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Group Communication During Resource Dilemmas

2. Effects of Harvest Limit and Reward Asymmetry

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A resource dilemma is a circumstance in which an aggregate of people share a slowly replenishing resource pool out of which each person can harvest a significant amount. Resource dilemmas normally make salient an allocation norm of equality in harvests among aggregate members. When asymmetry among aggregate members exists in terms of either access to the resource pool or reward for harvest, the equity allocation norm becomes equally relevant. In this study, groups experienced an experimental simulation of a resource dilemma under either symmetric, asymmetric harvest limit, or asymmetric reward conditions. Groups in the asymmetric conditions were more likely to choose explicitly to follow an allocation norm, and groups that chose to follow a norm had a far more task-oriented discussion and positive perceptions of their experience than groups that did not make an explicit choice. Neither experimental condition nor explicit norm choice revealed a discernible impact on harvesting.

Keywords: *small group discussion; resource dilemma; asymmetry; social norm*

Imagine that you are one of five people who fish on a lake harboring 25 trout and that these 25 trout are able to reproduce 5 of their kind every week. How many fish should you catch? If you go after 1 every day, you will be amply fed this week, but if your compatriots do likewise, by the time next week rolls around, no trout will be left. If instead, all of you limit yourself to 1 a week, you may be less satisfied immediately, but the lake will remain stocked to capacity for the rest of the season.

This little tale sums up the concept of *resource dilemma*. Resource dilemmas, also known as social traps or collectively as the tragedy of the commons, are situations in

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which an aggregate of people share a slowly regenerating resource pool from which each can harvest at any one time as much as desired (sometimes up to a relatively high limit). Although it is advantageous in the short-term for any person to harvest freely, it is to the long-term benefit for the aggregate to limit joint harvesting to an amount sufficient to ensure the resource pool's regeneration at a stable level. Just to name one example relevant to the story above, humanity's overuse of marine life for food is well documented, with examples of total seafood supply collapses ranging from fish in parts of the Grand Banks off of Newfoundland (Safina, 1995) to oysters in the Chesapeake Bay (McHugh, 1972) to blue whales in Antarctic waters (Clark, 1977).

Research beginning in the 1970s has revealed that people left on their own do a very poor job of maintaining resource pools without some form of aid. One such form is communication, and several studies have shown that the opportunity to communicate can have a very large impact on the ability of an aggregate of people to conserve a resource (see the meta-analysis by Sally, 1995). Analogous findings have emerged from research on public goods dilemmas, mirror images of resource dilemmas, in which the members of aggregates each have an individual endowment that they can either keep or contribute to a common pool that benefits the entire aggregate, including noncontributors (free-riders), if and only if a given number contribute; a relevant example is a public radio station.

In light of a review of experimental simulations of both resource and public goods dilemmas, Bornstein (1992) hypothesized that the opportunity to communicate increases aggregate members' understanding of their situation, allows for coordination of their actions, enhances mutual trust, aids in the emergence of cooperative social norms, enables promises and commitments to cooperate, and leads to the establishment of a group identity; these factors as a group ostensibly increase internal cooperation and, in turn, maintenance of the resource pool. A further review by Shankar and Pavitt (2002) revealed research support for all of these factors except the first and last. To date, there is no evidence that the opportunity to communicate increases participants' understanding of the situation, and although this opportunity definitely enhances group identity, it may not foster increased cooperation. However, none of these studies entailed more than a cursory examination of the content of the communication among participants; hence, these conclusions rest on circumstantial evidence at best.

The research reported herein is the second in a series of studies examining the content of communication during resource dilemmas. In the first study (Pavitt, McFeeters, Towey, & Zingerman, 2005), participants experienced an experimental simulation of a resource dilemma with either of two regeneration rates. Regeneration rate was associated with the proportion of types of communication content related with successful performance, in turn affecting total group harvest size, variation in harvests among participants, and participant judgments relevant to many of the factors Bornstein (1992) believed to be associated with good performance. In the present study, we manipulated the symmetry of the situation faced by the different members of aggregates facing the dilemma. In a control (symmetric) condition, all aggregate members had the same upper limit for their harvest at a given time and same reward for each harvested unit. In one experimental (asymmetric harvest limit) condition, mem-

bers differed in the upper limit of their harvest; in another (asymmetric reward), they differed in their reward per unit. The point of these manipulations was to permit examination of the impact of differing allocation norms in the context of the resource dilemma. In the following sections, we describe these norms and what this impact might entail.

Allocation Norms in Resource and Public Goods Dilemmas

If a group of people control a resource and must determine a method for dividing it, how is this division best accomplished? The answer to this question entails the idea of distributive justice. Homans (1967/1971) described this concept as follows:

> If a man [sic] is equal to me in what he gives, he ought to be equal to me in what he gets . . . If a man is better than I in what he gives . . . he ought to be better than I in what he gets . . . But the rule works both ways, and if he is better than I in what he gets, he also ought to be better in what he gives. (p. 461)

The implementation of this principle in human affairs has resulted in the evolution of a set of allocation norms relevant to resource distribution in different circumstances. Leventhal (1976) defined an allocation norm as "a social rule that specifies criteria that define certain distributions of rewards and resources as fair and just" (p. 94). At least three norms are relevant here. The equality norm presumes that all group members by the very fact of their membership deserve equivalent rewards; an example of its application is the winning World Series team in baseball in which the same champion's ring is awarded to the substitute as that given to the star. The equity norm presumes that rewards should be in proportion to the contribution made toward receiving that reward; corporate stock holdings are supposedly based on this notion. The social welfare norm presumes that group members should receive what they need; examples might include sharing within well-functioning families.

Both Homans (1950) and Thibaut and Kelley (1959) emphasized group members' felt obligation to adhere to relevant norms, along with the pairing of this obligation with the right of each member to expect norm-consistent behavior from one another and to punish deviance. Thibaut and Kelley explained the emergence of norms as the result of the efficiencies gained when a group facing an often-experienced problem uses past practice to solve that problem rather than renegotiate a solution every time. This alone does not, however, account for the possibility that norms from one group carry over to a person's expectations and evaluations when entering other groups. Yet clearly this occurs, whether through generalization from early experience or from socialization. Thibaut and Kelley likened this process to Kelman's (1961) idea of internalization. Behavior consistent with a norm become intertwined with those aspects of the person's value system made relevant by the situation, becoming rewarding to the person for its own sake. This does not mean that the person will necessarily

enact that behavior, as there may be overriding reasons to act otherwise, but at the very least, the behavior will be considered a possible response to the situation.

By their very nature, resource dilemmas make internalized allocation norms salient for their participants. Van Lange and Messick (1996) have listed perceptions of fairness as one of the basic motivational processes relevant to these circumstances. What is fair in resource dilemmas, however, is not always obvious. When people have equivalent access and can gain equivalent reward from their participation, the equality and equity norms have identical implications. But this situation only obtains infrequently. If an aggregate of people share a river, those upstream will often have a better opportunity to collect fresh water than those farther down. On a larger scale, we all share our atmosphere, but some can breathe fresher air, whereas others are saddled with ozone and pollutants. In these circumstances, the conflict between allocation norms becomes clear; should we all share equally, or are we satisfied when some have advantages over others?

Commentators (Samuelson & Allison, 1994; van Dijk & Wilke, 2000) have hypothesized that the equality norm is a standard background assumption that operates during resource dilemmas unless the situation either obscures its relevance or enhances the salience of other norms. Research has demonstrated that the equality norm is generally in effect for harvesting or contributing under the symmetric condition that participants have equal assess to a resource pool or equal allotments in public goods circumstances. For example, van Dijk and Grodzka (1992) and van Dijk, Wilke, Wilke, and Metman (1999) discovered that when people are unaware of differences in allotments in a public goods situation, they use an equality norm in their contributions and in making judgments about fairness in contributing. Messick et al. (1983) reported that participants led to believe that their group was underusing a resource pool increased their harvests in later rounds only when they believed others in the group had done so previously, whereas participants believing their group was overusing the resource pool decreased their harvests only when they felt the others would also; both effects appear to be attempts to equalize harvests across group members. In our earlier study (Pavitt et al., 2005), 20 of the 25 groups obviously meant to harvest in line with the equality norm, although in 3 of those groups, one member defected and intentionally overharvested.

