heatherton, 1996). In short, the associations people hold between perceived environmental cues and appropriate behavioral responses do not strictly determine behavior, but they do exert a powerful influence.

While most industrial/organizational psychology research has featured explicit measures of the products of deliberative processing, measures of implicit effects, such as word completion tasks and lexical decision tasks, can uncover important non-conscious phenomena that may elude explicit measurement (Johnson & Steinman, 2007). For one, effects at the implicit level may be stronger than effects at the explicit level (e.g. Johnson & Lord, 2007). In a work context, employees may rationally consider themselves part of a group but have independent goals and behaviors more accessible in memory. Assessing group identification at both levels permits comparison of the relative importance of each. Additionally, implicit measures may be less likely to alter the phenomenon of interest in the process of measurement, similar to the measurement difficulties in quantum physics that led to the statement of the Heisenberg uncertainty principle (Wheeler & Zurek, 1983). That is, it is possible that explicitly asking someone "Are you part of this group?" causes people to engage in deliberative processing they may not have otherwise. However, asking them to fill in a blank to complete a word as they see fit is far less likely to lead to

hypothesis guessing or other unintended processing. As such, I expected that implicit measures of identity level will aid prediction of cooperation in work groups.

Hypothesis 6. Implicit measures of identity level account for incremental variance in cooperation over explicit measures of identity level.

Chapter Two

Method

Participants

Two-hundred participants were recruited from the undergraduate psychology department of a large Southeastern university through an online participant pool. In a simulation study, Hoyle & Kenny (1999) found that samples of 200 were required if power of .8 or greater was desired for the test of the indirect path in a mediation model, based on reliabilities and correlations typical of psychological research. The sample was 82% female, and gender distribution was not significantly different between the two experimental conditions ($\chi^2_{1, 200} = .866$, $p = .35$). The average age of participants was 19.7 years. Participants received extra credit toward course grades in return for their participation, and were also entered in a drawing to win $120 to be divided among group members.

Procedure

Experimental sessions were conducted in a psychology laboratory featuring an open common area and four enclosed offices at each corner. Upon arrival, participants were seated either at personal computer workstations in the offices or at a shared, circular table in the common area. In both conditions, participants were assigned pseudonyms to protect their privacy and facilitate conversation during the experiment. In the face-to-face condition, participants' pseudonyms were written on placards and placed on the table; in the computer-mediated condition, the placards were placed at each station.

In the computer-mediated condition, participants were logged into a text-based electronic chat room using the Internet application Google Talk. For each participant, this application displayed the presence of the other participants in the chat room, using their pseudonyms, and also indicated the presence of the researcher. Participants in this condition received instructions explaining the purpose and proper use of the chat room. For certain minor experimenter interactions, such as directing participants to move to the next phase of the study, the researcher used this chat room to communicate with participants. However, for more extensive instructions, participants in both conditions were given identical written instructions to minimize differences in experimenter interaction between the two conditions.

The first set of instructions informed participants that they would each be solving puzzles, and that if their group as a whole scored above average on their puzzles, they would be entered in a drawing to win $120. This framed the group task as a pooled interdependence workflow arrangement, where the sum of each person's performance determines the group's performance.

After reading the instructions, the participants learned how to perform the experimental task, which involved solving standard American-style crossword puzzles. Participants read instructions on how to complete the puzzles and then completed a practice puzzle to determine if they understood how to complete them. In the face-to-face condition, the practice puzzle was completed using pencil and paper. In the computer-mediated condition, it was completed in the single-user mode of an online spreadsheet editor, EditGrid, which is similar in form and function to Microsoft Excel. Participants in this condition were given additional instructions on how to enter letters

into the puzzle. The researcher verified that all participants in the computer-mediated condition were able to use the EditGrid software correctly within moments of beginning the practice puzzle.

After all participants completed the practice puzzle, the experimenter handed them an instruction sheet for the implicit identity level measure, which was a word completion task. In order to reduce deliberate processing of their identity level, this task was framed as simply another practice puzzle. Once all participants read the instructions, the experimenter administered the implicit identity level measure. Shortly afterwards, participants completed a battery of pre-task survey measures, including explicit measures of independent and collective identity, goal commitment, and espoused values; these scales are elaborated on in the "Measures" section below.

Participants were then given instructions for the performance task, stating that each player would be assigned two puzzles, for a total of eight puzzles per group. Each group had 20 minutes to complete as many answers as possible, and all groups were told that they could work independently or cooperatively at their own discretion for the entire time.

In the computer-mediated condition, participants were given additional written instructions on how to use EditGrid to collaborate on a shared spreadsheet. This software allows multiple users to simultaneously view and edit spreadsheets in real-time. For this study, each puzzle was assigned to a separate sheet, such that only one puzzle could be viewed at once by any particular participant; however, participants were able to decide which sheet to view regardless of what sheets the other participants were currently viewing. Each sheet was accessible from a row of tabs in the bottom of the screen, and

each tab was labeled with the pseudonym of the group member responsible for that puzzle.

While participants were each responsible for particular puzzles, they were allowed to work on one another's puzzles. This meant that on any particular puzzle, as many as four people could be simultaneously entering answers. However, in the unmodified version of EditGrid, there is no display indicating who made a particular entry in the shared workspace. This awareness of "who made what change" is an inherent feature of face-to-face contexts, but may or may not be supported in computer-mediated contexts. In order to help participants identify who had entered a given answer on the puzzles, I wrote a macro in Java programming language that would identify each participant when they edited the workbook and apply a unique color to edits made by that participant (Appendix B). Each participant's name and assigned color was displayed on a card attached to each computer monitor for reference. Since participants in this condition had already used the basic functions of EditGrid, the only further instruction needed was to make them aware of the color-coding scheme and to direct them on how to switch from one sheet to another.

After the participants in the computer-mediated condition were instructed on the collaborative features of EditGrid, they were simultaneously logged into the shared workbook and began the experimental task. The researcher acted as a silent member of the group and noted any instances where a participant gave an answer to another participant through the chat window but did not enter it himself or herself. Also, the researcher noted all strategic or encouraging statements participants made through the

chat window. The Google Talk application automatically saved the content of each group's chat session for later review.

In the face-to-face condition, each participant was given two paper-and-pencil puzzles, marked at the top with their pseudonym. As in the computer-mediated condition, the researcher informed the participants that while they were responsible for their puzzles, they were also free to swap puzzles with the other participants. Participants were given different colored pencils to facilitate data collection, such that each participant's answers on their own puzzles could be quantified, as well as their contribution to other participants' puzzles. After the group began, the researcher observed them discreetly throughout the experimental task, making note of any instances where a participant told another participant an answer but did not write it on their sheet. To allow for later review of the groups' interactions, a digital video camera was used to record each group's performance during the experimental task. The researcher also noted any strategic or encouraging statements made by participants during the experimental task.

After twenty minutes, the researcher administered the post-task questionnaire, including the demographic and manipulation check items, the identifiability and accountability items, and the measure of group viability (see below). As each participant completed the post-task questionnaire, they were debriefed and dismissed.

Measures

Unless otherwise noted, responses for each scale were given on a 5-point Likert scale, where 1 represents a low standing on the construct and 5 indicates a high standing. Individual responses on each scale were averaged to create scale scores.

