A Social Dilemma Perspective on Cooperative Behavior in Organizations

THE EFFECTS OF SCARCITY, COMMUNICATION, AND UNEQUAL ACCESS ON THE USE OF A SHARED RESOURCE

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This study investigates groups' ability to manage resources under high and low scarcity. We offer a contingency model to reconcile competing predictions in the literature: Cooperative group behavior is moderated by group communication and the distribution of resources. A sample of 208 undergraduate students role-played 1 of 4 "division managers" in a fictional organization. They made independent organizational resource withdrawal decisions. Three independent variables were manipulated: (a) level of resource replenishment, (b) group communication prior to decision making, and (c) access to the resource. Our findings indicated strong support for the hypothesized effect of communication and moderate support for the effect of resource distribution. Results suggest that a decline in scarcity increases cooperation only when groups are allowed to communicate and when there is equal access to resources. Theoretical and practical implications of these findings for group behavior in organizations are discussed, and future directions for research are offered.

A defining feature of modern organizations is that their members are mutually dependent on common but finite resources (March & Simon, 1958). For this reason, organizations have been described as pools of shared resources for which individuals and groups compete (Kramer, 1991). When resources

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are abundant and sufficient to meet each member's needs, then conflict over resources is likely to be low (e.g., March & Simon, 1958). However, if resources become scarce, then employees may perceive a sharp disjunction between their interests and those of other organizational members (Kramer, 1989). If left unattended, this situation can lead to intragroup competition and conflict that negatively impacts organizational functioning (Cyert & March, 1963).

Over the years, scholars from many disciplines have been interested in how groups manage collective resources (e.g., Kramer & Brewer, 1986; Pfeffer & Moore, 1980). Based on the results from studies in the field (Libecap & Johnson, 1981) and laboratory (Messick & McClelland, 1983) settings, it is now generally recognized that group members typically behave in one of two ways. In some groups, members noncooperatively or competitively try to maximize their own share of resources, even if doing so harms the group as a whole. Other groups, however, act cooperatively by voluntarily limiting consumption to conserve the shared resource. When shared resources become scarce, the literature suggests two competing predictions about which of these orientations will dominate the behavior of group members (Wayne & Rubinstein, 1992).

Some writers have suggested that an increase in scarcity tends to decrease cooperation by encouraging individuals to maximize their own outcomes at the expense of the group (Kramer, 1989; Platt, 1973; Sahlins, 1965). Others claim that eliminating scarcity will not automatically lead to greater cooperation (Astley, 1978; Moch & Pondy, 1977). For example, it has been proposed that organizational slack, which is the opposite of scarcity, can encourage the pursuit of pet projects by company agents who show little regard for the interests of the principals they serve (cf. Jensen, 1993; Liebenstein, 1969; Nohria & Gulati, 1996). Slack also can lead to suboptimal problem-solving behavior because decision makers are more willing to sacrifice than to search for the most efficient way to allocate resources (Simon, 1957). What these divergent theoretical predictions suggest is that the relation between scarcity and cooperation is contingent on other factors.

The aim of this study is to reconcile competing predictions regarding the effects of scarcity on intragroup behavior. To address this question, the study adopts a social dilemma perspective (Kramer, 1989). The social dilemma has proven to be a useful metaphor for analyzing behavior in situations of conflict between multiple, interdependent actors who share a common resource (Dawes, 1980). As such, it captures two distinctive features of organizational life: interdependence and conflict over limited resources. Based on this framework, we propose that the effects of scarcity on intragroup behavior are

moderated by two factors: (a) the ability of group members to communicate, and (b) the distribution of access to resources within the group.

We used a simulated resource allocation task to test these propositions in the context of a business decision. In the following sections, we describe the social dilemma perspective and the theoretical background for our predictions. We then present data that directly test our hypotheses.

SOCIAL DILEMMAS IN AN ORGANIZATIONAL CONTEXT

A social dilemma occurs when individually rational decisions lead to collective disaster (Dawes, 1980; Hardin, 1968). The social dilemma is essentially an extension of the well-known Prisoner's Dilemma to more than two parties. Social scientists have used the social dilemma paradigm to study how individuals and groups adapt to scarcity in a variety of group decision-making contexts (e.g., Kramer & Brewer, 1986; Platt, 1973; Rutte, Wilke, & Messick, 1987). Hardin's "Tragedy of the Commons" is the classic example of a social dilemma. In this example, a group of herdsmen share a common pasture. It is in the interest of each herdsman to increase the size of his own herd; however, if all attempt to do so, the commons will be overgrazed and everyone will be worse off than if they had not acted solely in their own self-interest. Many organizational activities can be modeled using a commons analogy. Consider the following example drawn from a university setting.

A department is allocated a fixed sum of money to support faculty copying expenses during an academic term. Faculty are given free access to this shared resource with the expectation that it will be used only for work-related purposes. However, in the absence of surveillance and rule-enforcement mechanisms, some faculty begin to make large numbers of personal copies. Although this has minimal long-term consequences when only a few faculty behave this way, as more faculty begin to use the resource to make personal copies, the departmental budget becomes prematurely exhausted, and the benefits of the shared resource are perhaps lost to all.

