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**RESOLVING COMMUNICATION DILEMMAS  
IN DATABASE-MEDIATED COLLABORATION**

**CEO PUBLICATION  
G 99-12 (371)**

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Running head: COMMUNICATION DILEMMAS

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## Resolving Communication Dilemmas in Database-Mediated Collaboration

Abstract

In organizational settings, a communication dilemma exists whenever the interests of a collective (i.e., team, organization, interorganizational alliance) demand that people voluntarily share privately held information, but their individual interests motivate them to withhold it instead. This paper 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 individual contributions to a collectively shared database. In the model, motivation is a function of four individual level 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 contributed information will reach other members of the collective by means of the database; 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 that used a discretionary database. Each component of the model except information self-efficacy was highly significant and contributed sizeable amounts of explained variance in motivation to contribute 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 project websites, "lessons learned" records, expert repositories, data warehouses, intranets and extranets, groupware, and a variety of other conferencing and knowledge management systems. Shared databases support a variety of organizational tasks ranging from routine information management to the complex and highly non-routine activities of researchers, investigators, and project team members (e.g., see Monge, Fulk, Kalman, Flanagan, Parnassa & Rumsey, 1998; Rein, McCue, & Slein, 1997).

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. People are commonly tempted to take a "free ride" on the contributions of others out of a myopic concern for individual gain, despite the risk that others will behave likewise (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.

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. 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.

#### 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; Komorita & Parks, 1994; 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 on 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, research across these various disciplines has asked how collective actions ever succeed. Yet, they do succeed 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, p. 39; Von Neumann & Morgenstern, 1944). Two types of games are of particular interest here, the prisoner's dilemma and the assurance game. In a *prisoner's dilemma*, outcomes are best overall when everyone contributes and worst when no one contributes. In the middle range of contribution levels, free riders gain while contributors lose. By contrast, in an *assurance game* free riding is not possible because no one gains unless everyone contributes. But individuals still may not contribute to an assurance game if they think that others will not contribute because people typically withhold contributions if they fear their efforts might be wasted.

Recent work on social dilemmas 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. Bonacich & Schneider (1992) employed the term *communication dilemma* to specify a social dilemma that impedes communication. 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 instead. 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, 1998; 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 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.<sup>2</sup>

#### Motivation to contribute discretionary information

Klandermans (1984) and Staw (1984) used expectancy theory to build a motivational model 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 values of outcomes a person expects to occur from contributing, and (b) the strength of the person's belief that these outcomes are likely to occur (Lawler, 1981; Vroom, 1964). If either the value or the likelihood of a potential collective outcome decreases to zero, the outcome has no power to motivate. The result is a single-actor rational-choice model, meaning that people are assumed to seek maximum personal gains (the net result of costs and benefits; 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 personal gains 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 people place on organizational gain, while explicitly excluding distribution of any gains from the organization to its 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 ( $E_{OG}$ ).

$$\text{Motivation} = \text{ID} \times E_{OG} \quad (1)$$

Two changes are made to this model (Kalman, 1996). The first change is to substitute *organizational commitment* (OC) in place of ID. OC is an attitude that exhibits 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, Porter & Steers, 1982; Mowday, Steers & Porter, 1979). Substitution of OC for ID is possible due to the theoretical and operational convergence observed between the two

constructs (see Mathieu & Zajac, 1990; Miller, Allen, Casey, & Johnson, 1990; Sass & Canary, 1991). A psychological process of identification underlies OC (Mowday *et al.*, 1982; O'Reilly & Chatman, 1986; Sass & Canary, 1991), and group identification has been found experimentally 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 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 two 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 of sharing information requires consideration of how database users depend upon one another to attain collective success. One type of dependence is between a given contributor and all potential recipients. Contribution and subsequent retrieval by at least some recipients are mutually necessary conditions for any sharing of database information and thus database users face an assurance game. We limit our discussion to this type of interdependence and the context of an assurance game in deriving our specialized conceptions of collective efficacy and self-efficacy.<sup>3</sup> 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. The database must provide connectivity between users (Weik, 1996; cf. Monge *et al.*, 1998). Connectivity is the functionality offered by a system in which each user can reach every other user. Connectivity is effective only if other database users do their parts by retrieving at least some of the contributed information. *Connective efficacy* (CE) will refer to a person's belief that other people who can use contributed information will in fact retrieve it.