Implicit identity level. A word-completion task similar to that developed by Johnson and Lord (2007) was used to assess identity level (Appendix C). For this task, participants read a list of words that were missing letters (e.g. " _ E") and were directed to fill in blanks to create any legitimate English word. Participants completed twenty-nine words, and their responses were coded as indicating individual identity (e.g., "me"), collective identity ("we"), or neutral ("be"). A two-stage process similar to that used by Johnson and Lord (2007) was used to refine these twenty-nine words into an independent identity scale and a collective identity scale. First, items were dropped from the scales if less than 15% of responses for that word were independent or collective in connotation. The remaining items were divided by whether responses to the items indicated individual or collective identity, or both. Then the lists of items indicating independent and collective identity were separately submitted to exploratory factor analyses using LISREL 8.80. It has been noted that when data are ordinal in nature, as is the case here, factor analyzing the raw item-level data can result in the emergence of "difficulty" factors (see Gorsuch, 1983). To address this, I instead factor analyzed the polychoric correlation matrix for the set of items (Jöreskog & Moustaki, 2000). For both the independent and collective sets of items, a single-factor solution emerged; only items with loadings above .4 were retained. The final set included 6 indicators of independent identity and 3 indicators of collective identity.

Explicit identity level. Independent identity level was measured explicitly using the comparative identity subscale of Selenta & Lord's (2005) Levels of Self-Concept Scale (Appendix D). The comparative identity subscale includes 5 items that reflect

independent motives, e.g. "I feel best about myself when I perform better than others." The coefficient alpha for the scale in this study was .86.

Collective identity level was measured explicitly using Jackson, Colquitt, Wesson, and Zapata-Phelan's (2006) psychological collectivism scale (Appendix E). This scale includes 15 items reflecting collectivistic orientation, e.g. "Working in this group will be better than working alone." Coefficient alpha for the scale was .88.

Cooperation. Two measures of cooperation were taken for this study. First, the number of answers a participant gave to other participants during the performance task (as opposed to working on their own assigned puzzles) was counted. Additionally, cooperative statements participants made to the group were recorded, specifically, any statements that indicated an overt attempt to structure the group's efforts. For example, a typical statement was to suggest that the group should focus on one person's puzzle at a time. This variable was coded dichotomously, 0 if the participant did not make such statements during the task and 1 if they did. This variable showed an extremely low base-rate, with only 12% of participants making any such statements throughout the duration of the experimental task. As such, this variable was omitted from further analysis.

Performance measures. Nine unique 15-letter-by-15-letter crosswords were used, one for the practice task and eight for the experimental task. The total number of correct answers given during the practice crossword puzzle was recorded for each participant, to serve as a control for prior ability with crossword puzzles.

For the puzzles in the experimental task, the total number of attempted answers on participants' own puzzles was tallied, and a separate total was taken for the number of

attempted answers on other participants' puzzles. These totals are meant to indicate the relative attention participants devoted to their own vs. other participants' puzzles, irrespective of whether they answered correctly. No participant's answers indicated careless responding; all responses were plausible given the clues in the puzzle. Though actual task performance was not the primary interest of this study, for exploratory purposes, the numbers of correct responses for one's own and others' puzzles were also tallied.

Exploratory variables: Goal commitment. The 5-item scale developed by Klein, Wesson, Hollenbeck, Wright, and DeShon (2001) was used to measure commitment to the group goal of completing as many crossword clues as possible (Appendix F). An example item is "It's hard to take this goal seriously" (reverse-coded). Coefficient alpha for the scale was .81.

Exploratory variables: Entitativity. Participants' perceptions of the experimental groups entitativity were assessed using ten items adapted from Rydell and McConnell's (2005) entitativity scale (Appendix G). An example item is "To what extent do you believe that the task group in this study typifies what it means to be a 'group'?" Coefficient alpha for this scale was .82.

Exploratory variables: Values. Participants' espoused values were assessed along four relevant dimensions from Schwartz's (1992) values circumplex: universalism, benevolence, power, and achievement (Appendix H). According to Schwartz (1992), benevolence reflects a concern for the collective good, power and achievement reflect concern for individual benefit, and universalism represents mixed motives. Participants were presented with a series of possible life values with brief explanations, for example,

"SOCIAL POWER (control over others, dominance)." Responses were given along a 9-point Likert scale, with -1 indicating that a given value was opposed to one's personal values, 0 indicating that the value was unimportant, and 7 indicating that the value was highly important. Coefficient alphas were as follows: universalism, .87 (11 items); benevolence, .76 (7 items); power, .69 (5 items); and achievement, .83 (6 items).

Exploratory variables: Identifiability and accountability. Two single-item measures were adapted from Douglas & McGarty (2002). The first item assessed whether participants believed they were personally identifiable to other group members ("My performance on the group task could have been linked to me personally by the other members of the group"). The second item assessed whether they felt accountable to the group ("During the group task, I felt accountable to the other group members").

Exploratory variables: Group viability. The 3-item scale from Sinclair (2003) was used to assess participants' perceptions of the future viability of the experimental group (Appendix I). An example item is "I feel that this group of individuals would work well together on another task." Coefficient alpha for this scale was .85.

Manipulation checks and demographic variables. In a post-task questionnaire, participants completed a single Likert-type item assessing the extent to which they were motivated to engage in the experimental task. Additionally, two open-ended questions assessed whether participants noticed anything strange about the experiment and what they thought the purpose of the experiment was. In order to describe the sample, participants reported their age, gender, average hours spent using a computer per week, and relative percentages of time spent in independent vs. collaborative computer activities in an average week. Gender was coded as 0 for male and 1 for female.

Planned Analyses

For this study, the software package HLM 6.06 (Raudenbush, Bryk, & Congdon, 2008) was used for all hierarchical modeling. Separate mediation analyses were computed for the individual and collective identity scales, and for both the implicit and explicit measures of those scales. For the outcomes of interest, unconditional models were examined to determine the extent of variance explained at the group level, computed as the intraclass correlation coefficient (ICC) for that outcome (Raudenbush & Bryk, 2002). Since the outcome variable is a count of the number of cooperative actions each participant commits during the twenty-minute task, a constant-exposure Poisson sampling model and log link function were used to model the data (Raudenbush & Bryk, 2002, p. 309).

Per the Baron and Kenny (1986) approach for testing for mediation, three things must be demonstrated: first, that the independent variable is related to the dependent variable (Hypothesis 1); second, that the independent variable is related to the mediating variable (Hypothesis 2); and third, that the mediating variable is related to the dependent variable (Hypothesis 3). If all of the above hold, and the direct path from the independent to the dependent variable is no longer significant when the mediating variable is included, the model is said to be fully mediated; if the direct path remains significant, partial mediation is said to hold (Hypothesis 4). The mediating effect is equal to the product of the path from the predictor to the mediating variable and the path from the mediating variable to the outcome variable, and this path may be tested for significance. As the sampling distribution of the mediating effect is often not normal (Bollen & Stine, 2000), however, asymmetric confidence intervals are more appropriate for hypothesis testing,

and can be obtained using the PRODCLIN software program (MacKinnon, Fritz, Williams, & Lockwood, 2007).

Performing mediation analyses in HLM 6.06 requires special data formatting and analysis techniques, outlined in Tate and Pituch (2007). As with typical hierarchical analyses involving persons nested within groups, two separate data files are required by HLM 6.06, one for the person-level data and one for the group-level data. However, since both the mediating variable and the final outcome variable are endogenous variables, it is necessary to model multiple unique outcomes. Doing this in HLM 6.06 requires nesting outcomes within each participant in a third data file; the person-level and group-level data files are included as before.