The previous example highlights the two defining properties of a social dilemma: (a) there is a dominant incentive for each individual to act in his or her own interest, and (b) the result of each person acting on the dominant choice is a suboptimal outcome for the group. Several solutions have been proposed to deal with the problems posed by social dilemmas. According to Messick and Brewer (1983), these solutions fall into one of two types. The first type can be brought about through uncoordinated changes in the behavior of group members. This class of solutions emphasizes processes such as communication that allow group members to "transform" (Kelley, 1983) a com-

petitive situation into a cooperative one. The second type of solution requires a change in the structural features of the dilemma. Changing the payoffs for cooperation or altering the group's decision structure are examples of this second class of solutions.

If people are left alone to manage a shared resource, research shows that they generally fail to use the resource at an "optimal" level, where optimal has been defined as that level of use that would allow the resource to remain at its original size indefinitely (Komorita & Parks, 1994). This supports the predictions of most economic models that in the absence of surveillance or coercive force, people will not achieve the levels of cooperation needed to maintain or support collective resources over time (Buchanan, 1968; Hardin, 1968; Heilbronner, 1974). Yet, experimental research shows that some people do cooperate voluntarily, even when there are financial incentives to act otherwise (Dawes & Thaler, 1988). Although the levels of cooperation are seldom optimal, they often exceed the levels predicted by economic models.

In the context of a two-party Prisoner's Dilemma, Axelrod (1984) has shown that the fundamental basis of cooperation is the likelihood of future interaction and the ability to retaliate against cheaters. This conclusion is the basis for the systematic strategy TIT-FOR-TAT, which is based on the principle of reciprocal altruism. Following this strategy, a player begins by cooperating and then chooses on trial t the response the other player has made on trial $t-1$. Based on an analysis of the Prisoner's Dilemma game, Axelrod predicted that individuals and groups are least likely to cooperate when the future of the interaction is in doubt. This prediction has not, however, been consistently supported by data. As Dawes and Thaler (1988) pointed out, it is not uncommon to observe at least half of the participants in laboratory studies cooperating even in single trial experiments. This suggests that the possibility of future interaction alone does not explain why people cooperate.

Turning to Axelrod's (1984) second observation that the ability to retaliate against cheaters can promote cooperation, we propose that this mechanism is less effective when more than two parties are involved. In a multiparty context, it is difficult to play TIT-FOR-TAT or any other strategy based on reciprocal altruism. For example, if some members of a group cooperate on trial t while others defect, it is unclear what a player using TIT-FOR-TAT should do on the next trial. If a player retaliates by acting noncooperatively, he or she may unfairly "punish" those who behaved cooperatively on the previous trial. For this reason, Axelrod's analysis seems most applicable to situations involving two parties. When multiple parties are involved, other factors may influence cooperation more strongly than the expectation of future interaction and the ability to retaliate against "cheaters."

We propose that resource scarcity is one factor that may significantly affect whether group members behave cooperatively rather than competitively in a social dilemma. However, we also postulate that the effects of scarcity are moderated by other variables. Accordingly, we tested the interactive effects on scarcity of prior communication and the distribution of access to the shared resource. However, before presenting our arguments supporting these interaction effects, let us first consider arguments for why scarcity might directly affect cooperation in a social dilemma.

THE EFFECTS OF SCARCITY

Scarcity is defined in this study as an objective property of the situation. High scarcity exists when aggregate demand exceeds or nearly exceeds available supply. Conversely, low scarcity exists when the available surplus exceeds or begins to exceed aggregate demand. This definition implies that rather than being a discrete variable, scarcity varies along a continuum from high to low based on the degree to which demand exceeds available supply. When resources are shared, several parameters determine the level of scarcity faced by a group. Among these are the size of the resource pool, the number of group members using the resource, and the rate at which resources are being replenished or produced. Because these parameters define the objective interdependence structure of the payoff matrix of a social dilemma (Kramer, 1989), they can influence group members' decisions about how much to take from a common resource pool (Brewer & Kramer, 1986; Kramer, McClintock, & Messick, 1986).

Under conditions of high scarcity, Kramer (1989) argued that group members will find it increasingly difficult to justify self-restraint because the future availability of the resource becomes more uncertain. As a result, each group member is more likely to seek a sure gain now rather than gamble on uncertain future gains. If everyone in the group acts in accord with this decision, it will result in the rapid depletion of the shared resource (Brewer & Kramer, 1986). This analysis suggests that high scarcity will be associated with less cooperative responses. Using a game-theoretic framework, Goodin (1988) analyzed the effects of scarcity and reached a similar conclusion. Modeling decision making as being either cooperative or noncooperative, Goodin argued that scarcity makes mean (noncooperative) games meaner, whereas a decline in scarcity makes mean games kinder (more cooperative). Because the dominant incentive for the individual in a social dilemma is noncooperation (Dawes, 1980), it fits Goodin's description of a noncooperative game. Based on this analysis, we expect a direct, positive relation between cooperation and declining scarcity, as the following hypothesis suggests:

Hypothesis 1: In a social dilemma, cooperation increases as resources become less scarce.

However, the main argument of this article is that declining scarcity will not necessarily lead to increased cooperation. This is consistent with Astley's (1978) argument that the absence of scarcity may heighten conflict and competitiveness among group members by intensifying preexisting rivalries and throwing the organization "up for grabs." It is also in accord with the views of some organizational economists who argue that the presence of slack resources contributes to inefficiency by allowing agents to pursue their own interests rather than acting in the interests of the organization.