Asymmetric situations are more complicated. Unequal allotment in or responsibility for achieving a public good induces pressure toward equity, both behaviorally and in judgments concerning fairness of contributions. For example, Wit, Wilke, and Opperwal (1992) determined that those with higher initial allotments or greater rewards from a resource pool resulting from participants' contributions perceived higher amounts of contributions to be fair. These perceptions of fairness correlated at .74 with actual contributions; Van Dijk et al. (1999) found this correlation to be .87. In Budescu, Rapoport, and Suleiman's (1990) study, only 20% of the participants with unequal access to a resource pool observed equality norms, with 44% switching to equity and the remaining 36% falling somewhere in the middle. Participants appear to perceive resource dilemmas somewhat differently than they do public goods dilem-

mas. In this case, one can manipulate either the upper limit to what each group member can harvest or the proportion of the reward for each point taken. The two seem to work differently, with unequal harvest limits leading to the observance of equity notions but unequal rewards to attempts at maintaining equality. Participants with higher limits on their harvest took more than those with lower limits (Samuelson & Messick, 1986; van Dijk & Wilke, 2000; van Dijk et al., 1999). When rewards are unequal, those with smaller rates harvested more, consistently with the self-reported expectations of the participants; all of which looks similar to an attempt at maintaining an equality norm (Budescu et al., 1990; van Dijk et al., 1999).

None of the aforementioned studies provided an opportunity for participants to discuss their situation with one another before making their harvest or contribution decisions. A series of studies by Kerr and associates (Kerr, Garst, Lewandowski, & Harris, 1997; Kerr & Harris, 1996; Kerr & Kaufman-Gilliland, 1994), however, allowed for such an opportunity within a context in which participants differed in their allotment in a public goods dilemma. Each of these resulted in the usual findings of greater contributions by those with larger endowments and by those in experimental sessions allowed to communicate but no statistical interaction between these two factors. One reported studies allowing for the opportunity to communication in asymmetric resource dilemmas (Wade-Benzoni, Tenbrunsel, & Bazerman, 1996) showed symmetric groups to do a far better job of maintaining a sustainable resource than groups with asymmetric harvest limits. The study to which we will turn to next is the first in which communication content has been a variable of interest.

Application to the Current Study

A communication orientation to the study of resource dilemmas implies an input-process-output interpretation of the phenomena we investigated. In this interpretation, the difference in conditions (input) served to make differing allocation norms salient (also input), leading to differences in communication content (process) and, in turn, differences in harvests and participants' judgments of their experience (output). In the symmetric condition, there was no conflict between the equality and equity norms, as both suggested that participants within a given session should harvest equally. In the two asymmetric conditions, there was such a conflict, but the implication of this conflict differed between the two. With asymmetric harvest limits, equity implied that the advantaged could and should harvest more than the disadvantaged, resulting in differing rewards, whereas equality implied that all should harvest equally. With asymmetric rewards, equity implied that all should harvest equally, with greater rewards for the advantaged, whereas equality implied that the advantaged should harvest less than the disadvantaged and, thereby, evening the rewards.[1] These considerations led to three sets of hypotheses and research questions, with the first set relevant to communication content, the second to game performance, and the third to participants' judgments of their experience.

Communication Content

If one can assume that the conflict between salient norms in the asymmetric conditions would lead to more discussion relevant to understanding the rules of the game and deciding on relevant strategy, it follows that

H1: Asymmetry conditions result in a greater proportion of discussion devoted to task-relevant communication than a symmetry condition, and
H2: Asymmetry conditions result in a greater proportion of groups explicitly discussing allocation norms than a symmetry condition.

We also assume that groups facing allocation norm conflict will choose to follow one of these norms more often than groups not facing such conflict and that the effort to make the decision leads these groups to place more attention to figuring out the game and how to play. If so, then

H3: Groups acting consistently with an allocation norm will devote a greater proportion of discussion to task-relevant communication than groups not acting consistently with an allocation norm.

Game Performance

It might seem that greater attention to task would lead to better game performance with asymmetry. However, the implications of earlier research (reviewed in Shankar & Pavitt, 2002) and the explicit findings of our earlier study (Pavitt et al., 2005) suggest that although more discussion relevant to game strategy does help, discussion relevant to understanding the game is actually negatively related to good game performance. Therefore, as different types of task-relevant communication have the opposite impact on game performance, there was no theoretical rationale to make a prediction concerning the impact of communication on game performance. Furthermore, Wade-Benzoni et al. (1996) observed symmetric groups to outperform asymmetric groups in maintaining the resource pool, which might be inconsistent with the idea that asymmetry leads to more task-relevant communication. This gives rise to the following research question:

RQ1: Does asymmetry condition have an impact on average group harvests?

Given the logic linking Hypotheses 2 and 3, asymmetry condition and group choice to follow an allocation norm should have parallel impacts for all output variables. The following question follows:

RQ2: Does norm allocation choice have an impact on average group harvests?

We did expect a difference in the variation in harvests among members of the same group. The symmetric condition implied equal harvests no matter which norm the par-

ticipant deemed relevant, but the asymmetric conditions implied that at least some groups would approve of differing harvests among members. Hence,

H4: Asymmetry conditions result in more variation among members' harvests within groups than a symmetry condition.

The circumstances resulting from groups deciding on a specific allocation norm are complicated. Equal harvests are implicit in the equality norm in the asymmetric harvest limit condition, the equity norm in the asymmetric reward condition, and either norm in the symmetric condition. Unequal harvests are implicit in the equity norm in the asymmetric harvest limit condition and the equality norm in the asymmetric reward condition. There is no implication for groups that do not choose an allocation norm. This suggests

H5: Groups acting consistently with an allocation norm implying equal harvests show less variation in harvests among members than groups acting consistently with an allocation norm implying unequal harvests.

Participant Judgments

Our participants judged the extent to which they believed their experience reflected the factors Bornstein (1992) hypothesized to be involved in the relationship between opportunity to communicate and cooperation that were described earlier in this paper. If conflict in norms leads to greater effort, then

H6: Asymmetric conditions result in stronger participant judgments of their understanding of the situation, their group coordination, their mutual trust, their commitment making, and their group identity than a symmetric condition.

The participants also made judgments relevant to their beliefs that everyone should harvest the same amount of points and receive the same amount of money at the end of the game. These presumably differ across conditions. Because of the financial inequality inherent in the situation,

H7: Participants in an asymmetric reward condition have (a) greater concern with equal rewards and (b) less concern with equal harvests than participants in an asymmetric harvest limit condition or a symmetry condition.

Analogously to Hypothesis 6,

H8: Groups acting consistently with one of the allocation norms should have stronger participant judgments of their understanding of the situation, their group coordination, their mutual trust, their commitment making, and their group identity than groups not acting consistently with one of these norms.

Finally, analogously to Hypothesis 7,

H9: Participants in groups acting consistently with an allocation norm implying equal harvests should have (a) greater concern with equal rewards and (b) less concern with equal harvests than participants in groups acting consistently with an allocation norm implying unequal harvests.

Method

Participants and Sessions

Research participants were students in two courses taught at the University of Delaware during the spring 2003 semester.[2] Participants signed up for 1 of 39 available time slots. We intended to have 13 in each of the three conditions, but lost 1 session in the asymmetric harvest limit condition and 2 in the symmetric condition when only two people showed up. In these cases, the participants performed the task, but the data were excluded from the analyses. We lost the data for one additional group in the asymmetric harvest limit condition because of an inaudible videotape. We also had intended a group size of four, but because of either a lack of sign-ups for time slots or the absence of people who had signed up, we ended up with 17 three-member groups and 18 four-member groups about equally divided among the three conditions. Several studies have demonstrated smaller sized groups to be more cooperative in resource dilemmas than larger sized groups (e.g., Allison & Messick, 1985; Brewer & Kramer, 1986); hence, we will report preliminary examinations of group-size effects on group outcomes.

A total of 123 students participated in the 36 sessions for which we had usable data (along with 10 in the 4 sessions we lost). Of these, just more than two thirds were female (83) and one third male (40). In addition, 69 (56%) were freshmen, 26 (21%) sophomores, 23 (19%) juniors, and 5 (4%) seniors.

