ORGANIZATIONAL BEHAVIOR AND HUMAN DECISION PROCESSES 55, 298–324 (1993)

A Multiattribute Evaluation Approach to Structural Change in Resource Dilemmas

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This study investigated the effects of social values, efficiency of resource use, and inequity on harvest behavior and preferences for structural change in a resource dilemma. Evaluation of allocation systems was conceptualized as a multiattribute utility problem in which overall preference is represented as a simple additive weighted function of a set of attribute ratings. Undergraduates, in groups of six, harvested resource units from a common, replenishable pool over 10 trials. Following the harvest trials, subjects were asked to evaluate and choose among several allocation systems for the second session. The 2 × 2 × 2 factorial design crossed two levels of social value orientation (cooperative, noncooperative) with two levels of group resource use (extreme overuse, moderate overuse) and variance in others' purported harvests (low, high). As predicted, a higher proportion of cooperative subjects voted for a superordinate authority system in the extreme overuse conditions compared to the moderate overuse conditions. The majority of noncooperators, however, rejected this structural change regardless of the state of the resource pool. Additionally, cooperators placed greater importance on the fairness dimension while noncooperators assigned greater weight to the self-interest dimension in their evaluations of structural change alternatives. The results suggest the need for an interactionist perspective on structural change in social dilemmas.

A fundamental problem facing decision-makers in business and government concerns the efficient and equitable allocation of scarce resources to individuals and groups (Leventhal, 1976). In recent years, social and organizational psychologists have begun to analyze resource allocation in

This study was part of a doctoral dissertation submitted to the Department of Psychology at the University of California, Santa Barbara. I especially thank the members of my dissertation committee, David Messick, Charles McClintock, David Hamilton, John Cotton, and Robert Noel, for their constructive comments and support during this research project. Portions of this research were presented at the 97th Annual Convention of the American Psychological Association, New Orleans, August 1989. Preparation of this manuscript was facilitated by a research grant from the Texas Agricultural Experiment Station—College of Liberal Arts Research Program at Texas A & M University. I also acknowledge the superb work of Wendy Sage-Hayward as an experimenter in this study. Finally, the author thanks Scott Allison, Bill Graziano, Sandra Jacobson, Norbert Kerr, Jorge Mendoza, Jeff Simpson, and Steve Worchel for their helpful comments on an earlier version of this manuscript. Address correspondence and reprint requests to Charles D. Samuelson, Department of Psychology, Texas A & M University, College Station, TX 77843.

0749-5978/93 $5.00

groups as a "commons", or resource dilemma (Hardin, 1968, Messick & Brewer, 1983). For example, the commons metaphor has been usefully applied to such diverse organizational topics as intergroup relations (Kramer, 1991), allocation of time/effort within small work groups (Sniezek, May, & Sawyer, 1990), dynamics of coalition formation (Mannix, in press), and decisions to join unions (Messick, 1973).

Resource dilemmas belong to a larger class of situations known as social dilemmas (Dawes, 1980). According to Messick and Brewer (1983), the defining features of a social dilemma are that: (a) each group member has an individual incentive to make a self-interested choice, but that when all members make these "rational" choices, (b) the collective outcome is worse than if all members had made cooperative choices favoring the group interest. Thus, the paradox in social dilemmas is that individually rational choices often result in suboptimal group outcomes.

This article will focus primarily on structural solutions to social dilemmas (Messick & Brewer, 1983). Solving social dilemmas through structural change involves coordinated, collective action among members to either eliminate or transform the incentive structure that creates the social dilemma. The present study extends previous research exploring the conditions under which group members will voluntarily agree to change the decision-making structure for managing a shared resource (Messick, Wilke, Brewer, Kramer, Zemke, & Lui, 1983; Rutte & Wilke, 1984, 1985; Samuelson, 1991; Samuelson, Messick, Rutte, & Wilke, 1984; Samuelson & Messick, 1986a, 1986b; Sato, 1987). In these studies, small groups are given a limited, replenishable resource to manage over a series of trials. Subjects are instructed to "harvest" as many resource units as possible while maintaining the level of the common resource pool for future use. In the typical case, subjects are given an experience with the resource management task in a first session and then asked to choose the allocation system for a second session.

PAST RESEARCH ON STRUCTURAL CHANGE

Past research on structural change in resource dilemmas has led to several important conclusions. First, it appears that dissatisfaction with group outcomes per se is not a *sufficient* condition for structural change. Several studies have shown consistently that group members will vote to establish a superordinate authority (i.e., group leader) when they observe that the common pool is being rapidly depleted under the status quo system of free access (Messick *et al.*, 1983; Samuelson *et al.*, 1984; Samuelson & Messick, 1986a, 1986b). However, other data from these same experiments and subsequent work indicate that dissatisfied members do not *always* vote to change the allocation system. For example, when dissatisfaction is caused by perceived inequity in the distribution of re-

sources (Messick *et al.*, 1983; Samuelson *et al.*, 1984; Samuelson & Messick, 1986b), or when dissatisfaction is attributed to the uncooperative behavior of other group members (Samuelson, 1991), subjects do not vote for change to a superordinate authority system. In fact, Samuelson and Messick (1986a) found that 67% of subjects who reported being *satisfied* with the group's outcomes (in terms of efficiency and fairness) voted for structural change (i.e., proportional division of common pool) in preference to the status quo. Thus, while dissatisfaction plays an important role, decisions about structural change involve more than the simple application of a "win stay, lose change" heuristic (Samuelson, 1991).

Second, the evaluation of structural change alternatives can be strongly influenced by the specific reference point used by group members. The data suggest that the level of satisfaction with the status quo system sets the comparison standard for evaluating whether an alternative system is preferable or not (Samuelson & Messick, 1986a). The salience of the status quo as a reference standard is also consistent with other theories of outcome evaluation in social psychology and behavioral decision-making that emphasize the importance of a psychological reference point (Kahneman & Tversky, 1979; Thibaut & Kelley, 1959).

Third, past research has shown rather weak support for the importance of self-interest in decisions regarding structural change. One might expect that self-interest (as measured by previous harvest outcomes) should be a good predictor of subjects' evaluations of structural changes in the replenishable resource paradigm. However, several experimental studies have not observed strong relationships between harvest outcomes and voting behavior (Messick *et al.*, 1983; Samuelson *et al.*, 1984; Samuelson & Messick, 1986a, 1986b). Samuelson and Messick (1986a) suggested that these negative results may be due to the presence of other social values that enter into the decision-making process such as generalized attitudes toward social responsibility, personal control, or morality. While self-interest should be an important consideration, group members appear to use other criteria as well in choosing whether to institute structural changes.

THEORETICAL APPROACH TO THE EVALUATION PROCESS

Samuelson and Messick (in press) have recently proposed a general theoretical approach to the problem of structural change in resource dilemmas. The basic research question can be stated as follows: What are the psychological processes involved in comparing the current allocation system to possible alternative systems? Since this conceptualization provides the rationale for the present study, a brief summary is presented in this section.