The outcome-level data file includes two lines for each participant and five variables: the participant's group ID, the participant's individual ID, their "outcome" score (with their score on the mediator appearing on the first line for that participant, and their score on the final outcome appearing on the second), and two dummy-coded variables indicating whether the current line refers to the mediator or the final outcome. The alternating "outcome" variable is modeled at Level-1 as a function only of the dummy-coding variables; the intercept and Level-1 error term are suppressed. For suppression of the intercept, "INTRCPT1" is selected from the model screen and the "delete from model" option is chosen. For suppression of the Level 1 error term, under the menu "Other settings," the "Estimation settings" dialog is selected, and a very small number (e.g. 0.00001) is chosen for the option "Fix Sigma^2 to specific value". In this way, the two dummy-coded variables become outcome variables for the mediator and the

final outcome, to be modeled at Level-2 using person-level variables and at level-3 using group-level variables.

In the present analysis, the effect of each participant's ("actor") identity level on their own cooperative behavior was estimated, and the effect of all other participants' ("partner") identity level on the actor's cooperative behavior was estimated at Level-2, rather than being estimated as a group effect at Level-3 (Hypothesis 5). Finally, the difference in effect estimates for the implicit and explicit measures of identity was examined to test Hypothesis 6.

Chapter Three

Results

Preliminary Analyses

Responses on ten items were missing-at-random throughout the dataset, with three missing responses in the face-to-face condition and seven in the computer-mediated condition. In order to satisfy the operating requirements of the planned analyses, and given that the responses were missing at random, those ten responses were imputed using mean value imputation. Additionally, a continuous string of ten items was missing for one participant who did not complete the last page of the pre-task survey, which included items on the four values dimensions; these responses were left missing, resulting in an $N = 199$ for analyses which included the values dimensions. Inspection of each participant's responses during data coding did not reveal any serious instances of careless responding.

Descriptive statistics for the studied variables are provided in Table 1, and inter-correlations among studied variables are provided in Table 2. Comparisons of the two experimental groups indicate that there were no significant differences in participants' initial ability to complete the puzzles, use of computers at work, use of computers to collaborate, or motivation during the experimental task, as shown in Table 3.

Table 1. Descriptive Statistics

Variable	*N*	# of items	α	*M*	*SD*	Obs. Min.	Obs. Max
Independent Identity							
Implicit	200	6	--	0.55	0.20	0	1
Explicit	200	5	.86	2.73	0.81	1	5
Collective Identity							
Implicit	200	3	--	0.44	0.32	-.33	1
Explicit	200	15	.88	3.46	0.58	2	5
Practice: Correct	200	--	--	10.77	5.23	0	34
Experimental Task							
Attempted, self	200	--	--	8.72	5.87	0	33
Attempted, others	200	--	--	2.98	3.64	0	15
Correct, self	200	--	--	5.11	4.52	0	26
Correct, others	200	--	--	2.10	2.88	0	15
Goal Commitment	200	5	.81	3.66	0.65	2	5
Entitativity	200	10	.82	3.13	0.51	1.7	5
Values							
Universalism	199	11	.87	5.39	1.02	2.1	7
Benevolence	199	7	.76	5.72	0.93	2.1	7
Power	199	5	.69	3.56	1.16	0	6.8
Achievement	199	6	.83	5.91	0.91	2.0	7
Age	200	1	--	19.68	2.73	18	37
Gender	200	1	--	0.82	0.38	0	1
Computer Use for Work	200	1	--	0.61	0.27	0	1
Collaborative Computing	197	1	--	0.26	0.23	0	1
Motivation	200	1	--	3.65	0.93	1	5

Variable	*N*	# of items	α	*M*	*SD*	Obs. Min.	Obs. Max
Identifiability	200	1	--	2.88	0.96	1	5
Accountability	200	1	--	2.95	1.00	1	5
Group Viability	200	3	.85	3.36	0.80	1	5

Table 2. Correlations among Study Variables

	Variable	1	2	3	4	5	6	7	8
1	Context								
2	Independent identity, implicit	.03							
3	Independent identity, explicit	.01	-.03						
4	Collective identity, implicit	-.08	-.02	-.08					
5	Collective identity, explicit	-.05	-.04	.02	.01				
6	Practice: Correct	-.08	.15*	.08	.03	-.15*			
7	Task: Attempted, self	-.24†	-.09	.19†	.08	-.09	.39†		
8	Task: Attempted, others	.27†	.08	.09	-.01	-.04	.30†	-.22†	
9	Task: Correct, self	-.09	.00	.19†	.05	-.16*	.51†	.84†	-.09
10	Task: Correct, others	.29†	.10	.08	.00	-.03	.37†	-.16*	.95†
11	Goal commitment	-.03	-.01	-.15*	.00	.43†	.03	-.02	.03
12	Entitativity	-.07	-.15*	.07	.03	.53†	-.23†	-.04	.03
13	Universalism	-.12	.06	-.05	.09	.20†	.03	.00	.01
14	Benevolence	-.17*	-.03	.00	.13	.17*	-.10	-.01	-.04
15	Power	.02	-.04	.25†	.03	.11	-.16*	-.08	-.06
16	Achievement	-.09	.01	.05	.16*	.20†	-.09	.00	-.05
17	Age	-.13	-.06	.13	-.10	.05	.04	.03	-.07
18	Gender	-.07	-.07	-.22†	.11	.06	-.06	-.06	.02
19	Computer use for work	-.03	-.05	-.01	.08	.10	-.07	-.02	-.05
20	Collaborative computing	-.07	-.02	-.03	-.01	.04	-.14	-.15†	.01
21	Motivation	.11	-.04	-.04	.05	.21†	.06	.05	.11
22	Identifiability	.06	.01	.17*	-.06	.09	.00	-.02	.13
23	Accountability	.16*	.04	.09	.00	.07	.09	-.03	.21†
24	Group Viability	.03	-.07	-.21†	.05	.33†	-.09	-.15*	.10

*p<.05; †p<.01; N's ranged from 197 to 200.
For "Context," 0 = face-to-face, 1 = computer mediated.
For "Gender," 0 = male, 1 = female.

	Variable	9	10	11	12	13	14	15	16
1	Context								
2	Independent identity, implicit								
3	Independent identity, explicit								
4	Collective identity, implicit								
5	Collective identity, explicit								
6	Practice: Correct								
7	Task: Attempted, self								
8	Task: Attempted, others								
9	Task: Correct, self								
10	Task: Correct, others	-.03							
11	Goal commitment	-.04	.02						
12	Entitativity	-.11	-.01	.49†					
13	Universalism	-.04	.00	.04	.15*				
14	Benevolence	-.07	-.07	.08	.14*	.75†			
15	Power	-.15*	-.07	-.10	.06	.24†	.38†		
16	Achievement	-.04	-.08	.16*	.13	.63†	.71†	.48†	
17	Age	.05	-.07	-.06	.01	.09	.04	.05	.04
18	Gender	-.10	-.01	.16*	.05	.15*	.20†	-.04	.09
19	Computer use for work	-.02	-.06	.00	.12	-.07	-.08	.13	-.02
20	Collaborative computing	-.14	-.05	.03	.13	.06	.09	.25†	.08
21	Motivation	.09	.09	.43†	.28†	.14	.17*	-.05	.18*
22	Identifiability	.02	.10	.08	.23†	-.01	.01	.03	.01
23	Accountability	.07	.16*	.16*	.18*	.05	.10	-.07	.03
24	Group Viability	-.16*	.06	.26†	.34†	.16*	.14*	-.04	.12

*p<.05; †p<.01; N's ranged from 197 to 200.
For "Context," 0 = face-to-face, 1 = computer mediated.
For "Gender," 0 = male, 1 = female.