With respect to self-efficacy, the first two components of  $E_{OG}$  (OI and CE) come to naught in producing OG unless the potential contributor does in fact hold 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.

Since OI, CE 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 square brackets.

$$\text{Motivation} = OC \times [OI \times CE \times ISE] \quad (2)$$

This model leads to several predictions. Before presenting them, it should be noted that Equation 2 does not represent the effect of any mandates on contributions. If mandates are present in a given setting and differ between people, for example, because of different job assignments, they should tend to cause substantial between-subjects differences in the total amounts of information 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  $OC \times OI \times CE \times ISE$  will predict the motivation to contribute discretionary information.*

To follow up on H1, it is of interest to determine whether all components of the model contribute to its performance. Since the model is inherently multiplicative, this can be determined by comparing its performance to alternative models incorporating some but not all of the same factors. A core model is the product of OI and OC. OI indicates the instrumentality of the database for an organizational outcome (organizational gain), and OC indicates a person's interest in that outcome. Next, an alternative model can incorporate CE to establish whether a potential contributor believes that recipients exist for contributed information. Comparison of the three-factor model ( $OC \times OI \times CE$ ) to the core model ( $OC \times OI$ ) will indicate the incremental contribution of CE. Comparison of the complete model ( $OC \times OI \times CE \times ISE$ ) to the three-factor model ( $OC \times OI \times CE$ ) will indicate the incremental contribution of ISE.

Reflecting on Equations 1 and 2, there is another valid interpretation of the model. It could represent a statistical interaction between OC and  $E_{OG}$ . It should be emphasized that the model overall does not represent a four-factor interaction term; it does not consist of four independent predictors that could meaningfully stand on their own and recombine into all possible two-factor and three-factor interaction terms. However,  $E_{OG}$  alone could be a meaningful predictor since it represents expectation of an outcome that is potentially of value

to all organizational members (OG). By this interpretation, OC represents a moderating variable in relation to  $E_{OG}$ .

*Hypothesis 2 (H2). Controlling for mandates, OC will have a positive moderating effect on the relationship of  $E_{OG}$  (i.e.,  $OI \times CE \times ISE$ ), to the motivation to contribute discretionary information.*

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 (CE) and the value of an individual's own discretionary information to other people (ISE).

## Methods

### Participants

The participants comprised an intact work team of 28 aircraft design engineers in a large U.S. aerospace corporation. Senior management had decided to equip the team with a new document management and workflow control system, Metaphase™, called here the Design Information System (DIS). All team members were trained in basic user skills and the DIS became available for use a few weeks before the survey. While some DIS uses were mandatory, all team members were free to exceed mandates by sharing discretionary information in the shared DIS database. Each user could read all contributed information.

Team members shared a physical office space. In addition to face-to-face interaction members could share information by a number of alternative media including electronic mail, telephone, and file sharing in a separate computer network.

### Procedure

Following preliminary discussions with team leaders and several technical training and support personnel, researchers administered an on-site survey to team members. Respondents were assured of confidentiality and researchers immediately collected completed surveys. Several months afterward, unstructured follow-up interviews were conducted with six volunteer team members.

### 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 measured by three items. Two items asked the degree to which respondents felt they were required to use the DIS for information sharing. Responses were registered on an 11-point scale from 0 ("not required at all") to 100 ("absolutely required"). The third item, also an 11-point scale, asked how much work-related information they were required to contribute. Responses ranged from 0% ("none") to 50% ("half") to 100% ("all").

*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 would possibly result if many team members used the database to share information. Befitting a team-based setting, 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.” Responses were on a 7-point scale that ranged from 1 (“strongly disagree”) to 7 (“strongly agree”).

*Connective efficacy* (CE) was measured by five items. The instructions first posed a hypothetical situation: The respondents had contributed discretionary information to the database that other team members should consider valuable *if* they retrieved it. Then the respondents were asked to what extent they expected other team members to retrieve the information. The first four items described the number of team members who would be able to retrieve the information along with the likelihood that they would exercise this ability. The 11-point response scale ranged from 0% (“no one”) to 100% (“all”). The concluding item asked how likely it was that people 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”).

### Analysis

Preliminary analysis. Scales were tested for reliability using Chronbach’s alpha. 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).

Principal analyses. Hypotheses were tested by means of multiple linear regression. The control variable, mandates, was entered simultaneously with other factors in the first step of each regression. Analyses that involved a transformed variable were performed twice. First the untransformed variable was used to provide a baseline result. Then it was replaced by the transformed variable and the analysis was repeated to determine whether the variable’s non-normality had affected the baseline result.