A system for allocating shared resources to members of a group is a

social institution that can be evaluated on a number of dimensions. Samuelson and Messick (in press) assume that when people consider an allocation system, they think about its various features, its advantages and disadvantages, along a number of dimensions, with special emphasis on those dimensions that are most important to them. There are two general considerations, however, that will tend to make individuals conservative in favoring the status quo. First, any change in social institutions entails transition costs. Such transition costs often add to the attractiveness of the status quo. Second, there is usually less uncertainty about the status quo than about rival systems.

Both transition costs and risks of unfamiliarity must be compensated if group members are to endorse structural change. Other dimensions of evaluation must promise adequate benefits in order to justify the change. Samuelson and Messick (1986b; in press) proposed that these dimensions of evaluation will include *at least* the following four: efficiency, fairness, freedom, and self-interest. Efficiency refers to the capacity of an allocation system to provide satisfactory levels of a resource to group members *without* depleting the common resource. Fairness is defined as the degree to which the distribution of the resource satisfies principles of equality or equity. Freedom refers to the extent to which a system allows individuals personal autonomy to make resource use decisions. Self-interest, of course, refers to a member's evaluation of how his or her personal resource outcomes will be affected by a given allocation system.

Given these assumptions, Samuelson and Messick (in press) argued that there are two crucial features of the evaluation process. The first is the *perceived* positions of the various allocation systems on these evaluative dimensions. The second feature is the relative importance assigned to the various dimensions. This multiattribute evaluation framework (Edwards & Newman, 1982) assumes that the overall attractiveness of an allocation system will be a weighted function of the system's perceived attributes, where the weights are related to the importance of the dimensions. While there are numerous ways in which this information can be combined into an overall judgment, the simplest model is to assume that the overall attractiveness is a weighted average of the values of the system on the four evaluative dimensions described above. Thus, the perceived attractiveness of an allocation system is represented by a simple additive weighting model (MacCrimmon, 1973). Note that Edwards and Newman's (1982) *prescriptive* multiattribute utility technology (MAUT) decision aid is being used here as a *descriptive* model of group members' evaluation processes. According to Samuelson and Messick (in press), these overall attractiveness judgments of the various systems will then be compared with one's current outcomes under the status quo system. If an alternative structural change is available that is clearly better than the

status quo, then this alternative will be compared with any other systems available. If this option has a higher attractiveness value than the other systems, then the group member will choose this structural change in preference to the status quo.

Using this multiattribute evaluation model, Samuelson and Messick (in press) proposed that two factors should influence this evaluation process. First, systematic differences among individuals in the relative importance attached to the evaluative dimensions may result in predictably different evaluations. For example, a person who assigns great importance to fairness may find those allocation systems that assure equality (or equity) of outcomes more desirable. In contrast, an individual for whom freedom is most important may favor allocation systems that allow for greater individual autonomy over consumption decisions. Second, past experience with the status quo system should influence the perceived location of that system on the relevant evaluative dimensions. Members who have observed a shared resource pool rapidly decrease in size should be more likely to perceive that free access is a less efficient system compared to subjects who witness the resource pool maintained at an optimal level. Similarly, group members who experience large inequities in the distribution of resources would be likely to perceive that free access is less fair as an allocation system than members who observe relatively small differences in resource outcomes. One interesting implication of this argument is that even if two groups of subjects perceive different allocation systems as being similar in terms of their attribute scale values, individual differences in importance weights could produce different overall evaluations of these systems.

OVERVIEW OF EXPERIMENTAL DESIGN

The present study was designed to explore several implications of this theoretical framework. Individual differences were included in the experimental design by classifying subjects according to their social value orientation (McClintock, 1972, 1978). In situations of social interdependence, it has been repeatedly observed that individuals differ greatly in the relative importance assigned to own and others' outcomes (e.g., Knight & Dubro, 1984; Kuhlman & Marshello, 1975; Liebrand, 1984; Messick & McClintock, 1968). In this article, the term *social values* will be used to refer to consistent preferences for particular distributions of outcomes to self and other. Messick and McClintock (1968) have identified three primary social value orientations: (a) cooperative, preference for outcomes that maximize *joint* gains to self and others; (b) competitive, preference for outcomes that maximize the *difference* between gains for self and gains for others (i.e., relative gain); and (c) individualistic, preference for outcomes that maximize gains to *self* only, without regard for

others' outcomes. This value measure was expected to moderate the relative importance weights assigned to the four evaluative dimensions.

Subjects' experience with the allocation system was varied by situational manipulations of (1) efficiency of group resource use and (2) inequity in the resource distribution among group members. For the second session, subjects were asked to evaluate and choose among four allocation systems: (a) free access (i.e., status quo), (b) group leader, (c) equal privatization (i.e., divide common pool into private resource pools of equal size), and (d) harvest cap (i.e., maximum limit placed on individual harvest size per trial). The first three decision structures have been examined in previous studies (Messick *et al.*, 1983; Samuelson *et al.*, 1984; Samuelson & Messick, 1986a, 1986b). The harvest cap system, however, represented a new structural change that has some real-world analogs (e.g., bag limits for hunting and fishing) but has yet to be investigated empirically. Preferences for structural change were assessed through binary choices, rank ordering of alternatives, and ratings of systems on the dimensions of efficiency, fairness, freedom, self-interest, and overall attractiveness.

HYPOTHESES

Based on the theoretical approach of Samuelson and Messick (in press) and past empirical research, several hypotheses were generated. First, with respect to the importance weights, it was predicted that cooperators and noncooperators would differ in terms of the importance assigned to the evaluative dimensions of fairness and self-interest. Cooperators, given their primary motive for maximizing joint outcomes to self and other, should assign more weight to *fairness* relative to noncooperators (Hypothesis 1). Liebrand, Jansen, Rijken, and Suhre's (1986) "might over morality" study further supports this expectation in that cooperators were found to view the cooperation–competition dimension more in *evaluative* terms (i.e., "good" vs "bad"). Cooperators should be more concerned than noncooperators with the fairness of the resulting outcome distribution if they evaluate behavior in resource sharing situations in moral terms, seeking to establish relationships with others characterized by honesty and trust (Liebrand, Jansen, Rijken, & Suhre, 1986). A second prediction was that noncooperators (competitors and individualists), who are more concerned with maximizing *own* gain rather than others' outcomes, should assign greater importance weight to self-interest in their evaluations of structural change options (Hypothesis 2). This hypothesis is also supported by Liebrand, Jansen, *et al.'s* (1986) study which found that individualists perceived the cooperation–competition dimension

more in terms of power, seeking to establish relationships in which they can exert dominance over others to further their self-interest.

