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RESOLVING COMMUNICATION
DILEMMAS IN DATABASE-MEDIATED
COLLABORATION

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Abstract

In organizational settings, a communication dilemma exists whenever the interests of a collective (i.e., team, organization, interorganizational alliance) demand that people share privately held information but their individual interests instead motivate them to withhold it. This article develops and tests an expectancy model that predicts specific conditions under which collective benefits can be made to converge with private ones, thus resolving communication dilemmas and motivating voluntary contributions to a collectively shared database. In the model, motivation is a multiplicative function of individual-level attitudes and beliefs: (1) *organizational commitment*; (2) *organizational instrumentality*, an instrumentality that links successful collective information sharing to broader organizational gain; (3) *connective efficacy*, an expectation that information contributed to the database will reach other members of the collective; and (4) *information self-efficacy,* the self-perceived value of a contributor's information to other database users. The model was tested by a survey administered to members of an intact work team using a discretionary database. The multiplicative model was significant and explained sizeable amounts of variance in the motivation to contribute discretionary information. Implications for theory and practice are discussed. The model can be readily extended to predict information sharing by means of other communication media.

Resolving Communication Dilemmas in Database-Mediated Collaboration

Shared databases are rapidly becoming integral to an ever-increasing array of organizational communication systems (Korth & Silbershatz, 1997; Simon & Marion, 1996). Examples include relatively straightforward extensions of database technology such as in data warehouses, expert repositories and "lessons learned" records. But databases lie also at the core of other applications based upon information storage and supporting both real-time (synchronous) and asynchronous communication, ranging from groupware, project websites on intranets and extranets, shared whiteboards, and a variety of other conferencing and knowledge management systems. Shared databases are likewise becoming instrumental if not indispensable to a great variety of organizational tasks. These range from routine information management in small groups, to enterprise-level business process management, to the complex and highly non-routine activities of researchers, investigators, and project team members collaborating to create collective work products (e.g., see Monge, Fulk, Kalman, Flanagin, Parnassa & Rumsey, 1998; Rein, McCue, & Slein, 1997). To an increasing extent, the functionality of communication technologies to connect people across distance and time seems merged with the functionality of databases to enable the sharing of information. Despite this fact—or perhaps even because of it—we propose that it is useful to consider particular challenges arising when people employ shared databases as communication media. One of the challenges is to motivate voluntary collective sharing of information.

Users benefit from shared databases by pooling information at a commonly accessible location. Special difficulties arise, however, when users must themselves stock the database with *discretionary* information. Information is discretionary if it is "initially under the control of one organizational member, who can choose whether or not to make it available to others" (Connolly & Thorn, 1990, p. 219). Laboratory experiments have demonstrated a chronic problem of under-supplied discretionary information in shared databases (Connolly & Thorn, 1990; Connolly, Thorn & Heminger, 1992), especially when users are provided free access to the database regardless of

whether they contribute. As in other collective actions, people are commonly tempted to take a "free ride" on the contributions of others out of a myopic concern for individual gain, and despite the risk that others will behave likewise causing collective failure (Dawes, 1980; Hardin, 1982; Sweeney, 1973). The collective need to stock the database conflicts with their individual wishes to avoid paying the costs associated with contributing their own information.

Under some circumstances, one way to resolve the under-supply problem is to do away with discretionary information, making database contributions mandatory. But this strategy can be difficult or impossible to achieve. If people are rewarded for the quantity of contributions, the perverse effect may be to encourage lesser quality (e.g., lower accuracy) and thereby degrade the overall value of the database (Connolly & Thorn, 1990). Managers are ultimately at a disadvantage in any contest with subordinates over the control of many types of information (Miller, 1992), such as people's ideas, expertise, and knowledge. As Kim & Mauborgne (1997) observe, organizational success often requires that people share their knowledge, and yet, "Unlike the traditional factors of production—land, labor, and capital—knowledge is a resource that can't be forced out of people." Voluntary cooperation is extremely important. Even if management imposes mandates to guarantee a minimum level of contributions, users can exercise discretion to exceed the mandates. Consequently, the effectiveness of database-mediated collaboration depends on their motivation to do so. The present study develops and tests a model of database users' motivation to contribute discretionary information. It focuses on multi-user databases designed to help people share ideas and knowledge voluntarily. The paper begins by reviewing the literature on communication dilemmas and developing the hypotheses. The subsequent sections report on a test of the hypotheses in a design team in the aerospace industry. The paper concludes with implications for theory, research and practice.

Communication dilemmas and other serious games

  Situations that pit the interests of the collective (e.g., group, organization) against self-centered interests of its members are known as social dilemmas (Dawes, 1980; Messick & Brewer, 1983; Rutte & Wilke, 1992; Van Lange, Liebrand, Messick, & Wilke, 1992). Social dilemmas underlie a host of societal problems involving publicly shared goods and resources, in terms of both under-supply (e.g., public television; roads and bridges; national defense) and over-consumption (e.g., over-fishing; overpopulation; environmental pollution). Researchers in many disciplines (e.g., communication, psychology, sociology, economics, political science, public administration) study such critical situations (e.g., for reviews see Dawes, 1980; Foddy, Smithson, Schneider & Hogg, 1999; Komorita & Parks, 1994; Liebrand & Messick, 1996; Lopes, 1994; Messick & Brewer, 1983; Oliver, 1993; Robertson & Tang, 1995; Sandler, 1992). In the organizational realm, social dilemmas underlie a number of common problems, from information hoarding and social loafing in teams to interorganizational communication failures. Ever since Olson (1965) proclaimed that voluntary participation in collective action is incompatible with the self-interests of economically rational individuals, researchers across these various disciplines have examined how collective actions ever succeed, since they do with some regularity.

  In every collective action the outcomes that people experience depend on their own choices in conjunction with others' choices. Their interdependence can take many forms, sometimes described as games (e.g., see Lewis, 1969; Luce & Raiffa, 1957; Komorita & Parks, 1994; Sandler, 1992; Von Neumann & Morgenstern, 1944). Only a few types of game are of particular interest here. One is the *prisoner's dilemma* where collective outcomes are best when everyone contributes, and worst when none contribute. When some contribute and others do not, the net effect is to benefit non-contributors (free riders) at the expense of contributors, who take a loss. By contrast, free riding is impossible in some other games. In a *best-shot game*, the greatest contribution by any one individual sets the collective gain for everyone; other contributions are redundant at best. It is then

critical to ensure only that someone does contribute. Conversely, in an *assurance game* no one gains unless all contribute. Players need not fear exploitation by free riders but they still may withhold contributions, fearing someone else will withhold, making all contributions go to waste (Sandler, 1992, p. 39).

Recent work on social dilemmas of various types recognizes that communication is an important factor in collective action. Laboratory research has shown that communication among members of a collective can be of exceptional importance for promoting cooperative choices in a social dilemma (Dawes, van de Kragt & Orbell, 1990; Kerr & Kaufman-Gilliland, 1994; Komorita & Parks, 1994; Lopes, 1994; Messick & Brewer, 1983). Field researchers have likewise found communication activities to be key for mobilizing a collective into action (e.g., Collins-Jarvis, 1997; Diani & Eyerman, 1992; Klandermans, 1984; 1992; Marwell & Oliver, 1993). Communication helps people better understand their situation, plan and promise cooperation, and come to identify more closely with each other's interests (Dawes, van de Kragt, & Orbell, 1990; Kerr & Kaufman-Gilliland, 1994; Orbell, van de Kragt & Dawes, 1988; Skjei, 1973).

Ironically, communication itself may fall prey to the same game-playing motives that impede the very actions it was meant to facilitate. Communication is not just a useful mechanism for coordinating individual behaviors; it is itself a collective action. Terms that have been used to specify a social dilemma impeding communication include *communication dilemma* and *information dilemma* (Bonacich & Schneider, 1992; Zucker, Brewer, Darby, & Peng, 1994). Either term might be applied to describe the social dilemma faced by people deciding whether to share discretionary information in a database. We employ the term communication dilemma to connote the connective function we see the database playing as a medium of communication within and between workgroups. In organizational settings, a communication dilemma exists whenever the organization's interests demand that people share discretionary information but their individual interests motivate them to withhold it. The impact of communication dilemmas upon an

organization's interests depends upon the particular characteristics of the work setting, communication system, and specific activities where people use shared information (Fulk, Flanagin, Kalman, Monge & Ryan, 1996; Kalman, 1999; Kalman, Fulk & Monge, 1999; Monge et al., 1998). But in all communication dilemmas, the overall structure of incentives ultimately inhibits discretionary information sharing.

