DECISION MAKING IN COMMONS DILEMMAS: A GROUNDED THEORY ANALYSIS

by

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ABSTRACT

The present study employed verbal protocols and personal interviews to investigate decision making in commons dilemmas, a problem-solving task involving the management of a limited, shared resource. Grounded theory was used to identify the main motivational, cognitive, and emotional factors that underlie harvest choice, and to organize these factors into a framework that describes how harvest decisions are made. The core category that emerged from the analysis was labeled goal satisficing. Most participants adopted or formulated specific harvest goals prior to and during the simulation. These goals guided the decision-making process, determining which strategies were employed, and ultimately how many points were harvested from the pool on each trial. Five action strategies that participants used to pursue their goals were identified. These included developing an initial harvest plan, monitoring pool size and others' harvests, developing expectancies about others, simulating possible outcomes, and attempting to elicit cooperation from others. The results of this study suggest that defection occurs in commons dilemmas for two main reasons: a failure to adopt cooperative goals, or a failure to implement effective action strategies to achieve cooperative goals after such goals have been adopted.

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CHAPTER 1

INTRODUCTION

The past decade has seen a substantial increase in interest in environmental issues such as deforestation, biodiversity loss, and dwindling fish stocks. Billions of dollars are spent annually on programs designed to ameliorate these and other problems. Unfortunately these programs often are ineffective or have unexpected consequences because the political, economic, and psychological dynamics of issues at hand are not adequately understood.

The present study employs verbal protocols (Ericsson & Simon, 1980, 1984) and semi-structured interviews to investigate decision making in a simulated resource management task. The aim of the study is to identify important motivational, cognitive, and emotional factors that contribute to individuals' resource use decisions, and to organize these factors into a framework that describes how and why individuals make their harvest choices.

Many environmental problems share important features of what psychologists and sociologists call social dilemmas (Dawes, 1980; Messick & Brewer, 1983). Social dilemmas are situations that involve a conflict between individual and group interests. According to Dawes (1980), all social dilemmas share two general properties: (1) each individual in a group receives a higher payoff for self-interest actions (i.e., defection) than for public-interest actions (i.e., cooperation) regardless of how others act, and (2) the total payoff associated with universal defection is lower than for universal cooperation. Social dilemmas also often involve a temporal component; the negative consequences of self-interest action may be delayed (Messick & Brewer, 1983).

Social dilemmas that involve the management of a limited shared resource are known as commons dilemmas. Commons originally referred to jointly owned pastures on which herdsmen grazed their cattle (Lloyd, 1837/1968), but the term is used more broadly today, typically referring to any desirable resource held jointly by a group of individuals (Gifford, 1987).

Problems associated with managing common-property resources have long been recognized.

> What is common to the greatest number gets the least amount of care. Men pay most attention to what is their own; they care less for what is common; or at any rate, they care for it only to the extent to which each is individually concerned. Even when there is no other cause for inattention, men are more prone to neglect their duty when they think another is attending to it... (cited in Waldron, 1988, p. 6).

A more recent analysis of the problem was presented by English political economist W. F. Lloyd in a lecture on population checks delivered at Oxford University. Lloyd (1837/1968, pp. 31-32) used a parable involving a group of herdsmen and a common pasture to illustrate the dilemma. He noted that there are benefits and costs associated with increasing one's herd size, and that herdsmen will only add cattle to the pasture as long as the benefits for doing so outweigh the costs. In a private pasture situation, where each herdsman grazes cattle on his own land, the benefits and costs associated with adding cattle are experienced directly by the individual herdsmen themselves. However, if the cattle are grazed on a common pasture, each herdsman receives all the benefits associated with adding cattle, but pays only a fraction of the costs, which are shared equally by all those using the pasture. In other words, the economic checks that control population levels in the private-property situation are removed in common-property situations. Lloyd argued that when these checks are withdrawn, herdsmen will add cattle to the pasture because it is in their best economic interest to do so. However, if all herdsmen continue to add to their herds, the number of cattle will exceed the pasture's capacity, the cattle will starve, and the herdsmen will be worse off than if they had decided to limit the size of their herds.

Lloyd's ideas regarding common property were popularized by Garrett Hardin (1968) in his now-classic article "The Tragedy of the Commons". Like Lloyd, Hardin argued that unregulated use of the commons will result in its inevitable destruction. In perhaps one of the most widely cited paragraphs in the social sciences, he describes the tragedy:

> Each man is locked into a system that compels him to increase his herd without limit - in a world that is limited. Ruin is the destination

> toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons.

Hardin suggests that in some situations destruction of the commons can be averted through privatization, that is, by dividing the resource up into individually owned territories. But what of common resources, such as air and water, that are not readily divisible? In these situations, he recommends mutually agreed-upon laws or taxing systems to encourage public-interest behavior. He acknowledges that this solution may be inconsistent with traditional views of personal freedom, but argues that such measures are often necessary to save common resources from ruin.

H. Scott Gordon (1954, cited in Ostrom, 1991) has offered a slightly different perspective on the commons problem. According to Gordon, fear of being a sucker (i.e., of being the sole cooperator in a world of defectors) is the critical factor underlying overuse in the commons.

> There appears then, to be some truth in the conservative dictum that everybody's property is no one's property. Wealth that is free for all is valued by no one because he who is foolhardy enough to wait for its proper time of use will only find that it has been taken by another... The fish in the sea are valueless to the fisherman, because there is no assurance that they will be there for him tomorrow if they are left today (p. 3).

Contemporary examples of commons dilemmas. Contemporary examples of commons dilemmas abound. In their recent environmental treatise, Isaac Asimov and Frederik Pohl (1991) provide an excellent example of an international-level commons dilemma: setting standards for carbon-dioxide emissions.

> Country X will well understand that it, along with all the rest of the world, is threatened by increasing carbon dioxide emissions ... but its leaders may reason that if everybody else does the no doubt difficult and expensive things necessary to deal with the problem, the relatively small damage that will be done to the environment by the Xians won't make any real difference. Therefore X can coast along in the good, old fashioned, high-polluting way - and be able to out-compete the rest of the world in the price of the export manufactures while they do it, since they won't have pay the bill for the sacrifices (p. 312).

The rapid depletion of cod and salmon stocks off the east and west coasts of Canada constitutes a second contemporary example of a commons dilemma. Overfishing and lack of governmental intervention have caused stocks in many areas to deplete to alarmingly low levels. Cod stocks are so low off the coast of Newfoundland that the government has imposed a two-year moratorium on fishing, and fishery officials now believe that it may be necessary to keep the ban in place until the turn of the century (Demont, 1993).

Like the government policy-makers in Asimov and Pohl's carbon dioxide example, Canadian fishers (prior to the ban, at least) were faced with a difficult decision. Should they limit their consumption of the resource, a choice that may or may not be sufficient to save the fishery in the long-run? Or should they continue to overfish and maximize their profits while the resource is still viable? Those who choose to limit their harvests place themselves in a vulnerable position. They relinquish the benefits associated with large harvests, yet are given no guarantee that others will also limit their harvests and not extinguish the resource. In the absence of effective government regulation, and with no guarantee that others will cooperate, the temptation to overharvest can be very strong.

Psychological Research on Commons Dilemmas

Most psychological research on commons dilemmas has been conducted in the laboratory using computer simulations (e.g., Fusco, Bell, Jorgenson, & Smith, 1991; Gifford & Wells, 1991; Mosler, 1993; Parker et al., 1983; Summers, 1993). In a typical simulation experiment, participants are required to manage a limited, self-regenerating resource (e.g., points, fish, sheep, trees, etc.) with several other group members. Simulations are programmed to last for a set number of harvest trials, or until the resource is extinguished. Feedback about the number of resource units remaining in the pool and the number of units harvested by other group members is often provided after each trial. Each group member is usually instructed to acquire as many resource units over the course of the simulation as possible, without extinguishing the resource. Payoffs are set such that harvesters can maximize their immediate outcomes by overharvesting from the pool. But if all players overharvest, the pool will be extinguished prematurely leaving everyone with fewer points than had they harvested fewer points per trial and maintained the pool for a longer period of time.

A variety of dependent variables have been employed to measure cooperation in commons dilemma research. These measures fall into two general classes: measures of individual harvest restraint, and measures of group resource management efficiency. Individual restraint is generally operationalized as the number of resource units harvested by each individual per harvest trial (e.g., Messick et al., 1983; Samuelson & Messick, 1986a, 1986b). Taking few points from the pool on each trial is considered to be a cooperative response, whereas taking many points reflects self-interest or defection.

Group efficiency refers to how well the group, as a whole, manages the resource pool. Typical measures include total points harvested (efficient groups may take less in the short-term, but maximize their long-term harvests), number of trials completed (efficient groups maintain the pool longer than inefficient groups), and points replenished to the pool (over the course of the simulation, efficient groups replenish more points to the pool than inefficient groups). These measures are often highly intercorrelated, and in some instances are aggregated to form an overall efficiency index (e.g., Gifford, 1982; Hine & Gifford, 1994).

To date, much of the psychological research on commons dilemmas has been aimed at identifying factors that increase individual restraint and group efficiency. In a recent meta-analysis, Hine (1990) identified 27 such factors and computed average effect sizes for each. An abridged summary of the meta-analysis is presented in Table 1.1. The factors with largest effect sizes included: allowing communication among group members, dividing the pool into privately managed territories, providing feedback about the number of points remaining in the pool, providing strategies for maximizing long term outcomes, and limiting group size.

Table 1.1: Effects of Selected on Harvest Restraint and Resource Management Efficiency in Commons Dilemmas (based on Hine, 1990).

Independent Variable	Mean Effect Size (r)	Standard Deviation	N
Communication	.54	.32	11
Territorialization	.50	.45	5
Social Values	.43	.31	5
Pool Feedback	.36	.44	4
Providing Strategies	.33	.30	4
Group Size	-.31	.25	10
Group Identity	.18	.20	4
Moral Suasion	.17	.02	2
Gender	.05	.10	13

Mean effect sizes are expressed as Pearson correlation coefficients. N refers to the number of studies used to compute each mean effect size. The positive effect size for Gender indicates that females were slightly more cooperative than males.

Cognitive mediation in commons dilemmas. Although most research has focused on the direct impact of dispositional and situational variables on harvest behavior, in recent years there has been growing interest in the mediating role of cognition. For example, Allison and his colleagues (Allison & Messick, 1990; Allison, McQueen, & Schaerfl, 1992; Samuelson & Allison, 1994) have conducted a series of studies on social decision heuristics and harvest choice. These studies suggest that a common "rule of thumb" used in resource sharing situations is to divide the resource equally among all group members, and that several situational and dispositional factors appear to be associated with deviations from equal division. These factors include high payoffs for defection, pool sizes that are difficult to divide into equal parts, role assignment (i.e., being designated as a supervisor as opposed to a leader or guide), and noncooperative social values.

The mediating role expectancies about others has also received considerable attention. The general finding in the literature is that participants who expect others to cooperate tend to cooperate themselves, whereas those who expect others to defect tend to defect (Dawes, 1980; Pruitt & Kimmel, 1977; Wilke & Braspenning, 1989). Expectancies have also been used to explain differences in the harvest choices made by individuals with cooperative and noncooperative social values. Most studies show that individuals with cooperative values tend to expect high levels of cooperation from others, whereas those with noncooperative orientations tend to expect others to cooperate less (e.g., Kramer et al. 1986; Kuhlman & Marshello, 1975; Liebrand, Wilke, Vogel, & Wolters, 1986; van Lange & Liebrand, 1991a, 1991b). Gifford, Hine and Miller (1993) found that expectancies also appear to mediate the effect of communication on cooperation; relative to members of groups in which communication was not permitted, members of communicating groups were more likely to expect others to cooperate, and were more likely to cooperate themselves.

Several researchers have also investigated the relation between attributions and harvest choice. Gifford and Hine (1993) demonstrated that harvester attributions were subjects to several biases. Participants were more likely to attribute others' harvest decisions to dispositional factors than to the situation, tended to assume that others would adopt a resource management strategy that was similar to their own, and took less personal responsibility for negative outcomes in the commons than for positive ones. Van Lange, Liebrand, and Kuhlman (1990) compared the causal attributions made by cooperators and noncooperators for cooperative and noncooperative targets. They found that views about what constituted a rational harvest choice were closely linked to havester's behavioral predispositions; harvesters who were predisposed to be cooperative viewed cooperation as the intelligent choice, whereas harvesters who were predisposed to be noncooperative viewed defection as the intelligent choice. Van Lange et al. also reported that both cooperators and defectors tended to attribute others' cooperation to concern for others, and others' noncooperation to fear of being a sucker and to greed. Hine and Gifford (1993) extended this research by comparing self-attributions to ignorance, concern for others, fear, and greed with the same attributions made for cooperative and noncooperative others. They found that self-attributions resembled those made for similar others, although a pervasive self-serving bias was evident, especially among the unrestrained harvesters. Finally, Rutte, Wilke, and Messick (1987) have shown that attributions may also be an important determinant of harvest choice; harvesters were more likely to limit their harvests if they attributed a resource shortage to environmental factors as opposed to human factors.

Several theoretical positions have also been proposed that emphasize the role of cognition in commons dilemma decision making. Dawes (1980) concluded his review of the literature with the following proposition.

> The analysis and literature reported thus far support a very simple theoretical proposition, one derived from extensive literature documenting that people have very limited abilities to process information on a conscious level, particularly social information. This ability is "limited" relative to what we naively believe; that is, study after study has shown a surprising inability to process information correctly on what appear to be the simplest of tasks, provided that they are not overlearned or automatic...
>
> Such cognitive limitations may often result in an inability to understand or fully grasp the utilities in a social dilemma situation other than those that are most obvious, i.e., those connected with the payoffs. But it is precisely the payoff utilities that lead the players to defect, while

> the other utilities - e.g., those connected with altruisms, norms, and conscience - lead the players to cooperate. It follows that manipulations that enhance the salience of these utilities should increase cooperation (p. 189-190).

Pruitt and Kimmel (1977) have offered an alternative perspective emphasizing harvester goals and expectations. Goal-expectation theory was originally proposed to explain choice in 2-person prisoner's dilemma games, but can be generalized to n-person situations (e.g., Yamagishi, 1986). The theory suggests that two main conditions must be satisfied for cooperation to occur. First, players must become committed to the goal of mutual cooperation. They must recognize that unilateral defection is untenable as a long-term strategy because it inevitably leads to mutual defection, an outcome that yields lower payoffs than mutual cooperation. Second, players must expect that others in their group will also cooperate. If others are expected to defect, one must also defect to avoid a sucker's payoff (i.e., the payoff associated with cooperating when everyone else defects).

Finally, Samuelson and his colleagues (Messick et al., 1983; Samuelson & Messick, 1986a, 1986b; Samuelson et al.; 1994) have proposed a three-factor model to account for harvest decisions in commons dilemmas. According to the model, harvest decisions are governed by three main motives: self-interest, a desire to use the resource wisely, and the desire to conform to implicit group norms. The model assumes that the relative strength of each motive will vary and across situations. For example, in situations where there is little variation in others' harvests (i.e., everyone is harvesting similar amounts from the pool), the pressure to conform to the implicit group norm will be higher than in situations where others' harvests are more disparate.

The Present Study

The primary aim of the present study is to identify the main motivational, cognitive, and emotional factors that underlie harvest choice, and organize these factors into a descriptive/explanatory framework. Although this is not the first study to investigate decision making in commons dilemmas from a cognitive perspective, it differs from previous studies in several important respects.

(1) Whereas most previous studies have employed questionnaire measures of cognition or have involved inferring cognitions indirectly from behavior, the present study attempts to measure cognitions more directly using verbal protocol (Ericsson & Simon, 1980, 1984). Participants are asked to think aloud as they engage in a computerized commons dilemma simulation. All utterances are recorded and transcribed, and potential mediators are coded from the transcripts. Post-experimental interviews are also conducted to clarify ambiguous passages in the transcripts, and to probe more deeply for underlying motives, emotional responses, etc. A discussion of the methodological issues associated with verbal protocols analysis is presented in Appendix A.

(2) Whereas previous studies have tended to focus on one or a few cognitive variables in relative isolation, the present study employs a more holistic approach in which motivational, cognitive, and emotional factors are all considered together.

(3) Whereas most previous studies have been geared toward testing hypotheses derived from existing theories, the present study employs an analytic strategy (grounded theory) aimed at generating theory. A grounded theory analysis begins with no a priori hypotheses. Relevant categories (variables) and the relationships among them are derived inductively as the analysis proceeds (Glaser & Strauss, 1967; Strauss & Corbin, 1990). A detailed overview of this approach is presented in the next chapter.

Social values and pool-size uncertainty. A secondary goal of the present study is to investigate how the decision making processes vary as a function of personality and context. One dispositional variable (social values) and one situational variable (pool-size uncertainty) were included in the study to address this issue. Both variables have been shown to influence harvest behavior in past studies, but it is presently unclear how cognition may mediate their effects.

Social values refer to preferences for particular distributions of outcomes for self and others in interdependent contexts (Kuhlman & Marshello, 1975; McClintock, 1972, McClintock & Keil, 1983). McClintock (1972) identified three basic social value orientations: cooperative, individualistic, and competitive. Individuals with cooperative orientations prefer outcomes that maximize the outcomes of both self and others. Individuals with individualistic orientations prefer to maximize their own outcomes, regardless of what happens to others. Finally, individuals with competitive orientations prefer to maximize the difference between own and other's outcome, that is, they prefer to maximize their relative gain. A fourth orientation, referred to by Liebrand (1984; Liebrand & McClintock, 1988) as altruism, has also been identified. Altruists prefer to maximize others' gain, regardless of their own outcomes. This orientation, perhaps unfortunately, is relatively uncommon (Liebrand & McClintock, 1988), and will not be considered here.

A common finding in the literature is that individuals with cooperative social values tend to display more restraint and make more cooperative choices than individuals with noncooperative (individualistic and competitive) social values (e.g., Kramer, McClintock, & Messick, 1986; Liebrand, 1984; Liebrand & van Run, 1985; Liebrand et al., 1986). The present study will attempt to identify important differences in the decision making processes of these two types of individuals.

A second issue that has generated considerable recent interest among commons dilemma researchers involves the impact of pool size uncertainty on harvest behavior. In most commons dilemma simulations, participants are provided with precise information about the number of resource units remaining in the common pool. This is often not realistic. In most real-world commons, the exact resource quantity is rarely known; only rough estimates of stock size are available.

Two recent studies (Budescu, Rapoport, & Suleiman, 1990; Hine & Gifford, 1994) have investigated pool-size uncertainty, and both found that harvesters display less restraint as uncertainty increases. Budescu et al. (1990) also reported that as uncertainty increases from moderate to high levels, harvesters estimates' of the number of units in the pool also tend to increase, as does the variability in these estimates. These findings suggest harvesters' pool-size estimates may mediate the uncertainty effect: uncertainty may lead harvesters to overestimate pool size, which in turn may cause them to increase their harvests. The present analysis will explore this possibility, as well as other potential mediators.

CHAPTER 2

AN OVERVIEW OF GROUNDED THEORY

Grounded theory is a systematic approach for generating theory from qualitative data in the social sciences. The procedure was originally proposed by two sociologists, Glaser and Strauss (1967), in response to what they considered to be an overemphasis on "armchair-deductive" theorizing and hypothesis testing in their discipline. They noted this preoccupation with theory testing often resulted in

> ...forcing and distorting of data to fit the categories of the deduced substantive theory and the neglecting of relevant data which seem not to fit or cannot be forced to fit into preexisting sociological categories (p. 261).