	Variable	17	18	19	20	21	22	23
1	Context							
2	Independent identity, implicit							
3	Independent identity, explicit							
4	Collective identity, implicit							
5	Collective identity, explicit							
6	Practice: Correct							
7	Task: Attempted, self							
8	Task: Attempted, others							
9	Task: Correct, self							
10	Task: Correct, others							
11	Goal commitment							
12	Entitativity							
13	Universalism							
14	Benevolence							
15	Power							
16	Achievement							
17	Age							
18	Gender	-.10						
19	Computer use for work	-.05	.03					
20	Collaborative computing	-.13	.09	.06				
21	Motivation	-.07	.01	.05	-.05			
22	Identifiability	-.05	-.06	.00	.00	.30†		
23	Accountability	-.11	-.03	-.02	-.01	.45†	.52†	
24	Group Viability	-.01	.06	.12	.06	.49†	.20†	.31†

*p<.05; †p<.01; N's ranged from 197 to 200.
For "Context," 0 = face-to-face, 1 = computer-mediated.
For "Gender," 0 = male, 1 = female.

Table 3. Comparisons Between Face-to-Face and Computer-Mediated Participants

Variable	Face-to-face		Computer-mediated			
	M	*SD*	*M*	*SD*	*t*	*p*
Practice: Correct	1.05	0.18	1.01	0.22	1.37	.18
Computer Use at Work	61.7	27.4	60.3	26.0	0.37	.71
Collaborative Computing	0.27	0.23	0.24	0.23	0.98	.33
Motivation	3.55	0.96	3.76	0.90	-1.60	.11

Note. $N = 100$ for all cells except Collaborative Computing: Face-to-face, $N = 99$; Computer-mediated, $N = 98$.

Hypothesis Testing

Hypothesis 1 stated that context would relate to cooperation, with greater cooperation occurring in the face-to-face condition versus the computer-mediated condition. Given that the outcome variable, cooperation, is count-level data, the hierarchical models of this variable use a Poisson sampling model and a log-link function at level-1 in the model. Prior to testing Hypothesis 1, an unconditional model for the cooperation variable was run (hereafter "Model 1"). Specifically, individuals' cooperation was modeled at the person-level using a structural model with no predictors. At the group-level, mean group cooperation was modeled as a function of only the grand mean and a group-level error term, also without any predictors. Typically, the intraclass correlation coefficient (ICC) computed from such an unconditional model is informative of how substantial the group effect is. However, when non-linear link functions are used, the ICC is no longer meaningful, as level-1 variance is heteroscedastic; instead, it is more informative to examine the 95% confidence interval for the intercept, or the log-rate of cooperation, from the unit-specific model (for details, see Raudenbush & Bryk, 2002, p. 298). For this model, the 95% confidence interval for the log-rate of cooperation was [-1.298, 2.754], which corresponds to a 95% confidence interval for rate of cooperation of [.273, 15.706]. Thus, the expected rate of cooperation for most groups is between about 0 and 16 answers shared per group, reflecting considerable variation among groups.

Model 2a augments Model 1 with gender and log-transformed prior ability as predictors at the person-level, and context as a group-level predictor of cooperation, the slope for gender, and the slope for prior ability. Since the effect of the group-level context variable was the primary interest, prior ability and gender were centered around

their respective grand means (Enders & Tofighi, 2007). The effects of prior ability and gender were fixed, i.e. the group-level error terms for each were suppressed. A population-average model was tested, given the substantive research question and the increased robustness of the population-average model to faulty assumptions regarding the distribution of random effects relative to the unit-specific model (Heagarty & Zeger, 2000; Raudenbush, 2000).

The effect of condition on cooperation was unexpectedly positive, with groups in the computer-mediated condition offering *more* answers to their fellow group members rather than less; thus Hypothesis 1 was not supported. Additionally, though the main effect of prior ability was not statistically significant, the interaction of prior ability and context was significant, such that prior ability was only associated with greater cooperation in the computer-mediated condition. As has been noted by Hofmann and Gavin (1998), centering around the grand mean can suggest significant cross-level interaction effects when no such effect exists in the population. However, the interaction of prior ability and context remains significant when gender is instead centered around its group mean (Model 2b), suggesting that the interaction effect is not a statistical artifact of grand-mean centering. Parameter estimates for Model 1 and Models 2a-2b are given in Table 4.

Table 4. Hierarchical Modeling of the Effect of Context on Cooperation

Fixed Effects		1	2a	2b
Intercept (β_0)				
	Intercept (γ_{00})	1.11†	.70†	.71†
		(.15)	(.19)	(.20)
	Context (γ_{01})	-	.65*	.63*
			(.27)	(.28)
Gender (β_1)				
	Intercept (γ_{10})	-	-.32	-.32
			(.22)	(.22)
	Context (γ_{11})	-	.31	.31
			(.25)	(.25)
Prior ability (β_2)				
	Intercept (γ_{20})	-	.88	.89
			(.48)	(.50)
	Context (γ_{21})	-	1.29*	1.24*
			(.56)	(.57)

*p<.05; †p<.01. Standard errors are given in parentheses. Parameters are derived from the population-average model. Gender is grand-mean centered in both models. Prior ability is grand-mean centered in Model 2a and group-mean centered in Model 2b.

Prior to testing Hypothesis 2, regarding the effect of context on identity level, unconditional models were run for each of the four identity level measures (Models 3a-3d). Unlike Models 1 and 2a-2b, here the outcome of interest is a continuous variable, so simple hierarchical linear modeling suffices, i.e. the sampling model is the default (the standard normal distribution) and there is no need to specify a link function. The group-level error terms for these four models were not statistically significant, suggesting that group composition effects did not relate to the identity level of participants (see Table 5). As such, independent-samples *t*-tests were performed for each of the four measures, with context as the grouping variable. Though effects were in the direction hypothesized, no significant differences between groups were found for independent identity measured explicitly (t = -.191, p = .648), collective identity measured explicitly (t = .647, p = .600), independent identity measured implicitly (t = -.467, p = .739), or collective identity measured implicitly (t = 1.100, p = .221). Thus Hypothesis 2 was not supported, and by extension Hypothesis 4, which specified a mediating effect of identity, was also not supported.

Table 5. Hierarchical Modeling of Identity Level

		Model			
Fixed Effects		3a	3b	3c	3d
Intercept (β_0)					
	Intercept (γ_{00})	2.73†	3.83†	.55†	.44†
		(.06)	(.04)	(.01)	(.02)
Random Effects					
	Level-2 (μ)	.00	.00	.00	.00
	Level-1 (*r*)	.66	.34	.04	.10
Deviance		486.11	355.76	-69.76	116.61
Number of estimated parameters		2	2	2	2

*p<.05; †p<.01. Standard errors are given in parentheses.