Bonacich & Schneider (1992) recounted an especially tragic case where a communication dilemma led in 1986 to the destruction of the United States' Space Shuttle Challenger, killing the astronauts aboard. Behind the mechanical malfunction and explosion lay a failure by senior managers at NASA in the months preceding the accident to share appropriate safety-related information. This withholding could be traced back to parochial individual interests and conflicting responsibilities toward the NASA organization.[1]

Motivation to contribute discretionary information

Klandermans (1984) and Staw (1984) used expectancy theory to build motivational models of individual choice in a collective action. Kalman (1996) extended these models to discretionary information contributions. In expectancy theory, motivation is predicted by the multiplicative product of (a) the valence of outcomes a person expects to occur from contributing, and (b) the strength of the person's belief these outcomes are likely to occur (Lawler, 1981; Vroom, 1964). Valence is the anticipated value, or attractiveness, of the outcome. If either the valence or likelihood of a potential collective outcome decreases to zero, the outcome has no power to motivate according to the original theory. These are single-actor rational-choice models assuming that people act in pursuit of maximum personal gains (the net result of benefits minus costs; Marwell & Oliver, 1993). Gains are determined by each person and can include material goods such as money, various psychic rewards such as positive feelings of sociability, and the attainment of a good purpose (Clark & Wilson, 1961; Knoke & Wright-Isak, 1982; Oliver, 1993; Opp, 1989; Sugden, 1991). A key challenge of

collaboration is to so intertwine the personal gains of each individual with the realization of collective success that the two become hard for people to distinguish.

Staw's (1984) classic work proposed a motivation model for individuals working toward the production of gain for the whole organization. The model incorporates a term for *identification* to indicate the value placed on organizational gain, while explicitly excluding from the model a distribution of gains from the organization to individual members. The idea is that people can be motivated to produce organizational gain for its own sake. The model can be summarized as the product of identification (ID) and the expectation of organizational gain (E_{OG}). In this model, ID substitutes for the valence term usually appearing in expectancy theory models because identification is meant to perform the same function as valence, indicating the degree to which a person values the specified outcome, gain to organization.

$$\text{Motivation} \ = \ \text{ID x } E_{OG} \tag{1}$$

Identification can be viewed as either a process of forming an attachment or as the product of that process (Sass & Canary, 1991; Scott, Corman & Cheney, 1998). In focusing on people's readiness to help pursue organizational gain, Staw implicated the product form. Drawing on Sass & Canary's (1991, p. 277) argument that the product form of identification is "conceptually and empirically similar" to attitudinal commitment and Scott et al.'s (1998, p. 299) assertion that identification "shares much overlap" with attitudinal commitment, our model substitutes attitudinal commitment as conceptually similar to identification, specifically identification-as-product.

The most well validated and well-used conceptual and operational definition of attitudinal organizational commitment in the organizational behavior literature is from Mowday, Steers and Porter (1979; Mowday, Porter & Steers, 1982). They defined organizational commitment as identification and involvement with an organization, reflected in three facets: (a) desire to remain a member of the organization, (b) concern for the organization's welfare, and (c) willingness to extend extra effort on the organization's behalf. Mowday et al. (1982) distinguish their attitudinal version of

commitment from behavioral commitment, which tends to be viewed as distinct and different from identification (Sass & Canary, 1991). Nevertheless, they and others have argued that there is a cyclical relationship between the two types of commitment in that each may tend to reinforce the other (Mathieu & Zajac, 1990; Reichers, 1985). The type of attachment associated with identification-as-product or attitudinal commitment is particularly valuable in developing a model related to communication dilemmas, because group identification has experimentally been found to promote cooperation in social dilemmas (Brewer & Kramer, 1986; Dawes, van de Kragt & Orbell, 1990; Kramer & Brewer, 1984) and, in particular, communication dilemmas (Bonacich & Schneider, 1992).

The second change we make to Staw's model is to elaborate E_{OG} so that it is more specific to discretionary information sharing. E_{OG} is the strength of a person's belief that individual performance (e.g., contributing information) produces gain to the whole organization, here called *organizational gain* (OG). E_{OG} will be decomposed into three component beliefs, each necessary to contributor motivation.

Organizational instrumentality (OI) refers to the belief that OG will result if people collectively use the database to share information. In the present model, stocking the database with information is only an intermediate goal and is not valuable in itself. Rather, OI establishes the instrumentality of collective database use for producing OG.

The two other component beliefs that comprise E_{OG} are specialized variants of constructs well known in collective action research: collective efficacy and individual self-efficacy. *Collective-efficacy* refers to the belief that people have the ability as a group to carry out a successful collective action (Riggs, Warka, Babasa, Betancourt, & Hooker, 1994; Shamir, 1990). *Self-efficacy,* in the context of collective action, refers to an individual's self-assessment that his or her own participation will make a difference in the collective action's success (Kerr, 1992; Oliver, 1993; cf. Bandura,

1986, p. 391). These perceived abilities of the collective and of the individual person combine to form an expectation that contributing is likely to result in a collective success.

To customize these two constructs to the action at hand—sharing information—requires careful consideration of the database users' interdependence in achieving collective success. One instance of interdependence is between any given contributor and all potential recipients. Contribution, and subsequent retrieval, of information are mutually necessary conditions for any exchange of information via the database. Contributors and recipients could thus be said to face an assurance game. We limit our discussion to this critical contributor-recipient interdependence in deriving specialized conceptions of collective efficacy and self-efficacy.[2] A motivational model derived within this focus should have wide applicability across shared databases, sets of users, and work settings.

With respect to collective efficacy, the question faced by each potential contributor is whether the database offers an effective means for reaching other people. To start with, the database must function to provide connectivity between users (Weik, 1996). What's more, when some users contribute, other database users must do their part by retrieving at least some of the contributed information. *Connective efficacy* (CnE) will refer to a person's belief that other people who can use contributed information will in fact receive it.

CnE has similarities with Fulk et al.'s (1996) concept of social connectivity (see also Monge et al., 1998). Both concern interconnection among members of a collective and depend on the mutual actions of recipients as well as contributors. But social connectivity is an emergent characteristic of the entire collective, whereas we employ CnE in constructing a model of individual motivation. CnE reflects the belief held by a person regarding the likelihood that his or her own contributions will find a receptive audience. Contributors' levels of CnE may differ for a number of reasons. They may hold different opinions about system connectivity overall, as some are better informed than others about aggregate system use. If contributors are identifiable in the database, then high-status users or

individuals with reputations for high task-relevant expertise will likely feel more confident that contributions will gain positive attention than others holding lesser status or reputations (Larson, Foster-Fishman & Franz, 1998; Stasser, Vaughan, & Stewart, 2000; Wittenbaum, 2000). By contrast, when the database provides anonymity, CnE may have less to do with user status or reputation. This factor has explained wider participation in discussions mediated by decision support systems providing anonymity (e.g., see Fulk & Collins-Jarvis, 2000). Still another reason for CnE levels to differ between contributors arises when some wish to reach recipients already known to use the database, while other potential contributors know or suspect the people whom they wish to receive information can only be reached using alternative communication media.

With respect to self-efficacy, the first two components of E_{OG} (OI and CnE) come to naught in producing OG unless the potential contributor holds valuable discretionary information. *Information self-efficacy* (ISE) will refer to a person's belief that others would value that person's information if they found it in the database. ISE refers particularly to information content, assessed on its own merits and (unlike CnE) focuses on the contributor's private assessment of information value. Where a contributor's identity is known to recipients, ISE and CnE may overlap to an extent, should contributors expect recipients to choose information based on attributions of source credibility, status or power. The contributor's private assessment, however, as represented by ISE does bear on confidence to put forward helpful information (Stasser et al., 2000). And this should be increasingly important to the degree that using a database to communicate tends to hide or reduce the salience of contributor identity when recipients choose which information content to receive.