Glaser and Strauss (1967) offered grounded theory as an alternative approach in which concepts and categories are derived, inductively, directly from the data. They argued that this ensures the theory will accurately reflect the social reality that it has been developed to explain.

Grounded theory has been embraced by researchers in sociology, education, and organizational studies. It has been used to study a diverse range of topics including: organizational communication (Browning, 1978), anti-nuclear organizations (Blum, 1982), marital dissolution (Laner, 1978), living with cancer (Pennington, 1983), and dying (Glaser & Strauss, 1965).

Despite its popularity in other fields, grounded theory has yet to gain widespread acceptance among psychologists (Henwood & Pidgeon, 1992; Rennie, Phillips, & Quartaro, 1988). This is unfortunate, given the many tangible benefits the procedure could produce for our discipline. As Rennie et al. (1988) have noted, psychologists have spent considerable time and effort developing sophisticated procedures for testing theory, but have tended to neglect a second equally important facet of science: the generation of new theory. The point is not that psychologists should dispense with hypothesis testing and focus exclusively on theory generation, but rather that a balance needs to be struck between testing and generation. The incorporation of grounded theory (and perhaps other procedures for systematically generating theory) into the standard arsenal of methods used to study psychological phenomena would represent a promising first step in establishing such a balance.

Steps in a Grounded Theory Analysis

Despite its emphasis on qualitative aspects of social phenomena, grounded theory is a very systematic and rigorous approach. As Martin and Turner (1987) note,

> grounded theory is [not] concerned with vague statements, poetic intuitions about society, or the kind of imprecise handling of data suggested by the term "soft science." On the contrary, the discipline

> urged upon grounded theorists through the processes of description, definition, and specification of relationships pushes such investigators toward a high degree of rigor in the handling and interpretation of data (p. 143).

The procedure itself involves a number of conceptually, although not temporally, distinct operations (open coding, axial coding, selective coding, and integration). Each of these will be discussed in turn.

Open coding. During the initial phase of the analysis, the researcher reviews the transcripts from his or her first few cases, and codes each meaningful unit of information. The researcher should be working very inductively at this stage. He or she should have no pre-set or valued hypotheses and should remain open to all theoretical possibilities (Glaser & Strauss, 1967). To the extent such theoretical neutrality is actually possible, this helps ensure that the researcher's capacity to generate categories is not constrained by his or her past knowledge or theoretical biases.

Unlike traditional content analysis, in which each information segment typically is given one and only code, grounded theorists often attach more than one code to each segment, a practice known as open categorization. Multiple codes can also be nested within segments. For example, a paragraph in a transcript may deal with a participant's strategy for maximizing his or her point total over the course of the simulation. The researcher may choose to attach the code STRATEGY to the whole paragraph. However, if within the paragraph there is a sentence that deals with distribution equity, a second code (EQUITY) could be attached to that sentence only. Open categorization and nesting enables the researcher to preserve subtle nuances in the data which are often lost when less flexible coding regimens are employed. These nuances are often critical for the development of conceptually dense theory that adequately captures the phenomena under investigation (Rennie et al., 1988).

During open coding, the research also attempts to identify properties and dimensions associated with each coding category. For example, if "harvester anger" was identified as a category, the researcher might want to outline important properties of this category such as "intensity" and "direction." Next, an attempt would be made to specify dimensions that are relevant to "intensity" (e.g., "low" to "high") and "direction" (e.g., "self-directed", "other-directed", or "situation-directed"). Finally, the dimensional framework may be used to classify specific cases (or instances within cases). For example, the analyst might note that during Trial 4 Participant X exhibited intense anger in response to the Green player's decision to defect and mild sadness that the resource pool had been extinguished.

Categories, once specified, are not permanent or unchangeable. At the beginning of the analysis, most of the categories that the analyst generates are descriptive. As the analysis proceeds, these original categories are typically subsumed by more abstract or conceptual categories that emerge as the theory develops. Thus, some rearrangement and development of the initial category structure is to be expected. The researcher continues to collect data until the categories saturate, that is, until further data collection produces no new categories, properties, or dimensions.

The method of constant comparison serves as a key guiding principle during open coding. According to Glaser and Strauss (1967):

> the basic defining rule for the constant comparative method (is) while coding an incident for a category, compare it with previous incidents in the same and different groups coded in the same category (p. 114).

Making constant comparisons sensitizes the researcher to the similarities and differences which exist both among and within the coded categories. This sensitivity is absolutely crucial to development of grounded theory because it ensures that the full diversity and complexity of the data are recognized and incorporated into the emerging conceptual framework (Glaser & Strauss, 1967).

Axial coding. During axial coding, the researcher begins to organize the categories into a preliminary theoretical framework. This stage of the analysis tends to be less inductive than open coding. The researcher alternates between inductive and deductive reasoning (Strauss & Corbin, 1990); initially making hypotheses about how certain categories might be related, and then returning to the data to test the proposed relations. Strauss and Corbin (1990) note that during axial coding it is often useful to organize categories in terms of a generic paradigm model. This involves sorting categories into the following groups:

(1) Causal Conditions - The events or incidents that lead to the occurrence or development of a phenomenon.

(2) Phenomenon - The central idea, event, or process in which the researcher is interested.

(3) Context - Properties of the phenomenon and/or the set of conditions in which participants' action strategies for dealing with the phenomenon take place..

(4) Intervening Conditions - Conditions, situational or dispositional, that act to facilitate or inhibit participants' strategies for dealing with the phenomenon.

(5) Action Strategies. Actions directed at managing, responding to, or carrying out a phenomenon.

(6) Consequences. Outcomes of the action strategy.

The paradigm enables the researcher to begin to organize the categories into a preliminary causal framework. It also facilitates systematic thinking, and is useful for identifying holes in the emerging theory, an issue that we turn to next.

Selective coding and theoretical sampling. During selective coding, the researcher strives to identify a single core category to which all other categories are tied, and develops a theory around that central process or idea. As the theory begins to unfold, it may become evident that certain categories are underdeveloped or in further need of refinement. For example, in some instances there may be little or no variability in a category that the researcher believes is central to the phenomenon under investigation. In such cases, the researcher may choose to selectively sample participants or contexts to ensure that sufficient variability is obtained. This practice is referred to as theoretical sampling (Strauss & Corbin, 1990) or theory-based sampling (Rennie et al., 1988) because data collection is guided by theoretical as opposed to statistical concerns.

In terms of the present study, theoretical sampling has a number of important procedural implications. The first involves choosing which variables should be manipulated in the experimental simulation. In typical psychological experiments, researchers choose the variables they intend to manipulate or measure before the study begins. In this study, only two variables (pool size uncertainty and social values) were pre-selected. As the study proceeds, however, other variables may be selected on the basis of their relevance to the ongoing analysis.

Ideally, the development of a comprehensive theory would entail the manipulation of all variables that have been shown to influence harvest behavior in commons dilemmas, and an exploration of the mediating cognitive mechanisms associated with each of these effects. However, given that almost 30 such variables exist (Hine, 1990), this goal seems unrealistic. My goal, therefore, is to limit my analysis to a few manipulated variables, and leave further elaboration to future studies. Note that this is entirely consistent with Glaser and Strauss's (1967) notion that theory generation is not a means to a precisely articulated end-point, but rather a developmental process in which one's understanding of a phenomenon is continually being extended to new populations and contexts.

Theoretical sampling also has implications for the manner in which the post-experimental interviews in this study will be conducted. Many studies employ highly structured post-experimental interviews in which all participants respond to the same set of questions. In this study, the content of the post-experimental interview was guided by theoretical sampling. As the analysis progresses, questions were added, deleted, and reformulated. This enabled me to pursue specific hypotheses that arose as the analysis proceeded.

Integration. The final stage in a grounded theory analysis involves integrating one's findings with the extant literature. The results of the analysis are compared and contrasted to existing models and frameworks. Implications for other findings in the literature are highlighted and discussed. Ideally, the new theory should provide a new perspective for interpreting the literature, help clarify contentious issues, and suggest directions for future research.

Memos

Grounded theorists keep detailed memos to document the theory's development during each phase of the analysis. These memos serve a number of important functions.

They help the analyst to obtain insight into tacit, guiding assumptions.

They raise the conceptual level of the research by encouraging the

> analyst to think beyond single incidents to themes and patterns in the data. They capture speculations about the properties of categories, or relationships among categories, or possible criteria for the selection of further data sources. They enable the researcher to preserve ideas that have potential value, but which may be premature. They are useful if gaps in the relation of theory to data arise, for they provide a record of the researcher's ideas about the analysis and can be used to trace the development of a category. They are used to note thoughts about the similarity of the emerging theory to established theories or concepts. Finally... they play a key role in the write-up of the theory (Rennie et al., 1988, p. 144).

In short, memos help researchers organize their thoughts and store the vast amount of information that accumulates during a study. Early memos are often unfocused and disjointed, reflecting the analyst's initial uncertainty about the content of the data set. As the analysis proceeds and the analyst becomes more confident, the memos tend to become more integrative. Links among categories are recognized and noted, and a coherent story-line emerges. Often these later memos are sufficiently detailed to be incorporated directly into the final write-up of the theory (Strauss & Corbin, 1990). A sample memo from the present study is presented in Appendix B.

Strengths and Weaknesses of Grounded Theory

No methodological approach is perfect. Like all methods employed by psychologists, grounded theory has specific strengths and weaknesses. Several of these are discussed below.

Strengths. Perhaps grounded theory's greatest strength is its capacity to generate theory. The development of new theoretical perspectives can pave the way for significant breakthroughs by recasting old problems in a new light, or by suggesting new directions for research that previously had been dismissed or overlooked.

A second advantage of grounded theory is that it provides psychologists with a relatively straightforward and systematic approach for dealing with qualitative data. Qualitative data are often neglected in psychological research because they do not fit nicely into the standard quantitative paradigm taught in most graduate training programs. This is unfortunate given that qualitative approaches constitute a potentially rich source of psychological information, and open up new possibilities for psychological research. For example, qualitative approaches enable psychologists to investigate new topics that would be difficult to assess using quantitative methods. Qualitative approaches also enable researchers to re-assess old familiar phenomena from a new perspective.

A third strength of the procedure is that it encourages intimacy with one's data. Each case is studied in detail, initially to generate categories and later to assess how well the case fits the developing theory. In quantitative studies, researchers tend to be further removed from their data; mean differences between aggregates are emphasized, while the variation that occurs within these aggregates is often left unexplored.

Weaknesses. Grounded theory suffers from several important weaknesses. First, grounded theory analyses, although systematic and rigorous, are inherently subjective. As Rennie et al. (1988) note,

> it is recognized that the researcher is a mediator of the phenomenon under investigation and that different investigators might develop somewhat different views of the same phenomenon, each of which may be credible within its own limits.

But given that the method requires that analysts ground their theories in data, the theories produced by different analysts are likely to be complementary rather than competing explanations of the phenomenon under investigation. Thus, although grounded theories are subjective, their subjectivity is constrained by the social reality in which the data are grounded. These constraints should help prevent wildly divergent or opposing accounts from emerging.

Closely tied to the problem of subjectivity is the issue of coding reliability. In traditional content analysis, several observers independently code the same data set, and a measure of inter-observer reliability is computed. High reliability indicates that observers can agree about what constitutes and what does not constitute an instance of a given conceptual category.

The grounded theory approach to theory generation makes standard tests of reliability unfeasible. Given that coding categories are constantly being developed and modified as the study proceeds, it is unclear at what stage of the analysis one would test for reliability. Of what use would it be to demonstrate that independent raters generate similar categories during initial coding when these categories are almost guaranteed to change as the analysis proceeds? Similarly, it hardly seems fair to compare the primary researcher's final categories, which may have taken months to develop, with those generated by an independent rater who has not worked as extensively or intimately with the data.

A grounded theory gains its credibility through its persuasiveness, not through the agreement of independent observers (Rennie et al., 1988). Analysts attempt to persuade their readers of the validity of the analysis by explicitly outlining how inferences were drawn, and documenting each category with examples from the original transcripts. This allows readers to decide for themselves whether or not they agree with the categorization and the logic of the analysis.

Despite these arguments, I decided that some form of reliability analysis would be desirable to act as a check on my interpretation of the protocols. The analysis involved determining whether an independent coder could accurately code segments of the protocols using my final categories. This approach does not address the issue of whether categories can be reliably generated by independent coders, but rather whether independent coders can reliably classify unstructured data into categories that have already been derived during the preliminary analysis. Further details about the reliability analyses are reported in Appendix D.

A second potential weakness of grounded theory involves the issue of generalizability. Grounded theory is extremely labour-intensive, resulting in practical limitations with respect to the number of cases that can be feasibly included within a single study. Because relatively few cases are actually examined, the generalizability of grounded theories is brought into question. According to Rennie et al. (1988), there is no simple solution to this problem; limited generalizability is accepted as a legitimate price to pay for getting close to one's data.

> It is intimacy with the phenomenon that grounded theorists seek much more than external criteria of ad. juacy such a generalizability derived from random sampling of a large number of individuals. Once again, the object of the approach is to create new theory that is directly tied to the reality of individuals. The object is not to verify the theory so generated beyond the verification yielded by saturation of categories. Additional verification is deliberately left to subsequent studies and/or other investigators (p. 147).

Conclusion. Subjectivity and lack of generalizability are legitimate limitations of the grounded theory approach, but are they sufficient to justify not using the procedure in the present study? In my opinion, the answer to this question is "Absolutely not!" The potential benefits associated with using grounded theory in this project far outweigh the costs. To date, most psychologists have investigated decision making in commons dilemmas using structured measures, quantitative methods, and tight experimental control. With its emphasis on qualitative features and case by case analysis, grounded theory represents a promising new approach for understanding decision making in commons dilemmas.

CHAPTER 3

METHOD

Participants

Eleven females and five males served as participants. Eleven were undergraduate psychology students, three were graduate students, one was a computer technician, and one was a high school student. Approximately half the undergraduates participated for additional course credit. All other participants were not remunerated, other than being given a chance to win their earnings in a lottery. The details of the lottery are described later in the chapter.

Pool-Size Uncertainty and Social Values

Participants were randomly assigned to one of two pool-size uncertainty conditions. Those in the certain pool-size condition were provided with feedback about the exact number of points (representing fish or trees) remaining in the pool following each harvest trial, whereas participants in the uncertain pool-size condition were provided with a range of possible pool sizes. The magnitude of the range was 5 points, that is 42% of the initial pool size of 12. Participants were told that all pool sizes within the range had an equal probability of being the actual pool size, although, in actuality, the range was centered around the actual pool size. For example, if the actual number of points in the pool was 8, participants in the uncertain pool-size condition were told that there were somewhere between 6 and 10 points available for harvesting.

Social values were measured using Kuhlman and Marshello's (1975) decomposed game procedure. This procedure is commonly employed in commons dilemma research, and has been succinctly described by Samuelson and Allison (1994):

> The value measure consisted of nine three-choice decomposed games in which participants were asked to choose which self-other outcome combination they most preferred. For each game, one pair of values represented maximization of joint outcomes (cooperative), one pair represented maximization of outcomes to self only (individualistic), and the final outcome pair maximized relative gain to self (competitive) (p. 10).

Participants were classified into one of the three social-value categories based on their responses. If they consistently preferred one outcome type over the others (as exemplified by choosing that outcome type in at least six of the nine decomposed games), they were classified into the category corresponding to that outcome. Participants who did not choose any one outcome type in six or more of the games were classified as having mixed social values. As in many previous social values studies (e.g., Kramer et al., 1986; Samuelson & Allison, 1994; van Lange & Liebrand, 1989), participants with competitive and individualistic social values were collapsed into one group, labeled noncooperative.

Hardware

The resource-management simulation developed for the present study was written in Turbo Pascal, and was run on an IBM compatible personal computer. Harvest choices were recorded by the computer and stored in a data file created by the program. The participants' verbal protocols were taped by a portable cassette recorder adjacent to the computer.

Procedure

Upon arriving at the laboratory, the participants were given a brief written description of the study, and were asked to sign a consent form. All agreed to sign the form. The participants were then told that the experimental simulation was not quite ready, and were asked to complete three questionnaires that were ostensibly being developed by the experimenter's supervisor for purposes unrelated to the present study. The second of the three questionnaires was Kuhlman and Marshello's (1975) social values measure.

After completing the pre-experimental measures, participants were given several warm-up exercises to familiarize themselves with the think-aloud procedure. These exercises were adopted from Ericsson and Simon (1984), and involved thinking aloud while naming 20 animals, and recalling the number of windows in one's house. The experimenter worked through several examples himself before asking the participants to complete the warm-up exercises.

Following the warm-up exercises, the rules of the commons dilemma simulation were explained to the participants. The experimenter's script is reproduced below.

OK, now we're ready to begin the main experiment. The resource management exercise involves harvesting from a pool of points (representing fish or trees) that you share with two other group members. In this particular study, the other members of your group will be simulated by the computer. But I want you to pretend that they are actually real people. The main goal of the exercise is to acquire as many points for yourself as possible over the course of the game. You should know, however, that there may be more than one way to achieve this goal, and that there is no one correct way. Do you understand, so far?

The pool will initially have 12 points in it [participants in the uncertain pool size condition were told that the pool will initially have somewhere between 10 and 14 points in it, and that each value within the range had an equal probability of being the actual pool size]. Each group member will be able to harvest between 0,1,2, or 3 points from the pool during each harvest trial. Following each trial, the number of points remaining in the pool will double. For example, if there are 4 [3 to 5] points remaining in the pool following trial 1, 8 [6 to 10] points will be available for harvesting at the beginning of trial 2. Note however, that the number of points in the pool can never exceed the original pool size, that is, 12 [10-14] points. For example, if 8 [7-9] points are left in the pool after Trial 1, the pool will only replenish itself to 12 [10-14] points for the beginning of Trial 2.

Following each trial, I will provide you with feedback about how many points you and the other group members harvested from the pool during that trial, as well as the number of points remaining in the pool, and the points available for the next trial. The game will last 10 trials or until all the points are drained from the pool, if that happens before the tenth trial.

As in the real world, the resource units used in this simulation are valuable. Each point that you harvest will be worth $3. I can't afford to pay everyone for the points they take. However, after I finish this study I will conduct a lottery in which three individuals will win their actual earnings. For example, if you harvested 10 points over the course of the simulation, and your name was drawn in the lottery, you would receive $30. If you harvested 2 points during the simulation, you would receive $6. Are there any questions before we begin?

At this point, the experimenter produced a sample feedback sheet and provided a concrete demonstration of how the resource management simulation would proceed. This sheet was identical to the feedback screen to be used in the computer simulation. Following the practice session, the experimenter turned on the computer and started the simulation for the participant. He told the participants to proceed at their own pace, and reminded them to verbalize everything that they were thinking as they worked through the task. For the first 13 cases the experimenter waited outside the computer room while the participants completed the simulation. For the last three cases, the experimenter remained in the room. This change in procedure was implemented to help ensure that participants verbalized their thoughts clearly and constantly as the simulation progressed.