In order to test the hypotheses, multiplicative models first were computed. For both H1 and H2, the model principally at issue was the product OC x OI x CE x ISE. Following up H1, incremental contributions to explained variance were found by comparing that principal model to two alternatives tested in separate regressions: (1) OC x OI, and (2) OC x OI x CE. For H2, the principal model was tested as an interaction term by entering it in the second regression step after its two component factors had been entered in the first regression step: OC and the product OI x CE x ISE. Data were analyzed with SPSS for Windows, version 6.1. The criterion for significance was 0.05.

### Results

### Preliminary Analyses

Scales. Table 1 summarizes the results of the analysis for scale reliability. Item analysis revealed two questions in each of the CE and ISE scales that suppressed overall scale reliability. When these were removed, scale reliability ranged from a low of .79 for mandates to a .95 for motivations, with an average reliability of .88. With respect to normality of the data, only one variable slated for use in the principal analyses required transformation, the 4-component product OC x OI x CE x ISE. (The ratio of skewness to standard error = 2.24.) The distribution was normal subsequent to transformation.

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TABLE 1 ABOUT HERE

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### Principal Analyses

Descriptive statistics for the six variables and their correlations are provided in Table 2. H1 stated that, controlling for mandates, the multiplicative product OC x OI x CE x ISE would predict motivation to contribute discretionary information. In the baseline result (untransformed), the full regression model (with mandates) tested significant,  $F(2,25) = 8.44$ ,  $p = .0016$  (40% of total variance explained). The four-component product (OC x OI x CE x ISE) individually tested significant,  $Beta = 0.65$ ,  $p = .0007$  (36% of unique variance explained). Transformation to correct for skewness improved the results in terms of the amount of variance explained. The full regression model again tested significant,  $F(2,25) = 10.32$ ,  $p = .0005$  (45% total variance explained), and the four-component product remained a significant predictor,  $Beta = 0.68$ ,  $p = .0002$  (41% unique variance explained). Hypothesis 1 was fully supported by the data.

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TABLE 2 ABOUT HERE

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Table 3 summarizes results comparing the four-factor model to the two alternative models (a) OC x OI, and (b) OC x OI x CE. The two-component product (OC x OI) explained 20% of unique variance in motivation (Beta = 0.44,  $p = .0173$ ), and together with mandates a total of 24% of variance was explained ( $F[2, 25] = 3.97$ ,  $p = .0318$ ). The three-component product (OC x OI x CE) tested significant (Beta = 0.65,  $p = .0004$ ) and explained with mandates a total of 43% of variance ( $F[2, 25] = 9.50$ ,  $p = .0009$ ), indicating that the incorporation of CE significantly increased the amount of explained variance by 19%. However, there was no significant difference between the three-component and four-component products in terms of total variance explained, indicating that the incorporation of ISE into the model did not significantly contribute to the model's performance.

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TABLE 3 ABOUT HERE

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Hypothesis 2 stated that, controlling for mandates, the two components (a) OC, and (b) OI x CE x ISE, would interact positively to predict motivation to contribute discretionary information. The interaction term was a product of two components: OC and the product OI x CE x ISE. The full regression equation, containing mandates, the two components and the interaction term, tested significant ( $F[4,23] = 6.70$ ,  $p = .001$ ;  $R^2 = .54$ ). The interaction term was also significant in the transformed case and explained 14% of unique variance (Beta = 2.03,  $p = .0155$ , though it was not significant in the baseline case, Beta = 0.71, n.s.). Hypothesis 2 was therefore supported by the data.

Discussion and Conclusion

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  $OC \times OI \times CE \times ISE$ . The hypothesis was supported by the data. The model explained 36% of unique variance before transformation to correct for skewness and 41% after transformation. Incremental contributions also were determined for three parts of the model: (a)  $OC \times OI$ , (b)  $CE$  and (c)  $ISE$ . A comparison of the explained variances revealed that the  $OC \times OI$  and  $CE$  components each contributed at least 19% of explained variance in motivation but the  $ISE$  component did not make any significant contribution.