Procedure

The rules for the simulation (described to participants as the Banking Game) were consistent with those in past resource dilemma research. At the beginning of the game, the resource pool (described to participants as a bank account) contained 25 points for each participant (100 points for four-member groups or 75 points for three-member groups). During any round of the game, group members in the symmetric and asymmetric reward conditions could withdraw up to 25 points in whole-number increments. In three-person groups in the asymmetric harvest limit condition, they could withdraw either 35, 25, or 15 points. In four-person groups in the asymmetric harvest limit condition, participants could withdraw 35, 30, 20, or 15 points. We chose these numbers to maintain the same mean harvest limit (25) among all three conditions and the same range among individual harvest limits (35 vs. 15) in the asymmetric harvest limit condition, regardless of the group size. Harvest limit in this condition depended

on seating arrangement, with the limits greatest for the participant who, in a random seating arrangement, happened to sit to the left and less for participants who chanced to sit to the right. In the symmetric and asymmetric harvest limit conditions, participants received 5 cents for each point they withdrew from the resource pool. In three-person groups in the asymmetric reward condition, participants were paid either 8, 5, or 2 cents per point. In four-person groups in the asymmetric reward condition, the figures were 8, 6, 4, or 2 cents per point. Again, the numbers had the same mean reward (5 cents) among all conditions and same range (8 cents to 2 cents) for all groups in the asymmetric reward condition. Reward depended on seating position, with greater rewards for participants who happened to sit further toward the left.

At the end of each round, the total number of points withdrawn was subtracted from the bank account, and the remaining number of points was multiplied by 1.2. The bank account for the next round was the product of this multiplication, except it could never exceed its beginning size of 25 per participant. If at the end of any round, the bank account included exactly 0 points, the game ended, and the participants received their withdrawn points for that round. If at the end of any round, the bank account was less than 0, the game ended, and the participants did not receive any withdrawn points for that round. If the bank account was maintained, the game continued for 10 rounds. We informed the participants of all of these rules, including the 10-round limit and the payment.

Ideal game strategy consisted of withdrawing just enough but no more than would keep the resource pool at its maximum until the 10th round and then during that final round withdrawing the entire account. A three-member group ideally would withdraw 12 points, and a four-member group 16 points, for each of the first 9 rounds, with (assuming an equality norm) each member receiving 4 of those points. Emptying the resource pool in the 10th round would earn each participant 25 more points for a total of 61 points each and, thus, a maximum payment of $3.05. Assuming an equality norm in the asymmetric reward condition requires an unequal division of those points among participants, with greater harvests for those with smaller rewards per point.

Data were gathered as part of a senior-level research practicum taught during the spring semester of 2003. The procedure began with informed consent forms and instructions. Each participant received a printed sheet listing the rules, along with a verbal explanation of the process of game play and an answer to any question relevant to the rules (but not to questions relevant to game strategy). Then, participants played a practice game of 3 rounds, so as to familiarize them with the rules. There were no payments for withdrawals during this practice game. After the practice game, any last questions about game rules were answered. Next, the participants engaged in a 10-minute videotaped discussion, with the experimenters absent. The actual game came next and lasted up to 10 rounds depending on how long the bank account remained solvent. Additional 2-minute discussions among participants, also videotaped and with the experimenters again absent, took place between any 2 rounds if any of the participants so requested. At the end of the game, the participants completed a questionnaire to be described shortly, were paid for their earnings, and received an information sheet explaining the study for the purposes of debriefing.

Transcript Preparation

Videotapes for 17 of the discussions were transcribed by members of the research practicum. Another 14 were transcribed by members of a senior-level course on conversational and interactional analysis during the spring semester of 2004. All transcripts were checked by the first author for accuracy. The first author transcribed the remaining 5.

Coding Procedures

Transcripts were broken into sentence-like units by means of a version of Auld and White's (1956) method including revisions designed specifically for group discussion (Whitchurch & Pavitt, 1990). An experienced coder did the separations. The second, third, and fourth authors, who had participated in the research practicum and were familiar with unitizing procedures, each unitized one group for the purpose of calculating unitizing reliability. We assessed unitizing reliability using Guetzkow's *U* (Guetzkow, 1950), a measure of coding disagreement, based both on the normal procedure of comparing total units across coders and the more stringent method recommended by Folger, Hewes, and Poole (1984) of comparing number of exact matches in units coded by both researchers. Unitizing reliability for 981 units was an excellent .003 for the normal method and a very respectable .041 for the more stringent one.

The category scheme developed via a multistage process. Initially, the first author constructed a preliminary scheme by examining transcripts from a spring 2001 pilot study of five groups engaged in procedures identical to the control condition. Second, students in a fall 2002 version of the aforementioned course on conversational and interaction analysis applied the scheme to transcripts from the earlier study (Pavitt et al., 2005) and reported their reliability and coding difficulties. The first author revised the category scheme on the basis of these students' reports. Third, students in the research practicum applied the scheme to transcripts of the present discussions; their reports led to further revisions. The final coding scheme, summarized in Table 1, includes two codes for each unit. The first, macrolevel topical focus code distinguishes discussion relevant either to (a) understanding the rules of the game, (b) occurrences during the practice or past rounds, (c) general strategy for subsequent rounds, (d) specific strategy for subsequent rounds, or (e) off-topic tangents. The second, microlevel functional focus code combines various aspects of coding schemes proposed by Bales and Strodtbeck (1951), Poole and Roth (1989), and Pavitt and Johnson (2001) with the addition of one category specific to resource dilemmas—arithmetic calculations. The complete coding manual is available from the first author.

The second, third, and fourth authors did the categorizing. Their earlier course participation had familiarized them with the category scheme, and each received approximately 10 hours of additional training before beginning the coding. Each had either 11 or 12 randomly assigned discussions to code. Although they knew in general about the replenishment manipulation, they were not aware of the specific hypotheses and research questions addressed in this study. All four authors categorized two groups

Table 1
Summary of Category Scheme

Topical focus categories

1. Game understanding: Discussion relevant to the rules of the game, with the general intent of increasing game players' understanding of how the game is played.
2. Past or practice round: Discussion relevant to what occurred during past rounds in the game or during the practice round.
3. General strategy: Discussion relevant to the general strategy to be used in subsequent rounds. They do not include discussion relevant to specific proposed strategies.
4. Specific strategy: Discussion relevant to specific proposed strategies (i.e., proposals including specific numbers of points to be harvested).
5. Off-topic tangents.

Functional focus categories

Substantive: Assigned if the unit is concerned with the substance of the discussion; in other words, if it is relevant to the decision. This would include discussion of the game, practice round, or past rounds, and of possible strategies for subsequent rounds.

1. Information: Statements about the nature of the game situation that are essentially objective and descriptive, along with acknowledgments following those statements. All substantive units during game understanding and practice and past round topical focus periods are coded as information. They can also occur during general and specific strategy topical focus periods.
2. Suggestion: Statements that introduce or ask for a proposal, along with acknowledgments following those statements. Suggestions will only occur during general or specific strategy topical focus periods.
3. Computation: Statements that ask for or are part of calculations relevant to proposals, along with acknowledgments following those statements. Computations cam only occur during specific strategy focus periods.
4. Elaboration: Nonevaluative statements about previously offered proposals and their consequences. Elaborations can only occur during general or specific strategy topical focus periods.
5. Evaluation: Statements that ask for or provide explicit or implicit acceptance or rejection of the proposal under consideration or asks for an evaluation. Evaluations only occur during general and specific strategy topical focus periods.
6. Confirmation: Statements that either state the decision in its final form or ask for or provide an explicit group acceptance of a proposal. Confirmations can only occur during general and specific strategy periods.

Maintenance: Assigned if the unit is concerned with maintaining (or damaging) group cohesiveness or individual morale. Maintenance units can occur during any topical focus period, but any that occur during off-topic tangents are coded 0.

11. Positive: Statements showing pleasure, joking, or positive response to expression of pleasure and jokes. Positive maintenance units can also indicate affiliation, social support for other group members, or identification with or praise for group as a whole. Finally, positive maintenance units may consist of positive responses to episodes of tension or antagonism.
12. Negative: Statements of disapproval or criticism for the group of other players, or expressions of nonconformity with the other players, along with direct responses to these statements. Negative maintenance units can also show displeasure, frustration or disinterest, and acknowledgments of incompetence.