The introductory screen of the simulation restated the rules and objectives of the resource management task. The second screen instructed the participant to turn on the tape recorder and answer the following question: "Do you have an initial action plan for maximizing your point total during the resource management simulation? If yes, please describe it, even if it seems vague or incomplete."

After answering this initial question, the participants were prompted to begin the actual simulation. As noted earlier, the simulation was programmed to continue for 10 trials or until there were no points remaining in the resource pool. The responses of the Green and Blue (computer) players were preprogrammed to ensure that the pool was extinguished prior to the tenth trial. Green, the noncooperative computer player, was programmed to cooperate (i.e., take two points from the pool) on the initial trial of the simulation, and defect (i.e., take three points) on all subsequent trials. Blue, the primarily cooperative computer player, was programmed to harvest two points from the pool on Trials 1 and 2, one point on Trials 3 through 6, two points on Trial 7, and three points on Trials 8 through 10. In all but two cases the pool was extinguished before Blue became noncooperative.

At the beginning of each harvest trial, the computer prompted the participants to continue to think aloud and reminded them not to edit their speech. After each trial, feedback was provided about the number of points harvested by each of the three harvesters, the total number of points taken from the pool, and the number of points remaining in the pool prior to and after regeneration. A sample feedback screen is presented in Appendix C, and the transcribed protocols are in Appendix E.

Following the simulation, the experimenter interviewed all participants. The interviews were used to supplement the protocol data, and provide additional information about motives and emotions. During the interviews, participants were asked to review the simulation trial by trial, recount what they were thinking as they made their choices, and describe which, if any, emotions they had experienced. Additional questions, related to issues that arose during the analysis, were added to the interview as the study progressed. These questions are described in the results section.

Following the post-experimental interview, participants were fully debriefed and thanked for participating. In a handful of instances, participants were contacted after the experimental session to clarify ambiguous passages in their protocols.

Analysis of the Verbal Protocols and Post-Experimental Interviews

The verbal protocols and interview transcripts were analyzed using grounded theory following the steps described in Chapter 2. The analysis involved identifying the main motivational, cognitive, and emotional factors underlying harvest choice, and organizing these factors into a framework describing the main strategies that participants employed to achieve their harvest goals. Most of the analyses reported in Chapter 4 were conducted using AQUAD 3.0 (Huber & Marcelo Garcia, 1991), software designed for coding and identifying linkages in qualitative data.

Keep in mind that the primary goal of grounded theory is to identify promising relationships among categories, not to provide rigorous tests of hypotheses. Thus, few significance tests are included in the sections that follow. Effect sizes, however, are often reported to provide a rough estimate of the magnitude of the associations discussed.

CHAPTER 4

RESULTS

Harvest Choices

On average, participants harvested 1.80 (SD = 0.55) points per trial, managed the resource pool for 4.94 (SD = 1.57) trials, and acquired 8.56 (SD = 2.00) points over the course of the simulation. Three main harvest patterns were identified. Nine participants displayed a cooperative pattern in which they decreased their harvests in response to pool-depletion feedback. An intriguing variant of the cooperative pattern was also identified in which participants decreased their harvests as the pool declined until late in the game when they took the maximum number of points allowable. These late-trial defections were relatively common, occurring in four cases. Two participants displayed a noncooperative pattern in which they made large harvests throughout the simulation, regardless of the number of points remaining in the pool. Only one participant [13] could not be classified into one of the three main categories. This participant began the simulation by taking very few points, gradually increased her harvests as the pool began to decline, and then tapered off when the pool got very low. The coding rules and inter-coder reliabilities for harvest patterns are presented in Appendix D.

The Core Category: Goal Satisficing

In grounded theory, the core category is the central phenomenon around which all other categories are integrated (Strauss & Corbin, 1990). It represents the glue of the theory, and accounts for most of the variation in the patterns of cognition and behavior observed in a study (Strauss, 1987). The core category that emerged in the present analysis was labeled goal satisficing. Participants almost always adopted or formulated specific harvest goals prior to and during the simulation. These goals, in turn, guided the decision-making process, determining what action strategies were employed, and ultimately, how many points were harvested from the pool on each trial. However, given that few participants systematically evaluated alternative strategies, or attempted to formulate optimal strategies to achieve their goals, goal satisficing was considered a more accurate label for the core category than goal optimizing or goal achievement.

Harvester goals appear to arise from two main sources: the experimenter, and the participants themselves. During the instruction period preceding the simulation, the experimenter outlined the primary objective of the game. "The main goal of the exercise is to acquire as many points for yourself as possible over the course of the game." This goal was reiterated by the computer when the simulation began. In short, the resource management simulation was framed as a problem-solving exercise in which the primary goal was to maximize one's points.

Almost all participants accepted the point-maximization goal as framed by the experimental instructions. "I was teetering between taking one and two [points], but the point of the thing was to maximize my grab so I went for two points." [1] "What I was trying to do was to get everyone to take two each time, which is most efficient. Then we'd all end up with 20 instead of now when we all end up with a lot less." [4] "I was just trying to maximize my points, which is what I was told to do." [5] "I was trying to maximize my total, and at the same time using pool size as a factor; it was still quite large so I didn't feel guilty about taking more." [10] "I was still thinking that OK I have to maximize my points. So I was thinking do I go zero, or do I go one." [14]

Goals other than point maximization were also often adopted. In some instances, participants devised strategic subgoals, that is, "mini-goals" they believed would help them maximize their points (e.g., maintaining the pool for as many trials as possible, and eliciting cooperative responses from others). In other instances, participants formulated goals that were more or less orthogonal to point-maximization. One participant, for example, indicated that in addition to maximizing her points, she also wanted to "stay ahead" of her competitors.

Although most participants added goals that were subsidiary to, or at least consistent with, personal point-maximization, one participant rejected this goal outright and replaced it with a new goal that was more consistent with her moral orientation.

> I believe in the interdependence of us all and... if I maximize my point count then someone else is going to be minimized, and ultimately I

> believe that is going to hurt me. And if not me, it's certainly going to hurt my children and grandchildren, and people down the road. And so the whole notion of maximizing at some else's expense is repugnant to me and has long been repugnant to me. I'm much more interested in maximizing for everyone; some sort of cooperative way of maximizing what everybody gets. I'm prepared to take a little less if I can be sure that other people get a fair share too.

Thus, even though the objective of the simulation (i.e., maximizing one's personal point-total) was clearly outlined on several occasions, this did not ensure that all participants adopted this goal, nor did it prevent additional goals from being adopted.

Summary

The resource-management task was framed as a problem-solving exercise in which the primary goal was to harvest as many points as possible over the course of the simulation. Most participants adopted this goal, but also formulated supplementary goals such as preserving the pool and accumulating more points than others. Subsequent sections of this chapter describe the specific action strategies that participants employed to accomplish their harvest goals. The coding rules and inter-rater reliabilities associated with each action strategy are presented in Appendix D.

Action Strategies

A review of the verbal protocols and interview transcripts revealed that the participants employed a variety of action strategies to maximize their point totals and accomplish their other harvest goals. These included: developing initial harvest plans, monitoring pool size and others' behavior, developing expectancies about others, simulating possible outcomes, and attempting to elicit cooperation from others. Each of these will be discussed in the sections that follow.

Initial Harvest Plans

Prior to the simulation, participants were asked whether or not they had developed an initial plan to help maximize their point totals. Although the majority of participants (12 of 16) indicated that they had a plan, most plans were vague and imprecise, consisting of no more than a sentence or two. In fact, only one participant [4] systematically evaluated several courses of action before finally settling on one.

> Well, obviously what you want to do is you want to, among the three people, take a total of six because that way you get the most regeneration over the next trial and you take the most that you can. So you want to take a total of six. And since there are three people, obviously what you want to do is to take your maximum which is three, and get the others to take like two and one, or one another person to take three. But obviously, they're going to want to take as much as they can too. So if you try and be equal, if you try to all take the same thing, then that would be two. But if you wanted to take advantage then you would want to take three, but then they're going to want to take three too, then there would only

> be three left and you would eventually lose your resource. So obviously what you would try and do is to convince everyone to take two, so that you take six, you get back to 12, you take six each time. But then of course the problem is that you don't get enough for yourself because you only take two each time and you only get a total of 20. Then you can get into a competitive thing where everyone takes the most which is three and you won't get as many over the long run, so the idea is to get everyone to take two.

Major Themes

Two major themes (pool preservation, and monitoring and adjusting) and two minor themes (fairness and equality, and competition) were identified in participants' initial harvest plans. The frequencies associated with each of these themes are presented in Table 4.1.

Table 4.1

Themes in Participants' Initial Harvest Plans

Theme	Frequency
Pool Preservation	6
Monitor and Adjust	6
Fairness/Equality	2
Competition	1
No Initial Plan	4

Some initial strategies were coded into more than one category, thus the frequencies do not sum to 16.

Pool preservation. Six participants indicated that they intended to keep the resource pool at a high level and/or make the game last as many trials as possible. "I guess my strategy would be to take some points, but to make sure that there is enough left over so that when they double you're always at a pool of somewhere around 12." [2] "My strategy for harvesting the fish or the trees is to not take too many trees the first couple of times, and try and keep the stock up." [7] "I think the strategy that I will use for maximizing the total points during the simulation would be to have [the simulation] go over the 10 trials..." [8] These excerpts suggest that a substantial proportion of the sample realized that they could acquire more points in the long-term by restricting their harvests in the short-term.

Of the six participants who indicated that the they intended to preserve the pool, five displayed cooperative harvest patterns, that is, they reduced their harvests as the pool declined. Thus, most participants with pool-preservation plans harvested in a manner that was consistent with their initial plans throughout the simulation. The only exception was Participant 4, who cooperated on most trials, but defected late in the simulation when it became clear that Green was about to extinguish the resource pool.

Monitoring and adjusting. Monitoring and adjusting was the second major theme present in participants' initial harvest plans. Six participants indicated that they intended to closely monitor the pool and others' choices, and then adjust their harvests to fit the needs of the situation. "I think I'll start out in the middle of things and see how the other players go, and adjust my scores accordingly." [14] "I would like to start off by accumulating a few points, and then taper off depending on what the competition is doing." [6]

Although most participants with monitor-and-adjust strategies did not explicitly state that they intended to make adjustments that would help preserve the resource pool, their subsequent harvest choices suggest that preserving the resource was an important underlying motive. Of the six participants who indicated that they planned to monitor and adjust, four displayed cooperative harvest patterns. In short, pool preservation appears to have been an implicit subgoal for most participants' with monitor and adjust strategies.

Minor Themes

Fairness and equality. Several themes that I expected to be important were rarely mentioned by participants when they discussed their initial plans. For example, only two participants raised the issue of dividing the resource fairly and equally among all group members. Participant 3 indicated that she was willing to take less for herself to ensure that others also got their fair share. "I'm much more interested in maximizing what everyone gets. I'm prepared to take a little less if I can be sure that other people will get their fair share too." Participant 4 also indicated that he was in favour of distributing the points equally. However, this decision appears to have been based more strategic principles than moral ones. "So if you try and be equal, if you try to all take the same thing, then that would be 2. But if you wanted to take advantage then you would want to take 3, but then they're going to want to take 3 too... Then you get into a competitive thing where everyone takes the most which is 3, and you won't get as many in the long run..."

Although only two participants mentioned fairness and equality when describing their initial harvest plans, eight participants harvested two points from the pool on the initial trial of the simulation, an amount that suggests these participants were attempting to strike a balance between equality with optimality. If all group members harvested two points on each trial, all would receive an equal number of points over the course of the game, and the pool would be maintained at its maximum level indefinitely. A review of the verbal protocols, however, failed to support this interpretation. Although equality appears to have been an underlying motive for several players, most indicated that they harvested two points on the initial trial for other reasons. "I decided to choose two to sort of see what would happen, how the other participants would line up and if that had any relationship to what I had taken." [8] "It wasn't as greedy as three, and it was more than one. I thought that it was a safe number to take." [12] "I thought that two would be good because it's right in the middle. It's not too much to start off with, but it's not too little." [14] "I didn't want to start off with three, to take too many. But I also didn't want to start off too low so that Green and Blue would be ahead of me." [15]

Competition. A second theme that I thought might be important, but was rarely mentioned, was competition. Although several participants referred to Green and Blue as competitors, only one [10] explicitly stated that she wanted to acquire more points than the other players in her group when asked about her initial strategy.

Interestingly, this participant abandoned this goal early in the simulation. When the pool began to decline, she took fewer points than either of the two computer players.

No initial plan

Four participants were coded as having no initial harvest plan. "Until I see what is exactly going on with the simulation, I have no idea what to expect. So I don't have a strategy right now." [5] "I don't really know what this is about yet. So I guess I'll just see as it goes along and try to think up a strategy." [11]

Not having an initial plan was associated with three main consequences. First, all participants (4 of 4) who did not have an initial strategy reported feeling confused at the start of the simulation or displayed behavior clearly indicative of confusion (e.g., attempting to take more than the maximum allowable points from the pool on the initial trial). In contrast, only 2 of the 12 participants who had initial plans reported feeling confused or displayed obvious symptoms of confusion.

Not having an initial strategy also was linked to high initial harvests. Three of the four participants who did not have an initial plan harvested the maximum number of points allowable on the first trial of the simulation, as opposed to only three of twelve of the participants who had an initial plan. It appears that when participants are confused and unclear about how to proceed, they attempt to maximize their point totals through the most obvious means available, that is, by harvesting as many points from the pool as the rules allow.

Finally, not having an initial plan also was associated with high rates of defection late in the simulation. Three of the four participants with no initial plan displayed shifting harvest patterns; they initially decreased their harvests in response to pool-depletion feedback, but defected late in the simulation when the pool was nearly depleted. In contrast, only one of the twelve participants with initial strategies displayed this pattern. That the "no initial plan" participants initially reduced their harvest when the pool began to decline indicates that they were somewhat motivated to preserve the pool. However, the high rate of late-trial defections suggests that their committment to pool preservation was not as strong as for those participants who explicitly indicated at the beginning of the simulation that they intended to preserve the pool. Recall that this latter group tended not defect even when pool extinction appeared imminent.

Summary

Before the simulation began, participants were asked whether they had formulated a plan to maximize their point totals. Most indicated that they had a plan, although many of these turned out to be vague and imprecise. A common strategy involved maintaining the resource pool at a relatively high level so that the group could harvest points over a longer period of time. All participants who indicated that they intended to preserve the resource pool decreased their harvests as the pool declined, although one increased his harvests late in the game when he perceived that the pool was about to be extinguished. A second common plan was to wait and see how the simulation unfolded and then adjust one's harvest decisions to fit the needs of the situation. Finally, relative to participants who had initial plans, participants without initial plans were more confused, made larger initial harvests, and were more likely to shift from a cooperative strategy to a noncooperative strategy late in the simulation.

Monitoring

Most participants monitored pool size and others' harvests very closely during the simulation. In general, participants appeared to attend to aspects of the simulation that were most relevant to their harvest goals.

Monitoring Pool Size

Explicit references to pool-size were coded for 61% of all harvest trials, indicating that participants regularly attended to this feature of the simulation. Moderate levels of pool-size monitoring occurred during the first two trials of the simulation. But as the resource began to decline, attention to pool size increased and remained high for the remainder of the simulation (see Table 4.2). This pattern of responding is not especially surprising given that most participants had adopted point-maximization strategies that involved sustaining the resource pool for as long as possible.

Not all participants monitored pool size closely; Participants 5 and 15 made no references to pool size in their protocols. Interestingly, both participants consistently defected across trials. Participant 5 represents an interesting case because, unlike most participants in this study, he failed to make the association between pool-preservation with point-maximization. When asked whether he realized that it was possible to acquire more points in the long run by preserving the pool, he responded "No, I was just trying to maximize my points which is what I was told. So... yeah, I never thought of that." Participant 15's protocol also contained no references to pool size. Like Participant 5, this participant consistently defected across trials and appeared to be more concerned with acquiring more points than others than preserving the pool. Taken together, these two cases suggest that individuals may only monitor aspects of the simulation that are relevant to their goals.

Table 4.2

Breakdown of Monitoring by Harvest Trials

Harvest Trial

	1 (n=15)	2 (n=15)	3 (n=15)	4 (n=13)	5 (n=9)	6 (n=4)	7 (n=4)	8 (n=2)	Total
Pool Size	5	8	12	9	6	3	2	2	47
Green and Blue		13	5	5	2				25
Green Only			7	4	4	2	2	1	20
Blue Only									0
SOC Harvest		7	2		2				11
SOC Points			2	2					4

Values in the table are frequencies, and refer to the number of cases in which references were made to pool size, others' harvests, etc. SOC Harvest refers to self-other harvest comparisons. SOC Points refers to self-other comparison of cumulative point totals. Participant 12's protocol could not be transcribed, and therefore is not included in the analysis.

Pool-depletion feedback was strongly related to harvest choice, providing further evidence that monitoring plays an integral role in the decision-making process. The Pearson correlation between average points taken per trial and average points available per trial was r (6) = .95, $p < .001$; participants tended to reduce their harvests as the pool declined (see Table 4.3). However, note that this correlation is based on aggregate data and glosses over much of the interesting variation occurring at the case level. For example, recall that several participants consistently defected across trials, and others increased their harvests late in the simulation when the pool was close to extinction.

Table 4.3

Breakdown of Points Available and Points Harvested by Harvest Trials

Harvest Trial

	T1	T2	T3	T4	T5	T6	T7	T8
Points Available	12.00	11.25	9.00	8.25	6.77	6.44	6.00	5.00
Points Harvested	2.25	2.13	2.00	1.56	1.31	1.25	1.00	0.50

Values in each cell are means (the average number of points available for harvesting during each harvest trial, and the average number of points harvested during each trial).

Monitoring Others' Harvests

Most participants also paid close attention to the harvest choices made by other members of their group. Participants tended to monitor the choices of both Blue and Green during the early trials of the simulation. However, as can be seen in Table 4.2, when the pool began to decline many shifted their exclusive attention to Green (the noncooperative player). "This Green participant seems really greedy, so the pool is going down instead of up." [8] "Green took a lot again... If Green keeps taking more, then we're going to run out and not have much more to take from." [7]

This shifting pattern of attention is consistent with the view advanced earlier that participants monitor features of the simulation that are most relevant to their harvest goals. Given that Blue repeatedly cooperated across trials, (s)he was not perceived to be a threat to the resource or an obstacle to pool preservation. Green's choices, on the other hand, were inconsistent with preservation, and therefore warranted more attention. Interestingly, most participants did not respond to Green's repeated defection by defecting themselves. They appeared to be more concerned with stopping the pool's decline.

Monitoring others' harvests sometimes involved an element of self-other comparison. "OK, it appears that they are not going to be as greedy as I am." [1] I got three, and they got two each." [3] "We all chose two. That seemed to work out really well." [7] Self-other comparisons occurred most often during the second trial of the simulation, but infrequently after that (see Table 4.2). These comparisons appear to serve an orientation function. Participants were often uncertain about how to choose early in the simulation, so they compared their choices with others to determine whether they were responding appropriately. In several instances, participants adjusted their harvests to conform with what others had taken. "OK, they took two points... I'm not sure why they're taking that many points. Maybe I'll just take two this time." [16]

<u>Monitoring Cumulative Point Totals</u>

Explicit self-other comparisons of cumulative point totals were relatively rare, occurring on only 5% of all trials (see Table 4.2). Once again, this is consistent with the interpretation that participants' goals are an important determinant of what features of the simulation are monitored most closely. Given that few participants expressed an interest in acquiring more points than others or ensuring that the points in the pool were equally distributed, it makes sense that few point-total comparisons were made. Self-other point-total differences simply were not relevant to most participants.