The proposed multiattribute evaluation model suggests that overall evaluations should be a simple additive function of the attribute scale ratings multiplied by their respective importance weights. Thus, it should be possible to predict subjects' attractiveness ratings of each structural change option from knowledge of their actual attribute ratings and importance weights. A third hypothesis was that there should be a strong, positive correlation between subjects' predicted overall attractiveness ratings and their actual ratings of each of the three allocation systems (Hypothesis 3). Samuelson and Messick's (in press) approach also predicts that past experience should exert a systematic effect on group members' evaluations of the status quo system. Therefore, main effects were expected for both resource use and harvest inequity on the attribute scale ratings of the free access system for efficiency and fairness (Hypothesis 4). Subjects who experience rapid depletion of the common resource (extreme overuse) should rate the free access system as less efficient compared to subjects who witness a more modest decline (moderate overuse). Similarly, subjects who observe heterogeneity in other group members' harvests (high variance) should rate the free access system as more unfair than subjects who witness homogeneity in others' harvests (low variance).

Previous research findings on structural change (Messick *et al.*, 1983; Samuelson *et al.*, 1984; Samuelson & Messick, 1986a, 1986b) guided predictions about the effects of the design variables on subjects' voting behavior. Overall, it was expected that subjects would opt for structural change more often under extreme overuse of the common pool compared to moderate overuse. However, due to the cognitive and motivational differences between cooperators and noncooperators noted above, this efficiency main effect was not predicted to hold across all three forms of structural change. Specifically, main effects for resource use were hypothesized for the equal privatization and harvest cap systems (Hypothesis 5). For the leader option, however, it was expected that the efficiency effect would hold for cooperators, but *not* for noncooperators (Hypothesis 6). Liebrand, Jansen, *et al.*'s (1986) data provide support for this hypothesized interaction between social values and resource use. Noncooperative subjects, regardless of the state of the common resource pool, should reject the imposition of a superordinate authority because they perceive the interdependency situation more in terms of power relations (Liebrand, Jansen, *et al.*, 1986). Thus, on the vote to elect a leader, noncooperators were expected to prefer allocation systems (i.e., free access) that allow unrestricted competition for the shared resource.

METHOD

Subjects

The subjects were 117 undergraduates (69 women, 48 men) enrolled in an introductory psychology course at the University of California, Santa Barbara. Eighty-seven of these students participated in the study in partial fulfillment of a course requirement. Due to a shortage of available subjects, the remaining 30 subjects were recruited from the same class by offering a cash payment of $2.00 for participation in lieu of course credit.

Six subjects were scheduled for each experimental session. When fewer than six subjects arrived for the experiment, confederates were employed. Subjects within each social value classification (cooperative, noncooperative) were randomly assigned to experimental conditions. The number of subjects per condition ranged from 10 to 17.

Design

The study used a 2 × 2 × 2 (Social Value × Resource Use × Variance) between-subjects factorial design. Subjects were classified a priori according to their social value orientation (cooperative, noncooperative). Efficiency of group resource use (extreme overuse, moderate overuse) was manipulated during the first session harvest trials by providing preprogrammed feedback about the size of the common resource pool. Harvest inequity (low, high) was manipulated by varying the homogeneity in the purported harvests of the other five "bogus" group members during the first session trials.

Apparatus

A DEC PDP 11/34 computer was used to conduct the study. The computer was connected to six CRT terminals with keyboards, each located in a semiprivate booth. Partitions separated the booths so that subjects could not see each other. The computer was programmed so that each of the six terminals displayed instructions that were appropriate to one of the experimental conditions. To ensure confidentiality, each group member was assigned a different color, indicated by a large sign in each booth. The computer facility and software are described in detail by Parker *et al.* (1983).

Procedure

Social values measurement. To reduce potential reactive effects of the procedure, each subject's social value orientation was assessed prior to the experimental session by one of two measurement techniques. The majority of subjects (N = 85) were classified by the Ring Measure of Social Values (Liebrand, 1984; Liebrand & McClintock, 1988; Mc-

Clintock & Liebrand, 1988). This measure is based on the geometric model of social motives proposed by Griesinger and Livingston (1973) in which various motivational orientations are represented in a two-dimensional own–other outcome plane. These 85 subjects had taken part in an earlier unrelated study in which the Ring Measure was administered.

The remaining 32 subjects who had not participated in the earlier study were classified by a modified version of Kuhlman and Marshello's (1975) 3-choice decomposed game procedure. This value measure, consisting of nine 3-choice decomposed games, was administered in introductory psychology classes at the beginning of the academic term. The own–other outcome choices in these decomposed games were designed to measure three distinct social values: cooperation, competition, and individualism (Messick & McClintock, 1968). Due to the smaller number of individualists, both competitors and individualists were combined and classified as noncooperators (see Kramer, McClintock, & Messick, 1986; Liebrand, Wilke, Vogel, & Wolters, 1986). Similarly, altruists and cooperators were pooled into the cooperative category. Liebrand and Van Run (1985) have reported that when altruistic and cooperative subjects are combined into a single category, the Ring Measure of Social Values (Liebrand & McClintock, 1988) and the Kuhlman and Marshello (1975) method produce high levels of agreement (i.e., 73% of cases resulted in same social value classification).

Replenishable resource task. Upon arrival at the laboratory, subjects were escorted individually by the experimenter to a booth containing one of the computer terminals. The experimenter explained the operation of the terminals and informed subjects that all further experimental instructions would be shown on the video monitors. The experimenter instructed subjects that communication among members was prohibited during the experiment. Subjects were told that they would be interacting with the other group members via the computer network. In reality, each subject received preprogrammed feedback about the pool size and the other five members' choices on each trial. In other words, subjects' choices did *not* affect either the size of the resource pool for each trial or the other group members' choice behavior. Subjects did, of course, receive veridical feedback about their own choices during the experiment.

The instructions provided subjects with a general orientation to situations involving the use of common resources. The interdependence of group members was stressed and that the resource pool was replenishable. Subjects were given two objectives in this task: (a) to gain as many resource units as possible for themselves during the experiment, and (b) to make the common pool last as long as possible so that resources could be harvested over a longer period. Subjects were also told that optimal group performance consisted of "taking, as a group, only the amount of

resource units on each trial that can be replaced by the replenishment rate during that period."

To provide a monetary incentive, the instructions stated that subjects would have a chance to exchange their resource units for cash. Subjects were told that a lottery would be conducted at the end of the academic term and that one group would be randomly selected to receive payment for their participation. Specifically, the instructions stated that each member of the winning group would be paid 5 cents for each resource unit collected during the experiment.[1] The maximum individual payoff possible was $15.00, assuming that a subject collected the maximum harvest (30 units) on each of 10 trials.

Subjects then received more detailed instructions about the experimental task. Subjects were told that they would share, as a group, a resource pool with an initial (and maximum) size of 900 units. Each group member could harvest from 0 to 30 units on each trial. The instructions explained that the computer would collect the data after all group members had typed in their choices, subtracted this group total from the current pool size, and then multiplied the remaining units by a variable replenishment factor. The exact replenishment rate was not specified and subjects were told that the replenishment factor would vary from trial to trial, depending on the experimenter's roll of a die. Subjects were instructed that they could continue to harvest units from the common pool provided that the resource was maintained at a level above zero or until the experimenter stopped the experiment.