As stated previously, the competing theoretical predictions regarding the effects of scarcity can be reconciled by a contingency perspective. Based on prior theory and research, we propose two alternative hypotheses to the main effect predicted in Hypothesis 1. The first alternative hypothesis predicts that the effect of scarcity on cooperation depends on group members' ability to communicate prior to decision making.

THE EFFECTS OF COMMUNICATION

There is compelling evidence that communication prior to decision making increases cooperation in many types of social dilemmas (Dawes, McTavish, & Shaklee, 1977; Edney & Harper, 1978; Kerr, N. L., & Kaufman-Gilliland, 1994; Orbell, van de Kragt, & Dawes, 1988). The direct effects of communication can be attributed to two forms of social influence: *informational influence* and *normative influence* (Deutsch & Gerard, 1955). The first form of influence occurs because communication can be used to convey information and formulate strategies for how to solve the social dilemma. Through discussion, group members who have a better understanding of the dilemma may be able to provide less knowledgeable members with information that may convince them of the long-term benefits of cooperation. Communication also can be used to convey information about group norms and values. By providing group members with information about social norms governing the limits of acceptable competition and self-interested behavior, communication can facilitate the execution of strategies devised during discussion (Kramer, 1989).

We hypothesize that communication moderates the degree to which a decline in scarcity leads to cooperative behavior in a social dilemma. In the absence of communication, we postulate that an increase in the unit size of a shared resource will not necessarily produce a corresponding increase in cooperation, as Goodin's (1988) game-theoretic analysis suggests.

Rather, what is needed to transform (Kelley, 1983) a competitive situation into a cooperative one is a process that: (a) allows the group to recognize the benefits of cooperation, and (b) conveys tacit norms that limit competition and individual payoff maximization (Kramer, 1989). This process is communication.

When group members are unable or unwilling to communicate, we predict that the group's ability to take full advantage of declining scarcity will be impaired. This will occur for two reasons. First, group members who recognize the long-term benefits of cooperation cannot exert informational influence on those who inaccurately perceive the structure of the social dilemma. Second, group members will be unable to exert normative influence by agreeing on socially defined rules that limit competitive behavior. Together, these conditions can prevent groups from effectively increasing cooperation in direct relation to an increase in the unit size of a shared resource. To test this argument, the following alternative to Hypothesis 1 is proposed.

Hypothesis 2: When group members are allowed to communicate, a decrease in scarcity increases cooperation in a social dilemma. However, when group members are not allowed to communicate, a decrease in scarcity does not increase cooperation.

Communication is a process-based solution to a social dilemma. But competition and conflict over resources also can be managed through structural solutions designed to regulate group members' access to resources (Campbell, 1982; Pfeffer & Salancik, 1978). Based on this argument, we theorize that another moderator of scarcity is the distribution of access to a shared resource.

THE EFFECTS OF RESOURCE ACCESS

In organizations, members may be given varying levels of access to a collective resource. This implies that the allocation of resources is at least partially centralized. Returning to our earlier example of a university setting, it is not uncommon for a department chair to allocate resources like research funds or lab space among various faculty members. Under this system, a salient attribute of the structural arrangement is the degree to which access is equally or unequally distributed. A study by Aquino, Steisel, and Kay (1992) examined the effects of inequality in the distribution of resources on cooperative behavior in a social dilemma. They found that cooperation was greater when resources were distributed equally rather than unequally. However, other research has found either inconclusive or no significant evidence that the distribution of resources within a group affects cooperation (Marwell &

Ames, 1979: Samuelson & Messick, 1986). Consistent with our contingency argument, we propose that these mixed empirical results are explained by the fact that structural inequality interacts with other variables to influence cooperation. Our prediction here is that inequality in access to resources moderates the effect of decreasing scarcity on cooperation.

We hypothesize that the positive relation between declining scarcity and cooperative behavior is less likely to occur when access to the shared resource is unequally rather than equally distributed. Alternatively stated, we predict that when resources are scarce, fewer group members will voluntarily exercise restraint when access to the resource is unequally distributed. However, when access is equally distributed, group members will be more willing to act in a way that advances the interests of the group rather than just their own interests (i.e., they will be more cooperative). This prediction is based on an application of social psychological theories regarding the effects of resource inequalities on intragroup perceptions and motivations.

Several theorists (e.g., Deutsch, 1975; Kabanoff, 1991; Kerr, J., & Slocum, 1987) have argued that equal distributions of resources enhance feelings of group harmony, cooperation, and social responsibility. This in turn can promote cooperative responses to perceived scarcity (Kramer, 1989). Unequal distributions, on the other hand, promote individualism and competitiveness (Deutsch, 1975). Such motivations are likely to intensify during periods of extreme scarcity leading to greater conflict and competition for resources (Booth, 1984; Wade, 1987). Ultimately, this will be reflected in more self-interested behavior (Sahlins, 1965) and the premature depletion of the shared resource. To test these predictions, the following hypothesis is proposed:

Hypothesis 3: When access to a shared resource is distributed equally, a decrease in scarcity increases cooperation in a social dilemma. However, when access to a shared resource is distributed unequally, a decrease in scarcity does not increase cooperation.