What is the relationship between self-other point-total comparisons and harvest choice? It seems reasonable to suggest that unfavourable comparisons may serve as a precursor to defection. For example, when participants realize that they have acquired fewer points than others, a natural inclination might be to increase their harvests to narrow the difference. No evidence was found to support this hypothesis. Two cases were identified in which unfavourable point-total comparisons were made, and in both cases participants reduced their harvests on the subsequent trials. In general, participants appeared to be more concerned with preserving the resource than ensuring that points were allocated equally. The following excerpt from Participant 3's protocol is consistent with this interpretation.

> The Green one who has been taking three now has eight. I have five and that other person [Blue] also has five. And we're not getting anywhere because the pool size is decreasing at all times. OK there's only two points left. Well if there's only two points left... one person is dominating the whole show here. But that's no

reason... it's a limited resource... so that's still no reason to increase what I'm taking...[3]

Summary

Most participants closely monitored pool size and others' harvests during the simulation. Self-other comparisons of harvests and cumulative point totals occurred, but were relatively rare. Monitoring tended to shift across trials; as the resource pool began to decline, participants attended more closely to pool size and to the noncooperative (Green) player's harvests. In general, factors that threatened to prevent participants from attaining their harvest goals attracted more attention than nonthreatening factors. A strong link between pool-size monitoring and harvest choice was also found. In short, participants not only attended to pool size, but also adjusted their behavior in response to this cue.

Expectancies

In commons dilemmas, personal outcomes are dependent not only one's own harvest choices, but also by the choices made by the other members of the group. Cooperating can produce positive outcomes if others also cooperate. However, if others defect, the cooperator is left with a sucker's payoff. Because self's outcomes are tied to others' harvests, it is clearly advantageous to develop expectancies about how others will act, and to use this information to make choices that are most likely to produce goal-consistent outcomes. Perhaps the most straightforward way to develop expectancies is to ask others how they intend to harvest. However, group members were not permitted to communicate in the present simulation, so alternative approaches had to be employed. These are discussed in the sections that follow.

Origin of Expectancies

When the simulation began, most participants (eight of the nine who could be classified for Trial 1, see Appendix D) indicated that had not yet developed expectancies about how others in their group would approach the task. "I had no clue what they were going to do [12]." "I have no idea what to expect. [4]." Perhaps this not too surprising given that participants knew little about the other players in their group. Had more information been provided about others' personality, financial status, etc., the number of initial trial expectancies may have been considerably higher. The one participant [11] who reported expectancies for Trial 1 indicated that she expected both Blue and Green to harvest 3 points (the maximum number of allowable).

All participants developed expectancies as the simulation progressed. In general, expectancies were consistent with the feedback provided about others' choices, that is, most participants came to expect Green to defect and Blue to cooperate. The high correspondence between feedback and expectancies suggests that most participants acted like trait theorists, and assumed that past behavior would be a useful predictor of future behavior. They carefully monitored others' harvests, attempted to identify a pattern, and based their expectancies on that pattern.

Inconsistencies between feedback and expectancies arose, but only occasionally. Several participants indicated that they expected Green to cooperate, even after receiving feedback that Green had defected for several trials in succession. These participants appear to have based their expectancies primarily on situational factors rather than others' past behavior. Their protocols indicate that they assumed that pool-depletion feedback would cause Green to reduce its harvest. "...so that lowered the points to eight. I thought for sure that Green would drop the points, but he or she didn't [2]." "I could see the pool was getting low in size and I didn't want to take any more points at that point. And I expected my competitors to do the same, but... [6]." "Basically the reason I did that was just to get the pool back up to a higher size. I didn't think Green would take three again. [16]" In short, these participants acted more like traditional social psychologists, believing that Green's predisposition to defect would be overwhelmed by situational factors.

Rate of Development

A breakdown of expectancies by harvest trials is presented in Table 4.4. Most participants developed expectancies relatively rapidly, usually by the third or fourth trial of the simulation, although some variation was evident. As noted earlier, one participant developed expectancies at the outset of the simulation, prior to receiving feedback about others' choices. Two others, Participants 12 and 13, did not develop expectancies about others until Trials 7 and 8, much later than the norm. Both late-developers indicated that they paid little attention to others' harvests (the main source of expectancy generation for most participants) during the simulation.

"I didn't really think about Green and Blue that much. I was just more worried about what I was taking and the pool size." [12]. "I think I was concentrating more on pool size for some reason." [13] These excerpts provide further support for the contention that monitoring others' harvests is an important source of expectancies about others. When individuals fail to monitor others' harvests, they tend not to develop expectancies about others.

Table 4.4

Breakdown of Expectancies by Harvest Trials

Harvest Trial

	T1 (n=16)	T2 (n=16)	T3 (n=16)	T4 (n=13)	T5 (n=9)	T6 (n=4)	T7 (n=4)	T8 (n=2)
E0	8	8	3	1	1	2	1	0
EGD	1	0	3	3	4	1	2	1
EBD	1	0	1	1	0	0	0	0
EGC	0	1	1	3	0	0	0	0
EBC	0	1	2	5	3	0	0	0
Unclass	7	7	9	6	4	1	1	1

In several instances, participants reported having more than one type of expectancy, thus the frequencies for each column will not always sum to n. E0 indicates that the participant had no expectancies. EBD and EGD indicates the participant expected Blue to defect and Green to defect, respectively. EBC and EGC indicates that the participant expected Blue to cooperate and Green to cooperate, respectively. Unclass indicates that expectancies were not reported or could not be classified. See Appendix D for a more detailed discussion of the coding rules used for this category.

Expectancies and Harvest Choice

The breakdown of harvest decisions by trials and expectancies presented in Table 4.5 indicates that participants tended to cooperate (i.e., take few points from the pool) when they expected both Blue and Green to cooperate, and defect (i.e., take the maximum allowable) when they expected both Green and Blue to defect.

On trials in which participants expected only Green to defect, harvest choices were less uniform; some restrained their harvests, whereas others did not.

The protocols suggest that most of those who cooperated when they expected Green to defect believed that their long-term interests would be best served by preserving the pool. They hoped that if they kept the pool alive, Green would eventually "see the light" and become cooperative. "I think I'll take 1 again and hope that Green will notice that it's taking everything." [4] "I wonder if I tried it [taking zero] one more time. Is that being foolish? Is that being a patsy or is that giving the other guys a chance to see the light?" [3] "I thought that maybe if I took less, maybe the other competitors would take less, and therefore increase the pool." [10] This suggests that participants' immediate expectancies about Green were not a critical determinant of harvest choice in these cases. Of greater importance was the belief or hope that Green would eventually cooperate before the resource was extinguished.

Several others noted they felt a moral responsibility to try to preserve the pool, regardless of what others were doing. Thus, even though they expected Green to continue to defect and eventually deplete the pool, they were unwilling to defect themselves. This selfless commitment to conservation may have been partially elicited by the experimental instructions which asked the participants to "try to act as if you were managing a real resource (like fish or trees) in the real world." Although, it may also reflect enduring values held by these participants.

Most participants who defected when they expected Green to defect did so late in the simulation. The main precipitating factor of these late-trial defections appears to be lost hope; participants finally came to the realization that Green was unlikely to cooperate, and as a consequence, decided to take as many points for themselves before the pool was extinguished. "Well if there's two left... I may as well take two. Otherwise I won't get anything..." [4] "I thought that I'm going to take three because I figured that because it always took three that it would probably take three again. I thought that I better get some points in here." [11] "I thought that the pool was getting really small, and if I didn't do it now [take three], I would lose my chance." [16]

Although lost hope appears to be the main reason why participants defected when they expected Green to defect, it was not the only reason. For example, Participant 11 indicated that she harvested three points from the pool on the initial trial of the game because there seemed to be many points available, and she expected others to also take three for the same reason.

P11: Well I just figured that there were a lot...so I thought that I would take as many as I could.

E: Had you developed expectations about how Green and Blue would behave on that particular trial?

P11: Yeah, at first I thought that they would take the same amount...

E: The same amount as you?

P11: Yeah, the same amount as me.

In this case the participant's expectancy that others would defect coincided with her decision to harvest three points from the pool, but the two factors do not appear to be causally linked. Instead, both the expectancy and the harvest decision appear to be caused by a third factor, the participant's perception that there were many points available in the pool.

Summary

Expectancies reduce the uncertainty associated with othe..' choices, and enable harvesters to make choices that are more likely to produce goal-consistent outcomes. Most participants indicated that they had no expectations about others on the initial trial of the simulation. By the third or fourth trial, most participants had developed expectancies. Participants appeared to rely heavily on feedback about others and pool-size to develop their expectancies. Participants tended to cooperate when they expected both others to cooperate, and defect when they expected both others to defect. If only Green was expected to defect, harvest choices varied. Most participants cooperated if they believed that Green would eventually cooperate. However, if they lost hope that Green would ever cooperate and perceived the pool to be on the verge of extinction, they often increased their harvests.

Table 4.5

Breakdown of Harvest Choice by Expectancies and Points Remaining in Pool

Points Remaining in Pool

Expectancy	**1-3**	**4-6**	**7-9**	**10-12**
Expect Blue and Green to Defect	0 1 2 * 3	0 1 2 3 *	0 1 2 3 *	0 1 2 3 *
Expect Blue or Green to Defect	0 ** 1 2 ** 3	0 ** 1 *** 2 3 **	0 1 * 2 3 *	0 1 * 2 ** 3 **
Expect Blue and Green to Cooperate	0 1 2 3	0 * 1 2 3	0 1 * 2 * 3	0 1 * 2 * 3
No Expectancy	0 1 2 3	0 1 2 3	0 1 * 2 * 3	0 1 **** 2 ************ 3 ******
Unclassifiable	0 * 1 2 * 3	0 *** 1 *** 2 * 3 *	0 * 1 ** 2 * 3	0 * 1 *** 2 ********* 3 *****

Numbers are possible harvest choices. Each asterix denotes one occurrence of a given harvest choice. See Appendix D for a more detailed discussion of the coding rules used for this category.

Simulating Possible Outcomes

Simulating possible outcomes represents yet another action strategy that participants employed to achieve their harvest goals. Prior to actually making their harvest decisions, participants often worked through the potential consequences of their own choices and the choices of others, and then used this information to make harvest decisions that they believed would produce goal-consistent outcomes.

Participants simulated possible outcomes on just under half of all harvest trials (i.e., 32 out of 73 possible trials). Most simulations involved the actions of both the self and others, a few focused only on the self, and very few focused only on others. In terms of consequences, most simulations explored the possible effects of self-other choices on pool size. Simulations that examined the impact of potential harvest decisions on personal point totals were relatively uncommon, as were simulations of the effects of self's choices on others' choices, and vice versa. A breakdown of simulated possible outcomes by actor and consequence is presented in Table 4.6.

Table 4.6

Breakdown of Simulated Possible Outcomes by Actor and Consequence

	Actor		
Consequence	**Self and Other(s)**	**Self Only**	**Other(s) Only**
Pool Size	13	9	1
Point Total	2	1	0
Self's Choice	0	0	2
Pool and Points	1	2	0
Pool and Self	1	0	0

Values in the table are frequencies.

<u>Distribution of Mental Simulations Across Harvest Trials</u>

Mental simulations were most common during the middle and late trials of the simulation (see Table 4.7). Early in the game, the pool was well-stocked and not in immediate danger, thus participants may have believed that they did not have to think much about the consequences of their choices. As the pool declined, however, the possibility that the pool might be prematurely extinguished became more salient, causing participants to think about their harvests more intently.

A second possibility is that participants may have been reluctant to simulate possible outcomes early in the simulation because they were uncertain about the harvest intentions of the other group members. Given that the outcome of each harvest trial depends on the combined choices of all group members, participants may have been unwilling to waste their time speculating about future outcomes when they had no idea about how others would act. If this explanation is correct, participants should be more likely to simulate when they have clear expectancies about others' probable choices. Data from the protocols were consistent with this hypothesis; participants simulated possible outcomes during 55% of the trials on which they had expectations about one or both others' choices, as compared to only 17% of the trials on which they had no expectations about others.[1]

Table 4.7

Breakdown of Simulated Possible Outcomes by Harvest Trials

Harvest Trial

	T1 (n=15)	T2 (n=15)	T3 (n=15)	T4 (n=11)	T5 (n=8)	T6 (n=3)	T7 (n=3)	T8 (n=2)	Total
Simulations	4	4	9	5	5	2	2	1	32

Values in table refer to the number of participants who simulated at least one possible outcome on each trial. Participant 12's protocol could not be transcribed, and therefore is not included in this analysis.

Number of Simulations

How many outcomes are typically simulated before a harvest decision is made? When I began the study, I envisioned participants systematically working through several alternatives and selecting the one that promised to produce the most favourable outcome. I found little in the protocols to support this view; most participants simulated one, and only one, outcome prior to making their harvest choices.[2] The following excerpts are typical. "So if we all take two points, that'll be six points [left] and that would double to leave 12." [2] "OK, so now there are only six. Oh... we want to get that to 12. If everyone took zero, that would work." [3]"So if we keep going at this rate, we're going to run out of trials and that will really knock down the points for each of us in total. So this time I'm going to take one." [2]

In the first two excerpts, participants simulated positive outcomes, deemed these outcomes to be acceptable, and then made their choices accordingly. The possibility that others might not conform to the participants' projections was not considered, nor was the possibility that alternative choices might produce superior outcomes. In the third excerpt, two negative outcomes (pool extinction and suboptimal point total) are simulated, prompting the participant to take evasive action. But, as in the two earlier cases, no attempt was made to identify an optimal harvest choice. Again, this is consistent with the interpretation that harvesters were satistificing as opposed to optimizing.

Only two participants consistently simulated more than one outcome prior to making their harvest decisions. Excerpts from their protocols are presented below.

> And now the idea, I think, is for everyone to take 4, a total of 4 so that there are 6 left and we will be back to 12 again. And I think to do that I'm going to try... now I can't decide if I should take one or two. Because if I take two, then they all might take two and we would run our resource down eventually. I think I'm going to take... Oh boy... because if I take two, then they might all take one. So if they take two or three that would be six and that would be four left, and the pool would be down to eight, and they are just going to totally run it down. So I'm going to take one and hope that they follow. Because, eventually, if I take one and they follow, that would be more for both of us. [4]

> OK, I'm a bit unsure right now because I don't know whether... if I stick high then what's that going to do if they stick high... then our pool's going to go down really low. But if I start low, there is no guarantee that they are going to stay low with me. Hmm... and right now I'm down by two and up by one. Umm... if I go two and he goes with two and Blue goes with two, that would be six and that would [leave] us with nothing. That Green guy is taking so many. Umm... OK so I'm thinking that if the Green guy is high, he is probably going to stay high no matter what I do... so he's going to take at least two. The Blue guy will probably stay reasonably low so that the most would be two, four, zero... double that would give us four. If I went in with two that would be six and we'd have nothing left. I think I'll... but then if we go one, he's going to go two which is three, four... double two which would be four. Wow, I guess I shouldn't have done that three in the beginning. OK, I'm going to try one... that's the safest. [14]

One interesting feature of these excerpts is that both participants employed "screening" strategies to reduce the number of outcomes they simulated. For example, Participant 14 developed expectancies about Blue and Green, and then simulated only outcomes that were consistent with those expectancies. Participant 4 employed a slightly different strategy. He computed the optimal number of points that the group should take as a whole, and the number of points that he should take for himself (one or two). He then simulated possible outcomes for each of these choices.

Simulating Possible Outcomes and Harvest Choice

As noted earlier, harvesters appear to use mental simulations as a tool to help them make goal-consistent choices. If this interpretation is correct, harvesters who simulate more (i.e., think more about the implications of their choices) should manage the resource pool more successfully and acquire more points than those who simulate less.

To test this proposition, Pearson correlations were computed between the proportion of trials containing simulations and three harvest indicators (number of trials played, average harvest per trial, and total points harvested). Participants who simulated more kept the resource pool alive longer [r (13) = .54, $p < .05$], and harvested fewer points per trial [r (13) = -.74, $p < .01$] than those who simulated less. Simulation rate was unrelated to total points harvested [r (13) = .01, ns], but this null finding may be artifactual. High-simulators took fewer points on each trial, hoping to keep the pool alive longer and increase their overall point totals. Green's repeated defection, however, caused the pool to be extinguished before these long-term aims could be achieved. Had Green been programmed to be more cooperative, the pool may have been maintained long enough for the high-simulators to acquire significantly more points than those who simulated less.

Moderating factors. The previous analysis revealed a strong association between simulation rate and conservative harvesting; participants who simulated more took fewer points per trial than those who simulated less. A review of the individual cases, however, suggests that this finding may be qualified by at least two moderators:

(1) Harvest goals. As noted earlier, harvesters appear to use mental simulations to help make goal-consistent choices. If this interpretation is correct, mental simulations should elicit restraint only from participants with pool-preservation strategies. A review of the protocols appears to bear this out. Consider the following two examples. Participant 15, whose primary concern was to acquire more points than others, noted that she would fall behind the other players if she reduced her harvest on Trial 3 ("If I took a lower one, I'd be behind."). To avoid this goal-inconsistent outcome, she harvested three points (the maximum allowable) from the pool. On Trial 7, Participant 4 simulated that the resource pool would be extinguished on the following trial even if he continued to cooperate. Thus, to maximize his point total, he took all the points remaining in the pool for himself.

These examples suggest that encouraging harvesters to think about the implications of their choices will not necessarily increase harvest restraint. Mental simulations only help participants make goal-consistent choices. Thus, if participants' goals are inconsistent with pool preservation, simulating possible outcomes may actually decrease restraint, rather than increase it.

(2) Cognitive errors. In some instances, mental simulations can lead to overharvesting even if the simulator intends to preserve the resource pool. This can occur if the simulation involves faulty logic, bad data, or a mathematical miscalculation. For example, on the second trial of the simulation, Participant 3 indicated that she intended to replenish the pool back to its maximum level ("So to maximize you want to get that up to 12 next time."). Unfortunately, when she computed how many points to take, she assumed that there were 12 points remaining, when, in fact, there were only 10. As a result she exceeded the optimal harvest level, and the pool declined. "There's only three points left. How come... oh because there was only ten to begin with. Oh I miscalculated. That was stupid." [3] This illustrates an important point. Processing errors can lead even the most cooperative of participants to overharvest.

<u>Summary</u>

Participants often simulated possible outcomes prior to making their harvest decisions. Working through the implications of potential choices helped them avoid choices that would damage the pool or lead to other unfavourable outcomes. Most simulations focused on the potential impact harvest decisions had on the resource pool. Participants tended to simulate more when the pool was in danger, presumably because the consequences of making a poor choice in this context were more severe. In general, participants who simulated more harvested fewer points per trial and preserved the pool longer than those who simulated less. However, harvest goals and processing errors may moderate this effect.

Strategic Influence

Strategic influence refers to explicit attempts to influence the choices of others, and, in particular, to elicit responses that are consistent with one's own harvest goals. In theory, strategic influence can take a variety of forms: verbal exchanges, dirty looks, signed agreements, etc.. In the present study, however, direct communication among harvesters was not permitted, which significantly reduced the possible modes of influence participants could employ.