Hypothesis 3 stated that identity level would affect cooperation, with more salient independent identity being related to less cooperation and more salient collective identity related to more cooperation. A series of four hierarchical models were run (Models 4a-4d), one for each of the four identity measures (see Table 6). At the person-level, cooperation was modeled as a function of the given person (or "actor")'s identity level, their partners' average identity level, their prior ability on the task, and their gender. All of the above person-level variables were grand-mean centered, and their effect estimates were fixed, i.e. the group-level error term for these effects was omitted. For each person-level variable, the interaction with context was also estimated.

For Model 4a, the model using independent identity measured explicitly, a significant negative effect was found for partner identity, $\gamma_{31} = -1.13$, $p = .007$. That is, actors whose partners reported more independent identities tended not to cooperate as much. Interestingly, the interaction of partner identity and context approached statistical significance ($\gamma_{41} = 1.00$, $p = .068$); future studies may consider whether computer mediation mitigates the negative effect of partners' average independent identity on cooperation. For Models 4b-4d, the effects of actor and partner identity were not statistically significant. Therefore, Hypothesis 3 was not supported, and Hypothesis 5 was only partially supported.

Table 6. Hierarchical Modeling of the Effect of Identity Level on Cooperation

		Model			
Fixed Effects		4a: Exp., ind.	4b: Exp., col.	4c: Imp., ind.	4d: Imp., col.
Intercept (β_0)					
	Intercept (γ_{00})	.60†	.68†	.68†	.69†
		(.20)	(.20)	(.20)	(.20)
	Condition (γ_{01})	.74†	.65*	.67*	.61*
		(.27)	(.02)	(.28)	(.28)
Gender (β_1)					
	Intercept (γ_{10})	-.32	-.33	-.27	-.38
		(.22)	(.23)	(.22)	(.23)
	Condition (γ_{11})	.43	.31	.29	.36
		(.26)	(.26)	(.26)	(.26)
Prior ability (β_2)					
	Intercept (γ_{20})	.62	.81	.70	.94
		(.49)	(.48)	(.51)	(.49)
	Condition (γ_{21})	1.41*	1.56†	1.49*	1.17*
		(.57)	(.57)	(.58)	(.57)
Actor identity (β_3)					
	Intercept (γ_{30})	-.08	-.02	.96	.30
		(.16)	(.20)	(.75)	(.39)
	Condition (γ_{31})	.24	.17	-1.31	-.59
		(.20)	(.26)	(.91)	(.53)
Partner identity (β_4)					
	Intercept (γ_{40})	-1.13†	.43	-.79	-.12
		(.41)	(.51)	(2.08)	(1.02)
	Condition (γ_{41})	1.00	-.87	2.01	-.97
		(.54)	(.68)	(2.52)	(1.44)

*p<.05; †p<.01. Standard errors are given in parentheses. Parameters are derived from the population-average model. All level-1 predictors are grand-mean centered. Exp. = explicit, imp. = implicit, ind. = independent, col. = collective.

Hypothesis 6 stated that the implicit measures of identity would account for incremental variance in cooperation beyond that accounted for by explicit measures of identity. However, as noted above, only the explicit measure of partners' independent identity was found to be a significant predictor of cooperation; therefore, Hypothesis 6 was not supported.

Exploratory Analyses

On an exploratory basis, the effect of context was estimated for a number of outcome variables: goal commitment, endorsed values (universalism, benevolence, power, and achievement), and entitativity, all measured prior to the experimental task; and group viability, identifiability, and accountability, measured after the experimental task. For each outcome, an unconditional HLM model was run to estimate whether the outcome was subject to group composition effects (Models 5a-i; see Table 7). Only the models for accountability and group viability showed significant group-level error terms; thus for all other outcomes, independent-samples *t*-tests were performed with context as the grouping variable (see Table 9). A significant difference was also found for benevolence, $t = 2.390$, $p = .02$, such that participants in the face-to-face condition endorsed more benevolent-oriented values. No other statistically significant differences were found.

For accountability and group viability, separate HLM models were tested, with context as a group-level predictor (Models 6a-6b). However, context was not a significant predictor at $\alpha = .05$ for either accountability or viability (see Table 8).

Table 7. Hierarchical Modeling of Exploratory Variables: Unconditional Models

		Model								
		5a Goal commitment	5b Identifiability	5c Accountability	5d Entitativity	5e Universalism	5f Benevolence	5g Power	5h Achievement	5i Viability
Fixed Effects										
Intercept (β_0)										
	Intercept (γ_{00})	3.66†	2.88†	2.95†	3.13†	5.39†	5.72†	3.56†	5.91†	3.36†
		(.05)	(.07)	(.08)	(.04)	(.08)	(.07)	(.08)	(.07)	(0.08)
Random Effects										
	Level-2 (μ)	.00	.01	.12†	.01	.03	.03	.00	.00	.17†
	Level-1 (*r*)	.43	.91	.88	.24	1.02	.85	1.37	.82	.48
Deviance		398.84	550.82	564.18	296.77	567.10	530.07	618.00	518.97	463.10
Number of estimated parameters		2	2	2	2	2	2	2	2	2

*p<.05; †p<.01. Standard errors are given in parentheses.

Table 8. Hierarchical Modeling of Exploratory Variables: Full Models

		6a Accountability (full model)	6b Viability (full model)
Fixed Effects			
Intercept (β_0)			
	Intercept (γ_{00})	2.80†	3.34†
		(.11)	(.11)
	Condition (γ_{01})	.31	.05
		(.16)	(.15)
Random Effects			
	Level-2 (μ)	.12	.17†
	Level-1 (r)	.88	.48
Deviance		564.12	466.76
Number of estimated parameters		2	2

*p<.05; †p<.01. Standard errors are given in parentheses.

Table 9. *t*-tests for Equality of Means for Exploratory Variables by Context

Variable	Context	*M*	*SD*	*t*	*df*	*p*
Goal commitment	0	3.68	.68	.475	198	.64
	1	3.64	.63			
Identifiability	0	2.83	.93	-.807	198	.42
	1	2.94	.98			
Entitativity	0	3.16	.54	1.024	198	.31
	1	3.09	.47			
Universalism	0	5.51	1.01	1.696	197	.09
	1	5.26	1.03			
Benevolence	0	5.87	.93	2.390*	197	.02
	1	5.56	.90			
Power	0	3.53	1.23	-.265	197	.79
	1	3.58	1.10			
Achievement	0	5.99	.93	1.217	197	.23
	1	5.83	.89			

*$p<.05$; †$p<.01$. Context, 0 = face-to-face, 1 = computer-mediated.

Finally, the effect of context on task performance was estimated. Four variables are of interest: each group's total number of attempted answers and total number of correct answers, which speak to task performance and task effectiveness, respectively; and each group's total number of answers attempted on group members assigned puzzles and on each other's puzzles, which speak to their division of effort between independent and cooperative task performance. An independent-samples *t*-test was performed for each, with context as the grouping factor (Table 10). No significant differences were found for the total answers attempted or correct between groups. However, a difference was found for answers attempted on one's own puzzles, $t = 2.87$, $p = .006$, indicating that groups in the face-to-face condition tended to generate more answers on their own puzzles. Conversely, the opposite effect was found for answers attempted on other group members' puzzles, $t = -3.06$, $p = .004$, with groups in the computer-mediated condition generating more answers on other group members' puzzles.

In summary, the study hypotheses were generally unsupported, except for Hypothesis 5, which was partially supported. Group members whose partners endorsed independent identities tended to cooperate less with those group members. Prior ability was relevant to cooperation only in the computer-mediated condition, where it enhanced cooperation. On the performance task, groups in the face-to-face condition attempted more answers on their own puzzles, while participants in the computer-mediated condition generated more answers on other group members' puzzles.