Several practice trials were included to ensure that subjects understood the task. Prior to the actual experimental trials, subjects responded to a brief pretrial questionnaire designed to assess their understanding of the task and their a priori expectations about the other members' behavior and the group's performance on the task.

The first session of the experiment consisted of 10 decision-making trials. At the beginning of each trial, subjects were presented with the current pool size and asked to indicate how many resource units they wished to withdraw from the pool. After all group members made their harvest choices for that trial, the computer paused for several seconds, and then displayed the next preprogrammed pool size and the five bogus others' harvest choices on the previous trial. Subjects were instructed to write down this feedback on a score sheet after each trial.

Following the harvest trials, subjects were given a brief post-trial questionnaire composed of six items. These questions served as manipulation checks on the resource use and variance manipulations. These questions

[1] At the conclusion of the entire study, a lottery was held and one group of subjects was paid in cash for the number of resource units collected during the experimental session.

were concerned with subjects' ratings of the group's performance on the task, their satisfaction with the group's performance and their own resource totals, and their satisfaction and fairness ratings of the differences in resource totals among group members. While subjects answered these questions, the bogus resource totals for each of the five other group members (subject's *actual* harvest total also presented in this display) and the final pool size were shown at the top of the video screens.

Assessment of preferences for structural change. Subjects then proceeded to the voting stage of the experiment. The instructions stated that there would be a second session immediately to follow and that the allocation system for this session would depend on the preferences of the group. Three allocation systems were presented for the second session in addition to the "default" system of free access (i.e., Session 1 procedure). The first option was to elect a leader from within the group who would harvest resource units from the common pool on each trial and then allocate these units to each of the group members, including himself or herself. Subjects were told that if a majority favored the leader system, then they would be allowed to cast votes for the member (including themselves) that they wished to be leader. The group member who received the most number of votes would then be declared the leader. The second alternative, harvest cap, was to establish a maximum allowable harvest of 15 units per trial during the second session, instead of the 30 unit maximum permitted in the first session.[2] The third option, equal privatization, was to divide the common resource pool into six private resource pools of equal size (Cass & Edney, 1978; Samuelson & Messick, 1986a, 1986b). Under this system, each subject would harvest units from a private resource pool instead of sharing a common pool with other group members. No other group members would be permitted to harvest units from a subject's private pool.

Following this information, subjects were presented with three binary choices, each pairing one of the alternative allocation systems with free access (status quo). The order of presentation was counterbalanced across-subjects such that all three alternatives appeared once in each of the three possible temporal positions and an equal number of subjects were exposed to each presentation order. Subjects were then asked to

[2] The choice of 15 units as the maximum harvest size was somewhat arbitrary. This value was reasonable given the mean harvest size of 13.8 units per trial for the five bogus others in the first session. Subjects were not permitted to choose the maximum level of the harvest cap for two reasons. First, allowing subjects in each group to choose their own maximum would result in loss of experimental control over the system's characteristics. Second, the primary goal of this study was to explore how the harvest cap system is judged on the four evaluative dimensions and in relation to other alternative systems.

rank order the four systems from most preferred to least preferred. The instructions stated that the second session would be conducted according to the majority preference in the group. In the event of a tie vote, subjects were told that the second session would be run using the free access system.

Following the rank ordering procedure, subjects completed two additional evaluation tasks. First, subjects rated each of the four allocation systems on five different 7-point Likert-type scales. Four evaluation criteria were: (a) efficiency ("How efficient do you think this system is for managing and allocating the common resource?") [1 = very efficient; 7 = not at all efficient], (b) fairness ("How fair do you think this system is for managing and allocating the common resource?") [1 = very fair; 7 = not at all fair], (c) freedom ("How much personal freedom do you think this system affords you in managing the common resource?" [1 = complete freedom; 7 = no freedom at all], and (d) self-interest ("How much do you think this system would advance your own self-interest (as measured by your resource unit total)?") [1 = very much; 7 = not at all]. The fifth scale item was an *overall* rating of each system ("All things considered, how attractive do you find this system?") [1 = very attractive; 7 = not at all attractive]. This summary evaluation was always presented after subjects had responded to the four attribute scales. All subjects completed the five scale items for the free access system first. The order of presentation for the remaining three systems corresponded to the counterbalanced order for the binary votes for structural change.

The final task required subjects to rank order the four dimensions used to evaluate the allocation systems (i.e., efficiency, fairness, freedom, and self-interest) from most important to least important.[3] Following completion of this ranking procedure, subjects were told that due to time constraints, the second session would be rescheduled for another date. This session, however, was never actually conducted. All subjects were then given a debriefing, thanked for their participation, and excused. At the end of the academic term, participants received a detailed feedback sheet that clearly explained the hypotheses under investigation and the deceptions involved in the experiment.

Manipulations. The resource use variable was manipulated by holding the behavior of others constant and varying the replenishment rate (see Samuelson *et al.*, 1984). The feedback about the other group members was constructed by determining the optimal harvest size that would maintain the pool at its original level. With a maximum pool size of 900 for six

[3] The order of the attribute rating and dimension ranking tasks was not counterbalanced as there was no empirical evidence in the literature to suggest that task order affects the accuracy of the linear multiattribute decision model (see Sawyer and Castellan, 1990).

persons and a replenishment rate of 10% (i.e., multiply remaining pool size by factor of 1.10), the optimal harvest per person is approximately 13.8 units per trial. Therefore, for subjects in all conditions, the *average* harvest of the other five bogus group members over the 10 trials was 13.8 units per trial.

Extreme overuse was defined by using an average replenishment rate of 3% (multiplication factor of 1.03). The preprogrammed sequence of 10 pool sizes shown to subjects in the extreme overuse condition was as follows: 826, 753, 681, 608, 538, 463, 386, 307, 226, 143. These numbers were calculated using an average replenishment factor of 1.03 and an average group harvest total of 85 units per trial. In the moderate overuse condition, the 10 pool sizes shown to subjects were: 895, 884, 875, 867, 854, 848, 834, 825, 813, 802. The average replenishment rate used to determine these values was approximately 10%.

Harvest variance was manipulated by holding the mean harvest size of the other group members constant (i.e., 13.8 units per trial) and varying the homogeneity of these harvests. In the low variance condition, the total harvests of the five other bogus group members were, from least to most, 104, 125, 132, 150, 179. In the high variance condition, the total harvests were 37, 52, 108, 224, 269 (see Samuelson *et al.*, 1984). This feedback was constructed such that *each* bogus member harvested relatively consistent amounts (range = 6–7 units) across the 10 trials.

RESULTS

Social Value Classification

Of the 117 subjects recruited for this study, 40 were classified as cooperative, 36 were competitive, and 29 were individualistic in social value orientation. The remaining 12 subjects were unclassifiable due to inconsistencies in their choices. For purposes of data analysis, the competitive and individualistic subjects were combined to form the noncooperative value orientation and the 12 unclassifiable subjects were dropped from the sample, leaving a total of 105 participants.