Since OI, CnE and ISE each are necessary conditions for E_{OG}, they together comprise three multiplicative components in an expectancy model. The resulting model is Equation 2. The three terms comprising E_{OG} have been set off in parentheses.

$$\text{Motivation} = \text{OC} \times (\text{OI} \times \text{CnE} \times \text{ISE}) \tag{2}$$

This model leads to several predictions. Before presenting them, it should be noted that

Equation 2 does not represent the effect of individual-level incentives. Management can mandate

contributions using cooperation-contingent incentives selectively accorded to contributors (i.e.,

rewards) or non-contributors (i.e., penalties). If mandates are present in a given work setting and

differ between people due to job assignments, for example, then mandates should tend to cause

substantial between-subjects differences in the total amounts of information that people intend to

contribute. Mandates will therefore be specified as a control variable in the hypothesis to ensure

generality across work settings.

> *Hypothesis 1 (H1). Controlling for mandates, the multiplicative product OC x OI x CnE x*
>
> *ISE will be positively associated with motivation to contribute discretionary information.*

H1 proposes a purely multiplicative model consistent with Vroom's (1964) original

hypothesis that motivation should fall off when deficient levels of any model component are reached.

Implicitly, the multiplicative model should demonstrate a significant incremental effect beyond the

variance explained by a purely additive model, OC + OI + CnE + ISE. The existence of a

multiplicative effect has received substantial empirical support over the years, although it has tended

to be small enough that some researchers employ only the additive model and dispense with the

multiplicative model (Baker, Ravichandran, & Randall, 1989; Oliver, 1993). One source of difficulty

is that the actual size of the interaction's effect is sensitive to arbitrary scaling of the measurement

instrument, particularly when ordinal data are collected. Nonetheless, it has been demonstrated that a

fair test of the effect's presence is obtained by forcing the product term into the final step of a

hierarchical regression after the additive model has been entered (Arnold & Evans, 1979).

With regard to the direction of effects, and the form of interaction, we expect first to find that

any main effects for components of the additive model are positive. The reason for this prediction in

the cases of OI, CnE and ISE is that any main effects should reveal these beliefs to be conducive to

information sharing via the database, while low levels should tend to deter such sharing. For OC, the

reason is the potential tendency for more committed employees to comply with wishes expressed by

management that employees should use the database, irrespective of whether an employee calculates

the behavior will produce organizational gain. OC has been found to correlate with organizational

citizenship behaviors, those behaviors outside of a person's role-defined performance requirements

that are either helpful to co-workers or comply with management wishes to promote welfare of the

organizational as a whole (Organ & Ryan, 1995). A similar correlation may be found directly relating

OC to discretionary information sharing. As for the predicted form of interaction, attitude and beliefs

represented in the model should combine for greater effect jointly than individually, resulting in a

positive interaction effect. These considerations lead us to the second hypothesis.

Hypothesis 2a (H2a). Any main effects for the additive model will be positive.

Hypothesis 2b (H2b). The multiplicative model's incremental effect over main effects will

remain positive.

In summary, this section has described how individuals who collaborate by using a database

to share information sometimes face a communication dilemma. The dilemma discourages them

from contributing discretionary information. As the Challenger disaster illustrates, the collective

costs of communication failure can be substantial. Individuals will tend to resolve the

communication dilemma and to share information in their own best interests when they hold certain

attitudes and beliefs. These include the attitude of organizational commitment (OC) in combination

with beliefs in the organizational instrumentality of sharing information (OI), their ability to use the

database as a means for connecting with other individuals (CnE) and the value of an individual's own

discretionary information to other people (ISE).

Method

<u>Participants</u>

The participants comprised an intact project team of 28 aircraft design engineers in a large U.S. aerospace corporation. The team was established approximately two years prior to the study for the sole purpose of designing a single, integrated airframe. Most members had worked for the organization before enlisting with this team, with tenures averaging ten years and ranging from six months to twenty-five years. Members served in a dozen team roles based upon engineering specialty and three sub-team leadership roles. Team workflow processes had been defined linking members across specialty, leadership and task roles.

After the team had been established, senior management decided to equip it with a system for document management and workflow control, Metaphase™; as implemented in this setting it is called the Design Information System (DIS). This technology was new to the organization and team members were informed that the DIS represented a pilot effort whose purpose was, in part, to assess the system's usefulness. Successful use by members of this team would result in a positive evaluation of the DIS and could precipitate more widespread implementation across the organization. Each member of this team was thus drawn into the mobilization of a collective action that could potentially spread, resulting in either gain or loss to the organization as a whole. These consequences made organization-level instrumentality (OI) and commitment (OC) directly pertinent to their use of the DIS.

All team members were trained in basic DIS user skills, and then the system became available for use a few weeks before the survey. DIS system use was mandatory for members performing the job role commonly called "designer," who made up about one-third of the team. DIS use was optional for all other members. But designers and all other team members were free to exceed mandatory use by sharing discretionary information in the shared DIS database. Each user was permitted to read all contributed information, and contributors were identifiable. It was possible

using DIS to contribute information that was either unique or redundant (i.e., already known to other users). The DIS database supplemented numerous other communication media available to the team. Members shared a physical office space permitting easy face-to-face contact. They could use electronic mail or telephone/voicemail. In addition, there was an established precedent for computer-based file sharing in a separate UNIX computer network, which members continued to use when the DIS became available.

Procedure

Following preliminary discussions with team leaders and several technical training and support personnel, researchers developed and administered an on-site survey to team members. Respondents were assured of confidentiality and researchers immediately collected completed surveys.

Measurement

The survey's opening instructions described several ways in which team members might voluntarily choose to share more information than management required. The level of *mandates* was determined by a combination of two methods. First, a list was constructed stating fifteen job roles (i.e., engineering specialties and sub-team leadership positions). Respondents were instructed to mark which roles they were responsible for performing. Their responses were coded into a dichotomous variable, *job role*, to make the key discrimination between designers (the team members required to use the DIS) and all other respondents. The second method used to determine the level of mandates was an attitude measure, *perceived mandate.* It was a scale comprised of three items. Two items asked the degree to which respondents felt required to use the DIS—at all and specifically to share information. Responses were on a scale ranging from a low of 0 ("not required at all") to a high of 100 ("absolutely required"). Numbers on the response scale increased in increments of 10 to create an 11-point scale overall. The third item asked how much work-related information respondents were required to contribute. Again, response options comprised an 11-point scale ranging from 0 to 100

but were labeled as percentages to describe an *amount*. Both endpoints and the mid-point were anchored to minimize the cognitive task of interpreting percentages, 0% ("none"), 50% ("half") and 100% ("all"). Although these and other 11-point scales used in the survey were alternately phrased in terms of degree or amount (i.e., percentage), care was taken to provide as much commonality in appearance between them as possible by aligning them vertically laying them out similarly and on the page.

Organizational commitment (OC) was measured by the 9-item version of the Organizational Commitment Questionnaire (OCQ; Mowday, Steers & Porter, 1979). Responses were on a 7-point scale that ranged from 1 ("strongly disagree") to 7 ("strongly agree").

Organizational instrumentality (OI) was measured by seven items stating organizational gains that might result if many team members used the database to share information. Two interrelated levels of organizational gain were conceived—gain to the team and gain to the whole organization. The stated outcomes were very broad, positively valenced, work-related outcomes such as to "be more successful," "do a better job at ... assigned tasks," and "receive more of the information ... [needed] to do a good job." One item expressly connected team success to organizational-level gains: "The team does more that helps the organization to achieve its goals." Responses were on a 7-point scale that ranged from 1 ("strongly disagree") to 7 ("strongly agree").

Connective efficacy (CnE) was measured by five items. The instructions first posed two hypothetical assumptions: (1) Suppose that you contribute information into the DIS; and (2) "Assume it is valuable information that will greatly benefit other team members *if* they receive it." They were next instructed to indicate what they expected to happen. For instance, one item read, "Out of all the team members who could benefit, the portion who will actually read this information using DIS is . . . ." The 11-point response scale ranged from 0% ("no one") to 100% ("all"). Other items asked how many team members would even be able to use the DIS, how many would receive information second-hand from someone else using the database, and how many would never receive the

contributed information. The fifth item asked the overall likelihood that other team members would receive the information "when they need it," on an 11-point scale from 0 ("not at all likely") to 100 ("extremely likely").