21. Procedural: Assigned if the unit is concerned with the process by which the decision is made. This would include attempts to guide the discussion. Procedural units can occur during any topical focus period, but any that occur during off-topic tangents are coded 0.

0. Off-topic tangents.

Table 2
Categorizing Reliability

		Coder One		Coder Two		Coder Three	
Content Category	Units	*P*	•	*P*	•	*P*	•
Topical focus							
Game understanding	148	.93	.92	0.62	0.59	.85	.82
Past or practice round	117	.97	.97	0.97	0.96	.97	.96
General strategy	134	.64	.61	0.79	0.76	.81	.78
Specific strategy	628	.96	.91	0.90	0.81	.92	.85
Off-topic tangent	240	.99	.99	1.00	1.00	.98	.98
Total	1267	.93	.90	0.88	0.83	.92	.88
Functional focus							
Information	330	.84	.79	0.79	0.73	.82	.77
Suggestion	122	.69	.67	0.63	0.60	.66	.62
Computation	68	.46	.44	0.43	0.41	.44	.43
Elaboration	298	.87	.82	0.73	0.63	.71	.61
Evaluation	38	.84	.83	0.63	0.61	.40	.37
Confirmation	44	.46	.44	0.36	0.35	.34	.33
Positive maintenance	32	.91	.90	0.69	0.68	.78	.77
Negative maintenance	18	.72	.72	0.44	0.44	.89	.89
Procedural	77	.84	.83	0.49	0.46	.70	.68
Off-topic tangent	240	.99	.99	1.00	1.00	.98	.98
Total	1267	.83	.79	0.74	0.68	.75	.70

from the previous (Pavitt et al., 2005) study of resource dilemmas, one at the beginning and one at the end, and two groups from the present study, one in the middle and the other at the end, for the purpose of assessing categorizing reliability. For categorizing reliability, we compared the codings of the second, third, and fourth authors with those of the first, both overall and category-by-category, using Guetzkow's *P* as a liberal index and Scott's *pi* as a conservative index (see Lombard, Snyder-Duch, & Bracken, 2002). Table 2 includes categorizing reliability. Reliability for topical categories was very good overall, although one of the coders had a bit of difficulty with general strategy and another with game understanding. Reliability estimates for functional categories were acceptable overall, but those for a few of the less prevalent categories were lower than desirable. In particular, the reliability coefficients for computation and confirmation were poor; all three coders had some difficulty distinguishing both from elaboration.

Questionnaire

Participants responded to a questionnaire designed to assess the validity, from the standpoint of participants' perceptions, of the various contributing factors that have been proposed to account for the impact of communication during social dilemmas (Bornstein, 1992). The questionnaire included two items related to each of the relevant

Table 3
Questionnaire Items and Factors Measured By Them

Factor Measured	Questionnaire Item
Understanding	Did talking to the other players help you better understand how the game works?
	Did the discussion among the players help you make sense out of the rules of the game?
Coordination	Did the players try to work together when playing the game?
	Was there a lot of coordination among the players when playing the game?
Trust	How much did you come to trust the other players to do what they said they were going to do?
	As the game went on, did you begin to believe that other players would do what they promised?
Cooperation	How cooperative was everyone playing the game with you?
	Did everybody playing the game try to work together?
Promising	Did you make promises about how many points you would take out?
	When you made promises, did you usually take out the number of points that you said you would?
	Did other members make promises about how many points they would take out?
	When other members made promises, did they usually take out the number of points they said they would?
Identity	By the end of the game, did you consider yourself as belonging to a group with the other players?
	Did the group of players become more cohesive as the game continued?
Social norms	Do you think that every player should take out the same number of points from the bank?
	Do you think that every player should receive the same amount of money at the end of the game?
	How much were you concerned that some people in the game were getting more points than they deserved?
	How much were you concerned that some people in the game were getting less points than they deserved?
Personal responsibility	How much responsibility did you feel you had for keeping the bank account high?
	Did you feel that it was important for you to make sure that the bank account did not run out early?

contributing factors: that communication helps group members come to better understand the situation, allows group members to coordinate their actions, enhances trust among members, helps cooperative social norms to emerge, is used strategically to make promises and commitments to one another, and helps members establish a group identity. In addition, the participants indicated their perceptions concerning four other factors believed to be related to cooperation during resource dilemmas: the acceptance of an equality norm, adherence to this norm, the felt responsibility to protect the resource pool, and whether voiced promises and commitments were actually kept.

They recorded their responses to items on 7-point scales, with labeled endpoints relevant to the question. These items are listed in Table 3.

Cronbach's alpha served as the estimate of internal consistency for each of the factors; the results appear in Tables 4 and 5. Alphas for equality norm adherence, promise keeping, and responsibility to protect the resource pool were somewhat lower than desirable. The alpha for equality norm acceptance was close to 0, which is not surprising and irrelevant given that the two questions comprising this factor, concern for equal money and concern for equal points across aggregate members, presumably have different implications in the asymmetric conditions. Thus, we treated the two questions representing it separately.

Data Analysis

We performed most analyses relevant to the hypotheses and research questions at the group level, with the exception of the analysis of survey results. The use of group-level data limits the types of inferential statistical procedures available because of problems in sample size (35 groups as compared with 123 individual participants) and, in particular, discourages the use of correlational methods for hypothesis tests stemming from lack of stability in the coefficient. A power estimate for these correlations, calculated using Faul and Erdfelder's (1992) GPOWER Program and assuming an acceptable correlation of only .2 for this size sample, is only .32.

To categorize the allocation norms that a group accepted—which was necessary for evaluation of Hypotheses 3, 5, 8, and 9 and Research Question 2—we looked both at verbal expressions of agreement concerning one or the other norm (noted through reexamining the transcripts) and the extent to which harvesting approximated a norm to classify each group. When the two were in contradiction, such as when a group professed a desire to harvest equally but ended up winging it so to speak, the verbal expression was taken as the better indicator of group intention. Of the 11 groups in the symmetric condition groups, 7 had no within-group variation in harvests; we judged those as following the equality norm, although the equity norm is just as relevant, because of the evidence described earlier that the equality norm is the background assumption and that equity concerns only come to participants' minds in asymmetric situations. Of the 11 groups in the asymmetric harvest limit condition, 8 chose to follow the equality norm and 3 the equity norm. Of the 13 groups in the asymmetric reward condition, 7 chose equality (including a brilliant group using a unique strategy to be described in the Results section), 5 equity, and 1 winged it. These findings were consistent with the assumption at the basis of the relevant hypotheses that asymmetric groups were more likely than symmetric groups to act consistently with an allocation norm. In fact, the difference in proportions among symmetric and asymmetric groups following a norm was significant, $\chi^2(2) = 6.67$, $p < .04$. In total, we judged 22 groups with 79 members as accepting the equality norm, 8 groups with 26 members as accepting the equity norm, and 5 groups with 17 members as accepting no norm at all.

Table 4
Questionnaire Data for Experimental Conditions

		Condition								
		Symmetric		Asymmetric Harvest Limit		Asymmetric Reward				
Factor	alpha	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*(2,87)	$p <$	ω^2
Cooperation	.77	6.54	0.59	6.07	1.21	6.56	1.24	8.36	.01	.06
Coordination	.86	5.90	1.31	5.77	1.53	6.23	1.11	3.11	.05	.02
Equality norm acceptance	.06									
Equal points		5.10	2.02	4.86	1.96	3.00	2.11	18.67	.01	.17
Equal money		5.59	1.77	5.72	1.72	6.32	1.33	3.47	.04	.04
Equality norm adherence	.56	2.94	1.28	3.19	1.59	3.14	3.47	0.60	.55	
Group identity	.70	5.45	1.27	5.54	1.51	6.07	0.97	0.75	.48	
Promise keeping	.42	6.21	0.99	5.86	1.47	6.53	0.91	12.95	.01	.07
Promise making	.98	5.61	1.98	6.39	0.99	6.10	1.61	3.40	.04	.02
Responsibility	.51	5.91	1.28	5.71	1.02	5.31	1.53	3.15	.05	.03
Trust	.88	6.09	1.16	5.75	1.70	6.50	0.75	8.62	.01	.07
Understanding	.81	6.07	1.12	5.81	1.26	6.18	0.97	1.98	.15	

$N = 123$.

