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A MOTIVATIONAL MODEL FOR RESOLVING SOCIAL DILEMMAS IN DISCRETIONARY DATABASES

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Abstract

Organizations have increasingly become sites of collective action, where task performers rely upon shared databases as flexible means to collect and distribute information widely. A database is discretionary if people supply the information to it voluntarily; successfully providing a discretionary database itself calls for collective action. Like classic public goods, discretionary databases tend to be under-supplied if potential contributors cannot expect to benefit individually when they contribute, and so, choose instead to free ride. It is proposed that organizational participants' identification with the collective (i.e., with the organization) will provide a mechanism to motivate contributions if, in addition, the participants hold several necessary beliefs. These beliefs regard the instrumentality of sharing information to produce positive outcomes for the organization, and participants' individual and collective abilities to share valued information via the database. The proposed motivational model could be extended to predict information sharing by means of any communication medium.

A Motivational Model for Resolving Social Dilemmas in Discretionary Databases

Concepts and theories of collective action have grown increasingly relevant to organizational studies in recent years (Robertson & Tang, 1995). One reason is that organizations rely to an unprecedented degree on self-managed units (e.g., individuals; teams; profit centers). A shift has appeared in management philosophy placing greater emphasis on systems that tap into the capacity of participants to assume collective responsibility for autonomous action. These changes have occurred in part to keep up with employee demands for greater participation (Lawler, 1986) and in part to exploit the efficiencies made possible by the latest information processing technologies, including computer-mediated communication (CMC) systems (DeSanctis & Fulk, in press). Activities within work organizations have come to mirror at least some of the voluntarism and self-organization long attributed to behavior outside of work organizations.

The introduction of new CMC systems has itself become an important occasion for collective action in organizations. Often these systems are expensive and highly visible investments that management intends to reshape the way people communicate and use information to accomplish work. But social dilemmas threaten the success of CMC system implementation when potential users lack assurance that they will benefit individually from system use (Connolly & Thorn, 1990; Markus, 1990) and thus lack the motivation personally to invest in system use.

In this paper we develop a motivational model for one type of CMC-based collective action: the production, distribution, appropriation, and consumption of information by means of shared databases within and between organizations. We begin by describing mechanisms for

transforming private goods (such as information controlled by individual people) into public goods, and particularly the role that identification plays in enhancing cooperation. We then review Staw's (1984) motivational model as it applies to participation in a collective action and to problems in producing public goods. With this basis, we then review theory and research on the public goods provided through CMC systems. This foundation enables us to adapt Staw's motivational model to the specific situation where CMC system users choose voluntarily to share information in a database.

Social Dilemmas and the Public-Good Transformation

Situations pitting 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 account for 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).

To foster CMC-based collective action in organizations, there are two principal ways for management to resolve social dilemmas (Kerr, 1992). On the one hand, management can try to ensure the success of a newly introduced CMC system by mandating that people use it. For shared databases, management could reward people who contribute information or penalize people who do not. Rewards and penalties that depend only upon the decisions people make individually to cooperate (e.g., to contribute information) create selective incentives. They guarantee benefits to contributors independent of collective success in making good use of the shared information. Paying out sufficiently valuable selective incentives performs a cooperation-contingent transformation on the situation perceived by participants in a collective action (Kerr,

1992). Participants no longer perceive a social dilemma once selective incentives become their dominant outcomes because the collective's demands on their behavior coincide with their individual interests. But the use of selective incentives places a burden on management, rather than individual members of the collective, to ensure that the rewarded behaviors closely match the organization's needs.

It can be very difficult to specify desirable performance well enough to apply selective incentives in directing the creation of information products. Management can specify the information sources people should consult and the procedures they should follow to ensure information is accurate and timely. The use of automated information systems might even help to centralize control over the assumptions people use in formulating information products (Simon, 1979). Yet, the content of information products is intrinsically uncertain prior to delivery, and all the more so when people must exercise on-the-scene judgment to generate these products. Especially difficult to program would be information products whose purpose is to innovate, to challenge assumptions, to revise how work is done. People must exercise judgment to identify the most important opportunities for change and then share their ideas. Informed discretion at all organizational levels figures into communicating these ideas effectively. Management would therefore seem particularly well advised when CMC systems support decentralized, non-routine information sharing to allow users discretion to obtain, process, and share information based upon what they judge will advance organizational, group, and private interests.

A second way to resolve social dilemmas, and an alternative to selective incentives, is to create a public-good transformation (Kerr, 1992). This transformation in participants' perceived situation occurs when they place increasing value directly upon collective gain. Once the collective gain available through cooperation is valued sufficiently in comparison to other

individual gains, conflicts of interest disappear. An advantage for management, and potentially for all participants, is that contributors become inclined to use their own best judgment in seeking to maximize collective gains. A public-good transformation should support participative, self-managed uses of the shared database to communicate. It avoids difficulties that attend selective incentives because it shifts responsibility for evaluating and regulating individual performance from management to each information producer. The identification of individual participants with the collective can provide a mechanism for public-good transformation.