Even though direct communication was not permitted, close to one third of the sample (five participants) engaged in strategic influence attempts. In all five cases, participants attempted to influence others' choices indirectly by modeling the behavior they wanted others to engage in; participants harvested few points from the resource pool, hoping that Blue and Green would reciprocate. "I could have taken more, but I suppose I wanted it [the simulation] to last as long as possible. And I thought that maybe if I took less, maybe the other competitors would take less."[10] "What I was trying to do was to get everyone to take two, which is most efficient... but some people wouldn't listen, like Green." [4] On the last one when I took zero, I was hoping that they would too. [13]

Strategic influence occurred most frequently during the middle and late trials of the simulation, suggesting that stopping the pool's decline was an important motive underlying this action strategy. This also suggests that strategic influence was employed primarily as a reactive strategy in response to unfavourable feedback. Only one participant attempted to use strategic influence proactively, that is, prior to receiving feedback that the pool was depleting. Before he made his initial harvest, Participant 4 indicated that he believed that the best way to maximize his point-total would be to get all group members to harvest two points from the pool on every trial. "So the idea is to get everyone to take two... I'm going to start off by taking two. That way I hope they'll get on to that... try to get everyone to take two." [4]

Interestingly, participants did not employ strategies other than modeling restraint to elicit cooperation from others. Axelrod (1984) has shown that tit-for-tat (i.e., cooperating when others cooperate and defecting when others defect) is an effective strategy for eliciting cooperation in two-person prisoner's dilemma games, and Wilke and Braspenning (1989) present evidence that some players may attempt to employ this strategy in n-person games. In the present study, however, few participants responded to Green's repeated defection by defecting themselves, and in the few instances in which they did, I found nothing in the protocols to suggest that they were attempting to elicit cooperation from Green. Perhaps individuals only apply tit-for-tat in situations in situations where defecting does not seriously jeopardize one's ability to acquire points in the future (e.g., in situations where the pool is not in immediate danger of being extinguished, or, as in Axelrod's studies, where a replenishable pool is not even employed).

Summary

Although direct communication among group members was not permitted during the simulation, five participants attempted to communicate indi ,ctly using their harvest choices. In all five cases, participants took few points from the pool hoping that this would elicit similar responses from the other members of their group.

Emotions

Participants reported a variety of emotions during the simulation. In terms of the overall framework presented thus far, emotions appear to mediate the relationship between monitoring and harvest choice. Feedback about pool size and others' harvests often elicited emotions, which in turn appear to have influenced harvest choice. A complete listing of emotions and their main eliciting factors is presented in Table 4.8. A breakdown of the emotions by harvest trials is presented in Table 4.9.

Table 4.8

Emotions: Frequencies and Eliciting Factors

Emotion	Trials	Cases	Main Eliciting Factor(s)
Anger [Angry, Frustrated, Mad, Annoyed]	22	9	Green, Pool Declined
Disappointment [Unhappy, Sad, "Bummed Out"]	15	9	Green, Pool Declined
Happiness [Happy, Glad Pleased]	8	8	Pool Maintained, Others Cooperated
Anxiety [Panicky, Helpless, Apprehensive]	8	3	Green, Pool Declined, Getting Less than Others
Guilt [Guilty, Contrite, Regretful]	4	4	Cognitive Error, Self's Overharvesting
Surprise [Surprised]	3	3	Pool Extinguished, Simulation Over
Embarrassment [Embarrassed]	1	1	Cognitive Error, Self's Overharvesting

Experimenter-generated meta-labels are in bold type (see Appendix D). Participant-generated labels are in square brackets. Trials refers to number of trials during which the emotion was reported. Cases refers to the number of cases in which the emotion was reported at least once.

Table 4.9

<u>Breakdown of Emotions by Harvest Trials</u>

Emotion	T1 (n=16)	T2 (n=16)	T3 (n=16)	T4 (n=13)	T5 (n=9)	T6 (n=4)	T7 (n=4)	T8 (n=1)	Sim Over	Total
Anger			4	6	4	2	1	1	4	22
Disappointed			2	2	3				8	15
Happiness		7							1	8
Anxiety		1	3	3	1					8
Guilt		1	1	1	1					4
Surprise									3	3
Embarrassed			1							1

Values in table are frequencies, and refer to the number of participants who experienced the emotion on each trial.

<u>Anger</u>

Over half of the participants experienced anger at least once during the simulation. Anger was most commonly elicited by the Green (the noncooperative player), who was perceived by most participants to be the main cause of the pool's decline. Initially, I thought that anger might operate as a trigger for noncooperative responding. To test this notion, I computed a partial correlation between anger (measured as the proportion of trials on which a participant reported feeling angry) and harvest behavior (measured as the average number of points harvested per trial), controlling for the average number of points available for harvesting. The resulting partial ($r_{partial} = -.42$) was reasonably large, but not in the predicted direction;

participants who were angry tended to harvest fewer points, not more, than their less-angry counterparts.

A review of the individual cases revealed only one instance in which an angry participant harvested three points, the maximum allowable. In general, angry participants were unwilling to deplete the pool to get back at Green. As Participant 10 noted, "I'm not going to take my frustrations out on the resource. I would rather take my frustration out on Green in a different way that would maybe affect his ability to collect resources and abuse them." This suggests that anger may elicit a desire for retribution, but this desire may not be acted upon unless an option is available that does not involve harming the resource pool.

Disappointment

Nine participants reported feeling disappointed during or after the simulation. Most attributed their feelings to the premature extinction of the pool. "It's disappointing that I only went through 5 trials before I lost all the points." [10] "I was bummed out. I was trying to preserve the pool, and Green and Blue both wiped the pool out." [12] Several participants indicated that they were disappointed because they had acquired fewer points than Green. "I didn't like it. I would have preferred to have more than Green." [16] I don't know what to say except that I guess I should have taken... more threes or something because I didn't really win." [15]

Only three participants reported feeling disappointed prior to the pool being extinguished. Two main eliciting factors were identified: Green's repeated defection, and the resource pool's rapid depletion. "I was a bit disappointed because I wanted him to be lower, and now I felt that I had to adjust mine and I'd have to go lower because... our pool ended up decreasing." [14] A breakdown of individual harvest choices by emotion and pool size failed to produce any evidence of a systematic link between disappointment and harvest choice.

Anxiety

Relatively few participants (only 3 of 16) reported feeling anxious during the simulation. Anxiety, when it occurred, appeared to be elicited by two main factors: fear of extinguishing the pool, and fear of acquiring fewer points than others in the group. Harvest choices varied depending on the source of the anxiety. The two participants [8, 16] who indicated that they were anxious about depleting the pool took few points from the pool, whereas the participant who was anxious about acquiring less than others [15] repeatedly overharvested across trials. The breakdown of responses displayed in Table 4.10 suggests that anxiety may be associated with extreme harvest choices; harvesters appear to make very small harvests or very large harvests depending on the source of their anxiety.

Guilt and Embarrassment

One quarter (4 of 16) of the sample reported feeling guilty or embarrassed at one or more points during the simulation. These emotions were typically elicited by pool-depletion feedback, particularly if participants attributed the depletion to their own actions (e.g., to overharvesting, or a computational error resulting in overharvesting).

> What I did wrong was to start off taking too many points. Because I divided the 12 by 3, not remembering that what you want is a few points left over. So I started out wrong. Then I continued the error on the second trial because I miscalculated how many points there were... I hogged the points, so therefore, presumably, the other people got what they could out of it and the game ended very fast." [3]

Without exception, all participants who reported feeling guilty and/or embarrassed reduced their harvests relative to the previous trial. However, note that guilt and embarrassment are confounded with pool depletion in this study; these emotions were always accompanied by a decline in pool size. Thus, it is difficult to tell which of these factors is most responsible for the observed harvest reductions.

Happiness

Eight participants reported feeling pleased, happy, or glad during the simulation. Positive affect was reported most frequently following the initial trial of the simulation, the only trial in which both computer players were programmed to harvest cooperatively. Of the seven participants who indicated that they were happy with outcome of Trial 1, five had indicated in their initial harvest plan that they intended to preserve the pool as long as possible. Thus, goal-consistent feedback appears to be an important elicitor of positive affect.

Positive affect was often followed by choice repetition. Most participants who indicated that they were happy with the outcome following Trial 1, repeated their Trial 1 choices on Trial 2. There were, however, several instances in which participants adjusted their harvests despite being pleased with previous outcomes. Three factors appear to underlie these adjustments.

(1) Experimentation. Participant 8 increased her harvest from two on Trial 1 to three on Trial 2 because she wanted to see whether she could acquire more points without damaging the pool. Thus, even though she was satisfied with the outcome of Trial 1, she wanted to see if she could do even better.

(2) Conformity. On the initial trial of the simulation Participant 16 harvested a single point on Trial 1, and noted that he was pleased the pool was maintained. During Trial 2, he looked to the other players for guidance, and conformed to the implicit group norm. "I'm not too sure why they're taking that many [2] points. Maybe I'll just take two this time."

(3) Excessive Caution. In a somewhat unusual case, Participant 12 took fewer points on Trial 2 than she took on Trial 1, despite having maintained the pool at its maximum level, and indicating that she was pleased with this outcome. This participant's post-experimental interview suggests that she was extremely concerned about preserving the resource pool.

> P12: I was glad that the pool size was 12, back to 12. So I didn't mess up too bad.

E: Then during Trial 2 you decreased your harvest down to one. What were you thinking about when you did that?

P12: I don't know. I guess I wanted the pool to last.

Summary

Participants reported a variety of emotions during the simulation. Most emotions appeared to be elicited by feedback about pool size and/or others' harvests, and several appeared to be linked to harvest choice. Anger, guilt and embarrassment were often followed by harvest reductions, anxiety was associated with extreme harvests, and positive affect often preceded choice repetition.

Table 4.10

Breakdown of Harvest Choices by Emotion and Points Remaining in Pool

Point Remaining in Pool

Emotion	**1-3**	**4-6**	**7-9**	**10-12**
Anger	0 *	0 **	0 *	0
	1	1 ****	1 *	1 ***
	2	2 **	2 *	2 **
	3	3	3 *	3 *
Disappointment	0 *	0	0	0
	1	1 *	1 *	1
	2	2	2 *	2 *
	3	3 *	3	3
Happiness	0	0	0	0 *
	1	1	1	1 **
	2	2	2	2 ****
	3	3	3	3 *
Anxiety	0	0 **	0	0
	1	1	1 *	1
	2 *	2	2	2 *
	3	3	3 *	3 *
Guilt and/or Embarrassment	0	0 ***	0	0
	1	1	1	1
	2	2	2	2 **
	3	3	3	3
No Emotion Reported	0 *	0 **	0	0
	1	1 **	1 *	1 *****
	2 **	2	2 *	2 ***********
	3	3 **	3	3 *******

Numbers are possible harvest choices. Each asterix denotes one occurrence of a given harvest choice.

Social Values

As noted earlier, a second aim of this study was to determine how the decision making process varied as social values and pool-uncertainty. Social values were measured prior to the simulation using Kuhlman and Marshello's (1975) decomposed game procedure. Nine participants were classified as having cooperative social values, six had noncooperative social values, and one could not be reliably classified.

Social Values and Harvest Choice

Participants with cooperative social values harvested fewer points per trial, kept the pool alive for more trials, and acquired more points over the course of the simulation than their counterparts with noncooperative values (see Table 4.11). None of these differences reached statistical significance due to the small size of the sample. However, the effect sizes (although small) were within one standard deviation of the mean reported for social values in Hine's (1990) meta-analysis (cf. Table 1.1).

Table 4.11

<u>Breakdown of Harvest Means by Social Values</u>

Social Values	Average Harvest	Trials	Total Points
Cooperative (n = 9)	0.22 (0.11)	5.00 (1.90)	8.67 (2.50)
Noncooperative (n = 6)	0.25 (0.14)	4.50 (0.55)	8.20 (1.17)
Mixed (n = 1)	0.17	7.00	10.00
Effect Size (r)	-.12	.17	.12

Nonbracketted values are means. Bracketed values are standard deviations. Average Harvest refers to the proportion of points remaining in the pool harvested by each participant averaged over trials. Trials refers to the number of trials played before the pool was extinguished. Total points refers to the number of points accumulated by participants over the course of the simulation. Effect sizes were computed by correlating social values (Cooperator = 1, Noncooperative = -1) with each harvest indicator. The participant with mixed social values was not included in the effect size computations.

Overall harvest patterns did not vary as a function of social values; both cooperators and noncooperators (as defined by the social values measure) displayed all three major patterns (see Table 4.12). Most participants, regardless of their value orientation, reduced their harvests as the pool declined (cooperative pattern). The rate of late-trial defection was slightly higher among noncooperators (33%) than cooperators (22%), but not substantially so. Finally, of the two participants who consistently defected across trials, one had cooperative values and other had noncooperative values.

This last comparison provides an excellent example of how two individuals can behave similarly, but for different reasons. Participant 15, the participant with noncooperative values, indicated that she repeatedly defected because she was afraid that she would acquire fewer points than the other members of her group. Participant 5, on the other hand, repeated defections cannot be attributed to fear or greed. He simply failed to recognize that the group could acquire more points by keeping the pool alive. This is an important finding because it suggests that even individuals with cooperative dispositions can destroy a commons if they are unaware of the potential benefits of preserving the resource.

Table 4.12

Breakdown of Harvest Patterns by Social Values

Harvest Pattern

Social Values	**Cooperative**	**Late-Trial Defection**	**Noncoop**	**Unclass**
Cooperative (n =9)	5	2	0	1
Noncooperative (n = 6)	3	2	1	0
Mixed (n = 1)	1	0	0	0

Values in table are frequencies. Cooperative pattern refers to participants who decreased their harvest as the pool depleted. Late-trial defection pattern 2 refers to participants who decreased their harvests in response to pool depletion feedback, but increased their harvests late in the game. Noncooperative pattern refers to participants who made large harvests throughout the simulation.

Social Values and Initial Harvest Plans

Most participants' initial harvest plans were consistent with their value-orientation (see Table 4.13). Five of the six participants with pool-preservation plans had cooperative social values, both participants with equal division plans had cooperative values, and the only participant with a competitive initial plan had noncooperative values. Finally, similar numbers of cooperators and noncooperators reported having monitor-and-adjust plans, a strategy that is vague enough to be consistent with either value orientation.

Table 4.13

Breakdown of Initial Harvest Plan Themes by Social Values

Social Values

Strategy	**Cooperative (n = 9)**	**Noncooperative (n = 6)**	**Mixed (n = 1)**
Preserve Pool	5	0	1
Monitor and Adjust	4	3	0
Equal Division	2	0	0
Competition	0	1	0
No Strategy	2	2	0

Values in the table are frequencies. Several initial harvest plans were coded into more than one category. Thus, the sum of the frequencies exceeds the sample size.

Social Values and Monitoring

The breakdown of monitoring by social values presented in Table 4.14 suggests that cooperators and noncooperators may attend to different aspects of the simulation when making their harvest decisions. For example, although both cooperators and noncooperators monitored others' harvests, cooperators were more likely to monitor Green (the noncooperative player) only, whereas noncooperators were more likely to monitor both Blue and Green. Noncooperators also were more likely to make self-other point-total comparisons than were cooperators.

Table 4.14

Breakdown of Monitoring Means by Social Values

References to:	Cooperative (n = 9)	Noncoop (n = 6)	Effect Size (r)
Resource Pool	.64 (.33)	.62 (.31)	.04
Others (Green and Blue)	.24 (.24)	.51 (.21)	-.53
Green Only	.39 (.26)	.07 (.16)	.60
Self-Other Comparison Previous Harvest	.19 (.22)	.14 (.17)	.12
Self-Other Comparison Total Points	.03 (.08)	.14 (.17)	-.44

Nonbracketted values are means and reflect the proportion of trials in which each type of monitoring occurred. Bracketed values are standard deviations. Effect sizes were computed by correlating social values (1 = cooperative, -1 = noncooperative) with the proportion of trials on which each type of monitoring occurred. Participant 12, the participant with mixed social values, was not included in this analysis.

Social Values and Expectancies about Others.

Social values do not appear to contribute to the development of initial expectancies. Most cooperators and noncooperators (whose expectancies could be classified) indicated that they had no expectancies about how others would harvest on Trial 1 (see Table 4.15). Moving beyond the initial trial, a different picture emerges. Noncooperators expected one or more others to defect on 28% (SD = 25) of all harvest trials, as compared to only 14% (SD = 22) for cooperators. The effect size associated with this contrast, expressed as a Pearson correlation coefficient, is -.31.

Table 4.15

Breakdown of Initial Expectancies about Others by Social Values

	Social Values		
Expectancies	**Cooperative (n = 9)**	**Noncooperative (n = 6)**	**Mixed (n = 1)**
No Expectancies	5	3	1
Expect both Blue and Green to Defect	1	0	0
Unclassifiable	3	3	0

Values in table are frequencies.

Social Values and Simulating Possible Outcomes

Recall that a strong positive association was found between simulating possible outcomes and conservative harvesting. Perhaps cooperators harvest less than noncooperators because cooperators simulate more. A comparison of the simulation rates for cooperators and noncooperators failed to provided support for this hypothesis. Noncooperators simulated possible outcomes on 40% (SD = 22. 60) of all trials, as compared to 37% (SD = 26.20) for cooperators. The effect size associated with this contrast was only r = -.05, indicating that the association between social values and harvest choice is probably not mediated by simulation rate.

Social Values and Strategic Influence

Given that both cooperators and defectors benefit from eliciting cooperation from others, similar rates of strategic influence were expected for both groups. This hypothesis was not supported; 50% of the participants with noncooperative social values attempted to elicit cooperation from others as opposed to only 22% of those with cooperative values (r = -.28).

Pool-Size Uncertainty

Pool-Size Uncertainty and Harvest Choice

Two recent studies (Budescu et al., 1990; Hine & Gifford, 1993) have investigated the impact of pool-size uncertainty harvest choice, and both found that harvesters display less restraint as uncertainty increases.[5] The present study failed to replicate this finding. Participants in the certain pool-size condition harvested more points per trial, extinguished the resource pool sooner, and acquired fewer total points than participants in the uncertain pool-size condition. None of these differences were statistically significant, but the effect sizes were moderate in magnitude (see Table 4.16).

Table 4.16

Breakdown of Harvest Means by Pool-Size Uncertainty

	Mean Harvest	Trials	Total Points
PS Certain (n = 10)	0.24 (0.12)	4.70 (1.42)	8.20 (1.81)
PS Uncertain (n = 6)	0.20 (0.12)	5.33 (1.86)	9.17 (2.32)
Effect Size (r)	r = .21	r = -.20	r = -.24

Mean Harvest refers to the proportion of available points harvested by each participant averaged over trials. Trials refers to the number of trials played prior to extinguishing the pool. Total points refers to the number of points accumulated by participants over the course of the simulation. Values in brackets are standard deviations. Effect sizes were computed by correlating pool-size uncertainty (certain = 1, uncertain = -1) with each of the harvest indicators.