Table 5
Questionnaire Data for Chosen Allocation Norms

		Condition								
		Equality		Equity		None				
Factor	alpha	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*(2,87)	*p* <	ω^2
Cooperation	.77	6.30	1.01	6.77	0.41	6.15	0.98	5.99	.01	.04
Coordination	.86	5.94	1.37	6.69	0.57	4.76	1.25	17.70	.01	.16
Equality norm acceptance	.06									
Equal points		4.24	2.36	4.08	1.92	4.35	2.12	0.15	.86	
Equal money		5.73	1.69	6.31	1.44	5.76	1.71	1.43	.24	
Equality norm adherence	.56	3.27	1.50	2.96	1.74	2.56	1.34	1.74	.18	
Group identity	.70	5.59	1.35	6.38	0.71	5.00	1.30	11.24	.01	.09
Promise keeping	.42	6.19	1.22	6.50	0.93	5.62	1.24	7.74	.01	.04
Promise making	.98	6.41	1.17	6.17	1.45	3.97	2.08	26.07	.01	.26
Responsibility	.51	5.79	0.99	5.37	1.51	5.12	1.48	3.48	.04	.03
Trust	.88	5.93	1.51	6.75	0.41	5.88	0.80	8.00	.01	.06
Understanding	.81	6.00	1.16	6.42	0.74	5.38	0.97	5.34	.01	.06

N = 123.

Results

Group Size Effects

Group size had no effect on proportion of possible points (three-person group M = 66.56, SD = 16.09; four-person group M = 74.71, SD = 13.46; $t(33) = 1.62$; $p = .12$) or on the standard deviation (SD) among these proportions within sessions (three-person group M = 12.13, SD = 12.67; four-person group M = 20.10, SD = 31.34; $t(33) = .99$; $p = .33$). For the responses to the questionnaire, only those for responsibility to protect the resource pool differed across sessions (three-person group M = 5.29, SD = .96; four-person group M = 5.86, SD = .49; $t(33) = .03$); given the number of t tests performed, this finding is likely because of chance. These findings allow us to collapse across session size in subsequent analyses.

Communication Content

Hypotheses 1, 2, and 3 are relevant to differences in communication content between the symmetric and two asymmetric conditions. The number of coded units differed substantially among sessions, from a high of 764 for a group that discussed the game between almost every round to a low of 150 for a group that only talked for parts of the required 10 minutes. As a consequence, to measure communication content relevant to Hypotheses 1 and 3, we computed the proportion among the various coding categories for each group, separately for the topical and functional focus categories. We then directly compared the means of those proportions between the two conditions using chi-square contingency analysis, for the entire data set, along with simple chi-squares for the individual categories, except for computation and confirmation, because of their lack of reliability. As the proportions for each category are, by their very nature, interdependent, we adjusted significance level for the simple chi squares to .01 for the topic focus categories and .005 for the functional focus categories. We used phi for the index of variation accounted for in chi-square tests, as in Hays (1973). We also reexamined the transcripts and noted instances in which groups explicitly discussed fairness issues concerned with either the point or reward scheme; the findings served as the test for Hypothesis 2.

Hypothesis 1 posited that the two asymmetric conditions would result in a greater proportion of task-oriented discussion than would the symmetric condition. Table 6 lists the mean proportions among the topical focus categories for both replenishment rates. The differences in proportions between conditions was significant: $\chi^2(8) = 98.17$, $p < .001$, $\varphi = .18$. Visual inspection indicated that the asymmetric reward condition was associated with the highest proportion of discussion relevant to past and practice rounds and game strategy and the lowest proportion of discussion relevant to understanding the game and off-topic tangents, with the asymmetric harvest limit condition lowest in the former and highest in the latter and the symmetric condition intermediate throughout. Posthoc simple chi-square comparisons revealed significant differences for general strategy, $\chi^2(2) = 23.53$, $p < .001$; specific strategy, $\chi^2(2) = 10.24$, $p < .001$; and off-topic tangents, $\chi^2(2) = 53.87$, $p < .001$.

Table 6
Proportions Among Content Categories

Category	By Experimental Condition			By Chosen Allocation Norm		
	Symmetric	Asymmetric Harvest Limit	Asymmetric Reward	Equality	Equity	None
Topical Focus						
Game understanding	8.81	9.98	7.63	8.77	7.21	11.06
Past or practice round	6.64	4.28	7.03	5.78	7.81	4.36
General strategy	10.20	6.47	13.32	8.31	11.60	16.22
Specific strategy	47.52	43.19	53.07	53.68	50.58	20.44
Off-topic tangent	26.86	36.10	18.96	23.48	22.84	47.94
Functional focus						
Information	20.23	19.14	24.60	20.41	24.32	22.86
Suggestion	5.64	7.37	9.54	7.60	9.58	4.64
Computation	4.91	2.50	5.76	4.35	5.54	3.28
Elaboration	30.96	23.21	27.19	30.72	24.88	14.88
Evaluation	2.56	2.87	3.54	3.49	3.43	2.80
Confirmation	1.92	2.21	3.04	2.86	2.01	1.20
Positive maintenance	1.99	2.39	1.92	2.40	2.01	0.84
Negative maintenance	2.30	2.26	2.47	2.14	2.63	2.80
Procedural	2.70	2.00	3.03	2.58	2.83	2.36
Off-topic tangent	26.86	36.10	18.96	23.48	22.84	47.94

$N = 35$

Table 6 also lists the mean proportions among the functional focus categories for both replenishment rates. The differences in proportions between conditions was significant: $\chi^2(18) = 103.41$, $p < .001$, $\varphi = .19$. The asymmetric reward condition was associated with the highest proportion of discussion relevant to information, suggestions, evaluation, and procedure, and the lowest proportion relevant to off-topic tangents. The asymmetric harvest limit condition was highest in off-topic tangents and lowest in information and procedural; the symmetric condition highest in elaboration and lowest in suggestion and evaluation. Posthoc simple chi-square tests showed a significant difference for elaboration: $\chi^2(2) = 11.09$, $p < .005$. All told, the asymmetric reward condition had the most task-relevant communication, consistent with Hypothesis 1, but the asymmetric condition the least, which was inconsistent with this Hypothesis.

Hypothesis 2 indicated that the two asymmetric conditions would show a greater proportion of groups explicitly discussing allocation norms than would the symmetric condition. Although a few of the groups in the symmetric condition mentioned in passing that their harvesting should be equal, only 1 of the 11 groups had an explicit discussion of the fairness of equal harvests. In contrast, 7 of the 11 groups in the asymmetric harvest limit condition and 11 of the 13 asymmetric reward groups explicitly discussed the issue. The difference in proportions was significant: $\chi^2(2) = 14.26$, $p < .001$. These data support Hypothesis 2.

Hypothesis 3 held that groups following one of the allocation norms would devote a greater proportion of discussion devoted to task than would those not following an allocation norm. Table 6 shows the mean proportions among the topical focus categories for groups accepting the equality norm, equity norm, and no norm. The differences in proportions between conditions was significant: $\chi^2(8) = 204.74$, $p < .001$, $\varphi = .32$. Groups not following an allocation norm spent a much higher proportion of discussion off topic than groups following an allocation norm and, although they were slightly higher in proportion of talk relevant to game understanding and general strategy, were a bit lower in talk about past play and much lower in talk concerned with specific strategy than groups with allocation norms. Posthoc simple chi-square comparisons revealed significant differences for general strategy, $\chi^2(2) = 26.25$, $p < .001$; specific strategy, $\chi^2(2) = 162.18$, $p < .001$; and off-topic tangents, $\chi^2(2) = 130.38$, $p < .001$.

Table 6 also lists the mean proportions among the functional focus categories for both replenishment rates. The differences in proportions between conditions was significant: $\chi^2(18) = 255.02$, $p < .001$, $\varphi = .36$. Groups not following an allocation norm had a lower proportion of discussion relevant to suggestions, elaboration, evaluation, and positive maintenance than groups following an allocation norm, with these deficits largely accounted for by the surplus of off-topic tangents. Posthoc simple chi-square values showed significant difference for suggestion, $\chi^2(2) = 16.98$, $p < .001$; elaboration, $\chi^2(2) = 54.70$, $p < .001$; and evaluation, $\chi^2(2) = 28.11$, $p < .001$. These findings strongly support Hypothesis 3.