Identification and the Public-Good Transformation

Social dilemmas occur because people look to their gains as individuals rather than making choices based on collective gain. Yet, one of the most robust findings in social dilemma research has been a tendency for people to cooperate in social dilemmas to a greater extent than would be expected if they cared exclusively for individual-level gain (Kerr & Kaufman-Gilliland, 1994). People often appear to base their choices at least in part upon maximizing collective gain (Dawes, van de Kragt & Orbell, 1990).

One factor that helps to explain such non-selfish cooperation is identification by one person with others in collective action. Identification has been suggested to promote cooperation due to a blurring of the distinction between personal and collective welfare (Brewer & Kramer, 1986). When people identify with the collective, situations they would otherwise perceive as social dilemmas are transformed such that collective interests converge with individual interests.

The importance of identification to collective success in organizations has long been recognized. For instance, Boulding (1968) claimed that “There must always be some small element of identification with the purposes of the organization if effective cooperation of an individual is to be obtained” (p. xxxiii). Indeed, identification has been found to promote

cooperation in a variety of social dilemma research studies (Bonacich & Schneider, 1992; Brewer & Kramer, 1986; Dawes et al, 1990; Kramer & Brewer, 1984).

Staw (1984) proposed an expectancy model that expressly incorporates a term for identification, and does so in a way that suggests how identification should perform a public-good transformation. This model offers an important basis for developing a model of the motivation to contribute to collective gain by participating in collective action.

Staw's Motivation Model

In Staw's (1984) model, the valued outcome is collective gain accruing to the whole organization. Staw's model explicitly excludes any term representing a distribution of gains from the organization to its individual members. The individual members are proposed instead to value organizational gain for its own sake to the same degree they identify with the organization. The model can be summarized as the product of identification (ID) and the expectation of organizational gain (E_{OG}).

$$\textbf{Motivation} = \textbf{ID} \times \mathbf{E_{OG}} \qquad (1)$$

$\mathbf{E_{OG}}$ is the perceived impact of individual performance (i.e., participation) on positive organizational outcomes (i.e., organizational gain). This expectation was represented in Staw's model as a single belief. However, his analysis delineated two possible components of this belief. The first component is the perceived effect of individual participation on collective performance in a given action. Individual participation, the only outcome directly under the control of the individual participant, is assumed not to be valuable for its own sake. Rather, individual participation is valued to the extent it is believed to cause successful collective action. The second component is the perceived effect of the collective action on organizational gain. Like individual participation, it is assumed not to be valuable for its own sake. Rather, collective

action is valued to the extent it is believed to cause organizational gain. Both of these components are necessary if participation is to produce organizational gain. If confidence in either component falls to zero, $\mathbf{E_{OG}}$ falls to zero. Following the logic of Staw's model and analysis, then, these two perceptions would therefore be multiplied together to estimate a person's overall expectation of organizational gain.

Staw's model is a variation on valence-instrumentality-expectancy theory, in which there are two types of cause-effect relationships, instrumentality and expectancy. Instrumentality is an association between outcomes, where a person believes that one outcome will be followed by another outcome (Vroom, 1964). In Staw's analysis, the success of a collective action is an antecedent outcome to organizational gain. An association between these two outcomes is therefore a form of instrumentality, which we label "organizational instrumentality," or **OI**, to emphasize the fact that both outcomes are realized at the level of the organization. A high level of OI means that a person believes successful collective action will produce organizational gain. Barring any offsetting effects from selective incentives, even people who value organizational gain highly should not be motivated to participate when OI is low.

Expectancy refers to the strength of a person's belief that choosing to engage in an action will produce the associated outcome. In Staw's analysis, expectancy consists of only one belief, the perception that individual participation will result in successful collective action. In the context of collective action research, this single expectancy has been decomposed elsewhere into two complementary beliefs known as collective efficacy and 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). In other words, a person asks the question, are people collectively able to apply the effort

and other resources required to produce collective success? This question is not to be confused with the independent matter of the action's instrumentality, which associates successful collective action with follow-on gain. Collective efficacy regards only the production of a successful collective action itself. A variety of factors may affect collective efficacy, such as (a) a sufficient amount of resources; (b) a distribution of these resources that makes it likely they will be used to act collectively (Oliver, Marwell & Teixiera, 1988); or (c) the availability of necessary coordination and organizing mechanisms (Marwell & Oliver, 1991).

Self-efficacy is a self-assessed belief that, by participating, the person can make a difference in the collective action's success (Kerr, 1992; Oliver, 1993). Self-efficacy is more narrowly conceived in collective action research than elsewhere in the psychological literature. Bandura (1986) defines self-efficacy as "a judgment of one's capability to accomplish a certain level of performance" (p. 391). In the context of collective action, the concept is cast specifically in terms of contributing to a collective success. Self-efficacy is a necessary condition if people are to expect their participation to help. Low self-efficacy predicts a tendency to free ride (Oliver, 1993). Even people who expect valued outcomes from collective action and exhibit high levels of collective efficacy should not be motivated to participate if self-efficacy is low.