METHOD

PARTICIPANTS

Participants were 104 male and 104 female undergraduate business students from a state university located in a southeastern city in the United States. Participants took part in the study as part of a classroom exercise. Seventy-three percent of the sample (n = 152) identified themselves as

Caucasian; 15% ($n = 32$) as African American; 9% ($n = 19$) as Asian; and 1% ($n = 3$) as Hispanic. Two participants placed themselves in an "Other" category. The mean age of participants was 24.5 ($SD = 5.2$).

DESIGN

The experiment was a 2 × 2 × 2 (Communication × Scarcity × Resource Distribution) design treating Resource Distribution as a nested (within-participants) factor. In this design, every participant made decisions under both resource distribution conditions. Participants were randomly assigned to one of four experimental roles, resulting in 13 four-person groups occupying each of four between-participant (Communication × Scarcity) cells.

PROCEDURE

The simulation exercise was based on exercises used in previous studies of behavior in social dilemmas (e.g., Brewer & Kramer, 1986; Rutte et al., 1987). Upon arriving in the classroom, participants were given background information and role-playing instructions for a "resource management task." Participants were presented with identical information describing a business scenario. According to the scenario, participants were told to assume the roles of top managers in four business units (A, B, C, and D) of a large corporation. These roles were randomly assigned to participants prior to the experiment. Participants were told that each unit in the corporation operated independently and competed against the others for company resources and rewards. To support product development, units could request funds from the company's "R&D pool" (the shared resource) at the beginning of each fiscal year, which was operationalized as one experimental trial. Each business unit was allowed to request a limited amount of funds from the pool during each trial. Participants made their requests in writing on a "Budget Request Form." The maximum amount that could be requested by all four units in any single trial was $160,000. The amount each individual unit could request, however, was systematically varied as part of the experiment.

The size of the resource pool initially was set at $160,000. Participants were informed that after subtracting the sum of their funding requests in each trial, the resource pool would replenish itself by a predetermined factor. Thus, the size of the pool across trials varied as a function of how much money remained in the pool after participants had made their budget request times the replenishment rate. Participants were told the experiment would continue for a randomly determined number of rounds, or until the sum of their requests in any trial equaled or exceeded the current size of the pool. To

minimize end-game effects, participants were not told the number of rounds they would play; in reality, all games were ended after six trials regardless of how much money remained in the pool. Participants were told that if the pool was overdrawn during any trial, the game would end and they would not receive the money they requested during that trial. The amount of money participants accumulated over the six trials depended on their individual decisions and ability to maintain the shared resource.

Participants were told that their goal in the experiment was to "maximize the amount of money they accumulated across trials." To provide an incentive for participants to behave realistically, they were told that their performance would be evaluated and the highest performer would be rewarded with a $10 gift certificate. High performance was defined as being able to accumulate the most money during the entire experiment compared to every participant who had been assigned the same role. Note that because we compared the relative performance of participants within each role, they were not competing directly against the other members of their group. As a result, participants who were randomly assigned to roles that gave them less access to the shared resource were not placed at any disadvantage and should have been just as motivated to compete for the $10 gift certificate as were those participants assigned to high-access roles.

Before beginning the trials, participants went through a series of practice trials so they would see the relation between total use, the replenishment factor, and the state of the resource. After completing the practice trials, participants answered a prequestionnaire that asked them to provide demographic information and perceptions of social identity. The experiment did not begin until participants completed the prequestionnaire.

Participants made all their decisions anonymously on the Budget Request Form. A student facilitator was randomly assigned to each group. The facilitator's role was to record withdrawal decisions on a data sheet, compute the pool size, and provide verbal feedback regarding the current size of the pool. The facilitator was instructed to make sure that participants did not communicate with one another during the decision trials. The facilitator did not provide participants with any kind of feedback about other group members' decisions; hence, all decisions were made independently. At the end of each game, participants completed a postquestionnaire.

EXPERIMENTAL MANIPULATIONS

Scarcity. Objective scarcity was manipulated by altering the replenishment factor. In the "high scarcity" condition, the replenishment factor was

TABLE 1
Hypothetical Example of the Effect of Replenishment Rate on Pool Size[a]

	Replenishment Rate	
Trial	*Pool Size at 3% (in dollars)*	*Pool Size at 15% (in dollars)*
1	160,000	160,000
2	124,000	138,000
3	87,000	113,000
4	47,000	84,000
5	8,000	50,000
6	0	12,000

a. Assuming a constant group withdrawal rate of $40,000 per trial.

1.03, or an increase of 3% in pool size per trial; in the "low scarcity" condition, the replenishment factor was 1.15, or an increase of 15% in pool size per trial. The effect of varying the replenishment rate on the objective size of the resource pool is illustrated in Table 1.

Table 1 shows that if a hypothetical group withdrew resources from the pool at a constant rate of $40,000 per trial, the pool would be exhausted by the fifth trial at a 3% replenishment rate. At that time, the group would receive a total payoff of $160,000. However, at a 15% rate, the group would be able to use the resource for an additional trial and would accumulate a total payoff of $200,000. This example illustrates how objective scarcity decreases as the rate at which the resource pool replenishes itself increases, given identical levels of resource use.