Two explanations for these unexpected findings seem plausible. First, the uncertainty manipulation used in this study may not have been strong enough to produce the expected effects. Hine and Gifford (1994) have suggested that pool-size uncertainty may lead to overharvesting because it prevents harvesters from recognizing that the resource is depleting. The level of uncertainty in the present study may have been too small to prevent pool-size feedback from being a useful cue for restraint. The verbal protocols support this interpretation; participants in the uncertain pool size condition appeared to have no difficulty determining whether or not the pool was depleting. "OK pool-size is getting a bit smaller." [16] "OK, so Green took one more which puts our stock down." [7]

Data from the post-experimental interviews are also consistent with this interpretation. Three participants were asked to review the simulation, and rate how endangered the pool was on each trial. These data, presented in Table 4.17, reveal a strong association between pool-size feedback and perceived danger to the pool. Even though there was considerable overlap between adjacent feedback ranges (e.g., 10-14 and 8-12 share two common values), perceived danger increased as the upper and lower bounds of the ranges decreased. Thus, even though the participants did not know the exact number of points in the pool, they were able to determine whether the pool was being maintained or depleted.

Table 4.17

Perceived Danger as a Function of Points Remaining in Pool

Pool Danger Index

Points Remaining	**1**	**2**	**3**	**4**	**5**
1-4					
2-6					2
4-8					2
6-10		1	1	1	
8-12		1	3		
10-14	10				

Values in the table are frequencies. Pool danger was measured on a scale ranging from 1 to 5 (1= "I didn't think that the pool was in danger at all.", 5 = "I thought that the pool was in grave danger.").

A second possible explanation is that individual differences may moderate the effect of pool-size uncertainty on harvest choice. When uncertain feedback is provided, some participants may assume that the actual number of points in the pool is near to the upper end of the feedback range, whereas others may assume that the actual number of points is near the lower end (e.g., if feedback suggests that there are 8-12 points in the pool, some may assume that there are 12 points remaining in the pool, whereas others may assume there are only 8). Differences in estimated pool size may, in turn, influence harvest choice; those who assume that more points are in the pool may harvest more, whereas those who assume fewer points are present may take less. In short, the positive association between pool-size uncertainty and restraint found in the present study may be due to the fact that most participants in uncertainty condition underestimated (as opposed to overestimated) the actual number of points in the pool.

To test this proposition, I asked four participants in the uncertain pool-size condition whether they assumed that the actual number of points in the pool was near the low, middle, or high end of the feedback range. Two participants (low estimators) indicated they assumed the actual pool size was nearer to the low-end of the range, one assumed it was nearer to the high-end (high estimator), and one indicated that his assumptions changed as the game progressed. In short, individuals appear to differ in their estimates of pool size under conditions of uncertainty. There was also evidence to suggest that pool-size estimates may be related to harvest choice. Both low estimators harvested a smaller proportion of the points remaining in the pool averaged over trials (.11 and .12) than the high -estimator (.15).

Pool-Size Uncertainty and Monitoring

Results discussed earlier suggest that the uncertainty manipulation used in the present study may not have been strong enough to significantly diminish the utility of pool-size feedback as a harvest cue. If this interpretation is correct, participants in the certain and uncertain pool-size conditions should both monitor pool-size at similar rates because pool-size feedback is a useful cue in both conditions. A breakdown of monitoring data by pool-size uncertainty revealed participants in the certain pool-size condition monitored pool size on 67% (SD = 32.50) of their harvest trials, as compared to 57% (SD = 29.90) for participants in the uncertain pool-size condition. The effect size associated with this difference was small ($r = .14$), suggesting that the two groups monitored pool size at similar rates.

Pool-Size Uncertainty and Strategic Influence

When pool size is certain, it is relatively easy to distinguish between cooperative and noncooperative responding, which makes using one's own harvests to elicit cooperative responses from others more feasible. On the other hand, when pool size is uncertain, it is often less clear what constitutes cooperative and noncooperative responding. For example, under conditions of uncertainty, harvests of one, two, or three points can be interpreted as being cooperative or noncooperative depending on one's belief about the actual number of points in the pool. In short, messages sent via harvesting are typically more ambiguous under conditions of uncertainty, and are therefore less likely to elicit the desired response from others.

Given that strategic influence has a better chance of being successful when the pool size is certain, it seems reasonable to expect influence attempts to be more common in certain than in uncertain conditions. Data from the protocols failed to support this hypothesis; of the five participants who engaged in strategic influence, three were in the uncertain pool-size condition. One possible explanation for this finding is that the magnitude of the pool-size uncertainty manipulation employed in this study was not large enough to dissuade participants in the uncertain condition from using this strategy.

CHAPTER 5

DISCUSSION

The present study employed verbal protocols and post-experimental interviews to investigate decision making in a simulated commons dilemma. The study had two main aims: (1) to identify the main motivational, cognitive, and emotional factors that underlie harvest decisions, and to organize these factors into a framework that describes how harvest decisions are made, and (2) to determine how the decision-making process varies as a function of harvesters' social values and pool-size uncertainty.

Overview of the Main Categories in the Decision-Making Process

Goal satisficing emerged as the core category in this study. Participants formulated or adopted one or more harvest goals before and during the simulation, and then implemented specific action strategies (e.g., planning, monitoring, simulating possible outcomes, etc.) to achieve these goals. These strategies, however, were often applied rapidly in a superficial and unsystematic manner. In general, participants seemed content with identifying solutions that were merely adequate rather than optimal.

The first thing that most participants did before beginning the simulation was to develop an initial plan to maximize their point totals. Initial plans often consisted of strategic subgoals, the most common of which was to preserve the resource pool as long as possible. Most participants recognized that their potential for acquiring points would be greatly enhanced by preventing the pool from being prematurely extinguished. Participants without initial plans often reported feeling confused, and tended to overharvest during both the early and late stages of the simulation.

A second common action strategy was monitoring. In general, harvesters appeared to monitor those aspects of the simulation that were most relevant to their harvest goals. Given that preserving the resource pool was an important goal for most participants, pool size tended to be monitored very closely. Green's (the noncooperative player's) harvest decisions also attracted considerable attention, as (s)he was perceived to be a significant threat to pool's welfare.

Pool-size monitoring was often followed by harvest adjustments. When participants realized that their pool-preservation goals were threatened, they reduced their harvests in an attempt to defuse the threat. Interestingly, participants with harvest goals unrelated to pool preservation did not monitor pool size, and did not reduce their harvests in response to pool-depletion feedback. This is consistent with the interpretation that participants tend to monitor only those aspects of the simulation that are relevant to their goals.

Monitoring was often accompanied by emotional responses; positive affect often followed goal-consistent feedback, whereas goal-inconsistent feedback often elicited negative responses such as anger, frustration, and disappointment. Several instances were noted in which emotions appeared to mediate the impact of feedback on harvest choice.

Monitoring also appeared to play a central role in the development of expectancies about others. In general, expectancies were consistent with the feedback provided about others' choices on previous trials. Harvesters tended to cooperate when they expected both others in their group to cooperate, and defect when they expected both others to defect. On trials in which only Green (the noncooperative player) was expected to defect, harvest choices were less uniform. Most participants restrained their harvests if they believed that Green would eventually cooperate and the pool could be saved. However, if they lost hope that Green would ever cooperate, they often increased their harvests to fortify their point totals before the pool was extinguished.

Participants often mentally simulated the possible outcomes of their choices before deciding how many points to harvest. Participants appeared to employ this strategy to help them make choices that would produce outcomes consistent with their harvest goals. Mental simulations occurred more frequently as the pool declined, presumably because the consequences of making poor decisions in this context were potentially more catastrophic. That simulations increased as the pool declined also suggests that the implementation of this strategy is tied to monitoring. A strong association was found between simulating possible outcomes and harvest choice. Participants who simulated more tended to harvest more conservatively than those who simulated less. Given that most participants in the sample had adopted pool-preservation goals, this finding is consistent with the interpretation that harvesters simulated possible outcomes to avoid making choices that were inconsistent with their goals.

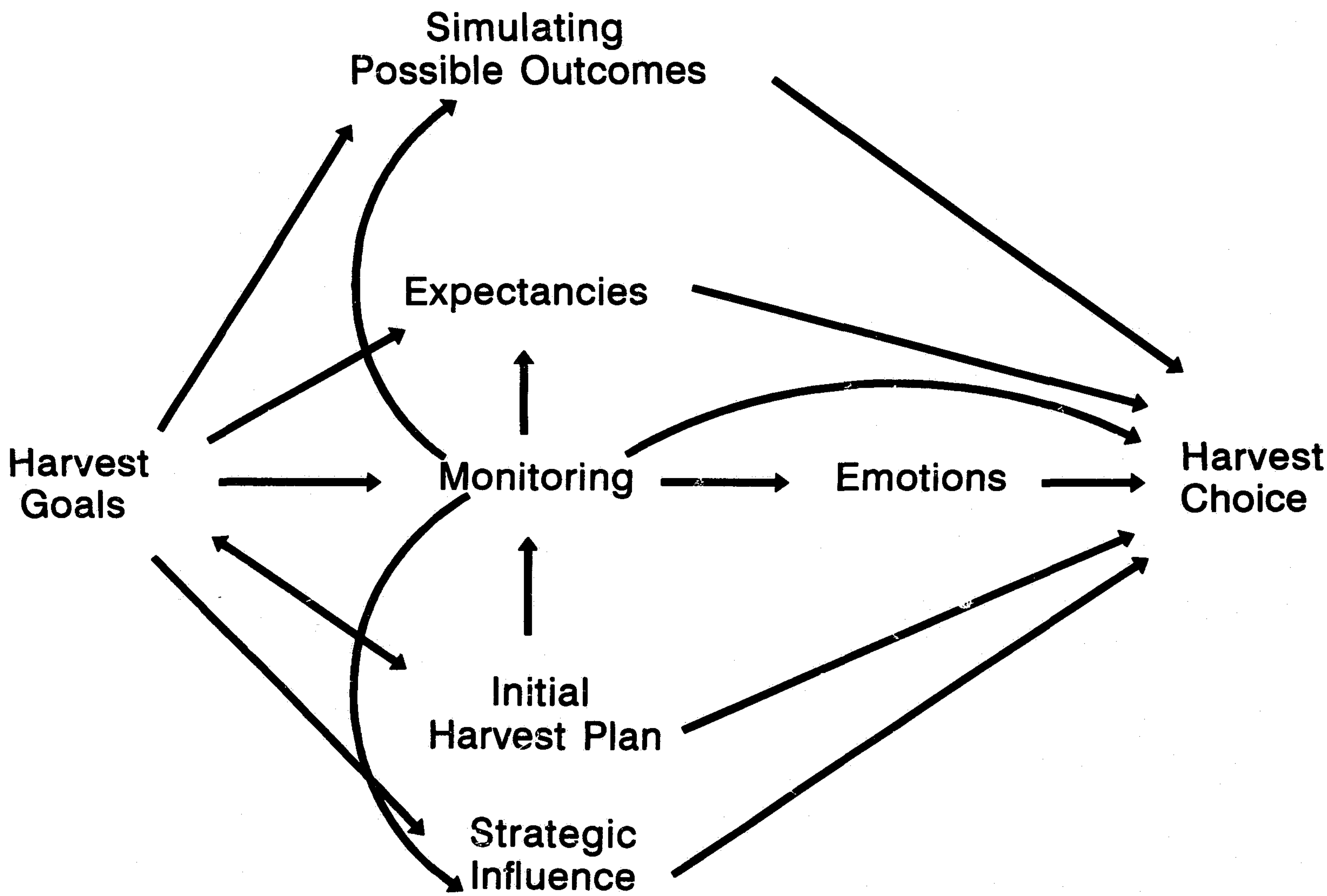
Finally, although direct communication among group members was not permitted during the simulation, several participants attempted to influence others harvests by modeling restraint and hoping that others would reciprocate. Strategic influence attempts occurred most frequently during the middle and late stages of the simulation, and appear to have been used primarily as a reactive strategy to stop the pool's decline.

A diagram that summarizes the main categories that emerged during the analysis is presented in Figure 5.1. This diagram is not meant as a formal causal model, but rather as loose conceptual framework showing how the main categories are related.

Experimental Instructions and Harvest Goals

The present study suggests that experimental instructions are an important source of harvester goals, and that goals are an important determinant of harvest behavior. Almost all participants adopted point maximization as their primary goal, and this influenced what action strategies were employed, and ultimately what harvest choices were made. Had the instructions been phrased differently, very different results may have been obtained. For example, had the instructions emphasized acquiring more points than others, few participants likely would have bothered to decrease their harvests when the pool began to decline. Conversely, explicitly instructing participants to avoid extinguishing the pool likely would have reduced the incidence of defection late in the simulation.

Figure 5.1: Overview of the Decision Making Process



Given that instructions play a fundamental role in the formation of harvest goals, it is worthwhile to consider whether the goals elicited by the instructions in simulated commons dilemmas are the same as (or at least similar to) the goals guiding the behavior of harvesters in the real world. In most simulations, participants are instructed to acquire as many points for themselves over the course of the game, or in other words, to maximize their long-term outcomes. Although long-term maximization is undoubtedly an important goal for many individuals and businesses in the real world, it is presumptuous to assume that maximizing long-run outcomes is the default goal adopted by most individuals most of the time. For example, in her discussion of time discounting, Ostrom (1990) notes:

> Discount rates are affected by the levels of physical and economic security faced by the appropriators. Appropriators who are uncertain whether or not there will be sufficient food to survive the year will discount future returns heavily when traded off against increasing the probability of survival during the current year (p.35).

Even in the absence of physical and economic threats, certain individuals may be dispositionally predisposed to discount future outcomes in return for immediate gratification in the short term. Others simply may not be interested in maximizing their outcomes, future or immediate, at all (e.g., monks and minimalists).

In short, the standard instructions employed in most commons dilemma simulations fail to capture the rich diversity of motives operating in the real world. One interesting avenue of future research might involve the use of less-structured simulations in which participants are required to formulate their own harvest goals. Situational factors could be systematically varied to determine their impact on goal formation and discount rates. This unstructured approach would also be ideal for investigating the effects of dispositional factors on harvest behavior given that participants' response tendencies would be less fettered by the experimental instructions.

Initial Harvest Plans

Surprisingly, few participants referred to fairness and equality in their initial harvest plans, nor during the course of the simulation. This may be partly attributable to how the experimental task was framed. As noted previously, participants were simply instructed to acquire as many points for themselves as possible. Framing the exercise as a point-maximization task, as opposed to a resource-sharing task or a group management task, may have prevented them from recognizing fairness and equality as relevant to the task. Another possibility is that participants downplayed the importance of fairness and equality because they knew that they were sharing the resource with computer-simulated players, not real people. Group identity studies suggest that individuals tend to be less concerned with allocating resources fairly when dealing with out-groups than in-groups (e.g., Tajfel

& Turner, 1979). Perhaps computer-simulated players represent an extreme form of out-group.

A second interesting finding was that not having an initial strategy was often associated with confusion and overharvesting, especially early in the simulation. Most of the confused participants failed to recognize, at least initially, the potential benefits of preserving the resource pool. Thus, they attempted to maximize their point totals through the most obvious means available to them, that is, by harvesting the maximum number of points allowable from the pool. This finding, as well as findings from several previous studies (e.g., Edney & Harper, 1978; Neidert & Linder, 1990; Rapoport, 1988; Schroeder et al., 1983; Stern, 1976), indicates that education may be an effective method for increasing cooperation in commons dilemmas. Programs that clearly spell out the benefits of using resource in a sustainable manner should help reduce confusion and encourage responsible harvesting. However, note that education in itself does not address the fundamental conflict between individual and group rationality that lies at the heart of most commons dilemmas. Even if harvesters are taught the potential benefits of cooperation, defection remains the dominant strategy for each individual, that is, regardless of what others do one always receives a larger payoff for defecting than cooperating.

Pool-Size Monitoring and Harvest Choice

This study suggests a strong association between pool-depletion feedback and harvest choice; as the pool declined, most participants sharply reduced the number of points that they harvested from the pool (r = .95). This effect was much stronger than those previously reported in the literature. Most past studies have reported that harvest levels tend to remain fairly constant across trials when pool-depletion feedback is provided (e.g., Messick et al., 1983; Samuelson & Messick, 1986a; Samuelson et al., 1984; Rutte & Wilke, 1984).

One possible explanation for this discrepancy is that most past pool-depletion studies have employed large initial pool sizes that declined relatively slowly over trials. For example in the American study reported by Samuelson et al.(1984), participants in the pool-depletion condition were provided with the following sequence of pool sizes (826, 753, 681, 608, 538, 463, 386, 307, 226, and 143). Given that each group consisted of 6 players and each player could harvest up to 30 points per trial, the only trial in which the pool was in immediate danger of being extinguished was the final trial (i.e., the trial in which there were 143 points in the pool). In the present study, the average number of points remaining in the pool for Trials 1 through 8 were 12.00, 11.25, 9.00, 8.25, 6.77, 6.44, 6.00, and 5.00. Given that each group consisted of three players, each of whom could harvest up to 3 points per trial, the potential for extinguishing the pool was present from the third trial onward. In short, the threat of prematurely extinguishing the pool was larger in this study than in past studies. This may have accounted for the sharp decline in harvests across trials.

A second intriguing possibility is that thinking aloud may have artifactually amplified harvester restraint as the pool declined. Perhaps when individuals are required to verbalize their harvest goals, they feel bound to act in a manner consistent with those goals. Recall that in the present study most participants who indicated that they intended to preserve the resource pool, stuck with this strategy throughout the simulation. In studies in which thinking aloud is not required, participants may feel less bound to adhere to their strategies as the simulation progresses.

If verbalizing one's intentions and goals is shown to have a binding effect on behavior, this could have serious implications for using think aloud protocols in future research. According to Ericsson and Simon (1980), one of the main advantages of the think-aloud method is that it does not significantly disrupt the natural flow of cognition and behavior. The results of the present study suggest that researchers may wish to test this assumption more thoroughly.

Expectancies

Three main sources of expectancies about others have been outlined in the literature: social values (e.g., Kramer et al. 1986; Kuhlman & Marshello, 1975; Liebrand et al., 1986), interpersonal trust (e.g., Brann & Foddy, 1988; Moore et al., 1987; Rotter, 1967), and knowledge of others' financial resources (e.g., Rapoport, Bornstein & Erev, 1989). The present study suggests that feedback provided to harvesters during the simulation constitutes a fourth important source of expectancies. Most participants began the simulation with no expectancies about how others would harvest. As the simulation progressed, expectancies developed on the basis of feedback provided about others' previous choices and pool size.

In terms of harvest behavior, a common finding in the literature is that harvesters who expect others to defect are more likely to defect themselves, whereas harvesters who expect others to cooperate are more likely to cooperate (e.g., Dawes, 1980; Pruitt & Kimmel, 1977; Wilke & Braspenning, 1989; Yamagishi & Sato, 1986). The results from this study were, in general, consistent with the literature. Participants tended to take more from the pool when they expected both others to defect, and harvest less when they expected both others to cooperate. Responses were less uniform when only one of the other two players was expected to defect; participants usually cooperated, unless they had lost hope that the pool could be saved or if they believed that resource could withstand widespread defection.

The present study raises several important methodological issues related to how expectancies are studied.

(1) Most previous research has ignored the important issue of how expectancies develop and can be shaped over time. Several studies (e.g., Dawes, McTavish & Shaklee, 1977; Van Lange & Liebrand, 1991) have employed single-trial games, and therefore ignored the temporal dimension altogether. Others have examined behavior over several trials, but have included only one expectancy measure at the beginning of the simulation (e.g., Kramer et al., 1986; Messick et al., 1983; Wilke & Braspenning, 1989). This latter approach implicitly assumes (a) that participants will have well-developed expectancies about others before the

simulation begins, and (b) that expectancies, once reported, will remain stable over time.