The overall expectation of organizational gain, $\mathbf{E_{OG}}$, is summarized by Equation 2. It is a function of the three beliefs just described: organizational instrumentality (OI), collective efficacy (CE), and self-efficacy (SE). The function is multiplicative because each of the three beliefs is necessary.

$$\mathbf{E_{OG} = OI \times CE \times SE} \qquad \mathbf{(2)}$$

Substituting this expression in Staw's original model (Equation 1) produces Equation 3, the elaborated Motivation Model.

Motivation = ID x [OI x CE x SE] **(3)**

Thus far we have elaborated a general expression for predicting motivation toward any collective action by organizational members. In the subsequent sections we adapt this general model to the specific situation where people can choose whether to contribute information to a shared database. Communication has been examined in collective action theory largely in the role of a facilitator or inhibitor of a specific collective endeavor, rather than as the central focus of action. Although research and theory from this perspective is relevant to the general case, for our purposes it is more important to examine how communication is itself a collective action, and in particular how database users' valued outcomes depend on one another's choices.

Communication as Collective Action

Four Theoretical Perspectives

Several approaches have been proposed for applying collective action theory to CMC systems use. These approaches have identified public-goods characteristics for the CMC systems (Markus, 1990), the functionality these systems provide to users (Fulk, et al. 1996; Monge, et al., 1998), the information provided (Connolly & Thorn, 1990; Connolly, Thorn & Heminger, 1992), and the goods produced as a result of communicating (Bonacich & Schneider, 1992).

Markus' formulation. Markus (1990) described universal access to a network communication system as a public good. The more people can access the system, the more valuable it becomes both to existing and potential adopters because they can use it to communicate with an increasing number of people. The value of the network system increases at an accelerating rate until access becomes universal among members of the public.

The system's low initial value presents an obstacle to providing universal access. Below a critical mass of usage, too few individuals are reachable to make adoption worthwhile. Unless

usage is boosted early on to attain a critical mass, early adopters are liable to un-adopt so that total usage peaks, then declines, and the system is finally rejected altogether. Markus recommended subsidizing early adopters' equipment and training costs, in effect borrowing against the system's future value during startup in order to boost usage up to a critical mass.

Markus' public good consisted of all available person-to-person links, not only the links in active use. However, Markus insisted that adopters must exercise "communication discipline" to make themselves available when others attempt to communication with them. For instance, in a telephone network people are linked if they at least answer their telephone when it rings (or respond to messages relayed by a telephone answering machine, facsimile, pager, and so on).

Connolly & Thorn's formulation. Connolly & Thorn (1990; Connolly, et al., 1992) defined a shared database that the users themselves stock with discretionary information to be a discretionary database. Discretionary information, in turn, is information that is "initially under the control of one organizational member, who can choose whether or not to make it available to others" (p. 219). Organizationally mandated contributions to a database would fall outside of the scope of discretionary information. When a database is discretionary, potential users are free to choose how much information to enter.

Connolly & Thorn (1990) argued that the act of entering a unit of information into the database potentially benefited all database users except for the contributor, who already had that unit of information. Insofar as users could not be excluded from the database contents (the database was nonexludable), is was a public good whose value at any given time corresponded to the quantity and quality of all the information it contained. But since users could benefit only from the contributions of other users and were free to contribute nothing, they faced a social dilemma that, in turn, explained a chronic under-supply of discretionary information.

Two methods to resolve the dilemma were tested. One was a market-type arrangement where information recipients paid contributors individually for the information they retrieved from the database. This method effectively privatized the good by granting contributors the right to buy and sell control over units of information. The other method was to pay a small bonus to the whole group of users, analogous to a profit-sharing plan, the bonus amount being based upon the sum of individual performances in a follow-on task where experimental participants made use of the database information. This second method in effect created another, follow-on, public good whose provision was contingent on group-level task performance. Both methods promoted contributions. Connolly, et al. (1992) attributed the effect of the small group-level bonus to in-group identification among the participants, as discussed by Messick & Brewer (1983).

Fulk & colleagues' formulation. Fulk et al. (1996) proposed an integrative scheme broad enough to include the types of situations proposed by both Markus and Connolly & Thorn. Monge, et al. (1998) applied the same scheme to analyze CMC systems adopted by the members of interorganizational alliances. Two principal types of communicative public goods were defined – communality and connectivity – corresponding to two types of functionality provided by CMC systems. Communality is provided whenever people jointly hold a single body of information. In its most general form, communality leads to “forging of a collective identity and purpose” (Fulk et al., pp. 68-69), such as when certain symbols or stories comprise a body of information familiar to every member of the public. Another possible variant of communality exists when members of a collective share access to a body of information but different members retrieve different units of information from it. There may not be a single person who is knowledgeable about its entire contents, let alone every member of the public being

knowledgeable. This situation bears some similarity to transactive memory systems (Wegner, 1987; Hollingshead, 1998; Anand, Manz & Glick, 1998).