Manipulation Checks

One postquestion was expected to measure the direct impact of the resource use manipulation: "Do you think that the group is taking too much, too little, or about the right amount from the pool?" (1 = too much; 7 = too little). A 2 × 2 × 2 (Social Value × Resource Use × Variance) ANOVA performed on this item yielded a significant main effect for resource use, $F(1,97) = 10.53$, $p < .01$, $\hat{\omega}^2 = .09$. Subjects in the extreme overuse condition reported that their group had taken too

much from the pool (M = 2.51) compared to moderate overuse subjects (M = 3.35).

Two postquestions were designed to assess the effectiveness of the variance manipulation: (a) "How satisfied are you with the resource unit total differences among group members?" (1 = very satisfied; 7 = not at all satisfied), (b) "How fair are the resource unit total differences among group members?" (1 = very fair; 7 = not at all fair). Univariate 2 × 2 × 2 ANOVAs on these items found main effects for variance on both questions, $F(1,97) = 4.18$, $p < .05$, $\hat{\omega}^2 = .03$, $F(1,97) = 6.45$, $p < .02$, $\hat{\omega}^2 = .05$, respectively. High variance subjects (M = 5.43) were less satisfied with the resource unit total differences than low variance subjects (M = 4.78). Moreover, subjects in the high variance condition (M = 5.69) reported that the resource total differences were more unfair than low variance subjects (M = 4.81). In general, these postquestionnaire results suggest that resource use and harvest variance were manipulated successfully.

Harvest Behavior

To analyze harvest behavior over trials, harvests for adjacent trials (i.e., trials 1 and 2, 3 and 4, etc.) were summed, creating five trial blocks. A 2 × 2 × 2 × 5 (Value × Resource Use × Variance × Trial Blocks) repeated measures ANOVA performed on the two-trial harvest totals found a significant main effect for resource use, $F(1,97) = 7.39$, $p < .01$, $\hat{\omega}^2 = .06$, a Resource Use × Variance interaction, $F(1,97) = 4.00$, $p < .05$, $\hat{\omega}^2 = .03$, a Variance × Trial Blocks interaction, $F(4,388) = 2.64$, $p < .05$, $\hat{\omega}^2 = .01$, and marginally significant interactions between value, variance, and trial blocks, $F(4,388) = 2.27$, $p < .07$, $\hat{\omega}^2 = .01$, and between all four factors, $F(4,388) = 2.20$, $p < .07$, $\hat{\omega}^2 = .01$. Table 1 presents the two-trial harvest means in each of the experimental conditions.

Table 1 shows that extreme overuse subjects (M = 27.35), on the average, harvested fewer resource units than moderate overuse subjects (M = 31.32). The Resource Use × Variance interaction revealed that high variance in others' harvests, relative to low variance, resulted in larger harvests *only* in the moderate overuse condition. No differences as a function of the variance manipulation were observed in the extreme overuse condition.

These findings are consistent with Messick *et al.*'s (1983) three-factor model of the harvest decision which states that harvest size will be determined by three motives: self-interest, a desire to use the resource responsibly, and conformity to implicit group norms. Since conformity pressures are held constant in this study through the bogus feedback (see Samuelson *et al.*, 1984), there is a conflict between self-interest (i.e.,

TABLE 1
MEAN TWO-TRIAL HARVEST TOTALS IN EACH OF THE EXPERIMENTAL CONDITIONS

	Resource use				
	Extreme overuse Variance		Moderate overuse Variance		
Social value	Low	High	Low	High	Mean
Cooperative	26.58 (10)	24.82 (10)	27.82 (10)	33.56 (10)	28.20 (40)
Noncooperative	28.25 (17)	28.46 (16)	29.26 (17)	34.51 (15)	30.01 (65)
Variance mean	27.63 (27)	27.06 (26)	28.73 (27)	34.13 (25)	29.32 (105)
Use mean	27.35 (53)		31.32 (52)		

Note. The mean number of resource units harvested by the five "others" was 27.6 units per trial block in all experimental conditions. The number of subjects per condition is given in parentheses.

desire to harvest as much as possible) and responsible pool use only in the extreme overuse condition. In the moderate overuse condition, this motivational conflict is reduced, and therefore subjects in this condition would be expected to harvest more resource units than in the extreme overuse condition. The general pattern of harvest behavior results observed in this study replicates findings reported in previous experimental studies using similar manipulations (Samuelson *et al.*, 1984; Samuelson & Messick, 1986a, 1986b).

Preferences for Structural Change

Importance rankings of evaluative dimensions. A direct test of Hypotheses 1 and 2 is to examine the importance rankings of the four evaluative dimensions (1 = most important; 4 = least important). First, to test the null hypothesis of equiprobability in the selection of dimensions, a χ^2 analysis was performed on subjects' first ranked choice. Overall, the majority of subjects (49.5%) ranked efficiency as the most important dimension for evaluating allocation systems, 28% favored fairness, 19% cited freedom as most important, and only 4% chose self-interest, χ^2 (3,N = 105) = 45.9, $p < .0001$, Cohen's $w = .66$. Second, to assess the consistency in subjects' rankings, Kendall's coefficient of concordance was computed for the entire sample, $W = .28$, χ^2 (3,N = 101) = 83.45, $p < .001$. The ordering of the rank sums in this analysis was identical to the preference ordering suggested by the frequency analysis of the first ranked dimension. While statistically significant, the degree of interjudge

TABLE 2
MEAN ATTRACTIVENESS RATINGS AND MEAN RATINGS ON EVALUATIVE DIMENSIONS FOR EACH OF THE ALLOCATION SYSTEMS

	Overall attractiveness	Evaluative dimension			
		Efficiency	Fairness	Freedom	Self-interest
System					
Free access	4.27	4.93	4.74	2.84	3.24
Leader	5.25	3.90	4.54	5.84	5.19
Equal privatization	2.75	2.69	2.60	2.73	3.00
Harvest cap	3.31	2.79	3.08	3.85	3.91

Note. Higher scores indicate *lower* attractiveness and/or *lower* ratings on the dimensions.

agreement (Kendall's W index) regarding the relative ordering of the dimensions was modest.[4]

To test Hypotheses 1 and 2, subjects' importance rankings for the dimensions of fairness and self-interest were analyzed by univariate 2 × 2 × 2 (Value × Resource Use × Variance) ANOVAs.[5] These analyses for the dimensions of fairness and self-interest revealed significant main effects for value, $F(1,95) = 8.56$, $p < .01$, $\hat{\omega}^2 = .07$, $F(1,96) = 15.52$, $p < .001$, $\hat{\omega}^2 = .13$, respectively. As predicted (Hypothesis 1), cooperative subjects ($M = 1.74$) ranked fairness as more important than did noncooperative subjects ($M = 2.28$). Moreover, consistent with Hypothesis 2, noncooperators ($M = 3.15$) assigned greater importance to self-interest than did cooperative subjects ($M = 3.79$).