Communication. In the "no communication" condition, participants were not allowed to communicate at all during the exercise. As soon as they formed their groups, participants were instructed not to discuss their decisions for the duration of the task. In the "communication" condition, participants were allowed to hold a 15-minute "consultation meeting" to discuss strategic issues for managing the resource. Once the 15 minutes elapsed, participants were instructed to refrain from further discussion.

Resource distribution. All participants made decisions in two resource distribution conditions, or games. The presentation of these games was counterbalanced to control for order effects. In each game, participants were given identical "Information Sheets" that showed the maximum amount of money each manager of a business unit could request from the resource pool during each trial. Thus, participants knew exactly how much they could withdraw

relative to other group members. After the first game was completed, participants were given a new information sheet showing a different distribution pattern. Participants were told that the pool would return to its original size in the second game.

In the "equality" condition, all business units (A, B, C, and D) were allowed to withdraw a maximum of $40,000 from the resource pool per trial. In the "inequality" condition, participants playing the role of managers for business unit A could withdraw a maximum of $80,000; those managing B, $40,000; those managing C, $24,000; and those managing D, $16,000. Participants were told to make withdrawals in $1,000 increments.

At the end of the experiment, participants were debriefed during a class discussion. Participants in each role who accumulated the most profit were given their gift certificates at the end of the research project.

DEPENDENT VARIABLES

Two dependent variables measured cooperation at the group level: (a) the total amount of profit accumulated by the group in each game, and (b) the number of rounds that the resource pool remained viable. The first dependent variable measures the group's ability to maximize collective benefit or joint gain. Several conflict theorists (e.g., Pruitt, 1983; Pruitt & Rubin, 1986; Walton & McKersie, 1965) have argued that the concept of joint gain is a useful criteria for evaluating cooperativeness, because it reflects the degree to which the interests of all parties are taken into account. The second variable measures the group's ability to preserve the shared resource over time. This measure bears some relation to the concept of an optimal use level, which we defined earlier as the ability to maintain the resource at its original size indefinitely (Komorita & Parks, 1994). Logically, groups that preserve a resource longer can be said to exercise greater social restraint than those who quickly exhaust the resource. Moreover, by preserving the resource, groups can allow it to increase in size due to the replenishment factor, which in turn can yield a higher joint gain. The relation between these two measures of cooperation is supported by their significant, positive correlation in this study ($r = .67$, $p < .001$).

All data were collected and analyzed at the group level. This was done because the behavior of participants after the first trial was influenced by the actions of other group members. Thus, observations at the individual level were not completely independent. Through analysis of group-level data, the dependent variables could be treated as being truly independent, thus satisfying an important assumption of the multivariate techniques used to test our hypotheses.

RESULTS

We performed a 2 × 2 × 2 (Communication × Scarcity × Resource Distribution) analysis of variance (ANOVA) with repeated measures on each dependent variable to test Hypotheses 1, 2, and 3. Several scholars (e.g., Cohen, 1977, 1994; Morrison & Henkel, 1970; Rozeboom, 1960; Thompson, 1992) have argued that researchers should pay more attention to effect sizes and report them routinely as part of the study findings rather than relying solely on significance tests as the basis for refuting the null hypothesis. Based on these recommendations, we present the results of both conventional tests of statistical significance and effect sizes (e.g., η^2s and *f* index[1]) associated with each of the experimental treatments to provide a more comprehensive assessment of our results. Table 2 summarizes the results of the ANOVA on the dependent variable joint gain.

Table 2 shows a significant main effect for communication, $F(1, 48) = 5.16$, $p < .05$, a finding that already is well established in the literature and was not of direct interest in this study. Of more interest was the test of Hypothesis 1, which predicts that groups behave more cooperatively as resources become less scarce. This hypothesis was supported by the significant main effect of scarcity, $F(1, 48) = 14.90$, $p < .001$. The results indicated that groups in the low scarcity condition accumulated higher joint gains (M = \$353,539, SD = \$73,643) than did groups in the high scarcity condition (M = \$292,615, SD = \$44,386). However, our alternative hypothesis (Hypothesis 2) states that the effect of scarcity is moderated by communication. The significant Communication × Scarcity interaction shown in Table 2 supports this prediction, $F(1, 48) = 3.92$, $p = .05$. Figure 1 illustrates the pattern of this interaction.

Figure 1 shows that when scarcity was high, "communication" (M = \$294,923, SD = \$45,038) did not produce a significant increase in joint gain compared to "no communication" (M = \$290,308, SD = \$45,436). However, when scarcity was low, cooperation increased when group members were allowed to communicate (M = \$387,077, SD = \$79,389) prior to decision making as compared to when no communication (M = \$320,000, SD = \$50,583) was allowed. Because lower-order effects cannot be interpreted accurately in the presence of higher-order effects (Aiken & West, 1991), the significant two-way interaction supports our prediction that the effects of scarcity on cooperation are contingent on other factors. In this case, that factor was the ability of group members to communicate prior to decision making. Hypothesis 3 predicted that resource distribution also moderates the effect of scarcity. As Table 2 shows, this hypothesis was not supported for the dependent variable

TABLE 2

Analysis of Variance Summary for Joint Gain (between participants)