It is also possible that units of information will pass between pairs of people but that, in the aggregate, people will engage in generalized exchange, a type of social exchange where each person acts to benefit, and receives benefits from, different people (see Ekeh, 1974). It is possible by means of generalized exchange for every user to be a contributor and a recipient even if every dyadic connection is principally a one-way transfer of valuable information. For every variant of communality, however, the shared body of information is nonexcludable. Communality decreases to the extent that information becomes excludable, such as when database users must pay to retrieve any given unit of information or when portions of a shared database are made accessible only to a restricted subset of users.

Connectivity is provided whenever people are able to reach one another by means of a communication medium (Monge, et al., 1998). Network communication systems such as those Markus (1990) considered provide connectivity by enabling users to transmit information to one another. Media whose normal use is to conduct private person-to-person communication (e.g., a telephone network) serve primarily to provide connectivity, serving much less well to provide communality. A shared database also provides connectivity to users, since users can transmit information to one another. If the database furthermore is nonexcludable, its use provides connectivity and communality jointly. To the extent that the database become excludable, however, communality decreases; then the database tends to provide connectivity alone.

The distinction between the mere availability of a communication medium and its active use gives rise to two kinds of connective goods (Fulk, et al., 1996; Monge, et al., 1998). They are physical connectivity, provided by the physical medium, and social connectivity, provided where

people use the medium to communicate or at least exercise the communication discipline to make themselves reachable. Weik (1996, p. 174) makes a similar distinction between these two aspects of availability and use in defining connectivity.

An important contribution of Fulk et al.'s theory to understanding CMC-based collective action is the distinction between communicative public goods and the technical systems that people use to provide them. Shmanske (1991) observed that a common weakness of public goods theory and research is that scholars rely too heavily on exemplars. In so doing, they fail to formulate underlying dimensions of public goods that would make empirical findings more directly comparable between cases and across different types of public goods. Nass & Mason (1990) made a parallel argument with respect to CMC research. They observed inconsistent findings across studies that they attributed to researchers' excessive attention to the technical features of each CMC system rather than the organizational tasks these systems performed. CMC systems that performed the same tasks equally well, they argued, should be treated as equivalent. Extending this rationale to Fulk et al.'s framework, technical systems for communication can be distinguished by how well they enable users to provide connectivity and communality.

Bonacich & Schneider's formulation. Bonacich & Schneider (1992) examined social dilemmas without discussing public goods, per se. But their experimental study involved the production of both communicative goods and follow-on public goods by means of discretionary information sharing. They assigned participants to a group with a problem-solving task. The group members started out with different items of information; each item was a clue to the problem's solution. For a certain cost, members could pass information to their neighbors in a partially connected network. The group succeeded once any member assembled enough clues to solve the problem. The researchers thus created a situation where voluntarily sharing information

enabled people to perform a follow-on collective action – the problem-solving task. The group's optimal strategy was to minimize communication costs by passing information to a central point in the network, where a single group member was best situated to collect clues at the least cost.

The cost of passing information was low enough compared to the reward for solving the problem to make a collective gain possible. But the reward was not distributed equally among group members. One part of the reward was equally divided, thus constituting a follow-on public good. Another part of the reward, a bonus, was paid to the single group member who solved the problem. A private good, this bonus was large enough to motivate group members to collect and hoard information in hopes of solving the problem before the others could. It thus created a social dilemma. Those members encountered the dilemma most who were well situated in the network to collect information but were not at the most central point where it was in the group's best interest to collect information. They tended to defect from the group's optimal strategy by not passing information along, thereby impairing collective gain.

Bonacich & Schneider called the situation a communication dilemma, a social dilemma that discourages communication. They found it was alleviated by an experimental manipulation crafted by Brewer & Kramer (1986) to enhance members' identification with the experimental group. Group members in the experimental condition of Bonacich & Schneider's study voluntarily chose to share more information than did those in the control condition.

Collective Use of the Shared Database

As a follow-on to the elaborated motivation model (Equation 3), which is applicable to public goods in general, the previous section described four theoretical perspectives on CMC-based public goods. The present section narrows the discussion further to particular goods and interdependencies associated with shared databases. Our aim is to analyze the collective use of

shared databases in sufficient detail to derive a model specifically addressed to this interesting form of collection action.

For this analysis, databases can be conceptualized in broad terms. A database consists of any body of information that is (a) required for a specific purpose for use by a system, project, enterprise, or business, (b) may consist of one or more data banks, and (c) may be geographically distributed among several repositories (Weik, 1996, p. 201). The information in a database may, or may not, be organized or automated. It could be stored within a CMC system or in other media (e.g., paper folders in an office filing cabinet). A database is "shared" if the database has more than one user.