Follow-up interviews suggest one possible explanation. Some respondents said the primary recipients they envisioned for discretionary contributions did not belong to the *current* team. They thought the shared database's best use was to document design decisions for reference by team members one or two years hence. Since the  $ISE$  measure employed in the survey used current team members as a referent, it may have underestimated overall  $ISE$  for those respondents whose primary referent was future team members. In essence, the  $ISE$  reported in the interview data was more supportive of the hypothesis than was the  $ISE$  as measured more narrowly in the survey. Future research should include consideration of how much a shared database is designed to function as organizational memory, a more enduring repository whose beneficiaries transcend current members of the collective.

Hypothesis 2 predicted that shared database users would be motivated more strongly by the prospect of organizational gain if they were more strongly committed to the organization. In support of the hypothesis, the interaction between  $OC$  and the product  $OI \times$

CE x ISE tested positive and significant (after transformation to adjust for non-normality). It should be noted that a square-root transformation did not alter the conceptual definition of the interaction term, which still represented OC-based motivation. The transformation compresses the high end of the variable's distribution to create a more normal curve. This results in values at the high end of the distribution becoming less dominant when deviations from the mean are computed. The interaction may have tested significant only after transformation because a comparatively large portion of motivation resulted from high OC combined with high levels of just one or two other multiplicative components (OI, CE and/or ISE). This interpretation is consistent with results showing that only two of the three components contributed significantly to the explanation of variance.

The study's sample size of 28 participants who comprised one design team, was small, which 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 any 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. The present study stands in contrast to works that use expected outcomes to predict communicator motivation only at the level of individual gain (e.g., Kellerman & Reynolds, 1990; Sunnafrank, 1990). It situates communicators as participants in a collective action.

Organizational commitment. This study confirmed that OC can work in conjunction with expected organizational gain to motivate specific work-related behaviors. 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 furthermore establishes the benevolent effects of group identification in communication dilemmas and other social dilemmas.

Managers seeking to promote database contributions should take care to align their appeals to database users' extant levels of OC, which must be sufficiently high if motivation is to be based on organizational gain. The development of OC appears particularly essential in situations where people cannot otherwise see how database contributions benefit them individually. Managers could seek to increase OC as part of a long-term effort increasing 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 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 CE focuses attention on the contributor-recipient relationship. It can be characterized as an assurance game because contribution and retrieval are mutually necessary conditions if people are to share information by means of the

database. The importance of CE 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 CE and it should help contributors to redirect their efforts over time should recipients' information needs change. The more freely communicators share information without demanding reciprocation, the more problematic their sustained motivation may become unless recipients extend the discretionary effort needed to provide feedback.

Information self-efficacy. Although evidence from user interviews suggested that ISE is relevant at least to some shared databases users, the survey data did not show an important role for ISE in relation to the current team. Which specific circumstances will give rise to a significant effect for ISE remains an open question. However, the results did underscore the importance of identifying precisely which recipients the respondents should consider in regard to ISE. Databases may not only support collaboration among contemporaries but can augment the long-term memories of participants, meeting the needs of future database users (Huber, 1990, Stein & Zwass, 1995; cf. Levitt & March, 1988). Multiple sets of recipients with substantially different information needs should be distinguished. This includes near-term versus long-term information recipients.

#### Future research

The focus on connective efficacy highlights the critical role of the recipient of information from a database, as well as the contributor. The model and logic developed here intends to predict an individual's motivation to contribute information, based on that individual's cognitive assessments. The logic and model for the contributors can be used as a starting point for building a separate model of individual motivation to retrieve information



from a discretionary database. As noted earlier, both contribution and retrieval are necessary conditions for database effectiveness.

This study made certain simplifications that future research should draw out in greater detail. One simplification was to focus on the contributor-recipient relationship. Other relationships should be investigated as well, including contributor-contributor and recipient-recipient interdependency. There are likely to be several variants of collective efficacy relating contributors to contributors, contributors to recipients, and recipients to recipients. Each variant would correspond to a different way in which users of a shared database rely upon one another's ability and effort to share information productively. For example, two contributors are highly interdependent if they have non-overlapping information, which they each need in order for the other's information to have value, much like two key pieces to a puzzle. Similarly, if two receivers must each retrieve a set of information in order for the set of information retrieved by the other to be of value, they are highly interdependent.

The study's focus on contributor-recipient interdependence was intended to identify predictors of motivation that would have the greatest possible generality across database applications and work settings. Even so, particular characteristics of the research site may explain why ISE did not predict motivation. For instance, face-to-face feedback was readily available from recipients. The advancement of theory will require careful differentiation among various types of shared databases and their contexts in the performance of organizational tasks.