Results from the present study suggest that both of these assumptions may be incorrect. As noted previously, many participants indicated that they had no idea how others would choose on the initial trial of the simulation. Furthermore, after expectancies had developed, they were not always stable across trials. For example, several participants who expected Green to cooperate early in the simulation, changed their expectancies as the game progressed.

(2) Most previous studies have measured generalized expectancies about others. For example, Messick et al. (1983) posed the following question to their participants "Suppose that you decided to voluntarily restrict the number of points you took per trial. How likely do you think that the other group members would respond similarly?" Kramer et al. (1986) asked their participants to "estimate how many points the others would take on average from the common pool." One important difference between the present study and previous studies is that this study measured expectancies about specific others as opposed to others in general. Participants were asked, "Did you have any expectancies about how Blue or Green would act on Trial X? If so, describe them."

The results from this study suggest that the distinction between generalized and specific expectancy measures is an important one. When others do not respond uniformly, participants often develop different expectancies for each member of the group. For example, it was not uncommon for participants to expect Green to defect and Blue to cooperate on a given trial. Furthermore, different Blue/Green expectancy combinations appear to be related to harvest choice. Recall that participants tended to defect when they expected both others to defect, cooperate when they expected both others to cooperate, but did not respond uniformly when they had different expectancies for Blue and Green.

(3) Most previous studies (e.g., Gifford et al., 1993; Kramer et al., 1986; Messick et al., 1983; Van Lange & Liebrand, 1991) have employed measures that force participants to report expectancies about others even if they don't have any. Participants are not asked whether or not they have expectancies. Expectancies are automatically assumed to exist, and the participant is asked to describe them. Responses such as "I don't really have any expectancies right now" lie beyond the scope of these standard measures.

To overcome this problem, the experimenter in the present study reviewed the simulation, and for each trial asked participants whether or not they had developed expectancies about others. If they indicated that they had, he asked them to describe what they expected. This procedure gave participants the option of reporting no expectancies if they so chose, and made possible the finding that expectancies do not typically develop until several trials of feedback have been provided.

(4) Finally, results from this study suggest that future research should distinguish between immediate and long-term expectancies. As noted previously, many participants in the present study continued to cooperate when they expected

Green to defect on the upcoming trial, but only if they believed that Green would eventually cooperate.

Simulating Possible Outcomes

Although participants often simulated possible outcomes prior to making their harvest choices, these simulations paled in comparison to the normative strategies described by decision theorists. According to Fischhoff, et al. (1987) making a good decision involves four steps: (1) identifying all possible response options, (2) evaluating the costs and benefits associated with each option and its consequences, (3) assessing the likelihood of each consequence, and (4) integrating these evaluations and assessments to choose the best course of action. Participants in the present study rarely advanced past the second step of this model; most evaluated only a single response option prior to making their decisions.

At present, it is not clear why most participants simulated so few outcomes prior to making their choices. Several explanations seem plausible. First, many participants may have been cognitively overwhelmed by the demands of learning a new game, keeping track of the various types of feedback provided, and thinking aloud. The stress of being in a novel situation, and the fear of being evaluated by the experimenter may have further hindered their ability to process and organize information efficiently. A second possibility is the participants were capable of, but unwilling to, expend the cognitive effort necessary to evaluate alternative strategies. Perhaps the relatively remote chance of winning one's earnings in the lottery was considered not to be worth the effort, although there was nothing in the protocols to suggest that this was the case. A third possibility is that the superficial processing reflected in the protocols accurately depicts how most individuals make decisions most of the time. This last explanation is consistent with Dawes' (1980) limited processing perspective, and also much of the work on cognitive heuristics reported in the social cognition literature (e.g., Fischhoff, Svenson, & Slovic, 1987; Nisbett & Ross, 1980).

Several recent studies have investigated heuristic processing as it applies to decision making in commons dilemmas (e.g., Allison, McQueen, & Schaerfl, 1992; Allison & Messick, 1990; Rutte, Wilke & Messick, 1987; Samuelson & Allison, 1994). These studies suggest that a common allocation rule in resource sharing situations is to divide the resource equally among all group members. Although I was able to identify several instances in which the equal division rule was applied, in general, it did not appear to be an important determinant of harvest choice in this study. Few participants raised the issue of equality in their protocols or during the post-experimental questionnaire, and when participants made choices consistent with equal division, they often attributed their responses to factors other than equality (e.g., a desire to "play it safe" or to "see how others react").

Several factors probably underlie the infrequent use of the equal-division heuristic in the present study. As discussed earlier, framing the simulation as a point-maximizing task and using computer-generated players both may have played an important role. Another possibility is that the cues associated with equal division may be less salient in multi-trial games than in single-trial games, the paradigm employed in most previous equal division studies In single-trial games, participants know that the only way to produce an equal outcome is to divide equally on the first (and only) trial of the game. In multi-trial simulations, points can be allocated equally in the long-run without dividing equally on each and every trial. Thus, the impetus to consider equal division on any given trial may be substantially reduced.

<u>Strategic Influence</u>

One of the strongest and most consistent findings the commons dilemma literature is that groups in which members are permitted to communicate cooperate more and manage the resource pool more efficiently than groups that are not permitted to communicate (Hine, 1990). Content analyses performed in previous studies revealed that members of communicating groups expend much of their time attempting to influence the choices of others. This is typically done by sharing information about optimal strategies, offering and extracting promises of cooperation, and chastising others who failed to cooperate on previous trials. (Dawes, McTavish, & Shaklee, 1977; Ostrom & Walker, 1989).

The present study indicates that harvesters will attempt to engage in strategic influence others' choices even when standard channels of communication are blocked. Recall that close to one third of the sample restrained their harvests with the intent of eliciting cooperative responses from others in their group. However, the question remains: Is modeling restraint a viable strategy for inducing others to cooperate?

Given that this study employed computerized others, it is impossible to tell whether the participants' influence attempts would have been attended to and accurately decoded by the other group members. Nevertheless, there is indirect evidence to suggest that modeling restraint may constitute an effective strategy. For example, most participants closely monitored others' harvest behavior during the simulation. This bodes well for strategic influence because it suggests that harvesters regularly attend to the communication channel on which strategic messages are most likely to be sent. Furthermore, recall that most participants developed expectancies about others based on how others have behaved in the past, and that harvesters who expected others' to cooperate were more likely to cooperate themselves. This suggests that if a harvester models restraint for several trials, others will expect him to cooperate in the future, and will be more likely to cooperate themselves. Of course, with larger group sizes, the salience of any one harvester's behavior will decrease, rendering this strategy less effective (Yamagishi, 1986).

Strategic influence represents a fertile area for future research. Unresolved issues include:

(1) Individual differences. The present study found that relative to participants with cooperative social values, participants with noncooperative social values were slightly more likely to try to elicit cooperation from others by modeling restraint. This result is puzzling given that all participants, regardless of their value orientation, benefit when others cooperate. It will be interesting to see if this

effect can be replicated in future studies. Other potential dispositional moderators should also be identified and tested.

A related question is whether individuals with different personality types employ different influence strategies. For example, in simulations where communication is permitted, do some individuals try to persuade others to cooperate using rational arguments whereas others rely on emotional appeals? Personality may also be related to the mode of influence that individuals choose to employ; some individuals may prefer to solicit cooperation through dialogue and negotiation, whereas others may prefer to lead by example, and essentially let their behavior do the talking.

(2) Context. The present study failed to provide support for the hypothesis that strategic influence attempts should occur more frequently when pool size is certain than when it is uncertain. One possible explanation for this null finding is that the range of pool-size uncertainty employed in this study was too narrow; despite being uncertain about the exact number of points in the pool, participants still may have believed that they could effectively convey their pro-cooperation message via their harvest choices. Further research is required in which more extreme ranges of uncertainty are employed. A second contextual factor that may influence the occurrence of strategic influence attempts is group size. As noted previously, modeling restraint should prove to be a more effective influence strategy, and thus may occur more frequently, in small groups than in large groups.

Emotions

Although several previous studies have examined emotions in the context of environmental decision making (e.g., Vining, 1987; 1992), to my knowledge this is the first to investigate emotions in commons dilemmas. Three basic questions were addressed: (1) Which emotions are experienced by participants in simulated commons dilemmas? (2) Which factors appear to elicit these emotions? (3) What, if any, impact do emotions have on harvest choice?

Despite the artificial nature of the task (e.g., participants knew that their actions had few real-world implications, and that others in their group were simulated by the computer), most participants reported that they experienced one or more emotions during the simulation. Anger and disappointment were the most commonly reported negative emotions, and were typically elicited by feedback that Green had defected and/or that pool had declined. Happiness, the only reported positive emotion, was typically elicited by feedback that others had cooperated and that the pool had been maintained. These findings are consistent with Oately and Johnson-Laird's (1987) conflict theory of emotion. According to this theory, negative emotions arise when goal-directed behavior is interrupted or blocked, whereas positive emotions follow goal-consistent feedback.

Emotions also were associated with harvest choice. Anger, guilt and embarrassment all tended to be followed by harvest reductions, anxiety tended to precede extreme choices, and positive affect tended to be associated with choice repetitions. In terms of the overall framework presented in Figure 5.1, emotions appear to mediate the effect of monitoring on harvest choice; monitoring is often accompanied by emotional responses which, in turn, appear to influence harvest choice.

From an applied perspective, these findings suggest interventions that elicit anger, anxiety, guilt or embarrassment about overharvesting and resource depletion may be an effective (although perhaps not ethical or pleasant) means of increasing conservation behavior. Several non-simulation studies support this proposition. Hine and Gifford (1991), for example, found that anti-pollution fear appeals significantly increased environmental concern and pro-environmental behaviors, and Vining (1987, 1992) reported that negative emotions, such anger and distress, often precede anti-development and resource-preservation decisions.

In future studies, researchers may wish to address some of the following issues.

(1) What is the relationship between the intensity of emotions and harvest choice? In the present study, anger, guilt, embarrassment, and anxiety about extinguishing the resource all tended to be associated with increased restraint. Do the strength of these associations change as a function of emotional intensity? For example, do mild, moderate, and intense emotions elicit similar levels of restraint? In terms of developing ethically acceptable interventions, it would be useful to know what minimal intensity of these negative emotions is needed to elicit restraint?

(2) Other than intensity, what other situational and individual difference factors moderate the relationship between emotions and harvest behavior? For example,

Vining (1992) found that negative emotions, such as anger, were associated with pro-preservation land-use decisions for environmentalists and the general public, but not for policy-makers. Similarly, it seems naive to expect all the emotion-behavior associations reported in this study to hold across all populations and situations. One promising moderator that deserves study is attributional reasoning. It seems reasonable that resource depletion attributed to environmental factors (e.g., a natural disaster) may elicit different emotions than depletion attributed to human factors (e.g., overharvesting). Rutte et al. (1987) have already shown that the perceived cause of a resource's demise influences harvest choice. Perhaps future research will show that harvesters' emotions mediate this effect.

(3) The present study focused primarily on emotions that were elicited by specific events that occurred during the simulation. Little is known about the effects of less-transient affective states, such as mood, on harvesting behavior.

Social Values

A second aim of this study was to discover how the decision making process varies vary as a function of social values and pool-size uncertainty. Although social values were only weakly related with harvest behavior, several interesting strategy differences between participants with cooperative social values and participants with noncooperative social values were identified:

(1) Participants with cooperative and noncooperative social values tended to monitor different aspects of the simulation. For example, noncooperators were more

likely to monitor the harvests of both Blue and Green, whereas cooperators tended to monitor only Green. A second difference was that noncooperators were more likely to make self-other point-total comparisons than cooperators. These findings are consistent with the motives typically ascribed to cooperators and noncooperators. Cooperators tend to be interested in establishing a cooperative solution from which all group members would benefit. Given that Green constituted the main threat to this goal, (s)he was monitored most closely. Noncooperators, on the other hand, tend to be more concerned with acquiring more points than others. Thus, they made more point total comparisons and monitored the harvests of both other players.

(2) Social values also appear to be implicated in the development of expectancies about others. Contrary to previous studies (e.g., Kramer et al., 1986; van Lange & Liebrand, 1991), social values do not appear to exert a strong influence on initial expectancies about others; as noted previously, most participants did not develop expectancies until several trials of feedback had been provided. Rather the data suggest social values may affect expectancy development indirectly through feedback about others. When provided with feedback revealing Green to be a chronic defector, noncooperators tended to develop expectancies consistent with that feedback. Cooperators, on the other hand, were less likely to develop negative expectancies about Green, suggesting that they may have been interpreting the feedback differently. Perhaps the old adage "It takes one to know one" is appropriate here. Noncooperators may be more skilled at

recognizing noncooperative tendencies in others, whereas cooperators may more willing to give others the benefit of the doubt.

(3) A third interesting difference involved the frequency of strategic influence attempts employed by participants with cooperative and noncooperative social values. Given that both cooperators and defectors benefit from others' cooperation, I initially expected to find similar rates of strategic influence for both groups of participants. As noted previously, the prediction was not confirmed; although both cooperators and noncooperators employed this strategy, noncooperators tended to employ it more. In retrospect, this finding makes sense. Although both cooperators and noncooperators benefit when others cooperate, noncooperators stand to benefit more. In the present study, the best possible scenario, from a point-maximization perspective, would be to defect on every trial after convincing others to cooperate.

Pool-Size Uncertainty

Past research indicates that pool-size feedback is an important determinant of harvest choice. Samuelson and his associates (e.g., Samuelson & Messick, 1986a, 1986b; Samuelson, Messick, Rutte, & Wilke, 1984) have shown that individuals provided with pool-depletion feedback harvest fewer points per trial than individuals provided with feedback that indicates underuse or optimal use. Other studies (e.g., Cass & Edney, 1978; Jorgenson & Papciak, 1981) have found that groups provided with exact (i.e., certain) pool-size feedback manage common resources more efficiently than groups not provided with pool-size feedback. Less extreme manipulations of pool-size uncertainty (i.e., manipulations in which harvesters are provided with a range of possible pool size as opposed to no feedback at all) have also been shown to significantly reduce harvest restraint and resource management efficiency (Budescu et al, 1990; Hine & Gifford, 1994). Taken together, these findings suggest that pool-size feedback operates as an important cue to harvest restraint. When feedback is uncertain, the utility of this cue is diminished, and it becomes less clear to harvesters whether or not they should decrease their harvests (Hine & Gifford, 1994).

The present study confirmed the importance of pool-size feedback as a harvest cue; most participants regularly monitored pool size whether feedback was certain or uncertain. However, it failed to replicate previous findings that pool-size uncertainty causes overharvesting. In fact, harvesters in the uncertain pool-size condition actually took slightly less than those provided with certain feedback. Supplementary data from the verbal protocols and post-experimental interviews revealed that participants in the uncertain feedback condition had no difficulty recognizing that the pool was depleting. This suggests that the uncertainty manipulation used in this study may have been too weak to produce the predicted effects.[6]

The results from the present study also suggest that individual differences may moderate the impact of pool-size uncertainty. Post-experimental interviews revealed that uncertain (i.e., range) feedback was interpreted differently by different participants; some assumed that the actual number of points remaining in the pool was near the high end of the feedback range whereas others assumed that it was near the low end of the range. There was also some indication that high-estimators may harvest more than low-estimators.

This is an important finding because it suggests that pool-size uncertainty is not necessarily a bad thing to have in a commons. For example, if everyone using the commons is a low-estimator, conservation behavior would be expected to be higher under uncertain conditions than certain conditions. Future studies should investigate the stability of harvesters' estimation tendencies across time and situations, and also identify the factors that contribute to the development of these tendencies.

Implications for Existing Models and Theories

What, if anything, can the results of the present study tell us about the veracity of existing commons dilemma theories? Limited processing theory (Dawes, 1980), goal-expectation theory (Pruitt & Kimmel, 1977), and three-factor theory (Messick et al., 1983) will be discussed in light of the present findings.

Limited processing theory. The results from the present study support Dawes' (1980) general contention that individuals possess limited abilities to process information accurately, efficiently, and completely. Participants' protocols were full of examples of cognitive errors, confusion, and superficial processing. Also consistent with the limited processing view was the finding that these factors tended to be associated with increased rates of defection. Recall that defection rates were much higher among confused participants than nonconfused participants, and that participants who thought more about the implications of their choices were less likely to defect than those who thought less about their choices.

However, note that this last effect was moderated by harvesters' goals. Simulating possible outcomes was linked to restraint for participants with pool-preservation goals, but not for participants who were unconcerned with preserving the pool. This has important implications for the limited processing view because it suggests that simply encouraging harvesters to think harder about their choices will not necessarily increase restraint. In order for such an intervention to be effective, harvesters must first be convinced that preserving the resource is a worthwhile goal. In short, deeper processing, by itself, is not the panacea that will save the commons, a desire to cooperate must also be present.

Goal-expectation theory. According to goal-expectation theory, two conditions must be satisfied for cooperation to occur in mixed-motive dilemmas: participants must recognize that their long-term goals are better served by cooperating than defecting, and must expect others in their group to cooperate. The present study provides only limited support for this theory. Most participants reduced their harvests as the pool declined suggesting that they recognized (either implicitly or explicitly) that mutual cooperation in this context was desirable. Expectancies that others would cooperate, however, did not appear to be a necessary prerequisite for cooperation. Recall that many participants cooperated on the initial trial of the simulation before they had developed expectancies about how others would choose. Furthermore, as the pool declined, many participants reduced their harvests even when they expected Green to defect.

This is not to say that expectancies about others are not an important determinant of harvest choice. The results from this study and previous studies suggest that they probably do exert an influence. The point is that an expectation that others will cooperate is not absolutely necessary for cooperation to occur. Most harvesters were willing to restrain their harvests if they believed that there was even a remote chance that others would also begin to cooperate before the resource was extinguished.

Three-factor model of harvest decisions. According to Samuelson and his colleagues (Messick et al, 1983; Samuelson & Messick, 1986; Samuelson et al.; 1984), harvest decisions are governed by three main motives: a desire to use the resource wisely, self-interest, and a desire to conform to implicit group norms. In the present study, most participants reduced their harvests as the pool declined, hoping that they could acquire more points in the long run by preserving the pool. This is consistent with Samuelson et al.'s contention that the desire to use pool wisely and self-interest are important motives. That several participants increased their harvests late in the simulation when pool extinction appeared to be imminent is also consistent with the three-factor approach.

The design of the present study allowed for only a limited test of the conformity hypothesis. The only trial on which the computer players harvested a similar number of points (thus creating an implicit group norm) was Trial 1. Blue and Green both harvested two points. If conformity pressure was an important determinant of harvest choice, (1) more participants should have harvested two points from the pool during Trial 2 than during Trial 1, and (2) the variability in harvest size should have been smaller during Trial 2 than during Trial 1. Although several instances of conformity were identified, neither prediction was confirmed. Equal numbers of participants (eight in both cases) harvested two points on Trials 1 and 2. Furthermore the harvest standard deviations were nearly identical for these two trials ($\underline{SD}_{T1}$ = .68, $\underline{SD}_{T2}$ = .72). In short, the conformity motive did not appear to be an important determinant of harvest choice in this study.