Shared databases perform several information-processing tasks. These tasks are comparable with the four-step sequence Plott & Meyer (1975) described as necessary to realizing any public good: production, distribution, appropriation, and consumption.

Production creates the public good. A shared database supports production by enabling users to enter and store information in the database. The database of course provides only an information medium. It is still up to the users to make the choice to contribute discretionary information. The second step is distribution, where a good is made available to members of the public. A shared database automatically distributes information to all users, and they are free to retrieve this information contingent on any usage fees imposed. There are no usage fees attached to items of information in cases where the database is nonexcludable.

The third step in realizing the benefits of a public good is appropriation, where people avail themselves of the good. Only in certain unusual cases are people unable to refuse appropriation of a public good. If a good is distributed to people who cannot refuse it, then it becomes a “public bad” to who do not want it (Plott & Meyer, 1975). Retrieval is the term

commonly used to describe appropriation in the context of database use. Software accompanying a computer database aids retrieval to the degree people can better find the information they want and exclude all else. On the other hand, database information takes on the quality of a public bad when users are presented with excessive amounts they do not want, which they must manually sift in order to find the information they do want.

The final step is consumption, where people take pleasure in a public good for its own sake, or they use it to acquire other goods. A shared database performs no task that corresponds directly to consumption. However, when a CMC system incorporates a shared database with other functions, it would not be surprising to find users who perceive no clear distinction between the functionality of the database and the rest of the system. For instance, a system that combined the shared database with a graphics program to help present information, or a decision aid to help employ it, could perform tasks enabling more enjoyable and productive consumption.

In all of its implementations, alone or in combination with other CMC system services, a shared database distributes information publicly. As such, one advantage over private, person-to-person media is that contributors can make information widely available without to having to address recipients by name. Even when database contributors do address recipients personally, as they sometimes do when using interactive CMC services (e.g., chat rooms, e-mail list servers, newsgroups), what they say is open to public view. Other users are free to listen in, as it were. A contributor hopefully can establish dyadic connections with particular recipients when intended, but chance meetings are possible too. This contrasts to person-to-person media, like the telephone, that are designed to exclude uninvited participants. By using a shared database to communicate, people can interact with people they do not know, whose interests they could not

have anticipated. The potential for serendipitous exchanges of information grows with the number and variety of database users.

In the organizational settings of interest, distribution is normally only "public" within the boundaries of a private network, not to the general public outside of the organization (Held, 1995, p. 331). Database use could be bounded by membership in a work group, a single organization, or set of organizations that have entered into an alliance. As a type of good or resource, the database information is thus a common-property resource – a resource for which there exists a closed set of rights holders – as opposed to an open-access resource (Tang, 1992, p. 28). The impact of this distinction from a contributor's standpoint is that it lends greater predictability to the follow-on outcomes likely to result from sharing information. For instance, even if contributors' information could be used against the organization's interests by competitors, contributors can set aside any concerns over such misuse so long as they retain confidence in the system's security (Monge, et al, 1998). Nonetheless, public distribution in a private network offers greater possibilities for serendipitous exchange than private person-to-person communication within the same organizational boundaries.

Connectivity and communality by means of a shared database. It should be noted that Monge, et al. (1998) and Fulk, et al. (1996) emphasized difference over similarity among CMC systems in the capacity of these systems to provide communicative public goods. Connectivity was associated with direct network connections among people, and communality with the use of shared databases. It is important to acknowledge, however, that such exemplars illustrated sufficient, but not necessary, conditions for the provision of connective and communal goods.

The essential condition for communality, which is both necessary and sufficient, is that people share a body of information. Use of a nonexcludable database is sufficient, but it is not

necessary, to establish the fact that CMC system users share information communally. For instance, CMC system users can use e-mail to broadcast information to every member of a given public. Multiple addressing can be done manually or by means of an automated list-server application. Recipients of a message can then each retrieve a copy of it from their respective e-mail in-boxes, much as if the information had been stored for them in a single, shared database.

Communality is ever present in many local area networks (LANs) where all the information transmitted over the LAN is accessible to every machine physically connected to it. Machines select the information they have been programmed to receive. Usually, they receive only information addressed to their respective users, but network machines also can be set to "promiscuous" mode where they receive all network traffic, irrespective of address. Therefore, such LANs provide communality even if there is no shared database connected to the network.

Broadcast radio and television also exemplify media providing communality while information storage, if any, is up to the discretion of independent users. People tune in to receive whatever programming they wish in real time and, if suitably equipped, they can choose whether to record it (e.g., using a video cassette recorder to record a television program). As Fulk et al. (1996) suggest, even face-to-face conversation is a means to make information commonly available and, thereby, to provide communality.