Table 10. *t*-tests for Equality of Means for Performance Measures by Context

Variable	Context	*M*	*SD*	*t*	*df*	*p*
Total attempted	0	48.44	14.65	.890	48	.38
	1	45.16	11.17			
Total correct	0	27.04	10.27	-1.182	48	.24
	1	30.60	11.02			
Attempted on assigned puzzles	0	40.40	16.16	2.874†	48	.01
	1	29.36	10.38			
Attempted on each other's puzzles	0	8.04	9.93	-3.06†	48	.01
	1	15.80	7.86			

*$p<.05$; †$p<.01$. Context, 0 = face-to-face, 1 = computer-mediated.

Chapter Four

Discussion

The present study was designed to contribute to research on computer-mediated communication and group cooperation by investigating the mediating role of group members' identification with the group. In addition, this study extended prior research by testing for identification processes operating outside of the group members' awareness, through the use of veiled, "implicit" measures. Finally, the study incorporated recent developments in hierarchical modeling, most notably the actor-partner interdependence model, which was used to separately estimate the effects of each group member's identity level and the average identity level of their fellow group members.

Surprisingly, many of the hypotheses were not supported. It was expected that groups collaborating via computer would cooperate less with one another, but in fact the opposite was found, with computer-mediated groups sharing more answers with one another than groups working face-to-face. The context that groups worked in was unrelated to their identity level, either measured by self-report or by the word completion measure. Each group member's identity level was unrelated to their cooperation with group; however, participants were less likely to cooperate if their partners tended to endorse more independent identities. Given the lack of a relationship between context and identity level, the conditions for mediation were not met. Finally, the word

completion measure did not improve prediction of cooperation, relative to the explicit measures of identity level.

The nature of the context manipulation may partly explain this set of findings. In this study, participants shared more answers with one another in the computer-mediated context. One potential reason for this is that the particular set of technological resources available in the computer-mediated context allowed participants to share the task space more easily. In a face-to-face environment, there are physical limitations on how many people can look at a shared sheet of paper and make edits to it simultaneously. Participants in the face-to-face condition occasionally would huddle around a puzzle, with the person nearest the puzzle writing down answers the group generated; this left people on the fringes of the huddle less able to see the puzzle or directly make edits. No such limitations exist in a computer-mediated environment like that used in this study, as all participants could look at one puzzle without restrictions on their view or their ability to make edits. It may be that this functional difference between conditions led computer-mediated group members to treat the entire set of puzzles as their own independent task. These group members still made the majority of their edits on their assigned puzzles, but spent relatively more time on other group members' puzzles than did participants in the face-to-face context. This difference in contexts, rather than being a methodological flaw, captures one way that realistic computer-supported cooperative work arrangements can change the nature of work.

On a related note, it is interesting that prior ability was only associated with increased cooperation in the computer-mediated context, and that this effect was quite strong. The effect may be due to those with greater ability having easier access to the

entire set of puzzles, allowing them to scan for familiar clues; however, many face-to-face groups also swapped puzzles around the group. Alternately, it is possible that face-to-face groups engaged in dysfunctional group processes that suppressed the performance of more capable group members. For example, the greater visibility of group members in that context may have supported the formation of counterproductive group norms about how much effort should be devoted to the task. The finding that prior ability only enhanced cooperation in computer-mediated groups bears attention in future studies.

Theoretical Implications

Participants in this study reported similar identity levels and similar perceptions of entitativity, identifiability, and accountability, irrespective of their assignment to the face-to-face or computer mediated context. For theories of group perception and identification, this suggests that contextual factors such as physical proximity and visibility may be less influential than properties of the group, such as common purpose and common fate. In terms of social presence theories relevant to technology-mediated contexts (e.g. Short, Williams, & Christie, 1976; Daft & Lengel, 1984), these findings are somewhat equivocal. Participants in the face-to-face context endorsed benevolent values more strongly, suggesting that perhaps these participants were more cognizant of their fellow group members' presence. However, the lack of significant differences between groups for identity level and perceptions of group viability is inconsistent with the proposition that computer-mediated groups suffer considerably from a lack of social presence.

One explanation for the lack of support for these theoretical perspectives is that the grounds they are based on may be shifting. That is, as computer-supported

interaction and cooperation become more commonplace, the perception of entitativity and social presence in these contexts may be less difficult. The demographic characteristics of the current study's sample were somewhat narrow, with most participants being young, female undergraduate students. That population is likely to be extremely familiar with computer-supported work in general, as well as with a variety of telecommunication media including e-mail and text chat. Participants reported using computers at work an average of 61% of the time, and out of the time they spent using computers for work, the average time using collaborative features was 26%. Thus it may be that this generation of workers has reached a high enough level of fluency in computer-supported cooperative work that they can perceive "virtual" group membership in the same way they perceive group membership in face-to-face contexts. As the relevant work population continues to gain technological fluency, theory in this area may need to move beyond the "more information richness is better" perspective, instead focusing on what boundary conditions mark the threshold of sufficient support for effective group processes, and how those boundary conditions differ for those with varying degrees of technological expertise.

These findings do not support strong conclusions about the relevance of dual-process theories to group identification processes. The implicit and explicit measures of identity level were uncorrelated with each other, suggesting that they are measuring different constructs. Given the relative novelty of the implicit identity measure, however, we have little information about what precisely this measure reflects. From the present study, there are a few potentially informative results. As shown in Table 2, implicitly-measured independent identity was associated with greater performance on the prior

ability measure and lower perceptions of entitativity, while the explicit measure was not associated with either. Conversely, explicitly-measured independent identity was associated with more time spent on one's own assigned puzzles, lower goal commitment, more endorsement of power-oriented values, and lower perceptions of group viability. It may be that the implicit measure is indeed tapping an independent identity outside of conscious awareness and distinct from more consciously-accessible independent identity. However, it would not be prudent to put too much emphasis on the findings for the implicit measure; with only two significant correlations out of twenty-two correlations, and an alpha level of .05, it is likely that at least one of those correlations is simply a Type I error. Further research will be needed before more conclusive statements can be made about the relevance of non-conscious identification processes in group interactions.

Practical Implications

One take-home message from this study for organizations is that computer-supported cooperative work can lead to positive outcomes in certain situations. For the puzzle-solving task used in this study, computer mediation proved to be an ideal solution: it allowed simultaneous viewing and editing of the task space, and sufficiently supported group members' awareness of each other's actions. Group members were only minimally interdependent on one another to complete their work, and were able to use the software with a minimum of training and with no significant difficulties. Of course, this sort of computer-mediated arrangement may be less optimal for different tasks. More sophisticated technological support may be needed for more interdependent tasks, and such support may require more extensive training before groups can effectively use it to complete their work. For highly intensive group workflow arrangements, there may be

no acceptable alternative to face-to-face interaction. Perhaps the best suggestion for organizations is that they must carefully consider the nature of the task, select an appropriate level of technological support for that task, and do follow-up evaluations of whether that choice was appropriate. While there is reason to be cautiously optimistic, proper planning and post-implementation assessment are essential to success when designing computer-supported cooperative work arrangements.