Source	df	MS	F	p	η^2	f
Scarcity	1	24125.54	14.90	.00	.10	.33
Communication	1	8352.15	5.16	.03	.24	.56
Scarcity × Communication	1	6339.85	3.92	.05	.08	.29
Error	48	1619.26				

Analysis of Variance Summary for Joint Gain (within participants)

Resource distribution	1	1302.15	.82	.37	.02	.14
Resource Distribution × Communication	1	5208.62	3.29	.08	.06	.24
Resource Distribution × Scarcity	1	81.38	.05	.82	.00	.03
Resource Distribution × Scarcity × Communication	1	129.38	.08	.78	.00	.03
Error	48	1581.18				

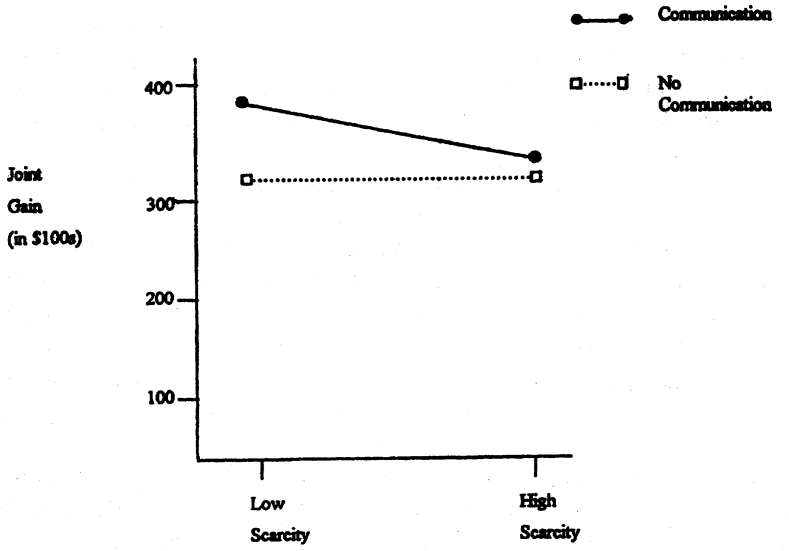

Figure 1: Scarcity Communication Interaction Effect on Joint Gain

TABLE 3

Analysis of Variance Summary for Number of Rounds (between participants)

Source	df	MS	F	p	η^2	f
Scarcity	1	13.16	3.34	.07	.07	.27
Communication	1	66.24	16.83	.00	.26	.59
Scarcity × Communication	1	.01	.00	.96	.00	.00
Error	48	.73				

Analysis of Variance Summary for Number of Rounds (within participants)

Resource distribution	1	.24	.11	.75	.00	.04
Resource Distribution × Communication	1	.01	.00	.95	.00	.00
Resource Distribution × Scarcity	1	8.09	3.61	.06	.07	.27
Resource Distribution × Scarcity × Communication	1	1.63	.73	.40	.02	.14
Error	48	1581.18				

joint gain. According to Cohen (1977), an *f* index value of .10 indicates a small effect size; a value of .25 indicates a medium effect size; and a value of .40 or higher indicates a large effect size. Based on these standards, Table 2 reveals that communication had a large effect on joint gain, and scarcity and the Communication × Scarcity interaction had medium effect sizes. Table 3 summarizes the results of the ANOVA on the number of rounds the pool remained viable.

Consistent with our earlier finding, communication had a significant main effect on cooperation, $F(1, 48) = 16.83, p < .001$. However, there was no evidence that a decline in scarcity enhanced groups' abilities to preserve the shared resource. This result failed to support Hypothesis 1. We also failed to replicate the Communication × Scarcity effect obtained in our earlier analysis. We did, however, find modest support for Hypothesis 3. Specifically, the ANOVA showed a marginally significant Resource Distribution × Scarcity interaction, $F(1, 48) = 3.61, p = .06$. The pattern of the interaction is depicted in Figure 2.

Figure 2 shows that in the high scarcity condition, whether groups had equal ($M = 3.3, SD = 1.9$) or unequal ($M = 3.8, SD = 1.9$) access did not significantly affect their ability to preserve the resource. However, in the low scarcity condition, allowing equal access ($M = 4.6, SD = 2.0$) allowed groups to preserve the resource longer than when access was unequally distributed

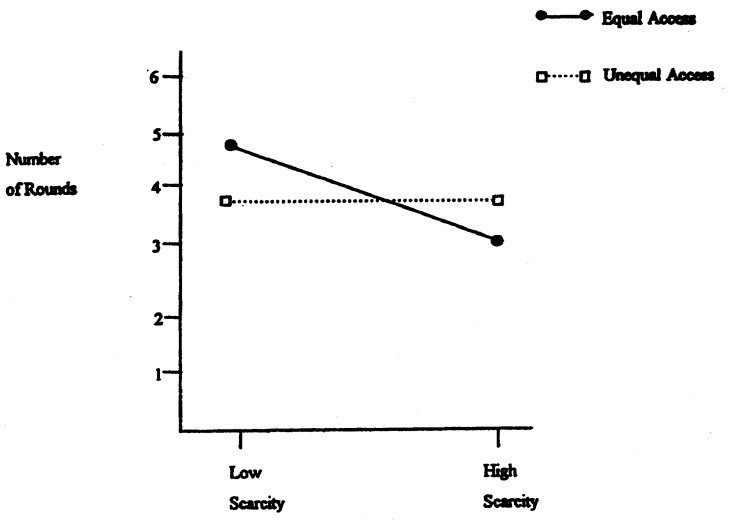

Figure 2: Scarcity × Resource Distribution Interaction Effect on Number of Rounds the Pool Remained Viable