Meanwhile, the essential condition for connectivity, which is both necessary and sufficient, is that people can reach one another by information transfer. Direct person-to-person communication is sufficient, but it is not necessary, because people may connect by passing information through one or more mediating systems, or even intermediary people (e.g., human messengers). The overriding question with regard to the level of connectivity a medium provides is how well users can meet their needs to reach other people. Numerous considerations affect

connectivity, such as how many people can be reached and the quality of communication in such terms as reliability, timeliness, privacy, and undistorted content. If communicators have no desire for privacy, and a shared database meets all of the other performance criteria they do desire, then the shared database provides connectivity to users as surely as would any other communication medium that met the same performance criteria.

The relationship between communality and connectivity as public goods is that connectivity is a necessary condition for communality, but not vice versa. A medium providing communality (e.g., a shared database) must also provide connectivity, since communality requires, at a minimum, the ability to distribute information to every member of the public from at least one location in the network that is serving to interconnect people. A shared database to which every user can contribute information furthermore enables public distribution from every point in the interconnecting network (i.e., full connectivity). On the other hand, private person-to-person media provide connectivity but they do not automatically make information public. Users of these private media are permitted to choose between sharing information privately within dyads, or within other subsets of the public, versus making the information fully public.

Types of interdependence among database users. There are several sources of interdependence among database users. These interdependencies relate to the different roles users play, the information they share, and the uses to which they apply the information. To begin, a set of database users could be the members of any collective (e.g., a work group). In a collective comprised of N users, the people who contribute information and people who draw information out of the database comprise two user subsets – contributors and recipients. The number of people playing either role can range from 0 to N. When there are fewer than N contributors and N recipients, subset memberships might overlap fully, partially, or not at all.

One source of interdependence derives from the relationships of contributors to one another. With respect to the quantity of information contributed, a situation may require few, many, or all users to contribute information in order to stock the database fully. With respect to avoiding redundant contributions, one approach contributors might take is to specialize so that different people contribute information on different topics, as in transactive memory systems (Wegner, 1987; Hollingshead, 1998; Anand, Manz & Sims, 1998.)

A second source of interdependence relates contributors as one subset to recipients as another subset. The relationship is a complementary one where both must do their parts for communication to succeed. Recipients depend upon contributors to stock the database with information. Contributors, in turn, depend on recipients to draw at least some of the information out of the database, lest their costs of contributing go to waste. In the use of consumer database applications, particularly where people enjoy the process of communication mainly as a means of socializing and entertainment, contributors may be disinterested in what recipients do beyond drawing information out and contributing information of their own in turn. In work settings, however, some of the same intrinsic benefits of communication still exist but the instrumental uses of database information are normally of overriding importance. People use shared databases to disseminate work-related information to other organizational participants. Recipients then employ the information in follow-on actions performed individually and collectively.

A third source of interdependence relates recipients to recipients. While it is possible for recipients to use information independently, it also is possible for recipients' uses for information either to complement one another or to conflict. For example, members of a work team could depend on one another to draw information from the database to support team activities; their uses for information complement one another. The degree to which everyone should draw out

the same information will depend upon what purposes the information serves within the team's activities. For categories of information used to effect coordination, all members would be expected to draw out the same information for common reference (e.g., the team's work schedule). For other categories of information, team members might be expected to draw out differing items from the database, selected to match their respective task specialties.

Efficacy of contributions

In the previous section of the paper we have discussed the functional features of CMC systems as public goods and have shown some of the intricacies of such a communication-based formulation. We have also discussed several key motivational variables, including the instrumentality of connective and communal public goods for achievement of collective goals. We have, in the process, also indicated some ways in which identification with the collective can be implicated in the motivation to produce, distribute, appropriate, and consume information, giving rise to communication-based collective action and public goods. In the previous subsection we have applied these ideas to the particular case of the shared discretionary database.

A final piece of the motivational puzzle is the dual roles of collective efficacy and self-efficacy as they are manifest in efforts toward providing communication-based public goods. The following subsection examines the collective efficacy and self-efficacy of contributors to a shared database.

Collective efficacy among database contributors. When a potential contributor considers the likely behavior of other users, each source of interdependence between the contributor and other users potentially has a bearing on collective efficacy. Whomever a contributor depends on to participate must be expected to do so, be they recipients or other contributors. A general model could be constructed that considers the contributor's expectations for the behavior of all

other interdependent users. However, exactly what sorts of beliefs would indicate collective efficacy would change from case to case as the interdependence between a contributor and other users varied.

Somewhat greater simplicity could be achieved -- conceptually as well as operationally -- if a model could be founded on qualities of database use that do not vary from one case to another. The analysis up to this point has shown that interdependence among database users takes various forms both among contributors and among recipients. One constant, however, is the interdependence between contributors and recipients. Information sharing fails when either of two events occurs: 1) contributors fail to distribute information to recipients, or 2) recipients fail to retrieve contributed information.