This study specifically suggests that for tasks such as this, computer mediation may encourage more information sharing from a group's most capable members. However, while this possibility is worth considering, it should be taken with a grain of salt. Computer-mediated groups in this study did not have significantly more correct answers than face-to-face groups, so rather than enhancing overall performance, the context manipulation seems to have encouraged cooperation at the expense of independent work. This orientation toward sharing the task, rather than working independently, may itself be desirable to organizations trying to establish a more cooperative climate. However, it is no guarantee of improved overall group performance.

Finally, this study sheds a bit of light on the current state of groupware available to organizations. The EditGrid software program functioned without errors or crashes with four participants working simultaneously, and it features many of the spreadsheet functions of Microsoft Excel. However, as is likely to be the case with many currently-available collaborative software solutions, the focus of development has been on replicating the individual-user experience with as high a degree of fidelity as possible, rather than on facilitating cooperation. Thus, it was necessary to augment the software with a macro to enable a modicum of workspace awareness. Hopefully we will see vast

improvements in this area as organizational researchers pair up with software developers to improve the support of group processes. The take-home message for organizations considering collaborative software is to evaluate how different software solutions support (or fail to support) actual collaboration, rather than simply choosing software based on how well it replicates current practice in independent work.

Limitations

As noted previously, the sample used in this study was not broadly representative, but rather reflects a young adult population pursuing a college degree. While this limits the generalizability of the findings, its specificity is also a strength in that it suggests how computer mediation affects performance among the next generation of professional workers. It would be ideal for a future study to augment this sample with a sample from an older population (preferably without sacrificing sample size) in order to examine whether effects are present in one population and not the other.

The experimental nature of this study helps quell internal validity concerns, but at the expense of external validity. The actual task, while somewhat artificial, was chosen to be moderately difficult for participants and was selected to be representative of the kind of collaborative document editing and problem solving that organizations engage in. Additionally, participants performed this task in environments that closely approximated typical office workspaces, using professional software to complete their task. However, there are important differences between the study conditions and those in a typical work setting. Participants in this study had no history of interaction, no expectation of future interaction, and only a very brief time together. While most participants indicated that they were motivated to do well on the task, it may have been less consequential to them

than would be their performance at an actual job. Thus it is possible that the processes observed here would be fundamentally different among extant work groups in organizational settings.

Lastly, the measurement of non-conscious identity level requires further refinement. It may be that the word completion measure is not sensitive to subtle differences in identity level, and a different measurement instrument would be preferable. One alternative would be to use computer-based reaction time measures to assess how accessible concepts are in memory. For example, a lexical decision task (Meyer & Schvaneveldt, 1971) could be used, in which participants are presented with a series of letter strings on a computer screen, with the task being to indicate whether the letter string is a legitimate word or a nonsense word. Presuming that certain contexts make independent concepts more accessible, participants' response latencies on words related to independence (e.g. "solo") should be enhanced. However, it becomes difficult to differentiate between computer-mediated and face-to-face contexts when participants in both conditions must be put in front of a computer to complete the lexical decision task.

Another alternative, which still allows a paper-and-pencil mode of delivery, is the sentence construction task (Srull & Wyer, 1979), in which participants are presented with a scrambled set of words and are asked to form a proper sentence using all but one of the words presented. For instance, the word set "solution we I a found" could be solved as "I found a solution" or "we found a solution", with the former suggesting a more independent identity level and the latter suggesting a more collective identity level. While it is preferable not to use an excessive number of measures, particularly when hypothesis guessing is a concern, it may be prudent to include a variety of implicit

measures in an experiment until their psychometric properties and construct validity are better understood.

Future Directions

One exciting trend in current psychological research is the increased use of experience sampling methodologies in workplace settings (e.g., Miner, Glomb, & Hulin, 2005; Ilies & Judge, 2004; for discussion of the methodology, see Larson & Csikszentmihalyi, 1983; West & Hepworth, 1991). These studies generally involve brief surveys administered repeatedly at random times during participants' work day over the course of a few weeks, often using pagers or palmtop computers to prompt participants to respond to the survey. This methodology allows within-person examination of how hour-to-hour fluctuations in employees' work experiences, such as their interactions with others or the context they are working in, relate to important work outcomes such as citizenship behavior or withdrawal from work. With respect to the research questions of this study, experience sampling methodology could be used to assess how differing work contexts (e.g. working independently at a cubicle, working independently in an open office arrangement, or meeting with coworkers around a table) influence an employee's identity level, and how that in turn relates to their subsequent behavior at work.

Future research should consider how the relationship between identity level and cooperation may differ for various tasks. That is, a task that inherently requires cooperation to be completed is likely to constitute a "strong" situation, in which even independent-minded group members would be compelled to participate. For such a strong situation, it is unlikely that a relationship between identity level and cooperation would be found (Tett & Burnett, 2003). Alternately, a highly independent task could be

used to create a weaker situation than that used in this study. In the case of knowledge management systems such as corporate "wikis", organizations are asking employees to post discoveries and best practices that they come across during their independent work. In the absence of overt pressure to meet some quota for contributions to the wiki, it may be that only those employees with a strong collective orientation are inclined to consider their fellow employees and contribute to the wiki. In that situation, it is more likely that a relationship between identity level and cooperation would be detected, and factors affecting identity level would thus be more relevant to the prediction of cooperation as well. Since such contributions are likely to be a low base-rate event, this sort of research is probably ill-suited for brief experimental designs; instead, a longitudinal approach in an organizational setting would be ideal.

Conclusion

While many of the hypotheses were not supported, this study nonetheless shed light on how computer use relates to group behavior and suggests directions for future research. For all of the questions this research generates, one thing is quite certain: Computer technology will play an increasingly influential role in the daily lives of knowledge workers. Studying how computer use affects intermediate employee mental states and their consequent behaviors will be essential to understanding, predicting, and enhancing employee satisfaction and performance.