($M = 3.9$, $SD = 1.9$). This pattern is consistent with Hypothesis 3. Examination of the effect size indexes shows that communication had a large effect on the number of rounds the pool remained viable. Scarcity and the Resource Distribution × Scarcity interaction had medium-sized effects. A comparison of the effect sizes obtained from the analysis of the two dependent variables suggests that communication had a stronger effect on both joint gain and the group's ability to maintain the resource over time than did the distribution of resources.

DISCUSSION

The main finding of this study was that communication moderates the effect of scarcity on cooperation when operationalized in terms of joint gain. We also found some evidence that inequality in the distribution of access to a shared resource moderates the effect of scarcity on the group's ability to preserve a resource over time. Lastly, the study provided additional support for already robust findings that communication prior to decision making increases cooperation in a social dilemma.

THEORETICAL EXPLANATIONS AND CONTRIBUTIONS

There have been competing theoretical predictions regarding the effects of scarcity on intragroup behavior in organizations. Whereas some writers have argued that scarcity promotes an increase in competitive behavior (Kramer, 1989; Platt, 1973; Sahlins, 1965), others contend that a reduction in scarcity may not necessarily increase cooperation (Astley, 1978; Jensen, 1993; Moch & Pondy, 1977). In this study, we adopted a social dilemmas perspective to examine these competing predictions in a group context in which members where mutually interdependent. Under these conditions, we proposed that the effect of scarcity is contingent on several factors: the ability of group members to communicate and the distribution of access to resources within the group. The data provided the strongest support for the moderating effect of prior communication.

That a decline in scarcity resulted in a significant increase in joint gain when groups were allowed to communicate compared to when no communication was allowed suggests that scarcity does not, by itself, provide an adequate explanation for cooperative behavior in a social dilemma. Many theoretical frameworks have been used to explain cooperation and noncooperation in groups. We suggest that the influence of scarcity is perhaps best understood from the perspective of structural models (Blau, 1974). Structural models generally explain cooperation and its absence in terms of aggregated conditions of the system in which cooperation occurs (Smith, Carroll, & Ashford, 1995). Consistent with this perspective, we argued that scarcity influences group members' decisions by determining the objective interdependence structure of the payoff matrix in a social dilemma (Kramer, 1989). However, as our data showed, a change in objective scarcity did not produce a direct, monotonic effect on joint gain. Indeed, when no communication was allowed, we found that a decline in scarcity did not significantly increase joint gain.

This finding suggests that an alternative explanation is needed to account for the emergence of cooperation under varying levels of scarcity. Based on the fact that communication can be conceptualized as a procedural mechanism that facilitates group members' use of informational and normative influence, perhaps a more appropriate framework is one based on social modeling theories (Bandura, 1977; DiMaggio & Powell, 1983). These theories provide a potentially richer explanation of how intragroup processes contribute to the formation of norms of cooperative behavior through learning and innovation. Unfortunately, the present data do not allow us to explore in great detail how groups in the low scarcity condition capitalized on communication (i.e., what kinds of strategies were pursued), because we did not record

the content of communication. What the behavioral data do suggest, though, is that future studies should focus more explicitly on the content of discussion and the learning process that may have occurred through the mechanism of communication.

We found some evidence that level of access moderates the relation between scarcity and cooperation. In contrast to communication, this effect was centered on the group's ability to preserve the resource rather than on joint gain. The predicted interaction between scarcity and level of access was based on social psychological theories of how individual motivations and perceptions are influenced by inequality. We proposed that a decline in scarcity would lead to increased cooperation when access to resources was distributed equally rather than unequally.

The data provided some support for this hypothesis. As Figure 2 shows, the pattern of the interaction between scarcity and access to resources was consistent with Aquino et al.'s (1992) finding that an equal distribution of resources leads to greater cooperation than does an unequal distribution. However, we extended this result by showing that the pattern emerges only when resources are less scarce. One implication of this finding is that a more egalitarian distribution of resources may not promote cooperation, as some writers (e.g., Deutsch, 1975; Kabanoff, 1991) have suggested, unless resources are perceived as being sufficient to meet group members' needs.

LIMITATIONS OF THE STUDY

This study has several limitations that deserve comment. First, the moderated effects of communication and access to resources did not receive consistent support across both dependent measures. Moreover, the predicted interaction between scarcity and access to resources failed to reach statistical significance at .05 on either dependent measure. However, this finding, by itself, should not lead us to reject the hypothesis entirely. A number of scholars (e.g., Cohen, 1977, 1994; Morrison & Henkel, 1970; Rozeboom, 1960; Thompson, 1992) have argued persuasively that there are a number of problems associated with the use of null hypothesis significance testing as the sole basis for assessing a study's findings. According to Cohen (1977), researchers also should consider effect sizes. In this study, we reported the results of both conventional statistical significance tests and effect sizes. It was found that the effect sizes of the predicted interactions fell within the middle range of standards proposed by Cohen (1977), which leads us to suggest that there are reasonable grounds for concluding that our theoretical predictions received some empirical support. Of course, the best way to assess the validity of our theoretical propositions is through replication (Cohen, 1977).