Information self-efficacy (ISE) was measured by five items. These items asked about respondents' ability to provide discretionary information that other team members would consider valuable *if* they retrieved it. The items were selected and adapted from Riggs et al.'s (1994) Personal Efficacy Beliefs Scale, a general-purpose instrument designed to measure self-efficacy toward overall job performance. The 7-point response scale ranged from 1 ("strongly disagree") to 7 ("strongly agree").

Motivation was measured by five items. Respondents were instructed to consider *only* discretionary information sharing. Four items asked how much effort they intended to put into sharing information by means of the DIS. The items reiterated four ways of contributing discretionary information described in the survey instructions: sharing information sooner, in greater amounts, in additional types, and more widely among team members. Responses were registered on an 11-point scale that ranged from 0 ("no effort at all") to 100 ("a great deal of effort"). The final item asked respondents how likely it was they would contribute information at their next opportunity. Response options were provided on an 11-point scale from 0 ("not at all likely") to 100 ("extremely likely").

<u>Analysis</u>

<u>Preliminary analysis</u>. Scales were tested for reliability using Chronbach's alpha and item analysis. Individual items were considered for removal if they detracted from reliability. In the case of skewed variables, a square-root transformation was performed so the mean would provide a better indicator of the data's central tendency (see Tabachnick & Fidell, 1983, p. 84).

<u>Principal analyses</u>. Hypotheses were tested by means of hierarchical linear multiple regression. In preparation, multiplicative models first were computed to create product terms for

entry into the regression. The principal model at issue was the product OC x OI x CnE x ISE. The first hierarchical regression step contained the control variables representing mandates—job role and perceived mandate. Succeeding steps tested main effects, then the product term. Analyses involving a transformed variable were performed twice. The untransformed variable was used to provide a baseline result. It then was replaced by the transformed variable and the analysis was repeated to determine whether the variable's non-normality had affected the baseline result. Data were analyzed with SPSS for Windows, version 7.5. The criterion for statistical significance was 0.05.

<div align="center">Results</div>

Preliminary Analyses

Scales. Table 1 summarizes results of the analysis for scale reliability. Item analysis revealed two items suppressing reliability in scales for CnE and for ISE. When these items were removed, reliability of the scales averaged alpha = .88 and ranged from a low of .79 for perceived mandate to a high of .95 for motivation. For the OCQ, alpha = .93 in line with typical published values of approximately .90 (e.g., see Mowday et al., 1979). For the ISE scale, alpha = .84, comparing favorably with reliability reported by Riggs et al. (1994) for the Personal Efficacy Beliefs scale (alpha = .86). Mean scores for the three 7-point scales (OC, OI, ISE) all were grouped in the range M = 4.5 to 4.7, or slightly above the scale mid-point (4.0). Other mean scores (on the 11-point scales) for Motivation (M = 43) and CnE (M = 40) were not significantly different than their scale mid-point (50). There was one case of missing job role data; list-wise deletion was applied. With respect to normality, only one variable required transformation, the 4-component product OC x OI x CnE x ISE. (The ratio of skewness to standard error = 2.24.) It was normally distributed following transformation.

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TABLE 1 ABOUT HERE

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<u>Principal Analyses</u>

Descriptive statistics for the six variables and their correlations are provided in Table 2. Tests of the hypotheses are summarized in Table 3.

Hypothesis 1 predicted that, controlling for mandates, the multiplicative model (OC x OI x CnE x ISE) would be associated with motivation. The effect was tested by comparison to the corresponding additive model (OC + OI + CnE + ISE). Results of the first regression step showed no significant effect for control variables, $\underline{F}(2,24) < 1$, <u>ns;</u> $\underline{R}^2 = .07$. In the second step, the four components of the additive model were entered simultaneously. The additive model showed a significant effect overall, $\Delta\underline{F}(4,20)= 4.84$, $\underline{p} < .001$; $\Delta\underline{R}^2 = .46$. There were main effects for two components, CnE (<u>Beta</u> $= 0.53$, p $= .01$, $\Delta\underline{R}^2 = .18$) and OC (<u>Beta</u> $= 0.35$, p $= .05$, $\Delta\underline{R}^2 = .10$), and no main effects for ISE (Beta $= 0.01$, <u>ns</u>) nor OI (Beta $= 0.06$, <u>ns</u>).

TABLES 2 & 3 ABOUT HERE

The hypothesized multiplicative model was entered in the third step. The full regression model tested significant in baseline case, $\underline{F}(7,19)= 4.61$, $\underline{p} < .01$; $\underline{R}^2 = .63$. Furthermore, the predicted interaction was significant (<u>Beta</u> $= 0.93$, $\underline{p} < .05$, $\Delta\underline{R}^2 = .10$). Transformation to correct for skewness did not alter the results in terms of the amount of variance explained. The full regression model tested significant, $\underline{F}(7,19)= 4.52$, $\underline{p} < .01$, $\underline{R}^2 = .63$, matching the baseline case in variance explained. The transformed interaction also was significant and matched the baseline case (<u>Beta</u> $= 1.50$, $\underline{p} < .05$, $\Delta\underline{R}^2 = .10$). Hypothesis 1 was supported by the data.

Hypothesis 2a predicted that significant main effects would be positive. As reported above, there were two significant main effects and the regression coefficient was positive for each, <u>Beta</u>

(CnE) > <u>Beta</u> (OC) > 0. Hypothesis 2b predicted that the incremental effect of the multiplicative model over main effects would remain positive. This, too, was supported for both the baseline (<u>Beta</u> = 0.93 > 0) and transformed data (<u>Beta</u> = 1.50 > 0).

<u>Post-Hoc Analyses</u>

The principal analyses indicated main effects for some, but not all, of the four model components. Effects were found only for OC and CnE. Inspection of results after the first regression step revealed a significant partial correlation between not only motivation and OC ($\underline{r} = 0.42$, $\underline{p} <$ .05.), and between motivation and CnE ($\underline{r} = 0.59$, $\underline{p} < .01$), but also between motivation and OI ($\underline{r} = 0.43$, $\underline{p} < .05.$). Nevertheless, regression results suggested OI and ISE either (a) contributed to model performance only through interaction, or (b) did not contribute. An alternative post-hoc model was constructed to explore the latter possibility.

The model was comprised of additive terms OC and CnE with their interaction (OC x CnE). It was tested by means of a hierarchical regression in three steps: (1) control variables (job role and perceived mandate); (2) OC and CnE; and (3) OC x CnE.

Following the control variables in the first step, $\underline{F}(2,24) < 1$, <u>ns;</u> $\underline{R}^2 = .07$, the second step revealed effects for the additive model overall, $\Delta\underline{F}(2,22)= 10.55$, $\underline{p} = .001$; $\Delta\underline{R}^2 = .46$, and both components, CnE (<u>Beta</u> $= 0.57$, $\underline{p} = .001$, $\Delta\underline{R}^2 = .29$) and OC (<u>Beta</u> $= 0.37$, $p < .05$, $\Delta\underline{R}^2 = .13$). In the third step, the full post-hoc regression model tested significant, $\underline{F}(5,21) = 7.03$, $\underline{p} = .001\underline{;}$ $\underline{R}^2 = .63$, as did the interaction term (Beta $= 1.27$, $\underline{p} < .05\underline{;}$ $\Delta\underline{R}^2 = .10$). Notably, explanation of 46% unique variance for the post-hoc additive model (OC + CnE) matched the performance of the hypothesized four-component model (OC + OI + CnE + ISE). Furthermore, the explanation of 10% variance by the interaction (OC x CnE) matched performance of the hypothesized four-component interaction.

Discussion

This research examined communication dilemmas in the use of a shared database to support collaborative work. Communication, as a form of collective action in its own right, is subject to failure if people withhold valuable discretionary information from other database users. The research showed how organizational commitment and expected outcomes predict motivation to contribute, thus providing a resolution of the communication dilemma.