Attractiveness ratings. The mean attractiveness ratings and the mean ratings of the attribute scales for each of the allocation systems are presented in Table 2. An inspection of Table 2 reveals that the leader option received relatively poor ratings on both the freedom and self-interest

[4] It is interesting to note here that interjudge agreement was somewhat higher among cooperators, $W = .48$, $\chi^2(3,N = 38) = 55.14$, $p < .001$, than among noncooperators, $W = .22$, $\chi^2(3,N = 63) = 41.27$, $p < .001$. As predicted, the rank ordering of dimensions for cooperators (as indicated by the magnitude of the rank sums) was as follows: fairness, efficiency, freedom, and self-interest. For noncooperators, the ordering of rank sums was as follows: efficiency, fairness, freedom, self-interest.

[5] Parametric tests were used here on ordinal data due to their superior power and flexibility for analyzing factorial designs (see Gaito, 1959; Gardner, 1975; McNemar, 1969; Toothaker & Chang, 1980). Gardner (1975) has summarized the heated debate over scale strength and appropriate statistics, concluding that parametric tests such as ANOVA and t test yield valid conclusions for subinterval level data. This position is supported by empirical studies demonstrating that ANOVA procedures are robust to nonnormality and heterogeneity of variance (Box & Anderson, 1962; Glass, Peckham, & Sanders, 1972). In addition, to protect against inflation of Type I error rate due to possible violations of ANOVA assumptions, a more conservative significance level of .01 was chosen for these analyses.

dimensions. Equal privatization fared quite well on all four dimensions with means ranging from 2.60 to 3.00 on the 7-point scale. Free access was rated worst on efficiency and fairness, with more positive evaluations on freedom and self-interest. Harvest cap, like equal privatization, received fairly good ratings on all dimensions, with slightly poorer mean scores on freedom and self-interest.

To assess the effects of the design variables on subjects' attractiveness ratings, a 2 × 2 × 2 × 4 (Value × Resource Use × Variance × Systems) repeated measures ANOVA was performed. This analysis found a significant main effect for systems, $F(3,291) = 41.26$, $p < .0001$, $\hat{\omega}^2 = .23$, and a Value × Resource Use interaction, $F(1,97) = 4.78$, $p < .04$, $\hat{\omega}^2 = .04$. In general, the equal privatization system was rated most attractive ($M = 2.75$), followed closely by harvest cap ($M = 3.31$), with free access next most attractive ($M = 4.27$), and the leader option least attractive ($M = 5.25$).[6] Univariate ANOVAs conducted separately on each system revealed that the interaction between value and resource use was observed only for the equal privatization system, $F(1,97) = 3.84$, $p < .06$, $\hat{\omega}^2 = .03$. Among cooperators, attractiveness ratings did not differ as a function of resource use (extreme overuse, $M = 2.50$; moderate overuse, $M = 2.30$). However, among noncooperators, equal privatization was rated as less attractive in the moderate overuse condition ($M = 3.50$) than in the extreme overuse condition ($M = 2.46$).

To determine if subjects' actual attractiveness ratings could be predicted based on the proposed multiattribute evaluation model, a predicted attractiveness score for each alternative system was computed using a simple additive weighting model. For each subject, approximate importance weights for the four evaluative dimensions were derived from the direct importance rankings of the attributes using a rank reciprocal weighting procedure (Edwards & Newman, 1982).[7] These weights were then multiplied by their respective attribute ratings and summed to esti-

[6] This ordering of the allocation systems in terms of the attractiveness ratings was perfectly consistent with subjects' direct rankings of the four systems. Overall, the modal first choice preference (i.e., most preferred system) of subjects was equal privatization (43%), followed by harvest cap (29%), with free access third (21%), and the leader option least popular (8%), $\chi^2(3,N = 105) = 27.30$, $p < .001$. The index of interjudge agreement for the overall rankings of the systems was statistically significant but relatively low in absolute size, Kendall's $W = .20$, $\chi^2(3,N = 101) = 60.94$, $p < .001$. Because the results from the rankings were virtually identical to those from the attractiveness ratings, statistical analyses of the preference rankings were not included in this report.

[7] An alternative approach to estimating importance weights would be to conduct multiple regression analyses on the overall attractiveness ratings using the four attribute ratings as predictors. These analyses were performed within each experimental condition but did not yield stable estimates of the importance weights due to the small cell sizes (10–17) used in this study.

mate each subject's overall evaluation of each of the three allocation systems. Consistent with Hypothesis 3, the correlations between these predicted values and the actual ratings were strongly positive, Leader, $r(99) = .74, p < .001$; Equal privatization, $r(99) = .66, p < .001$; Harvest cap, $r(99) = .68, p < .001$.

A more stringent test of the proposed multiattribute evaluation model, however, was performed in which these correlations were compared with the corresponding correlations obtained by a unit–weight model in which the four attribute ratings were averaged using equal importance weights. This analysis found the following correlations for the unit–weight model: Leader, $r(99) = .79, p < .001$, Equal privatization, $r(99) = .66, p < .001$, Harvest cap, $r(99) = .67, p < .001$. Fisher's r to z transformation was performed on the correlations for the leader system to compare the size of the two correlations. This test found no significant difference between the correlations derived from the differential weighting MAU model and the unit–weight model, $z = 1.14$, ns. Thus, while the hypothesized differential weighting model did not outperform a unit–weight baseline model, it was evident from the magnitude of the correlation coefficients that a large proportion of the variance (43–55%) in subjects' attractiveness ratings of the systems can be accounted for by a multiattribute evaluation model.

Hypothesis 4 predicted that the attribute ratings of the status quo system of free access would be systematically affected by subjects' past experience with the task. To test this hypothesis, univariate $2 \times 2 \times 2$ ANOVAs were performed separately on the ratings of free access along the dimensions of efficiency and fairness. For efficiency, the ANOVA found the expected main effect for resource use, $F(1,97) = 5.43, p < .03$, $\hat{\omega}^2 = .04$. Extreme overuse subjects ($M = 5.25$) rated the free access system as less efficient than did moderate overuse subjects ($M = 4.62$). For the fairness dimension, the ANOVA found a main effect for use, $F(1,97) = 4.61, p < .04, \hat{\omega}^2 = .04$. The predicted variance main effect was not significant, $F(1,97) = 2.03, p < .20$. Similar to the pattern for efficiency, extreme overuse subjects ($M = 5.06$) rated the status quo system as less fair than did moderate overuse subjects ($M = 4.42$). Thus, Hypothesis 4 received only partial support.