Contributor-recipient interdependence is therefore adopted in the present paper as the basis for defining a conception of collective efficacy specially tailored to the study of discretionary information sharing. It is interesting to note that an analysis of shared databases leads to this point, in view of the fact that the same contributor-recipient interdependence is inherent to connectivity, that is, to communication through any medium. It is a question of the connectivity perceived to exist between each contributor and the prospective recipients of that contributor's information. Taking as an assumption there exists a prospect of collective gain, and further assuming that a contributor possesses relevant information to share with other users, then collective efficacy from the contributor's standpoint hinges on the belief that other users will receive information once it is contributed. This belief is defined as connective efficacy.

Connective efficacy can be compared to a perception that social connectivity exists among members of the public. Both beliefs would depend on recipients' exercise of communication discipline. But social connectivity is an emergent characteristic of the entire

network of interconnected people, whereas connective efficacy is an attribute of each individual person with valuable information to contribute. Connective efficacy specifically pertains to the information a person is able to contribute and the expectation that other people who can use the information are going to receive it, once it is contributed. A contributor might then benefit in two ways because other database users received the information: 1) those recipients reciprocate by contributing valuable information of their own; and 2) the recipients use the information so as to increase the level of a follow-on good in which the contributor holds an interest.

Of course, it is important that contributors reach the right recipients, with the right information, in order to produce benefits. The number of people who should receive a given unit of information will vary from case to case. For instance, the number of people who retrieve a given unit of information should be high if the hoped-for outcome is to effect coordination, but should be low if the information is known to meet only specialized needs of a few database users. If the number were high in both cases, it would ensure wide distribution while incurring some risk of overloading people with information they cannot use.

In order to connect with recipients effectively, the choice of a medium to distribute information more or less publicly must complement the ability of recipients to retrieve information with an appropriate degree of selectivity. Where physical connectivity is provided by a nonexcludable shared database, contributors know for certain that all recipients who might benefit could retrieve it. However, as the volume of information in the database grows, and as recipients' needs become more finely differentiated, it becomes increasingly important for recipients to retrieve only the information of interest to them. If the shared database is implemented in a CMC system that fails to support recipients' needs to retrieve information

selectively, then a more selective means of distributing information (e.g., a private person-to-person communication medium) would offer an advantage over the shared database.

Connective efficacy requires that contributors believe physical connectivity has been established, and that recipients have been trained to make use of it. Connective efficacy should be bolstered to the degree that mandates exist requiring organizational participants to retrieve information. Contributors' confidence in connectivity, then, increases to the extent that recipients' discretion is constrained. Insofar as recipients exercise significant discretion, connective efficacy requires that recipients at least exhibit communication discipline and that they possess sufficient understanding of the benefits to be gained through information sharing to make good use of the discretion afforded them. Otherwise, should contributors suspect recipients are not well trained, or that recipients misunderstand the benefits of database use so they are prejudiced against system use, contributors have good reason to doubt that recipients will retrieve information even if doing so would in fact benefit those recipients individually.

It should be noted that connective efficacy depends on the communication tasks at hand. For example, the more quickly and reliably information has to reach recipients, the more stringent the performance criteria contributors should have in mind. If performance criteria from one communication task to another are stepped up to become more stringent, then connective efficacy should be subject to erosion due to increasing doubt that a given CMC system's design and normal use will suffice to enable information retrieval when and where needed.

Self-efficacy among database contributors. The ability of contributors to share information to good effect depends on the value of information they hold. Even a high level of connective efficacy comes to naught if contributors believe the discretionary information under their control is worthless to other people. At issue is the ability of contributors to provide

valuable information. A specialized conception of self-efficacy will be employed to address this issue: Information self-efficacy refers to users' belief that they individually control discretionary information recipients would find to be valuable were they to receive it. Like the concept of connective efficacy, information self-efficacy is based upon the interdependence between information contributors and recipients. As a theoretical construct, and similar to connective efficacy, it should be broadly applicable across various CMC systems that incorporate shared databases, different types of information, and patterns of information use. But whereas connective efficacy concerns the collective ability of database users to play the role of recipient (and thus provide social connectivity once information has been contributed), information self-efficacy concerns the self-assessed ability of each person to play the role of contributor by providing worthwhile information in the first place.

Several considerations set the context for the development of information self-efficacy. People cannot perceive themselves able to contribute valuable discretionary information if they lack significant discretion to choose what information to contribute. Information that people share due only to externally imposed mandates does not come under the province of information self-efficacy. Assuming contributors do control some discretionary information, it does not support the development of information self-efficacy if it does not fit within the particular topic categories or levels of quality recipients are believed to require. (For example, a given database may be designated to contain information regarding project work about which a person has no knowledge and therefore no information of value to contribute.) Another factor prerequisite to information self-efficacy is that potential contributors possess the expertise needed to employ the communication medium at hand, be it a shared database or another medium.