Hypothesis 1 stated that contributor motivation would be predicted by the multiplicative product OC x OI x CnE x ISE. The hypothesis was supported by the data. The model's predictors explained 56% of variance overall, and the incremental effect of the product term was to explain 10% of variance in motivation. These results were unaltered after transformation of the product term to adjust for non-normality. In support of Hypothesis 2, the direction of all effects was positive, both for the main effects and for the interaction.

A post-hoc model was constructed from the three variables, OC, CnE and their interaction (OC x CnE). It performed as well as the hypothesized four-component model. Thus, dropping OI and ISE created an equally predictive but more parsimonious model. However, the pattern of results indicates OI still may play some role in predicting motivation, mediated by CnE. First, we note the medium-sized correlation between motivation and OI when partialling out the effects of mandates (r = 0.43). Second, we observe the large zero-order correlation between CnE and OI (r = 0.5), and the jump in unique variance explained by CnE from 18% in the hypothesized model (with OI), to 29% in the post-hoc model (without OI). Apparently, common variance suppressed main effects for CnE and OI in the hypothesized model to such an extent that OI presented no main effect.

We note that the study's sample size of 28 participants, who comprised one project team, was small. This translates to higher standard errors and thus requires larger correlations to obtain significance. Nevertheless, the results did show considerable significant relationships between the predictor variables and motivation. It is possible, however, that some portion of the correlation among the variables may have been an artifact of respondent bias toward self-consistency across

survey items. The single-point-in-time survey design similarly precludes determination of causality between the study's predictors and motivation.

Implications for theory and practice

The motivation to share discretionary information in a database can be understood at least in part as a rational choice to help produce organizational gain, by making information available to other people when and where they can use it. The present study stands in contrast to works using expected outcomes to predict communicator motivation only at the level of individual gain (e.g., Kellerman & Reynolds, 1990; Sunnafrank, 1990). It situates communicators instead as participants in a collective action.

Organizational commitment. This study supports the view that OC works in conjunction with expected outcomes to motivate specific work-related behaviors. It has been argued that general attitudes "seldom predict specific behaviors of the sort implied by productive performance. Rather, they predict aggregations of thematically related . . . behaviors over time and across varied situations" (Organ, 1994, p. 465). Yet in considering the workplace effects of OC on behavior, we need not be constrained to such broadly specified criteria. OC is not merely correlated with aggregations of behaviors—either in-role work performance behaviors or extra-role organizational citizenship behaviors (cf. Benkhoff, 1997). On the contrary, OC-based motivation can result from the joint effect of OC and situated beliefs relevant to a specified behavior such as contributing to a given database.

The OC-based motivation examined in this study is applicable to discretionary information sharing whether it represents in-role or extra-role behavior. We cast a wide net seeking to explain that extra measure of effort extended to use a shared database regardless whether users sought to enhance in-role performance or to behave as helpful or compliant organizational citizens (cf. Organ & Paine, 1999). But our research was particularly motivated by the fact that in-role behavior sometimes is discretionary. Even when management would prefer to direct it using positive or

negative incentives, doing so at times is either antithetical to a manager's ethic to promote willing cooperation or simply not cost-effective (Miller, 1992). This is a matter of special concern for motivating the discretionary sharing of high-quality, performance-relevant information.

In view of the identification processes that underlie OC, the data support Staw's (1984) conjecture that organizational identification can substitute in a rational-choice model for a person's self-centered pursuit of individual-level gain. As noted by Shamir (1990, p. 329), the "practical implications of regarding values and identities as potential sources of collectivist motivation in organizations have been known for many years…." Organizational leaders frequently seek to instill norms of cooperation and contribution, to link organizational actions with members' cherished values, and to increase the salience of organizational identity in members' self-concepts. The present study shares a common theme with Shamir (1990) in "strengthening the theoretical rationale underlying these common practices" (p. 330). It further establishes the benevolent effects of identification or attitudinal commitment in resolving communication dilemmas and other social dilemmas.

One cautionary note is struck for managers seeking to promote discretionary effort. They should take care to align their appeals to extant levels of OC, which must be sufficiently high if motivation is to be fostered by appeals based upon organizational gain. Otherwise, the question "what's in it for me?" based upon individual self interest could be expected to displace a manager's exhortations explaining only "what's in it for us." Development of OC appears particularly vital in situations where people cannot see how discretionary effort benefits them individually. Managers could seek to increase OC as part of a long-term effort to increase OC-based motivation. OC is not a fixed trait even though it is relatively stable compared to some work attitudes (Mowday et al., 1982). Indeed, a major challenge to organizations today may be to build commitment sufficient to overcome a general downward trend in organizational loyalty (Clancy, 1998, 1999). For database users with

low levels of OC, incentives will need to be more individualized, still taking care not to promote competitive behaviors antithetical to productive cooperation.

Connective efficacy. The concept of CnE focuses attention on the contributor-recipient relationship, underscoring the connective—communicative—quality of shared database use. The importance of CnE belies the assumption that the collective good is sure to be provided so long as people choose to make their information public in the database (cf. Connolly & Thorn, 1990; Fulk et al., 1996). Recipients must retrieve database information, and contributors must be informed of this fact. Feedback confirming the value of contributed information should help to sustain levels of CnE, and help contributors to redirect efforts over time should recipients' information needs change. The more communicators are asked to share information without reciprocation, the more problematic their sustained motivation may become unless recipients extend discretionary effort to provide feedback.

Organizational instrumentality. There was no contribution to the model's performance by OI, apparently due to a high correlation between OI and CnE. This suggests that database users may not have clearly differentiated between (a) the degree to which they expected other team members to use the database and (b) the instrumentality for organizational gain. It is possible even that they inferred one belief from the other. For instance, users may have concluded the database was instrumental only after gaining assurances from other team members that contributed information would be received. But once they formed alliances to share information the joint effect of OC and CnE explained motivation regardless of OI.

From conversing with participants after the survey, we learned that they shared no definite goal in using the database to share discretionary information. They were exploring its potential and held different ideas about its utility for sharing different types of information. Even to the extent users agree on the usefulness of a shared database, it may be that OI is incrementally relevant to motivation only if certain conditions are met (and is otherwise superfluous in the model). While we

can only speculate based on our findings, it could be that OI matters only when there is a salient outcome that lies beyond use of the database to share information, such as the attainment of a common goal.

Information self-efficacy. Survey data did not show a role for ISE in predicting motivation. Subsequent conversations with six of the participants suggested ISE was relevant to at least some, but it remains unclear what circumstances would give rise to a significant effect for ISE. User comments did underscore the importance of identifying precisely whom contributors had in mind as likely recipients. Some thought that this database's best use was to document how the team had reached design decisions for the benefit of people years in the future—not current members of this team. (Other readily available communication media reportedly served more immediate purposes.) Since our instrument for ISE addressed current team members, it may have underestimated ISE for respondents thinking about future team members. It might be wise when conceptualizing ISE to distinguish between recipients with differing needs, including near-term and long-term recipients. In general, databases may support collaboration among contemporaries as well augmenting participants' long-term memories, meeting the future needs of database users including some who do not yet work for the organization (Huber, 1990, Stein & Zwass, 1995; cf. Levitt & March, 1988).

Future research

Continued fieldwork is vital to develop a better understanding of communication dilemmas and other social dilemmas. The present study examined database users in a work setting, faced with actual choices. Field work complements the study of laboratory subjects who face only hypothetical choices, an approach that dominates social dilemma research and also is found in some related applications of expectancy theory (e.g., Snead & Harrell, 1994). The choice of behavioral intention as our dependent variable—rather than behavior—was appropriate for two reasons. First, behavioral intention is an indicator of future information system use (see Jackson, Chow & Leitch, 1997). Second, our data were all collected at a single time. While current attitude and beliefs should

determine current behavioral intentions, "usage in a current time period would be based on beliefs and attitude in a preceding time period" (Agarwal & Prasad, 1999, p. 366). It should be observed that people in this study encountered a newly introduced system and faced a classic social dilemma: collective action was possible, but as yet unrealized. When choosing to participate in such collective actions "persons have to decide at a point when they do not know whether others will participate" (Klandermans, 1984).