The theory and findings of the present study can be extended quite generally to predict the motivation of people sharing discretionary information by other media as well. 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, discretionary information sharing by means of other communication media should be similarly affected by CE and ISE.

Finally, OC-based motivation should be studied in relation to other forms of communication and to work motivation in general. Future research can seek to distinguish the relative importance of OC-based motivation when other sources of motivation are present at significant levels, including distinct individual-level gains and selective incentives. Longitudinal research can test the effectiveness of motivational appeals designed to enhance OC-based motivation. The concept also can be readily extended to people's interests in collective gain for collectives as diverse a group, an organization, or a profession.

### Conclusion

Sharing information in a database is only one form of communication. Several conclusions about other forms of mediated communication seem to be in order regarding communication in general and the use of shared databases.

Communication in collective action can be conceptualized in two complementary ways. First, communication in general can be understood as a low-cost/low-risk game that individuals play in order to increase the likelihood of success in follow-on collective actions that involve greater costs and risks. Communication, through its role as a coordinating mechanism among members of a collective, may permit individuals to bootstrap themselves into collective action. Second, communication can be a collective action in its own right, and can produce its own follow-on collective actions. For example, effective information sharing among members of a team (primary collective action) may position them to complete an additional follow-on collective task that has its own separate collective risks and rewards (e.g., being first to market with a new product developed by the team). The potential costs and risks associated with anticipated *follow-on* actions may influence motivation regarding the primary collective action. This situation could explain why people sometimes fail to

communicate even when it appears to be in their interests to do so. For example, a database developed through discretionary contributions to a team, as the property of an organization, might be appropriated by others in ways that disenfranchise its creators. Communication systems should be employed with an eye toward avoiding communication dilemmas.

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 the separate items of information could ever tell (Stasser & Stewart, 1992). The value of information is uncertain *until it is shared*. Contributors risk losing the strategic advantage of private information before they fully understand what value they can expect from sharing it collectively. In comparison to other types of individual performance where the value of contributions is more readily estimated 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 alongside the purchase and implementation of shared database technology. Technical factors must be complemented by social factors to enable and motivate communicative collective action. Wherever the bottom line for information sharing is organizational effectiveness (e.g., Monge *et al.*, 1998), it is all the more important to focus on how shared information supports follow-on collective action. In addition, attention should be paid to promoting the complementary uses of a shared database by contributors and by recipients alike. Only when both contributors and recipients are mutually assured of each other's cooperation can OC-based motivation come to fruition 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.

## Endnotes

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2. 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.
3. See Kalman (1998) 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
Mandates	.79	3	-	-



Table 2

Correlations among the variables and descriptive statistics.

	Motivation	OC <sup>a</sup>	OI	CE	ISE	Mandates
<b>Motivation</b>	-					
<b>OC</b>	.41*	-				
<b>OI</b>	.34	.27	-			
<b>CE</b>	.56**	.08	.50**	-		
<b>ISE</b>	.27	.28	.11	.27	-	
<b>Mandates</b>	.21	.02	.00	.28	.31	-
<b>Mid-points</b>	50	4	4	50	4	50
<b>Means</b>	43	4.5	4.7	40	4.6	52
<b>Std Dev</b>	27	1.2	1.1	27	1.4	32
<b>Range</b>	0-100	2.0-6.0	1.9-6.3	0-87	1.0-6.3	0-93

\*  $p < .05$     \*\*  $p < .01$

<sup>a</sup>OC = organizational commitment, OI = organizational instrumentality, CE = connective efficacy, and ISE = information self-efficacy

Table 3

Multiple regression results of predictors of motivation to contribute discretionary information<sup>a</sup>

Alternative Models	Unique $R^2$	$\Delta R^2$	Total $R^2$
<b>Hypothesis 1</b>			
OC x OI	.20*	.20*	.24*
OC x OI x CE	.39**	.19*	.43**
OC x OI x CE x ISE	.41**	.02	.45**
<b>Hypothesis 2</b>			
OC x (OI x CE x ISE)	.14*	N/A	.54**

\*  $p < .05$  \*\*  $p < .001$

Note. The results shown are for the transformed case.

<sup>a</sup>OC = organizational commitment, OI = organizational instrumentality, CE = connective efficacy, and ISE = information self-efficacy



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