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Appendices

Appendix A

Hypothesized Model

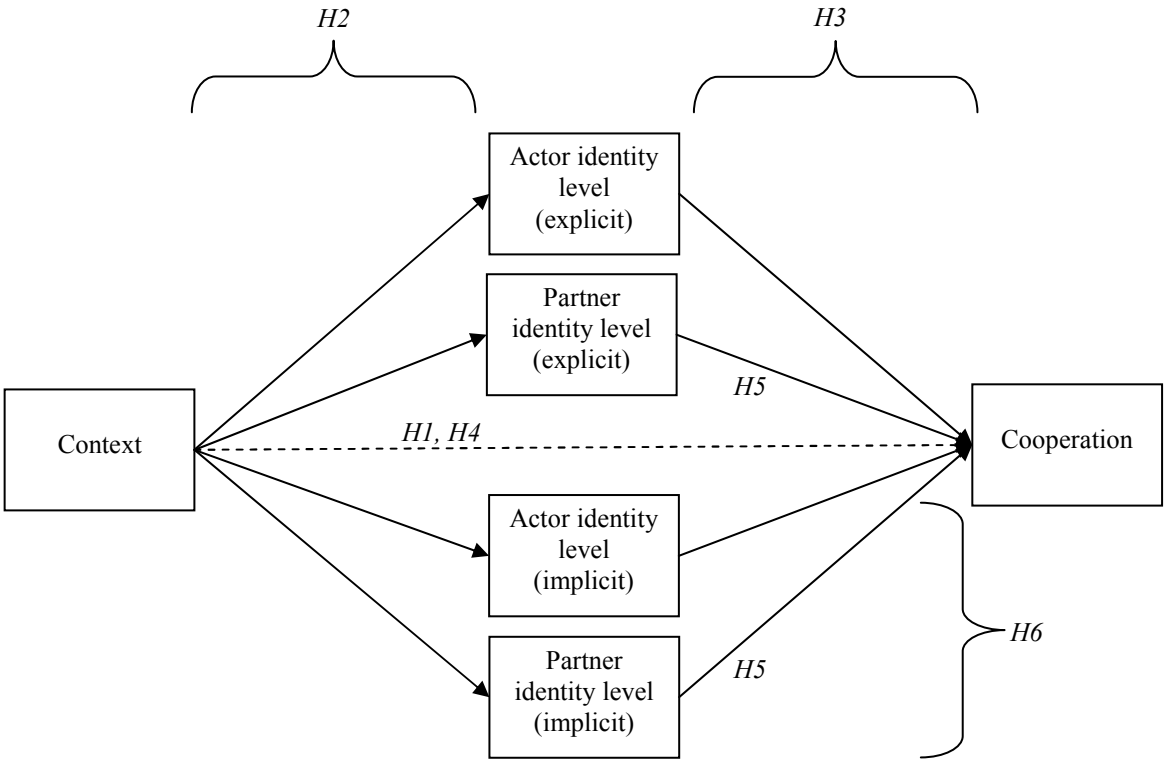

Figure 1. Hypothesized relationships between context and cooperation, including mediating and moderating variables.

Appendix B

EditGrid Workspace Awareness Macro

```
cursor.onStartEdit = function (inputText, cell)
{
var RED = 0xff0000, WHITE = 0xffffff, BLUE = 0x0000ff,
GREEN = 0x00ff00, PURPLE = 0xff00ff, BLACK = 0x000000;

var user = grid.getSessionInfo().userId;
     if (user == userId1)
          {
          cell.applyStyle({ backColor: WHITE, fontColor:
          RED });
          }
     else if (user == userId2)
          {
          cell.applyStyle({ backColor: WHITE, fontColor:
          BLUE });
          }
     else if (user == userId3)
          {
          cell.applyStyle({ backColor: WHITE, fontColor:
          GREEN });
          }
     else if (user == userId4)
          {
          cell.applyStyle({ backColor: WHITE, fontColor:
          PURPLE });
          }
     else if (user == userId5)
          {
          cell.applyStyle({ backColor: WHITE, fontColor:
          BLACK });
          }
     else
          {
          alert("Error");
          }
}
```

Note. The five values of "*userId#*" must be replaced with the unique user ID numbers assigned to the research administrator and each of the four group members by EditGrid.

Appendix C

Implicit Identity Level Word Completion Task*

Independent Identity Items

	Item	Individual responses	Collective responses	Sample neutral responses
1.	_ E	ME	WE	BE
2.	_ E _ S O N A L	PERSONAL	--	SEASONAL
3.	S _ _ F	SELF	--	SURF
4.	_ I N E	MINE	--	DINE
5.	S O L _	SOLO	--	SOLD
6.	D I S T _ N C _	DISTINCT	--	DISTANCE

Collective Identity Items

	Item	Individual responses	Collective responses	Neutral responses
1.	_ E A M	--	TEAM	SEAM, BEAM
2.	B U _ C H	--	BUNCH	BUTCH
3.	_ _ M M O N	--	COMMON	SUMMON

* Modified from Johnson and Lord (2007).

Appendix D

Explicit Independent Identity Level Scale Items*

1. I want to demonstrate that my abilities or talents are better than those of other group members.
2. I have a strong need to know how I stand in comparison to group members.
3. I intend to compete with group members.
4. I will feel better about myself if I perform better than group members.
5. I am attentive to the ways that I am better or worse off than group members.

* Selenta & Lord (2005).

Appendix E

Explicit Collective Identity Level Scale Items*

1. I prefer to work in this group rather than working alone.
2. Working in this group will be better than working alone.
3. I want to work with this group as opposed to working alone.
4. I feel comfortable counting on group members to do their part.
5. I am not bothered by the need to rely on group members.
6. I feel comfortable trusting group members to handle their tasks.
7. The health of this group is important to me.
8. I care about the well-being of this group.
9. I am concerned about the needs of this group.
10. I will follow the norms of this group.
11. I will follow the procedures used by this group.
12. I will accept the rules of this group.
13. I care more about the goals of this group than my own goals.
14. I will emphasize the goals of this group more than my individual goals.
15. Group goals are more important to me than my personal goals.

* Jackson, Colquitt, Wesson, and Zapata-Phelan (2006).

Appendix F

Goal Commitment Scale Items*

1. It's hard to take this goal seriously. ®
2. Quite frankly, I don't care if I achieve this goal or not. ®
3. I am strongly committed to pursuing this goal.
4. It wouldn't take much to make me abandon this goal. ®
5. I think this is a good goal to shoot for.

* Klein, Wesson, Hollenbeck, Wright, and DeShon (2001).

® Reverse-coded.

Appendix G

Entitativity Scale Items*

1. To what extent do you believe that the task group in this study typifies what it means to be a "group"?
2. To what extent do you believe members of the task group will be affected by the behaviors of the other group members?
3. How similar are members of the task group?
4. How organized do you think the task group is?
5. How motivated are members of the task group to achieve group goals?
6. How structured do you think the task group is?
7. How committed do you think the members of the task group are to their group?
8. How invested do you think the members of the task group are in their group?
9. How strongly bonded do you think the members of the task group are to their group?
10. To what extent do you believe members of the task group share common goals?

* Adapted from Rydell & McConnell (2005).

Appendix H

Espoused Values Scale Items*

Universalism Items

1. EQUALITY (equal opportunity for all)
2. INNER HARMONY (at peace with myself)
3. A WORLD AT PEACE (free of war and conflict)
4. UNITY WITH NATURE (fitting into nature)
5. WISDOM (a mature understanding of life)
6. A WORLD OF BEAUTY (beauty of nature and the arts)
7. SOCIAL JUSTICE (correcting injustice, care for the weak)
8. BROAD-MINDED (tolerant of different ideas and beliefs)
9. PROTECTING THE ENVIRONMENT (preserving nature)
10. RESPONSIBLE (dependable, reliable)
11. FORGIVING (willing to pardon others)

Benevolence Items

1. A SPIRITUAL LIFE (emphasis on spiritual not material matters)
2. MEANING IN LIFE (a purpose in life)
3. MATURE LOVE (deep emotional and spiritual intimacy)
4. TRUE FRIENDSHIP (close, supportive friends)
5. LOYAL (faithful to my friends, group)
6. HONEST (genuine, sincere)
7. HELPFUL (working for the welfare of others)

Power Items

1. SOCIAL POWER (control over others, dominance)
2. WEALTH (material possessions, money)
3. SOCIAL RECOGNITION (respect, approval by others)
4. AUTHORITY (the right to lead or command)
5. PRESERVING MY PUBLIC IMAGE (protecting my "face")

Achievement Items

1. AMBITIOUS (hardworking, aspiring)
2. INFLUENTIAL (having an impact on people and events)
3. HEALTHY (not being sick mentally or physically)
4. CAPABLE (competent, effective, efficient)
5. INTELLIGENT (logical, thinking)
6. SUCCESSFUL (achieving goals)

* Schwartz (1992).

Appendix I

Group Viability Scale Items*

1. I would be willing to participate in another study with this same group of individuals.
2. I feel that this group of individuals would work well together on another task.
3. I would enjoy working with this same group of individuals on another task.

* Sinclair (2003)