For future research, however, it will be important to explore both intentions and behavior. That will call, in turn, for a longitudinal research design. Over-time data can reveal how attitudes and beliefs associate with behavioral intention, then lead to behavior, and then by way of experience with collective use of the database cause changes in attitude and beliefs. This would indeed trace out the cyclic relation posited between attitudinal and behavioral commitment (Mathieu & Zajac, 1990; Mowday et al., 1982; Reichers, 1985).

Another direction for future research is to study commitment-based motivation for other commitment targets (e.g., team or profession). It would be a straightforward matter to adapt the model to study one type of commitment at a time, substituted in the model for OC. Instrumentality would be defined to match gains to the commitment target. But a more complex model would become required if multiple targets were considered in a single study.

The present study considered only commitment to an organization. The model assumed a two-level conception of action, dividing action between the individual and the organization-as-collective. That choice fit the team under study since its members were called upon to participate in a pilot effort assessing utility of the database for implementation across the organization. By contrast, if commitment toward organization and team were both considered, then the model would have to be modified reflecting a three-level conception of action. The increased complexity could be well justified if people's interests relating to different commitment targets were poorly aligned, competing for a person's loyalties and motivating contrary choices. Given suitable measures of commitment to

each target, these would be incorporated into separate multiplicative models and the effects compared.

Multiple targets of commitment would necessitate also a change in the conception of instrumentality. The present study meshed all supra-individual outcomes into a single OI construct. This approach appears to have suited the team under study. Survey items measuring OI asked alternately about organizational and team gains yet formed a reliable scale. Discussions afterward with participants did not reveal conflicts between team outcomes versus organization outcomes of database use. But a study designed to examine multiple commitment targets would need to distinguish instrumentality for each target.

Researchers employing the model to study group behavior could delve into factors that we considered only indirectly. Our approach was constructed to apply equally well to persons dispersed across an organization with no interaction outside of the shared database, or the members of a team who know one another well. Our participants happened to comprise an intact team, and we supposed the components of our model would be driven by many group-level factors not taken directly under study. For instance, we supposed that CnE is driven by numerous antecedent variables affecting participants' expectations for each other's behavior, such as task interdependencies, group norms, pre-existing communication patterns, on-line and off-line social influence, and so on. Although our focus on contributor-recipient interdependence was intended to identify predictors with great generality across database applications and work settings, particular characteristics of the research site may explain some of our non-significant results as well. The alternative media appear to have been particularly important, both as competing communication channels and auxiliary means to reduce uncertainty. (Face-to-face interaction may have facilitated alliances to use the database and obtain feedback on the value of contributions affecting ISE.) Similar face-to-face interaction would not be available in some other work settings.

A variety of antecedent variables could be researched, specifying more elaborate high-level models generalized across all groups, or models that characterize work processes of more specialized groups, such as the aircraft design team in our study (e.g., see Goodman, Ravlin & Schminke, 1987). There is such a diversity of shared database applications coming into use in organizations, that the advancement of theory will benefit from careful differentiation between various types of shared databases, information shared, group types, social contexts, and database tasks.

This study made certain simplifications that future research should draw out in greater detail. One simplification was to focus on the contributor-recipient relationship. There are likely to be several variants of collective efficacy relating contributors to contributors, and recipients to recipients as well. For example, two contributors are highly interdependent if they have non-overlapping information such that both must contribute if their information is to hold value for recipients, much like two key pieces to a puzzle. Similarly, two recipients are interdependent if each must use information for that information to provide value.

The focus on connective efficacy highlights the critical role of the information recipient—whose motivation complements the contributor's and is necessary for database effectiveness. The model and logic developed here to predict an individual's motivation to contribute information is based on the contributor's cognitive assessments. The same logic and model can be used as a starting point to build a separate model of motivation to retrieve information voluntarily from a shared database.

Theory and findings of the present study can be extended quite generally to predict the motivation of people sharing discretionary information by other media. The selected focus on the contributor-recipient relationship carried with it an implied focus on the connective function of the shared database. All communication media function to provide connectivity; consequently, CnE should similarly affect discretionary information sharing for other communication media.

Conclusion

Communication in collective action can be conceptualized in two complementary ways. First, communication can be understood as a low-cost/low-risk game that individuals play in preparation for collective actions involving greater costs and risks. For example, members of a product development team generate new ideas and also criticize them; they employ communication as means to test out ideas for new products before committing to the considerable expense of manufacture and marketing new products. The object is to increase the likelihood of success once deeds follow after words. Communication, by enabling people collectively to envision possible future situations, permits people to bootstrap themselves into collective action that they might never otherwise dare to undertake.

Second, communication can be a collective action in its own right, and it can produce follow-on collective actions of its own. To continue the product development example, when team members share new product ideas (the initial collective action) this positions them to perform other communication tasks (e.g., collectively reviewing and selecting the best ideas). Each action builds upon the last. But the potential costs and risks associated with anticipated follow up actions may influence motivation toward the initial collective action. Creative idea sharing could be discouraged among member of the product development team if, during the idea-selection process, they place too much emphasis on recognizing individuals for generating the "best" ideas. Communication systems should be employed with an eye toward avoiding communication dilemmas that arise from poorly applied individual-level incentives, discouraging people from communicating when it is in their best long-term interests.

While OC-based motivation is relevant to a broad spectrum of actions, there is reason to suspect it is especially important to communication. By sharing information, people piece together a larger story than could be guessed from separate items of information (Stasser & Stewart, 1992). The full value of information is uncertain *until it is shared*. Contributors lose the strategic advantage

of private information before fully understanding the value of sharing it. Compared to collective actions where contributions are readily valued in advance, fear of exploitation is likely to have a particularly severe chilling effect on information sharing.

Efforts to promote OC-based motivation should be seen as parallel investments beside the purchase and implementation of shared database technology. Social and technical factors complement one another in enabling communicative collective action. Wherever the bottom line for communication is organizational effectiveness (e.g., Monge et al., 1998), it is important to focus on the linkages joining communicative acts to each other as well as other types of action enabled by communication resulting in gains for organization, group and individual. For databases this includes at the very start the complementary usage of a database by contributors as well as recipients, who require mutual assurance of each other's cooperation if OC-based motivation is to result in substantial levels of contributed information. Given the growing importance of knowledge management systems and other forms of shared databases to contemporary organizations, efforts to induce voluntary contributions have become critical to organizational effectiveness.

References

Abt, C. C. (1970). Serious games. New York: The Viking Press.

Agarwal, R., & Prasad, J. (1999). Are individual differences germane to the acceptance of new information technologies? Decision Sciences, 30, 361-391.

Arnold, H. J., & Evans, M. G. (1979). Testing multiplicative models does not require ratio scales. Organizational Behavior and Human Performance, 24, 41-59.

Baker, D. D., Ravichandran, R., & Randall, D. M. (1989). Exploring contrasting formulations of expectancy theory. Decision Sciences, 20, 1-13.

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice Hall.

Benkhoff, B. (1997). Ignoring commitment is costly: New approaches establish the missing link between commitment and performance. Human Relations, 50, 701-726.

Bonacich, P., & Schneider, S. (1992). Communication networks and collective action. In W. B. G. Liebrand, D. M. Messick, & H. A. M. Wilke (Eds.), Social dilemmas: Theoretical issues and research findings (pp. 225-245). New York: Pergammon Press.

Brewer, M. B., & Kramer, R. M. (1986). Choice behavior in social dilemmas: Effects of social identity, group size, and decision framing. Journal of Personality and Social Psychology, 50, 543-549.

Clancy, J. J. (1998). The old dispensation: Loyalty in business. Madison, NJ: Fairlegh Dickenson University Press.

Clancy, J. J. (1999, June). Is loyalty dead? Across the Board, 36 (6), 15-19.

Clark, P. B., Wilson, J. Q. (1961). Incentive systems: A theory of organizations. Administrative Science Quarterly, 6, 219-266.

Collins-Jarvis, L. A. (1997). Participation and consensus in collective action organizations: The influence of interpersonal versus mass-mediated channels. Journal of Applied Communication Research, 25(1), 1-16.