Game Performance

To maintain consistency with the first and subsequent studies in this series, we assessed performance in the game on the basis of the proportion of points harvested as compared to the relevant maximum. In addition, we used standard deviations among each participant's proportion to represent harvest variation within groups. We used standard independent-group *F* tests for statistical comparisons relevant to Hypotheses 4 and 5 and Research Questions 1 and 2. For the analyses of variance, we used omega squared to represent variance accounted, as suggested in Hays (1973), and power estimates were calculated through the procedures described in Cohen (1977) and using Faul and Erdfelder's (1992) program. As hypotheses normally pitted one condition against the other two, the circumstances for these analysis of variance (ANOVAs) reflect Cohen's (1977) Pattern 3 (p. 279), and we estimated observed effect size accordingly.

Research Question 1 asked whether condition had an impact on average group harvests, and Hypothesis 4 suggested that the two asymmetric conditions would exhibit greater variation among members' harvests within groups than would the symmetric condition. Although the proportions of possible points harvested were greater for symmetric groups than in asymmetric groups, the differences were not significant: symmetric, $M = 76.55$, $SD = 11.40$; asymmetric harvest limit, $M = 69.73$, $SD = 15.22$; asymmetric reward, $M = 66.08$, $SD = 17.33$; $F(2,32) = 1.47$, $p = .25$. Although variations in harvests within groups were smaller in symmetric groups than for asymmetric groups, the differences were again not significant: symmetric, mean SD = 11.83, *SD* of SDs = 10.46; asymmetric harvest limit, mean SD = 13.09, *SD* of SDs = 14.62; asymmetric reward, mean SD = 21.99, *SD* of SDs = 35.38; $F(2,32) = .66$, $p = .53$. Posthoc statistical power estimates for the analysis of proportion of possible points, based on an effect size of .31 and given the reasonable approximation of a mean difference of 10 between the most extreme means and pooled SD of 15, was .33; for variation within sessions, based on an effect size of .24 and analogous approximations of 10 and 20, it was .21.

Note that the asymmetric reward means and within-group SD were both much greater than those for the other conditions. It turned out that this finding was attributable to one outlying group who realized that if the most advantaged member took out as many points as possible and then split the money with the others after being paid, all would come out far better than the conventional best strategy (we called this the brilliant group, as none of us had thought of that strategy). Its mean total harvest was in line with the others (89%), but the *SD* of the individual harvests was out of line (136.2). Removing that group resulted in a mean *SD* of 12.47 and a *SD* among SDs of 17.33, which was still insignificant: $F(2,31) = .03$, $p = .97$. We concluded that there was no difference in either total reward or variation in reward within groups because of condition; although the means were in the predicted direction, we could not claim support for Hypothesis 4.

Research Question 2 focused on whether norm allocation choice had an impact on average group harvests; Hypothesis 5 suggested that groups making allocation norm

choices implying equal harvests would show less variation in harvests among members than would groups making allocation norm choices implying unequal harvests. Although proportions of possible points harvested were higher in equality norm groups than in equity or no norm groups, the differences were not significant: equality norm, $M = 74.50$, $SD = 14.14$; equity norm, $M = 63.25$, $SD = 17.21$; no norm, $M = 64.60$, $SD = 12.92$; $F(2,32) = 2.18$, $p = .13$.

Hypothesis 5 requires a somewhat different view of norm acceptance than we have employed thus far. Groups have decided to equalize points if they accepted the equality norm in the asymmetric harvest limit, the equity norm in the asymmetric reward condition and either norm in the symmetric condition; 21 groups qualified. Groups have decided not to equalize points if they accepted the equity norm in the asymmetric harvest limit condition and the equality norm in the asymmetric reward condition; 8 groups did so. A third category consisted of the 6 groups that made no allocation norm decision. Not surprisingly, SDs were greatest for groups that decided not to accept equal points, mean $SD = 29.30$, SD of SDs = 38.39; and smallest for groups that did, mean $SD = 9.74$, SD of SDs = 12.41; with the winging it groups intermediate, mean $SD = 14.42$, SD of SDs = 7.86; but the difference was only marginally significant: $F(2,32) = 2.49$, $p = .09$. Removing the brilliant group from the set that decided in favor of unequal points still resulted in a greater SD for that condition—mean $SD = 17.42$, SD of SDs = 8.43—but the difference now was not significant, $F(2,31) = 1.61$, $p = .22$. Posthoc statistical power estimates for the analysis of proportion of possible points, based on an effect size of .31 and, given the reasonable approximation of a mean difference of 10 between the most extreme means and pooled SD of 15, was .33; for variation within sessions, on the basis of an effect size of .47 and analogous approximations of 10 and (without the brilliant group) 10, the value was .66. From either vantage point, Hypothesis 5 received little support.

Participant Judgments

Hypotheses 6 through 9 involved participant judgments relevant to their understanding of the game, the coordination, trust, cooperation, promising making, and promise keeping among the game players, group identity, personal responsibility for maintaining the bank account, and relevant social norms. We chose our statistical plan in response to two constraints: first, that the judgments would be highly intercorrelated and second, that judgments made by group members are interdependent, such that group and individual variance must be separated for valid analysis. As a consequence, we compared the means of the two responses for each contributing factor for the higher and lower replenishment rate via multivariate analysis of variance (MANOVA) with group nested within condition, followed by ANOVAs with group again nested within condition for each of the factors and posthoc Bonferroni contrasts between specific means.[3] Power estimates for the ANOVAs were computed in light of the procedures described in Cohen (1977) using Faul and Erdfelder's (1992) program.[4] The index of variance accounted for was eta squared for the MANOVA, as

noted by Bray and Maxwell (1985), and omega squared for ANOVAS, consistent with Hays (1973).

Hypothesis 6 held that the two asymmetric conditions would result in higher participant judgments of their understanding of the situation, group coordination, mutual trust, group commitment making, and group identity than would the symmetric condition, and Hypothesis 7 that participants in the asymmetric reward condition should show (a) greater concern with equal rewards and (b) less concern with equal harvests than would participants in the other two conditions. Table 4 details the means (averaged for the two questions) and SDs for all conditions and ANOVA data for the individual factors relevant to these hypotheses. The multivariate effect was significant both for the symmetric condition—Wilks's $\lambda = .38$, $F(22,154) = 4.33$, $p < .0001$, $\eta^2 = .07$—and for the group effect, Wilks's $\lambda = .002$, $F(352,836.24) = 1.89$, $p < .0001$, $\eta^2 = .12$. Posthoc statistical power assessments for the ANOVAs for the individual factors, assuming an effect size of .25 based on the reasonable estimates of a mean difference of 1 between the most extreme means and pooled *SD* of 2, was .22.

The results revealed significant differences among the conditions for 8 of the 11 judgmental variables: cooperation, coordination, desire for equal points, desire for equal money, promise keeping, promise making, responsibility to protect the resource pool, and trust. Bonferroni contrasts indicated that participants in the asymmetric harvest limit condition judged less promise keeping and trust than did participants in the asymmetric reward condition and less cooperation than did participants in both other conditions, and (consistently with Hypothesis 7b) participants in the asymmetric reward condition judged less desire for equal points than did participants in the other conditions. Two other easily interpretable findings were for more coordination and higher desire for equal money in the asymmetric reward condition; the latter finding was consistent with Hypothesis 7a. As a general rule, judgments in the symmetric condition were not less positive than those in the asymmetric conditions, contrary to Hypothesis 6. The group effect was significant for all variables, except desire for equal money, norm adherence, and group identity. The reader should also note the means themselves; with only two exceptions, all were well above 5 on a 7-point scale. The exceptions were desire for equal points and equality norm adherence.