One of the characteristics that tend to distinguish communication from other sorts of collective action is the high degree of uncertainty surrounding the value of contributed information to other people (Connolly, et al., 1992). Items of information not used to effect coordination usually derive much, if not all, of their value from the uniqueness of their content. The value of any single information item, then, is not only a question of its explicit content but also the recipients' extant knowledge, other information available to them already, and the circumstances of recipients' situations where they can use the information. These all are factors the contributors may understand but poorly, and which are liable to change over time. The more novel the contributed information, the less well contributors can find a basis even in past experience to estimate its value.

For contributors who fear negative feedback from recipients, perhaps the most daunting situation occurs where contributions are attributable to the contributor by name and every contribution will certainly be retrieved. Anonymity for contributors should ameliorate their fears, as would a shared database that enables recipients to filter unwanted information. At the same time, however, anonymity and selective retrieval diminish opportunities to acquire corrective feedback from recipients, leaving contributors with less reason to be confident that they know what recipients value and, consequently, weaker grounds on which to develop a strong sense of information self-efficacy.

Summary. People who act collectively to share information perform two complementary roles: contributor and recipient. Many varieties of information sharing are possible by means of a shared database, depending on CMC system design, social norms, mandatory system uses, and the choices participants make within the discretion afforded them. The present paper consolidates the uncertainty of contributors regarding the success of collective database use into

two beliefs: connective efficacy and information self-efficacy. These two beliefs represent specialized conceptions of collective efficacy and self-efficacy, respectively. Sufficient levels of both are requisite to contributors' expectation that contributed information will promote successful collective use of the shared database.

Motivation Model for Discretionary Database Participation

It is now possible to derive a model of motivation that is specific to the contribution of information to shared databases. The collective action of interest is for people to make good collective use of the shared database, of which the contribution of discretionary information is the key individual act of participation. Starting with the general form of the model expressed by Equation 3, the first two terms on the right side of the equation remain ID and OI. With regard to OI, this instrumentality specifically refers to a person's belief in the cause-effect relationship between the successful collective use of the shared database and organizational gain. Collective efficacy and self-efficacy in Equation 3 are meanwhile replaced by the specialized conceptions that were presented in the preceding section: connective efficacy (CNE) and information self-efficacy (ISE), respectively. The resulting model is expressed by Equation 4.

$$\mathbf{M = ID \times [OI \times CNE \times ISE]} \qquad \mathbf{(4)}$$

As in Equation 3, three terms on the right side of Equation 4 are set off in square brackets that together comprise E_{OG}, the expectation that a choice to contribute information will result in organizational gain.

It is useful to restate the model expressed by Equation 4 in verbal form. This enables us incorporate a potentially important consideration not represented in the equation: the effect of any mandates imposed by management to require some database contributions. If such mandates exist and they differ between users (e.g., due to different job assignments), the mandates should

tend to create differences in the amounts of information users intend to contribute independent of the motivation to contribute discretionary information. In formulating a verbal proposition based on Equation 4, mandates are specified as a control variable so as to ensure the generality of the predictions across settings where significant portions of the databases may be stocked with mandatory information in addition to discretionary information.

> **Proposition**. Controlling for mandates, the multiplicative product of (a) organizational identification, (b) organizational instrumentality, (c) connective efficacy, and (d) information self-efficacy, will predict the motivation to contribute discretionary information.

Summary and Conclusion

As organizations increasingly become sites for collective action, often they rely on shared databases as a means to link people together flexibly and to ensure wide dissemination of vital information. In these continually evolving works settings, the choices that participants make to share discretionary information comprise a form of collective action on which, arguably, all other action depends. Participative efforts to carry out organizational change and other distributed, non-routine work activities particularly would appear to demand that people at all organizational levels exercise discretion in producing, distributing, appropriating, and consuming information.

In this paper we explored one mechanism to resolve the social dilemmas that threaten to impair the successful use of discretionary databases. That mechanism is based upon the identification of individual participants with one another and with the organization as a whole. Also necessary to this proposed source of motivation are potential contributors' beliefs in the

instrumentality of sharing information to produce organizational gain, and their abilities both individually and collectively to share valued information by means of the database.

In addition to the need for empirical research to test the motivational model among discretionary database users, there is a need to elaborate the theory's consideration of identification, since identification could take different forms. If participants were, say, to identify closely with familiar work routines and longstanding organizational objectives, identification may cause them to be too slow to accept organizational change, let alone willing to initiate it, even when changes in the organization's environment make it advisable. The theory, as it has been developed here, instead calls for a form of identification whose outcome should be an ongoing concern for the organization's welfare, and a commitment to do what is required to help sustain it (Kalman, 1996; cf. Mowday, Porter & Steers, 1982). Future research also should consider possible interactions between differing sources of motivation felt by a single person such as identification, on the one hand, and selective incentives on the other.

The theory could be extended quite generally to predict discretionary information sharing outside of shared databases. The selected focus in the analysis on contributor-recipient interdependence carried with it an implied focus on connectivity. Since all communication media--not only databases--provide connectivity, connective efficacy and information self-efficacy should be equally important to the motivation to share discretionary information across all of the media people use to conduct organizational communication.

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