Connolly, T., & Thorn, B. K. (1990). Discretionary databases: Theory, Data, and Implications. In J. Fulk & C. W. Steinfield (Eds.), Organizations and communication technology (pp. 219-233). Newbury Park, CA: Sage.

Connolly, T., Thorn, B. K., & Heminger, A. (1992). Discretionary databases as social dilemmas. In W. B. G. Liebrand, D. M. Messick, & H. A. M. Wilke (Eds.), Social dilemmas: Theoretical issues and research findings (pp. 199-208). New York: Pergammon Press.

Dawes, R. M. (1980). Social dilemmas. Annual Review of Psychology, 31, 169-193.

Dawes, R. M., van de Kragt, A. J., & Orbell, J. M. (1990). Cooperation for the benefit of us--Not me, or my conscience. In J Mansbridge (Ed.), Beyond self interest (pp. 97-110). Chicago: University of Chicago Press.

Diani, M., & Eyerman, R. (1992). Studying collective action. Newbury Park, CA: Sage.

Foddy, M., Smithson, M., Schneider, S., & Hogg, M. (Eds.). (1999). Resolving social dilemmas: Dynamic, structural and intergroup aspects. Philadelphia, PA: Psychology Press.

Fulk, J. & Collins-Jarvis, L. (2000). Wired meetings: Technological mediation of organizational gatherings. In F. Jablin & L. Putnam (Eds.), New handbook of organizational communication (pp. 624-663). Newbury Park: Sage.

Fulk, J., Flanagin, A., Kalman, M. E., Monge, P. R., & Ryan, T. (1996). Connective and communal public good in interactive communication systems. Communication Theory, 6, 60-87.

Goodman, P. S., Ravlin, E., & Schminke, M. (1987). Understanding groups in organizations. Research in Organizational Behavior, 9, 121-173.

Hardin, R. (1982). Collective action. Baltimore, MD: John Hopkins University Press.

Huber, G. P. (1990). A theory of the effects of advanced technology systems on organization design, intelligence, and decision making. In J. Fulk & C. W. Steinfeld (Eds.), Organizations and communication technology (pp. 237-274). Thousand Oaks, CA: Sage.

Jackson, C. M., Chow, S., & Leitch, R. A. (1997). Toward an understanding of the behavioral intention to use an information system. Decision Sciences, 28, 357-389.

Kalman, M. E. (1996). The Motivational role of organizational commitment in the implementation of change: Focusing on the attitude-behavior relationship. Paper presented at the annual conference of the Speech Communication Association, November, 1996, in San Diego, CA.

Kalman, M. E. (1999). <u>The effects of organizational commitment and expected outcomes on the motivation to share discretionary information in a collaborative database: Communication dilemmas and other serious games.</u> (UMI Microform 9933735.) Ann Arbor, MI: UMI Dissertation Services.

Kalman, M. E., Fulk, J., & Monge, P. R. (1999). Resolving Communication Dilemmas: A Motivational Model for Information Contribution to Discretionary Databases. Paper presented at the annual conference of the Academy of Management, August, 1999, in Chicago, IL.

Kellerman, K., & Reynolds, R. (1990). When ignorance is bliss: The role of motivation to reduce uncertainty in uncertainty reduction theory. <u>Human Communication Research</u>, <u>17</u>, 5-75.

Kerr, N. L. (1992). Efficacy as a causal and moderating variable in social dilemmas. In W. B. G. Liebrand, D. M. Messick, & H. A. M. Wilke (Eds.), <u>Social dilemmas: Theoretical issues and research findings</u> (pp. 59-80). New York: Pergammon Press.

Kerr, N. L., & Kaufman-Gilliland, C. M. (1994). Communication, commitment, and cooperation in social dilemmas. <u>Journal of Personality and Social Psychology</u>, <u>66</u>, 513-529.

Kim, W. C., & Mauborgne, R. (1997, July-August). Fair Process: Managing in the Knowledge Economy. <u>Harvard Business Review</u>.

Klandermans, B. (1984). Mobilization and participation: Social-psychological expansions of resource mobilization theory. <u>American Sociological Review</u>, <u>49</u>, 583-600.

Klandermans, B. (1992). Persuasive communication: Measures to overcome real-life social dilemmas. In W. B. G. Liebrand, D. M. Messick, & H. A. M. Wilke (Eds.), <u>Social dilemmas: Theoretical issues and research findings</u> (pp. 307-318). New York: Pergammon Press.

Knoke, D., & Wright-Isak, C. (1982). Individual motives and organizational incentive systems. <u>Research in the Sociology of Organizations</u>, <u>1</u>, 209-254.

Komorita, S. S., & Parks, C. G. (1994). Social dilemmas. New York: Brown & Benchmark, Publishers.

Korth, H. F., & Silbershatz, A. (1997). Database research faces the information explosion. Communications of the ACM, 40(2), 139-142.

Kramer, R. M., & Brewer, M. B. (1984). Effects of group identity on resource use in a simulated commons dilemma. Journal of Personality and Social Psychology, 46, 1044-1057.

Larson, J. R. Jr., Foster-Fishman, P. G., & Franz, T. M. (1998). Leadership style and the discussion of shared and unshared information in decision-making groups. Personality and Social Psychology Bulletin, 24(5), 482-495.

Lawler, E. E. III. (1981). Pay and organizational development. Menlo Park, CA: Addison-Wesley.

Levitt, B. & March, J.G. (1988). Organizational learning. Annual Review of Sociology, 14, 319-340.

Lewis, D. K. (1969). Convention: A philosophical study. Cambridge, MA: Harvard University Press.

Liebrand, W. B. G., & Messick, D. M. (Eds.). (1996). Frontiers in social dilemma research. New York: Springer.

Lopes, L. L. (1994). Psychology and economics: Perspectives on risk, cooperation, and the marketplace. Annual Review of Psychology, 45, 197-227.

Luce, R. D., & Raiffa, H. (1957). Games and decisions: Introduction and critical survey. New York: John Wiley & Sons.

Marwell, G., & Oliver, P. (1993). The critical mass in collective action: A micro-social theory. New York: Cambridge University Press.

Mathieu, J. E., & Zajac, D. M. (1990). A review and meta-analysis of the antecedents, correlates, and consequences of organizational commitment. Psychological Bulletin, 108, 171-194.

Messick, D. M., & Brewer, M. B. (1983). Solving social dilemmas: A review. In L. Wheeler & P. Shaver (Eds.), Review of personality and social psychology (Vol. 4, pp. 11-44). Beverly Hills: Sage.

Miller, G. J. (1992). Managerial dilemmas. New York: Cambridge University Press.

Miller, V., Allen, M., Casey, M., & Johnson, J. R. (1990). A factor analytic investigation of the organizational identification questionnaire instrument. Paper presented at the annual conference of the International Communication Association annual conference, Dublin, Ireland.

Monge, P. R., Fulk, J., Kalman, M. E., Flanagin, A. J., Parnassa, C., & Rumsey, S. (1998). Production of collective action in alliance-based interorganizational communication and information systems. Organizational Science, 9, 411-433.

Mowday, R. T., Porter, L. W., & Steers, R. M. (1982). Employee-organization linkages: The psychology of commitment, absenteeism, and turnover. New York: Academic Press.

Mowday, R. T., Steers, R. M., & Porter, L. W. (1979). The measurement of organizational commitment. Journal of Vocational Behavior, 14, 224-247.

Olson, M. (1965). The logic of collective action. Cambridge, MA: Harvard University Press.

Oliver, P. E. (1993). Formal models of collective action. Annual Review of Sociology, 19, 271-300.

Opp, K.-D. (1989). The rationality of political protest: A comparative analysis of rational choice theory. Boulder, CO: Westview Press.

O'Reilly, C. A., III, & Chatman, J. A. (1986). Organizational commitment and psychological attachment: The effects of compliance, identification, and internalization on prosocial behavior. Journal of Applied Psychology, 71, 492-499.

Orbell, J. M., van de Kragt, A. J., & Dawes, R. M. (1988). Explaining discussion-induced cooperation. Journal of Personality and Social Psychology, 54, 811-819.

Organ, D. W. (1994). Personality and organizational citizenship behavior. Journal of Management, 20, 465-478.