Hypothesis 8 stipulated that groups following one of the allocation norms would have more positive participant judgments of their understanding of the situation, group coordination, mutual trust, group commitment making, and group identity than groups not following one of these norms. Table 5 shows the means (averaged for the two questions) and SDs for both conditions, along with ANOVA data for the individual factors relevant to these hypotheses. The multivariate effect was significant both for the symmetric condition—Wilks's $\lambda = .36$, $F(22,154) = 4.66$, $p < .0001$, $\eta^2 = .07$—and for the group effect—Wilks's $\lambda = .002$, $F(352,836.24) = 1.93$, $p < .0001$, $\eta^2 = .12$. Posthoc statistical power estimates for the ANOVAs for the individual factors, given an effect size of .25 on the basis of mean difference estimates of 1 between the most extreme means and pooled SD of 2, was .22. The results revealed that 8 of the 11 judgmental variables differed significantly among conditions: cooperation, coordination, group identity, promise keeping, promise making, responsibility to protect the

resource pool, trust, and understanding. Bonferroni contrasts showed members of groups accepting the equity norm as making more positive judgments of coordination, group identity, and trust than members of groups accepting the equality norm and more positive judgments of coordination, group identity, promise making, and understanding than members of groups accepting no norm. In addition, members of equality norm groups made more positive judgments of coordination and promise making than members of no norm groups. The ratings revealed a general pattern of means that was highest for equity norm groups in the case of 6 of the significant judgmental variables and equality norms for the other two; no norm groups always had the lowest means. These findings were in strong support of Hypothesis 8. Of the 3 judgmental variables for which there were no significant differences across conditions, 2 were desire for equal money and equal points: We turn to these now.

Hypothesis 9 predicted that participants in groups making allocation choices implying equal harvests would exhibit (a) greater concern with equal rewards and (b) less concern with equal harvests than would participants in groups making allocation choices implying unequal harvests. We conducted individual nested ANOVAs for each index of concern. The effect for the equal money question was significant—$F(33,86) = 1.76$, $p < .02$—and the means were consistent with Hypothesis 11a, equal harvest groups, $M = 5.76$, $SD = 1.14$; unequal harvest groups, $M = 5.54$, $SD = 1.15$; other groups, $M = 5.08$, $SD = 1.48$, although the differences between pair means were not significant according to the Bonferroni method. The effect for the equal points question was not significant—$F(33,86) = 1.14$, $p = .31$—although the means were in the expected order: unequal harvest groups, $M = 3.50$, $SD = 1.42$; equal harvest groups, $M = 3.02$, $SD = 1.80$; other groups, $M = 2.75$, $SD = 1.34$. These findings are, then, somewhat consistent with hypothesis. As reasonable estimates of mean difference and pooled SDs should be similar to those for Hypotheses 6 and 7, statistical power is also best estimated as .22.

Discussion

The intent of the study reported herein was to examine participants' reactions to norm allocation conflict during resource dilemmas. A good way to induce such conflict is to establish differences in the symmetry of either harvest limit or reward among the participants in resource dilemma games. Hypothetically, these differences should have an impact on participants' communication, game-related behavior, and perceptions of their experience, as mediated by the norm allocation procedure their group chooses. The manipulation for symmetry resulted in many of the expected responses. Groups in the asymmetric conditions were more likely to discuss explicitly and act consistently with an allocation norm than were groups in the symmetric condition. Asymmetric reward groups expressed a lower desire for equal points and a more pronounced desire for equal money than the other two conditions, which predictably revealed the salience of equality norm considerations in this condition. However, if anything, asymmetry led to slightly poorer game performance, consistent with the

earlier findings of Wade-Benzoni et al. (1996), and did not consistently lead to more positive perceptions of participants' experience than did symmetry. The manipulation had no other impact on how the participants played the game, and although the asymmetric reward groups' discussions were more task-oriented than were those of the symmetric groups, the asymmetric harvest limit groups' discussions were not. Therefore, in some but not all of the ways we imagined, asymmetry led participants to work harder at the task, although better outcomes were not forthcoming.

In contrast, the choice of a given allocation norm, irrespective of symmetry condition, was strongly associated with concentration on the task at hand. Groups explicitly adopting an allocation norm devoted more than three fourths of their discussion time to the game, whereas groups failing to agree to an allocation norm spent only slightly more than half of their talk time on topic. Specifically, on the macro level of topical focus, groups committed to an allocation norm put more than 60% of their discussional attention to game strategies, compared to less than 40% by noncommitted groups. Another important observation was norm-committed groups placing less talk time to understanding the game than the noncommitted. Our past research (Pavitt et al., 2005) revealed a weak but discernible positive association between strategy-relevant talk and successful game performance and negative relationship between discussion about the game itself and successful play. Turning to the microlevel of functional focus, groups verbalizing an allocation norm made greater proportions of suggestions, elaborations, evaluations, and positive maintenance comments than groups failing to do so; again, Pavitt et al. observed most of these categories to relate slightly positively with good game play. It would be misleading to conclude that explicit adoption of an allocation norm resulted in a greater proportion of discussion conducive to the task; rather, norm adoption came about as one aspect of certain groups' more task-relevant talk. Finally, participants in these groups reported more positive perceptions of their experience. It appears that groups that planned a strategy for game play and committed to a decision they perceived as fair had more positive experiences than groups that either only talked about the rules of the game or ignored the game in its entirety.

Given this, it is surprising that groups adopting an allocation norm did not fare significantly better in the game than groups that did not. The absence of an impact on game playing either for the manipulation or for the choice of an allocation norm warrants further discussion. The weaknesses of the experimental simulation paradigm we employed might be responsible for this outcome. In particular, as participants sometimes commented during their discussions, the possibility of winning about $3 is not comparable to, say, $300 in terms of motivating either serious play or more than occasional defection from agreed-on game strategies. We know from more natural contexts that negotiated agreements perceived by those affected as fair can be effective in maintaining resource pools (as in the case of the seafood example with which we started this paper, see Acheson & Brewer, 2003). Despite this limitation, the impact of the manipulation and, particularly, the choice of an allocation norm on communication content were substantial. Asymmetry led to greater explicit discussion of allocation norms; whether motivated by asymmetry, groups explicitly discussing norms also

exhibited a far greater proportion of task-relevant discussion overall. If we can assume that greater attention during discussion to a task would be associated with more satisfactory outcomes in less artificial resource dilemmas, then practitioners attempting to aid groups in such circumstances might be wise in making norms salient to participants.

Three other problems with this study need to be noted. First, the coders had some difficulty distinguishing units relevant to the functions of computation and confirmation from general elaboration about proposed strategies. It is difficult to determine whether this problem led merely to fuzziness in numerical findings or to actual inaccuracies of these findings as they apply to the study hypotheses. Second, as most statistical tests were at the level of group, sample size and, thus, statistical power were problematic, which may account for some of the nonsignificant findings. Third, the situation may not have provided a fair test for the asymmetric harvest limit condition. If groups played the game properly, their harvests (approximately 4 points per member each round) would be far smaller than the limit of even the most disadvantaged member. The issue would then only become relevant in the final round of the game, when astute groups who maintained a full bank account would know to empty the bank account but would be unable to do so unless group members followed the equity norm (e.g., with 100 points left, a four-person asymmetric harvest limit group would have to harvest consistently with each member's limit; 35, 30, 20, and 15, respectively). Thus, a single-round game would be a more direct test; with only one shot at the bank account, would members harvest their limit or limit their harvest to that of the least advantaged player?

Conclusion

We are not born into the world with equal access to scarce resources. Some people have greater opportunity to take advantage of earth's bounty than others, and some have greater opportunity to profit from what they have taken. However, at least when its consequences are obvious, many people become aware of these differences in advantage and strive to do what they perceive to be fair. Real world examples of responses to such perceptions have been noted; for example, Schlager (1994) described methods employed by some fishing cooperatives to provide equivalent opportunity to participants, such as daily rotation through different fishing spots to ensure equal time to every member for fishing at the most desirable locations. Having said this, we must expect individual variation in the extent to which people are willing to cooperate with their fellows. The next study in this series addresses such differences.

Notes

1. The social welfare norm is not made salient by symmetry considerations but could possibly be applied anyway. In the earlier study (Pavitt et al., 2005), a couple of groups granted a few extra points to members claiming special need, such as enough money to afford lunch after the session.

2. The authors thank Jenny Lambe for making her students available for research participation.

3. We choose nested MANOVAs rather than hierarchical linear modeling (HLM) for two reasons. First, valid estimates using HLM requires a far larger sample size than present here. Second, HLM only allows for single dependent measures and, thus, cannot adequately estimate coefficients for highly intercorrelated dependent variables.