Voting behavior. The number of votes cast for structural change (equal privatization, harvest cap, leader) at the end of the harvest trials was recorded in each of the eight experimental conditions. These binary choice frequencies were analyzed using a linear modeling procedure for categorical variables (Grizzle, Starmer, & Koch, 1969). For the equal privatization alternative, the analysis revealed a main effect for resource use, $\chi^2(1, N = 105) = 4.17, p < .05$, Cohen's $w = .20$. Extreme overuse subjects (81%) voted to replace free access with equal privatization more

often than moderate overuse subjects (63%). Contrary to predictions, the frequency analysis performed on the harvest cap system found no significant main effects or interactions involving the design variables. The overall approval level for this alternative was quite high (64%) across experimental conditions, a result consistent with past research using this form of structural change (Samuelson, 1987). Thus, Hypothesis 5 received partial support with the expected use main effect observed only for evaluations of the equal privatization system.

Table 3 presents the proportion of subjects voting for a leader in preference to the status quo in each of the experimental conditions. A frequency analysis yielded a main effect for resource use, $\chi^2(1,N = 105) = 5.56, p < .02, w = .23$, and a Value × Resource Use interaction, $\chi^2(1,N = 105) = 4.62, p < .04, w = .21$. Table 3 indicates that extreme overuse subjects (47%) voted to elect a group leader more frequently than moderate overuse subjects (29%). This overall effect, however, was qualified by the predicted Value × Resource Use interaction. Among cooperative subjects, there was a strong preference for a leader in the extreme overuse condition (70%) compared to the moderate overuse condition (25%). For noncooperative subjects, however, this efficiency effect disappeared (extreme overuse, 33%; moderate overuse, 31%). Thus, it appears that cooperators endorsed the leadership system only under conditions of inefficient management of the common pool, whereas most noncooperators were reluctant to favor this option regardless of the efficiency of resource use. This result is consistent with Hypothesis 6.

TABLE 3
PROPORTION OF SUBJECTS VOTING FOR A LEADER IN EACH OF THE EXPERIMENTAL CONDITIONS

	Resource use				
	Extreme overuse Variance		Moderate overuse Variance		
Social value	Low	High	Low	High	Total
Cooperative	.70	.70	.40	.10	.48
	(10)	(10)	(10)	(10)	(40)
Noncooperative	.29	.38	.24	.40	.32
	(17)	(16)	(17)	(15)	(65)
Variance total	.44	.50	.30	.28	.38
	(27)	(26)	(27)	(25)	(105)
Use total	.47		.29		
	(53)		(52)		

Note. The number of subjects per condition is given in parentheses.

Relationship between Harvest Total and Vote for Structural Change

One final set of analyses explored the relationship between subjects' harvest outcomes in the first session and their subsequent voting behavior. Correlations were computed between subjects' harvest totals for the 10 trials and their binary votes for each of the three alternative systems (0 = no, 1 = yes). Past research has shown rather weak relationships between these two variables for the leader option (Messick *et al.*, 1983; Samuelson *et al.*, 1984) with only a slightly stronger association for the equal privatization system (Samuelson & Messick, 1986a). The correlations obtained in the present study were significant and negative, Leader, $r(103) = -.29$, $p < .01$; Equal privatization, $r(103) = -.29$, $p < .01$; Harvest cap, $r(103) = -.34$, $p < .001$.[8] For all three alternatives, the higher a subject's harvest total, the lower the likelihood of the subject voting for structural change. The strength of this relationship, however, was modest in size, accounting for between 8 and 12% of the variance in subjects' voting behavior.

Since subjects received preprogrammed feedback during the first session trials about others' harvests, it is reasonable to assume that social comparison processes may have affected the level of satisfaction with their own harvest outcomes (Samuelson & Messick, 1986b). Because the mean two-trial harvest total of the "others" was held constant at 27.6 units per trial, it is possible to classify subjects according to whether their own two-trial harvest average was over or under the *mean* of the five other bogus group members. Does a subject's harvest position relative to the "norm" of the group affect preferences for structural change? Chi-square analyses indicated that relative position did strongly influence the harvest cap vote, $\chi^2(1,N = 105) = 14.59$, $p < .0001$, $\phi = .37$, $w^2 = .14$, and to a lesser degree, the vote for equal privatization, $\chi^2(1,N = 105) = 3.48$, $p < .07$, $\phi = .18$, $w^2 = .03$. Of the 57 subjects who were *over* 27.6 units, 27 (47%) voted for harvest cap over free access. In contrast, of the 48 subjects who were *less than or equal* to 27.6, 40 (83%) voted in favor of harvest cap. The general pattern was similar, although less extreme, for the equal privatization option: Of the 57 subjects over 27.6, 37 (65%) voted to replace free access with equal privatization; of the 48 subjects under or equal to 27.6, 39 (81%) voted for this alternative.

Do these relationships hold equally for cooperators and noncoopera-

[8] Due to the significant effects of the resource use and variance manipulations on harvest behavior, a secondary analysis was also performed in which the harvest total cell mean was subtracted from each subject's total and the residual harvest values were then correlated with the binary votes. These "corrected" correlations were also negative and statistically significant, Leader, $r(103) = -.23$, $p < .01$, Equal privatization, $r(103) = -.24$, $p < .02$, Harvest cap, $r(103) = -.33$, $p < .001$.

tors? As one might suspect, noncooperators' preferences for equal privatization and harvest cap were significantly affected by their relative harvest position in the group; cooperators' choices showed no systematic pattern. Of the 38 noncooperators whose two-trial harvest average was over 27.6, 22 (58%) voted for equal privatization; of the 27 noncooperators less than or equal to 27.6 units, 22 (81%) preferred this option to free access, $\chi^2(1,N = 65) = 4.02, p < .05, \phi = .25, w^2 = .06$. For the harvest cap alternative, the differences were even more striking. Of the 38 noncooperators over 27.6, only 16 (42%) voted for the harvest cap; however, of the 27 noncooperators under or equal to 27.6, 23 (85%) favored the harvest cap system over free access, $\chi^2(1,N = 65) = 12.21, p < .0001, \phi = .43, w^2 = .19$. These data provide additional behavioral evidence for the hypothesis that noncooperators' preferences for structural change are mediated more strongly by self-interest compared to cooperators.

DISCUSSION

The results of this study provide general support for the hypotheses. Two major findings are that: (1) cooperators assigned greater importance to the fairness dimension compared to noncooperators; in contrast, noncooperators assigned greater importance to the self-interest dimension compared to cooperators; and (2) subjects' evaluations of the superordinate authority system were determined by the *interaction* between individual differences in social value orientation and past experience with the status quo system (i.e., efficiency of resource use).

Theoretically, the most interesting results are that Hypotheses 1, 2, and 6 received clear support. Cooperators and noncooperators were found to differ systematically in the relative weight assigned to the dimensions of fairness and self-interest. The stronger relationships between harvest total and voting behavior among noncooperators (at least for harvest cap and equal privatization) further reinforces the conclusion that noncooperators weight self-interest higher than do cooperators. The predicted Value × Resource Use interaction also emerged in the binary vote for the leader system. As expected, when the resource pool was depleted rapidly (extreme overuse), cooperators strongly favored the election of a leader compared to cooperators facing a situation where the pool size declined slowly (moderate overuse). In contrast, the majority of noncooperators (68%) rejected the leader option regardless of the state of the resource pool.