Organ, D. W., & Paine, J. B. (1999). A new kind of performance for industrial and organizational psychology: Study of organizational citizenship behavior. In C. L. Cooper & I. T.

Robertson (Eds.), International Review of Industrial and Organizational Psychology (Vol. 14., pp. 337-368). New York: John Wiley & Sons.

Organ, D. W., & Ryan, K. (1995). A meta-analytic review of attitudinal and dispositional predictors of organizational citizenship behavior. Personnel Psychology, 48, 775-802.

Reichers, A. E. (1985). A review and reconceptualization of organizational commitment. Academy of Management Review, 10, 465-476.

Rein, G. L., McCue, D. L., & Slein, J. A. (1997). A case for document management functions on the web. Communications of the ACM, 40(9), 81-89.

Riggs, M. L., Warka, J., Babasa, B., Betancourt, R., & Hooker, S. (1994). Development and validation of self-efficacy and outcome expectancy scales for job-related applications. Educational and Psychological Measurement, 54, 793-802.

Robertson, P. J., & Tang, S.-Y. (1995). The role of commitment in collective action: Comparing the organizational behavior and rational choice perspectives. Public Administration Review, 55, 67-80.

Rutte, C. G., & Wilke, H. A. M. (1992). Goals, expectations and behavior in a social dilemma situation. In W. B. G. Liebrand, D. M. Messick, & H. A. M. Wilke (Eds.), Social dilemmas: Theoretical issues and research findings (pp. 289-305). New York: Pergammon Press.

Sandler, T. (1992). Collective action: Theory and applications. Ann Arbor: The University of Michigan Press.

Sass, J. S., & Canary, D. J. (1991). Organizational commitment and identification: An examination of conceptual and operational convergence. Western Journal of Speech Communication, 55, 275-293.

Scott, C.R., Corman, S.R. & Cheney, G. (1998). Development of a structurational model of identification in the organization. Communication Theory, 8 (3), 298-336.

Shamir , B. (1990). Calculations, values, and identities: The sources of collectivist work motivation. Human Relations, 43, 313-332.

Simon, A. R., & Marion, W. (1996). <u>Workgroup computing: Workflow, groupware, and messaging.</u> New York: McGraw-Hill.

Snead, K. C., & Harrell, A. M. (1994). An application of expectancy theory to explain a manager's intention to use a decision support system. <u>Decision Sciences,</u> <u>25</u>, 499-513.

Skjei, S. S. (1973). <u>Information for collective action: A microanalytic view of plural decision-making</u>. Lexington, MA: Lexington Books.

Stasser, G., Vaughan, S.I., & Stewart, D. (2000). Pooling unshared information: The benefits of knowing how access to information is distributed among group members. <u>Organizational Behavior and Human Decision Processes, 82</u>, pp. 102-116.

Stasser, G., & Stewart, D. (1992). Discovery of hidden profiles by decision-making groups: Solving a problem versus making a judgment. <u>Journal of Personality and Social Psychology</u>, <u>63</u>, 426-434.

Staw, B. M. (1984). Organizational behavior: A review and reformulation of the field's outcome variables. <u>Annual Review of Psychology</u>, <u>35</u>, 627-66.

Stein, E. W. & Zwass, V. (1995). Actualizing organizational memory with information systems. <u>Information Systems Research</u>, <u>6</u>, 85-117.

Sugden, R. (1991). Rational choice: A survey of contributions from economics and philosophy. <u>The Economic Journal</u>, <u>101</u>, 751-785.

Sunnafrank, M. (1990). Predicted outcome value and uncertainty reduction theories: A test of competing perspectives. <u>Human Communication Research</u>, <u>17</u>, 76-103.

Sweeney, J. W., Jr. (1973). An experimental investigation of the free-rider problem. <u>Social Science Research</u>, <u>2</u>, 277-292.

Tabachnick, B. G., & Fidell, L. S. (1983). <u>Using multivariate statistics</u>. New York: Harper & Row, Publishers.

Van Lange, P. A. M, Liebrand, W. B. G., Messick, D. M., & Wilke, H. A. M. (1992). Introduction and literature review. In W. B. G. Liebrand, D. M. Messick, & H. A. M. Wilke (Eds.),

Social dilemmas: Theoretical issues and research findings (pp. 3-28). New York: Pergammon Press.

Von Neumann, J., & Morgenstern, O. (1944). Theory of games and economic behavior. Princeton: Princeton University Press.

Vroom, V. H. (1964). Work and motivation. New York: Wiley.

Weik, M. H. (1996). Communications Standard Dictionary (3rd ed.). New York: Chapman & Hall.

Wittenbaum, G. (2000). The bias toward discussing shared information: Why are high status members immune? Communication Research, 27, 379-401.

Zucker, L. G., Brewer, M. B., Darby, M. R., & Peng, Y. (1994). Collaboration structure and information dilemmas in biotechnology: Organizational boundaries as trust production (ISSR Working Paper 1994-95 Vol. 6, No. 2). Los Angeles: University of California.

Endnotes

1. NASA/Challenger example dramatizes the fact that communication sometimes is what Abt (1970) called a *serious game*. Serious games are activities that "...relate to matters of great interest and importance, raising questions not easily solved, and having important possible consequences" (p. 10). Within the games' boundaries, the players' interests might be competitive, cooperative, or a blend of both. But players in a serious game share a common interest in the events to come afterward. Serious games therefore serve players as relatively low-cost/low-risk means by which to explore and to prepare creatively for future situations and outcomes.

2. See Kalman (1999) for a detailed discussion of other types of interdependence.

Table 1

Scale Reliabilities (Chronbach's alpha).

Scale	Final Scale Alpha	Final No. of Items	Alpha Before Modified	No. Items Dropped
Motivation	.95	5	-	-
Organizational Commitment	.93	9	-	-
Organizational Instrumentality	.90	7	-	-
Connective Efficacy	.84	3	.51	2
Information Self-efficacy	.84	3	.48	2
Perceived Mandate	.79	3	-	-

Table 2

Correlations and descriptive statistics among the variables.

	Motivation	OC [a]	OI	CnE	ISE	Job Role	P. Mandate
Motivation	-						
OC	.41*	-					
OI	.35	.27	-				
CnE	.56**	.08	.50**	-			
ISE	.27	.28	.11	.27	-		
Job Role	.25	-.19	-.13	.16	.11	-	
P. Mandate	.21	.02	.00	.28	.31	.52**	-
Mid-point	50	4	4	50	4	na [b]	50
Mean	43	4.5	4.7	40	4.6	na [b]	52
Std Dev	27	1.2	1.1	27	1.4	na [b]	32
Range	0-100	2.0-6.0	1.9-6.3	0-87	1.0-6.3	0 - 1	0-93

* $p =< .05$ ** $p =< .01$

[a] OC = organizational commitment; OI = organizational instrumentality; CnE = connective efficacy; ISE = information self-efficacy; and P. Mandate = perceived mandate

[b] Job role was dichotomous. Distribution: The data indicated nine participants in designer job role (dummy coded 1) and eighteen participants performing other job roles (dummy coded 0).

Table 3

Multiple regression results of predictors of motivation to contribute discretionary

information[a]

	Beta	Unique R^2	DR^2	Total R^2
Both models: First hierarchical regression step				
Step 1: Control for mandates			.07	.07
Job role	0.26	.05		
Perceived mandate	-0.02	.00		
Hypothesis 1: Additive + Multiplicative model				
Step 2: OC + OI + CnE + ISE			.46**	.53*
Main effects: OC	0.35 [b]	.10*		
OI	0.06	.00		
CnE	0.53 [b]	.18*		
ISE	0.01	.00		
Step 3: OC x OI x CnE x ISE	1.50 [b]	.10*	.10*	.63**
Post-hoc model				
Step 2: OC + CnE			.46**	.52**
Main effects: OC	0.37	.13*		
CnE	0.57	.29**		
Step 3: OC x CnE	1.27	.10*	.10*	.63**

* p =< .05   ** p =< .01   *** p =< .001

Note. The results shown are for the transformed case.

[a] OC = organizational commitment, OI = organizational instrumentality, CnE = connective efficacy, and ISE = information self-efficacy

[b] In support of H2, regression coefficients are positive for the main effects and interaction.