A second limitation of the study was alluded to earlier, namely, that we did not gather data on the content of the discussions among group members prior to decision making. It is conceivable that such data would provide greater insight into how group members may have exerted either normative or informational influence on other members and if, in turn, this affected their behavioral responses to declining scarcity. We can only infer the use of such influence tactics based on the outcomes obtained by groups. Although there is reason to suspect that such influence processes occurred, the absence of data on what was said in groups seriously restricts our ability to draw conclusions regarding this process in the present study.

A third limitation of the study is that the levels of the independent variables represent fixed rather than random factors. That is, the levels of the independent manipulations were selected arbitrarily and systematically to represent the entire population of treatment conditions that may be of interest. Although this is the most common approach taken in a situation where the number of potential levels at which a variable may be manipulated is exceedingly large, a limitation of this approach is that it restricts the generality of the results to those treatment effects observed within a particular set of conditions. Alternatively stated, it may be that had we selected a different level of scarcity, or varied the degree of inequality in access, we would have found different effects from those we observed.

Notwithstanding these limitations, we note that Keppel (1982) pointed out that the choice of using fixed rather than random factors must be guided by several considerations. The first is whether the full range of the stimulus dimension can be represented in an experiment. Clearly, it was impossible to represent the entire range of scarcity or inequality in a single design. Consequently, the next consideration is choosing levels that are expected to produce a reasonably large difference between adjacent levels. Based on the significant main effects for the independent manipulations found in our study, we believe it is reasonable to conclude that the levels of the independent variables chosen did produce differences across treatment groups. Finally, had we used a random selection procedure to arbitrarily choose levels of the independent variable, there is no guarantee that important points along the dimensions of these variables would be represented in the experiment. In sum, given the limitations of the fixed-factor procedure used in this research, future research should attempt to vary the levels of scarcity and inequality to identify whether there may be critical points of inflection. For example, some research suggests that the effects of slack on organizational innovation follow a curvilinear pattern (Nohria & Gulati, 1996). A similar pattern may describe the relation between scarcity and cooperation.

ORGANIZATIONAL IMPLICATIONS

It has been suggested that slack plays a vital role in resolving latent goal conflict between political coalitions in organizations, and that scarcity can increase internal conflict and discord (Cyert & March, 1963). We used a social dilemma framework to model a situation in which the motive to maximize individual interest "dominates" the motive to maximize group interest. As a result, the findings of this study offer several practical implications for how groups in organizations may capitalize on transitional periods from high to low scarcity, and vice versa.

In organizations, the transition from low to high scarcity often occurs so gradually that it may be imperceptible to some group members. For example, there often has been much uncertainty even among experts about the severity of resource crises or even whether resource shortages exist (cf. Hardin, 1968, and Maurice & Smithson, 1987). Similarly, it may not always be obvious when organizational resources have become more abundant. If this assumption is correct, then individuals may fail to accurately perceive changes in the objective payoff structure of organizational social dilemmas, which, in turn, can lead them to act as if resources were still scarce. In other words, they would continue to be motivated to maximize present gains because they perceived the future viability of the resource to be threatened.

Based on the preceding analysis, one implication of the present study is that organizations should institute procedural mechanisms that allow group members to develop strategies for taking maximal advantage of declining scarcity. Face-to-face communication should be a prominent feature of such mechanisms (Bradford, 1998). However, simply allowing members to communicate without also providing accurate information about the objective state of the resource may limit its effectiveness. From this perspective, the role of managers as information gatekeepers becomes relevant.

A single person controlling the information in an organization can affect decisions by allowing certain information to flow through channels (Bradford, 1998; Pettigrew, 1979). Similarly, O'Reilly (1980) argues that communication within an organization is selectively filtered by those controlling its flow. What these observations suggest is that the effectiveness of communication may be largely dependent on the type of information available to group members. In this study, all group members were given accurate and identical information about the rate at which resources were replenished and how much of the resource was available for use. In real organizations, however, accurate information may not always be available. This suggests that an important question for future research is to examine how information gatekeep-

ers in organizations might influence perceptions of scarcity and the subsequent levels of cooperation among group members.

When face-to-face communication is not feasible, then organizations may have to rely on structural mechanisms to capitalize on declining scarcity. Consistent with structural solutions, our findings suggest that providing members with more equal access to the shared resource can promote increased conservation during periods of low scarcity. However, recognizing that the empirical support obtained for both the direct and interactive effects of the resource distribution manipulation was not particularly strong, it may be that other structural mechanisms are more effective. One possible structural mechanism would be to implement a hierarchical solution that facilitates coordination and cooperation among group members. A common hierarchical solution is the election of a leader to make the decision for the group (Samuelson & Messick, 1986). Based on the hierarchical solution, it would seem reasonable for organizations to partially or perhaps fully centralize some resource allocation decisions, particularly when a group has shown a history of mismanaging a shared resource.

NOTE

1. Based on Cohen (1988, p. 284), the *f* index was computed based on the following formula: $f = (\sqrt{\eta^2} / 1 - \eta^2)$.

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