These results have some important theoretical implications. First, the differences observed between cooperators and noncooperators in importance weights support one hypothesis derived from Samuelson and Messick's (in press) multiattribute evaluation model of structural change decisions. Second, the interaction effect on the leader vote is the first em-

pirical demonstration that interpersonal differences in social value orientation affect not only *individual-level* solutions to social dilemmas (see Kramer *et al.*, 1986; Liebrand, 1984; Liebrand & Van Run, 1985; Liebrand, Wilke, *et al.*, 1986) but also preferences for *structural* solutions.

One issue that requires explanation is why the proposed multiattribute evaluation model did not outperform the baseline unit-weight model in predicting subjects' attractiveness ratings. There are several possible interpretations of this finding. First, it may be that Samuelson and Messick's (in press) differential weighting model is overly complex in that a unit or equal-weights model appears to do just as well in describing subjects' overall evaluations. There is certainly a large body of research that supports the robustness and utility of equal-weights linear models (e.g., Dawes & Corrigan, 1974; Dawes, 1979; Einhorn & Hogarth, 1975; Wainer, 1976). Second, it is also possible that the ranking procedure used to measure importance weights in this study was not sufficiently precise to provide an adequate test of the differential weighting model. For example, Edwards and his colleagues (Edwards & Newman, 1982; von Winterfeldt & Edwards, 1986) advocate the use of a ratio weighting method in MAUT applications in preference to ranking methods due to its enhanced accuracy in estimating importance weights. This explanation could be investigated in future studies.

A third possibility is that the strong performance of the equal-weights model is due to the relatively small number of attributes in this particular model and their positive intercorrelations (von Winterfeldt & Edwards, 1986; Wainer, 1976). Newman (1977) and Stillwell, Seaver, & Edwards (1981) have shown, for example, that when there are attributes in the final set that are negatively correlated, then a differential weighting model may prove to be superior to the unit-weight model. At this point, it is difficult to determine which of the above explanations is correct. Despite this unresolved weighting scheme question, it should be noted that the predictive ability of the hypothesized multiattribute evaluation model was significant, accounting for between 43 and 55% of the variance in subjects' attractiveness ratings.

A brief comment is also needed on the overall pattern of subjects' preferences for the various forms of structural change. Evaluations of the four allocation systems were unequivocal. Equal privatization was the most preferred structural change, with the harvest cap a close second choice. Free access was assigned to third place. The leader system was least preferred. While there were no formal hypotheses about the overall level of support for each of the structural changes, it is striking that the equal privatization system was so strongly endorsed in this study while

the leader alternative received rather negative evaluations. One previous experiment using similar alternatives found that equal privatization received the lowest level of support (Samuelson & Messick, 1986a).[9] However, Rutte and Wilke (1985) have found similar results to the present study among Dutch subjects when leadership was judged in relation to more democratic decision structures (i.e., unanimity, large majority rule). Participants in the present study appeared to strongly favor dividing the commons equally into individual pools for private consumption. The reasons for this preference are not entirely clear. One possible explanation is that many people prefer allocation systems that afford them a sense of *personal control* over resource use decisions. Both the equal privatization and harvest cap systems allow for personal autonomy. By contrast, the leader system is the only alternative structure that eliminates self-determination. Interestingly, past empirical studies on privatization (e.g., Acheson, 1975; Cass & Edney, 1978; Messick & McClelland, 1983) have also demonstrated this system's effectiveness in preserving common pool resources.

One general conclusion that emerges from this research is that the evaluation process regarding structural change reflects the joint impact of personality and situation. The present theoretical approach suggests that an interactionist view (Endler & Magnusson, 1976) of structural change decisions may be a more realistic and appropriate model for future research. The results of the present study and past work (e.g., Samuelson, 1991; Samuelson & Messick, 1986a, 1986b) imply that preferences for structural change in resource dilemmas are determined by a complex interaction between individual differences, situational factors, and the particular types of structural change available. Additional evidence from other research on cooperation and competition supports this interactionist position by reporting substantial interindividual variations in perception that account for significant variance in judgments of goal-oriented interpersonal situations (King & Sorrentino, 1983). Specifically, King and Sorrentino (1983) found that a weighted model, representing individual differences as weights applied to common judgment dimensions, resulted in a significantly better fit to the data compared to an unweighted model. Liebrand, Jansen, *et al.*'s (1986) findings regarding the cognitive differ-

[9] Because the Samuelson and Messick (1986a) experiment employed a between-subjects design, subjects were not given the opportunity to compare the equal privatization option with other alternatives such as the group leader system. Rather, the subjects in this study evaluated equal privatization only in comparison with the status quo system of free access. Consequently, it is difficult to draw conclusions from this study regarding the relative attractiveness of specific structural change options.

ences between cooperators and individualists also supports this interactionist viewpoint.

One potential weakness of the present laboratory research concerns the generalizability of the experimental results to real-world resource dilemma settings. It must be acknowledged that the external validity of the present findings is unknown and cannot be assessed using the methodology employed here. Other researchers, however, have begun examining institutional change in naturalistic settings to determine how local communities evolve institutions to manage and protect common resources (Ostrom, 1990). Elinor Ostrom's (1990) field research program has generated a bibliography (Martin, 1989) of over 5000 references to case studies and reports in diverse disciplines that analyze the "tragedy of the commons" in natural settings. Ostrom's systematic content analyses of these case studies produced a theoretical framework for institutional choice that includes many conceptual variables (e.g., transformation costs, enforcement and monitoring costs, current condition of common pool resource, type of proposed rules) that closely parallel a number of independent variables studied in laboratory research on structural change (Samuelson & Messick, in press). This convergence between conclusions from laboratory and field research is encouraging and suggests that laboratory experimentation may be used effectively to illuminate basic social psychological processes in social dilemmas (Messick & Brewer, 1983).

Several possible lines of research are suggested by the present study. First, it is apparent that a more comprehensive typology of various allocation systems will be required before significant theoretical progress can be made in understanding the evaluation processes involved in structural change decisions. Past research has examined only a small subset of possible decision-making structures for allocating shared resources, and the choice of these institutions has been rather arbitrary. Second, additional research is necessary to determine the underlying perceptual dimensions that people use to classify and evaluate various allocation systems. This paper suggests four possible evaluative dimensions as a point of departure, but other dimensions are likely to be important and could be derived inductively by methods similar to those employed by King and Sorrentino (1983). Third, more attention should be directed toward identifying relevant individual differences that influence structural change decisions. Social value orientation and interpersonal trust (Yamagishi, 1986, 1988) have now been shown to affect individuals' preferences for various structural solutions. Further systematic research will be required before firm conclusions can be reached about the relative importance of these interpersonal differences. More generally, the present study suggests that future researchers should recognize the complexity of structural change decisions by adopting an interactionist perspective.

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RECEIVED: November 26, 1990