4. Stevens (1980) describes power analysis for MANOVA and presents tables for its calculation. However, this analysis is based on four components; the computed Hotelling-Lawley trace coefficient (.83 for these data), the number of conditions (3), the sample size for each condition (approximately 40), and the number of variables (11). As none of the examples in the tables even remotely approximates this combination of values for these components in this study, we were unable to provide power estimates for our data.

References

Acheson, J. M., & Brewer, J. F. (2003). Changes in the territorial system of the Maine lobster industry. In N. Dolšak & E. Ostrom (Eds.), *The commons in the new millennium: Challenges and adaptation* (pp. 37-59). Cambridge, MA: MIT Press.

Allison, S. T., & Messick, D. M. (1985). Effects of experience on performance in a replenishable resource trap. *Journal of Personality and Social Psychology*, *49*, 943-948.

Auld, F., Jr., & White, A. M. (1956). Rules for dividing interviews into sentences. *Journal of Psychology*, *42*, 273-281.

Bales, R. F., & Strodtbeck, F. L. (1951). Phases in group problem-solving. *Journal of Abnormal and Social Psychology*, *46*, 485-495.

Bornstein, G. (1992). Group decision and individual choice in intergroup competition for public goods. In W. Leibrand, D. Messick, & H. Wilke (Eds.), *Social dilemmas: Theoretical issues and research findings* (pp. 247-263). Oxford, UK: Pergamon.

Bray, J. J., & Maxwell, S. E. (1985). *Multivariate analysis of variance.* Beverly Hills, CA: Sage.

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

Budescu, D. V., Rapoport, A., & Suleiman, R. (1990). Resource dilemmas with environmental uncertainty and asymmetric players. *European Journal of Social Psychology*, *20*, 475-487.

Clark, C. W. (1977). The economics of overexploitation. In G. Hardin & J. Baden (Eds.), *Managing the commons* (pp. 82-95). San Francisco: W. H. Freeman.

Cohen, J. (1977). *Statistical power analysis for the behavioral sciences* (rev. ed.). New York: Academic.

Faul, F., & Erdfelder, E. (1992). *GPOWER: A priori, post-hoc, and compromise power analyses for MS-DOS* [Computer program]. Retrieved June 22, 2004, from http://www.psycho.uni-duesseldorf.de/aap/projects/gpower

Folger, J. P., Hewes, D. E., & Poole, M. S. (1984). Coding social interaction. In B. Dervin & M. J. Voigt (Eds.), *Progress in communication sciences* (Vol. 4, pp. 115-161). Norwood, NJ: Ablex.

Guetzkow, H. (1950). Unitizing and categorizing problems in coding qualitative data. *Journal of Clinical Psychology*, *6*, 47-58.

Hays, W. L. (1973). *Statistics for the social sciences* (2nd ed.). New York: Holt, Rinehart and Winston.

Homans, G. C. (1950). *The human group*. New York: Harcourt Brace.

Homans, G. C. (1967/1971). Fundamental processes of social exchange. In E. P. Hollander & R. G. Hunt (Eds.), *Current perspectives in social psychology* (3rd ed., pp. 450-462). New York: Oxford University Press.

Kelman, H. C. (1961). Processes of opinion change. *Public Opinion Quarterly*, *25*, 57-78.

Kerr, N. L., Garst, J., Lewandowski, D. A., & Harris, S. E. (1997). That small, still voice: Commitment to cooperate as an internalized social norm. *Personality and Social Psychology Bulletin*, *23*, 1300-1311.

Kerr, N. L., & Harris, S. E. (1996). Why do cooperators cooperate? Efficacy as a moderator of social motive effects. In W. B. G. Liebrand & D. M. Messick (Eds.), *Frontiers in social dilemma research* (pp. 101-115). Berlin: Springer-Verlag.

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

Leventhal, G. S. (1976). The distribution of rewards and resources in groups and organizations. In L. Berkowitz & E. Walster (Eds.), *Advances in experimental social psychology* (Vol. 9, pp. 91-131). New York: Academic Press.

Lombard, M., Snyder-Duch, J., & Bracken, C. C. (2002). Content analysis in mass communication: Assessment and reporting of intercoder reliability. *Human Communication Research*, *28*, 587-604.

McHugh, J. L. (1972). Jeffersonian democracy and the fisheries. In B. J. Rothschild (Ed.), *World fisheries policy: Multidisciplinary views* (pp. 134-155). Seattle: University of Washington Press.

Messick, D. M., Wilke, H., Brewer, M. B., Kramer, R. M., Zemke, P. E., & Lui, L. (1983). Individual adaptations and structural change as solutions to social dilemmas. *Journal of Personality and Social Psychology*, *44*, 294-309.

Pavitt, C., & Johnson, K. K. (2001). The association between group procedural MOPs and group discussion procedure. *Small Group Research*, *32*, 595-624.

Pavitt, C., McFeeters, C., Towey, E., & Zingerman, V. (2005). Communication during resource dilemmas: 1. Effects of different replenishment rates. *Communication Monographs*, *72*, 345-363.

Poole, M. S., & Roth, J. (1989). Decision development in small groups IV: A typology of group decision paths. *Human Communication Research*, *15*, 323-356.

Safina, C. (1995). The world's imperiled fish. *Scientific American*, *273*(5), 46-53.

Sally, D. (1995). Conservation and cooperation in social dilemmas. *Rationality and Society*, *7*, 58-92.

Samuelson, C. D., & Allison, S. L. (1994). Cognitive factors affecting the use of social decision heuristics in resource-sharing tasks. *Organizational Behavior and Human Decision Processes*, *58*, 1-27.

Samuelson, C. D., & Messick, D. M. (1986). Inequities in access to and use of shared resources in social dilemmas. *Journal of Personality and Social Psychology*, *51*, 960-967.

Schlager, E. (1994). Fishers' institutional responses to common-pool resource dilemmas. In E. Ostrom, R. Gardner, & J. Walker, *Rules, games, and common-pool resources* (pp. 247-265). Ann Arbor: University of Michigan Press.

Shankar, A., & Pavitt, C. (2002). Resource and public goods dilemmas: A new issue for communication research. *Review of Communication*, *2*, 251-272.

Stevens, J. P. (1980). Power of the multivariate analysis of variance tests. *Psychological Bulletin*, *88*, 728-737.

Thibaut, J. W., & Kelley, H. H. (1959). *The social psychology of groups*. New York: John Wiley and Sons.

van Dijk, E., & Grodzka, M. (1992). The influence of endowments asymmetry and information level on the contribution to a public step good. *Journal of Economic Psychology*, *13*, 329-342.

van Dijk, E., & Wilke, H. (2000). Decision-induced focusing in social dilemmas: Give-some, keep-some, take-some, and leave-some dilemmas. *Journal of Personality and Social Psychology*, *78*, 92-104.

van Dijk, E., Wilke, H., Wilke, M., & Metman, L. (1999). What information do we use in social dilemmas? Environmental uncertainty and the employment of coordination rules. *Journal of Experimental Social Psychology*, *35*, 109-135.

Van Lange, P. A. M., & Messick, D. M. (1996). Psychological processes underlying cooperation in social dilemmas. In E. Gasparski, M. Mlicki, & B. Banathy (Eds.), *Social agency: Dilemmas and educational praxiology* (pp. 93-112). New Brunswick, NJ: Transaction.

Wade-Benzoni, K. A., Tenbrunsel, A. E., & Bazerman, M. H. (1996). Egocentric interpretations of fairness in asymmetric, environment social dilemmas: Explaining harvesting behavior and the role of communication. *Organizational Behavior and Human Decision Processes*, *67*, 111-126.

Whitchurch, G. G., & Pavitt, C. (1990). *Auld and White revisited: Expanded and updated rules for unitizing verbal interaction*. Unpublished maniscript.

Wit, A., Wilke, H., & Opperwal, H. (1992). Fairness in asymmetric social dilemmas. In W. Liebrand, D. Messick, & H. Wilke (Eds.), *Social dilemmas: Theoretical issues and research findings* (pp. 183-197). Oxford, UK: Pergamon Press.

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