This finding runs counter to several previous studies in the literature (e.g., Samuelson & Messick, 1986a, 1986b; Samuelson et al., 1984). One possible explanation for this discrepancy is that the present study employed 3-person groups, whereas most past conformity studies have used larger groups. A second possibility is that the pressure to conform to an implicit group norm may be reduced when that norm is established by computer-generated (as opposed to "real") others.

An integrated perspective. The three theories discussed above tend to emphasize different aspects of the decision-making process, and are perhaps best thought of as complementary, as opposed to competing, accounts of how harvest decisions are made. The results of the present study provide a basis for drawing together these diverse accounts into a single integrated perspective.

The present analysis suggests that decision-making in commons dilemmas can be broken-down into two main components: a goal-formulation component, and a strategy-implementation component. Harvesters typically develop or adopt one or more harvest goals, and then implement specific strategies to achieve those goals. According to this perspective, defection can occur for several reasons (see Figure 5.2).

(1) Harvesters may fail to recognize the potential benefits of preserving the resource pool. In the present study, most participants who cooperated believed that their point-maximization goals would be best served by restraining their harvests and preventing the pool from being prematurely extinguished. In several instances, however, limited processing appears to have prevented or delayed participants from making this important association. If harvesters fail to recognize the advantages of preserving the pool, they are unlikely to restrain their harvests. This is similar to the tenet in goal-expectation theory that states participants must first recognize the advantages of mutual cooperation, before adopting cooperation as a goal.

(2) Harvesters may adopt other goals, such as acquiring more points than others, that are incongruous with cooperation. Note that limited processing may or may not play an important role in this situation. In some instances, holding competitive goals may prevent participants from thinking about alternative courses of action. On the other hand, participants may be fully cognizant of the advantages of mutual cooperation and preserving the resource pool, but nevertheless decide to pursue other goals. In terms of three-factor theory, this would be equivalent to a

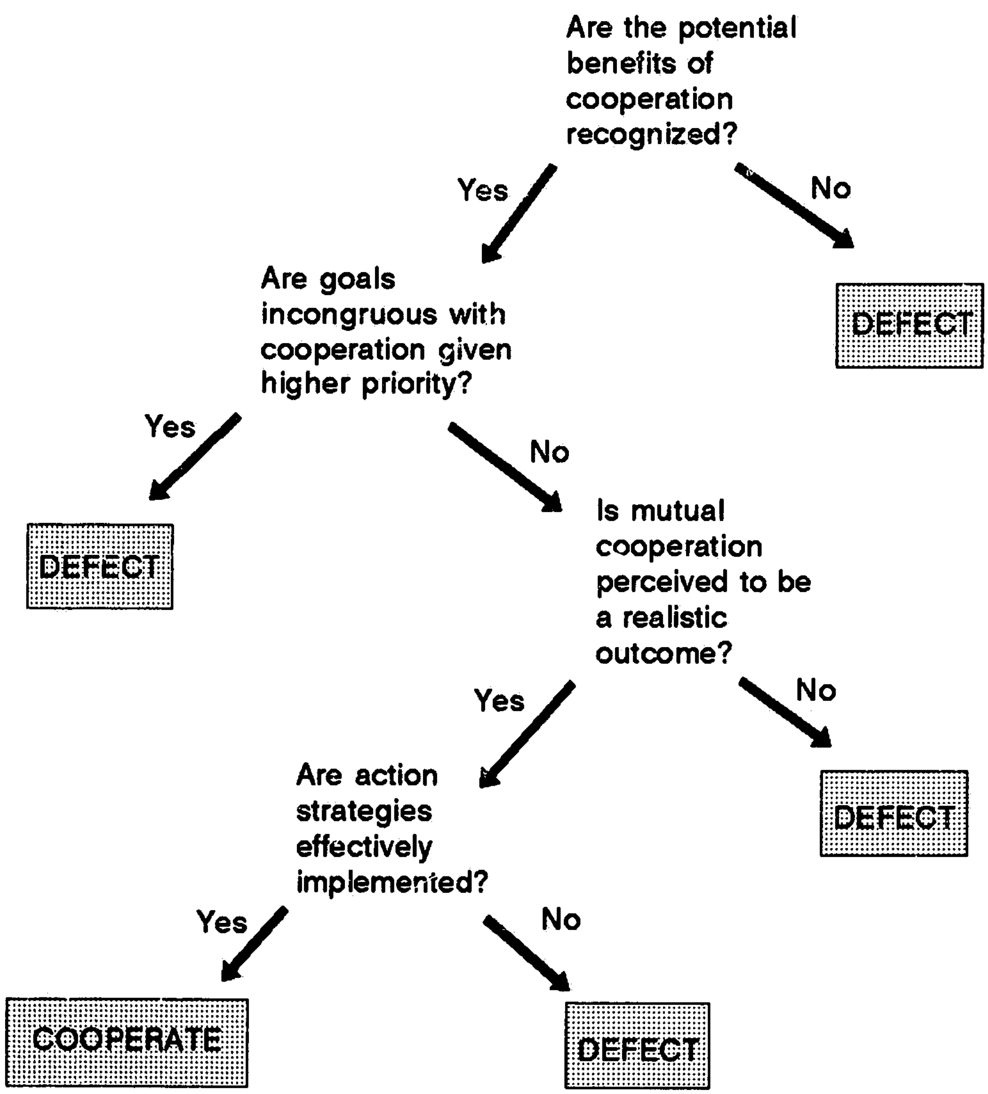
competitive self-interest motive simply overpowering a responsible-pool-use motive.

(3) Harvesters may believe that even if they restrain their harvests others will continue to overharvest and extinguished the pool. This is similar to goal-expectation theory's tenet that participants will only cooperate if they expect others to also cooperate, but with an important difference. The present analysis suggests full-blown expectancies are not necessary for cooperation to occur. As noted previously, most participants were willing to restrain their harvests as long as they believed there was a chance that others would cooperate before the pool was extinguished. Participants increased their harvests only after becoming convinced that a mutually cooperative solution was unlikely to be reached.

(4) Harvesters may adopt cooperative goals, but fail to implement effective action strategies to achieve these goals. Cooperative goals do not guarantee cooperative behavior. The present study suggests that misapplied action strategies (e.g., failing monitor pool size accurately, making computational errors, not developing an effective resource-management plan, failing to carefully consider the implications of one's choices, etc.) can undermine even the most cooperative intentions. Limited processing may play an important role at this stage of the decision-making process. If harvesters are unable, or unwilling to allocate the cognitive resources needed to implement effective action strategies, the possibility that they will inadvertently overharvest from the pool will increase.

Figure 5.2:

Factors Contributing to the Decision
to Cooperate or Defect in Commons Dilemma



In terms developing effective interventions, the present framework suggests that two separate aspects of the decision-making process must be targeted. Initially, steps must be taken to increase the likelihood that harvesters will formulate and adopt cooperative harvest goals. This may involve educating harvesters about the benefits of cooperation and the dangers of competition, and convincing them that mutually

cooperative solutions are a realistic possibility. But, instilling cooperative goals is not enough. Steps also must be taken to ensure that harvesters are able to develop and implement effective action strategies to achieve these goals. Much of the normative research in decision theory appears to be directed to this end (e.g., Fischhoff et al., 1987).

General Suggestions for Future Research

Several specific suggestions for future research have already been offered. But where, in general, do the results of the present study suggest that commons dilemma research should head in the future?

(1) The present study was conducted on a relatively small sample in highly controlled context. Additional simulation studies should be conducted to determine how harvester goals and action strategies change as a function of other dispositional and contextual variables not examined during the present study (e.g., risk-seeking, conservatism, interpersonal trust, intelligence, communication, group size, sanctioning power, underuse-overuse feedback, etc.). Research comparing

the goals and strategies employed by different cultural subgroups may also prove fruitful.

(2) To date, much psychological research on social dilemmas has been conducted in the laboratory using computer simulations (although for exceptions see Samuelson, 1990; Summers & Tohill, 1994). Field research is needed to determine whether the basic principles guiding behavior in the laboratory generalize to the real world. Extensive interviews with government and industry officials, as well as other resource consumers, may prove to be beneficial. The feasibility of using think-aloud procedures and naturalistic observation to track resource-use decisions as they actually unfold in the real-world should also be explored.

(3) The results of this study suggest that harvest decisions are often based on superficial processing. Surprisingly, however, few participants employed the equal-division rule; a heuristic that previous research suggests is widely used in resource allocation situations. Several explanations about why the equal-division heuristic was so infrequently employed in this study were offered. These should be tested. In future studies, researchers may not wish to rely exclusively on behavioral measures of equal division. This study suggests that in certain instances participants who appear to be applying an equal-division rule, may actually have motives other than equality in mind (e.g., adopting a middle-of-the-road approach). Further work is also needed to identify other common heuristics that harvesters employ.

(4) This study nicely illustrates the advantages of using alternative methods in psychological research. Verbal protocols and grounded theory contributed to the discovery of several important new findings that likely would have been overlooked had more traditional analyses been employed. The success of this study should encourage researchers to continue experimenting with new methods and perspectives, both qualitative and quantitative.

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FOOTNOTES

[1] This comparison was based on data from 43 harvest trials. Trials that could not be coded for expectancies were not included in the comparison. See Appendix D for a review of the coding rules for this category.

[2] Although it is possible that other mental simulations occurred but were not verbalized, the fact that most harvest decisions were made very quickly (apparently with little deliberation) suggests that this was probably not the case.

[3] Not all communication that occurs in commons dilemmas is strategic. Strategic influence refers to instances in which participants intentionally use their own choices to influence the choices of others. For example, if a participant decides to take zero points from the pool with the intention of getting others to also decrease their harvests, (s)he is clearly acting strategically. On the other hand, if the same participant takes no points to prevent the pool from depleting, (s)he may unintentionally communicate to others that they also should decrease their harvests. However, given that this latter message is not an intentional attempt to influence others, it is not strategic. The main point is that participants are almost always communicating when they make their harvest choices; sometimes intentionally, other times not.

[4] Surprise is often considered to be a positive emotion, but in the present context the connotations were clearly negative; participants were surprised that the resource pool had been extinguished so quickly.

[5] Two unpublished studies by Samuelson (1990; Samuelson & Hannula, 1992) failed to replicate these findings. However, these employed an uncertainty manipulation that was fundamentally different than those employed by Hine and Gifford (1994) and Budescu et al. (1990). For a more complete discussion of the issues involved, see Hine and Gifford (1994).

[6] Hine and Gifford (1994) employed the same range of uncertainty used in the present study, but found uncertainty led to a significant increase in harvesting. Why should the same range of uncertainty produce overharvesting in one study, but not the other? The inconsistency is likely due to differences in the computer simulations that were employed in the two studies. The simulation employed in this study provided participants with text-based feedback following each trial (i.e., participants were told that there were 10-14 points in the pool, 8-12 points, etc.). Hine and Gifford (1994) used a more complex simulation in which both text-based feedback and graphics-based feedback were provided. The graphics-based feedback consisted of two types of fish images: "real" fish (i.e., those truly available for harvest, these were displayed in FISH as filled-in fish) and "perhaps-real" fish (i.e., those that may or may not be available for harvest; these were displayed as outlined fish). Anecdotal evidence from pilot studies involving FISH suggests that when both types of feedback are provided, most participants attend more to the graphics-based feedback than to the text-based feedback. Furthermore, most participants do not appear to take the time to count the fish on the screen. Rather, they glance at the screen to get a general idea of the number of fish available, and then make their choice based on

this estimate. Under conditions of high cognitive load, participants may fail to distinguish between the "real" and "perhaps-real" fish. This, in turn, may create the illusion that more fish are in the pool than are actually there, leading the participants to harvest more.

APPENDIX A

Methodological Issues Concerning the Use of Verbal Protocols

Ericsson and Simon (1980) have presented a detailed discussion of the methodological issues associated with using verbal protocols. Important issues include: the completeness of verbal reports, the accuracy of verbal reports, and the obtrusiveness of thinking aloud. Each of these will be discussed briefly.

(1) The completeness of verbal reports. Ericsson and Simon (1980) identified several conditions under which think-aloud protocols are likely to be incomplete. Among these include: situations in which the task behavior has become highly automated, situations in which participants feel compelled to edit their verbalizations, and situations in which participants experience a high cognitive load.

Given the relatively short duration of the simulation, and the participants' unfamiliarity with the task, response automation is unlikely to pose a significant problem in the present study. Response-editing is also unlikely to be a problem given that the simulation does not involve thinking about issues that would normally be thought of as highly personal or private. Nevertheless, to minimize editing, participants will be provided with detailed instructions that encourage them to be as open and complete as possible.

High cognitive load represents the third, and possibly most severe, threat to protocol completeness in this study. According to Ericsson and Simon (1980), individuals provide less complete protocols when their cognitive resources are severely taxed. Initial pilot sessions using FISH (Gifford & Wells, 1991), a relatively complex simulation that provides participants' with over 20 types of feedback about pool-size, personal expenses, profits, etc., were consistent with this claim. The protocols collected during these sessions consisted primarily of descriptive summaries of the FISH's feedback screens, but provided little insight into why participants were making the harvest decisions that they were making.

To determine whether more complete protocols could be produced by reducing task complexity, new software was developed for this study that provided fewer types of feedback, and enabled the players to control the speed with which they progressed through the simulation. Pilot tests involving the new simulation produced more favourable results than those obtained with FISH. A detailed description of the new simulation is provided in the methods section.

(2) The accuracy of concurrent verbal reports. Concern has been expressed that respondents may be unable to provide accurate accounts of the cognitive processes that underlie their behavior. For example, Nisbett and Wilson (1977) have argued that people often do not have access to their higher level cognitive processes. When asked to explain their behavior, people tend to base their explanations on implicit theories about probable causes, rather than on their memories of the actual cognitive processes that mediated the response.

Nisbett and Wilson's (1977) conclusions are very controversial, and it is still unclear how much support they merit (Fiske & Taylor, 1991). In addition, important methodological differences make their conclusions somewhat tangential to the present project. For example, Nisbett and Wilson's participants provided only retrospective accounts of their cognitions, so memory failure cannot be ruled out a possible explanation for their findings. Furthermore, Nisbett and Wilson used leading questions that encouraged participants to theorize about their cognitions rather than attempt to directly remember them. Thus, even if memories of the cognitions had been formulated, it is unlikely that Nisbett and Wilson's methods would have elicited them (Ericsson & Simon, 1980). In the present study, participants report their cognitions as they occur, thereby minimizing the threat of memory failure. In certain instances, data from post-experimental interviews were used to supplement the verbal protocols. When the interview data were collected, questions were phrased to encourage memory recall rather than theoretical speculation on the part of the participant. For example, the experimenter used questions such as "What were you thinking when you took two points from the pool during the second trial?" rather than questions like "Why do you think you took two points from the pool during the second trial?"

(3) The obtrusiveness of concurrent verbalization. A third issue is whether or not thinking aloud significantly affects the normal structure and flow of cognitive processes. According to Ericsson and Simon's (1980) model of verbalization, in most cases thinking aloud should have no or only minor effects on cognition.

> When participants articulate information directly that is already available to them in STM [short-term memory], thinking aloud should not change the course and structure of the cognitive processes. Nor will verbalization under these conditions slow down these processes.
>
> When the information being processed... is not verbal or prepositional, the model predicts that the performance may be slowed down and the verbalization may be incomplete, but that the course and structure of the task performance process will remain largely unchanged (p. 227).

Considerable empirical support for these predictions was provided later in their review.

APPENDIX B

Sample Memo

Theoretical Note
November 22, 1993
Topic: Monitoring

Harvesters carefully monitor pool size and others' harvests as they engage in the simulation. Use these cues to determine how many points to harvest. Also seem to use this information to develop expectations as the simulation progresses.

Monitoring in terms of Strauss and Corbin's causal paradigm.

a. Monitoring is an action strategy tied to the core goal of point maximization. When asked about their initial strategy many Ss noted that they would <u>wait to see</u> what others would do before deciding on a definite plan of action. This suggests that monitoring was critical to their strategy.

b. Consequences. Monitoring helps harvesters develop expectations about others which in turn help guide future harvest decisions (Cues probably have a direct effect of harvester choice as well as operating indirectly through expectations). Pool size feedback is a second cue that seems to be used to guide harvest behavior. In general, as pool size declines, Ss reduce their harvests. Exception: if pool is near 0, and extinction seems inevitable.

c. Intervening Conditions. Distinction between uncertain and certain pool size feedback is important. Cue utilization should be weaker when feedback is uncertain? (If not Ss may be operating at the level of relative differences rather than absolute differences, 8-12 is probably less than 10-14 even though there is considerable overlap).

d. Other associations. [Hmm... monitoring seems like a pretty important category. Related to lots of other things.] Closely associated with information gathering and experimenting (may be an interesting distinction between active and passive information gathering). Also associated with conformity effects, self-other comparisons, emotions, etc..

APPENDIX C

Sample Feedback Screen from Resource Management Simulation

Trial	Pool Size	Red	Green	Blue	Total Taken	Points Left
1	12	3	2	2	7	5
2	10	3	3	2	8	2
3	4	1	3	1	5	0
4	0					

The resource pool has been extinguished; the simulation is over. Please give a brief reaction to the outcome. When you are finished, turn off the tape recorder (press STOP) and inform the experimenter.

APPENDIX D

Coding Rules and Reliabilities for Main Categories

The coding rules for each of the main categories were developed by the author, and then used by two independent raters to code the data set. Two indices of inter-rater agreement were computed for each category: percent agreement (the percentage of classifications on which the coders agreed), and Cohen's (1960) Kappa (K). Kappa is a reliability index for nominal scales that corrects for chance agreement among coders. Possible values of Kappa range from 0, when obtained agreement equals chance agreement, to 1, when inter-coder agreement is perfect. Maximum Kappa (Kmax), the maximum value that Kappa can reach given the obtained marginal frequencies, is also reported for all analyses. Maximum Kappa is especially useful for evaluating reliabilities associated with highly skewed marginal distributions. In such cases, the maximum possible value of Kappa can be severely attenuated.

Most coding disagreements that arose during the analyses arose from obvious oversights on the part of one coder or the other, and were easily resolved through discussion. In rare instances in which disagreements could not be resolved, protocols were coded as not reflecting the category or theme in question.

Harvest Patterns

Harvest patterns were coded into one of four subcategories. Participants who decreased their harvests as pool size declined were classified as cooperative.

Participants who consistently overharvested across trials were classified as noncooperative. Those who initially cooperated, but increased their harvests late in the simulation were classified as late-trial defectors. And finally, those who did not conform to any of these patterns were classified as other. Inter-rater agreement for this category was .94, K and Kmax were both .89; suggesting reliable coding.

Initial Strategy Themes

Prior to the simulation, participants were asked whether they had developed an initial strategy to maximize their point totals. Participants who indicated only that they intended wait and see what others would do were coded as not having an initial strategy (e.g., "I don't know what I'm going to do. I'll just wait and see what happens, I guess."). Participants who indicated that they intended to do something above and beyond waiting and watching were coded as having an initial strategy (e.g., "I don't really have a strategy. I'm just going to stay in the middle for now and then adjust when I see what the others are doing.".) Thus, some participants who claimed that they did not have strategies were coded as having them. Inter-rater agreement for classifying participants as having or not having a strategy was 100% (K = 1.00, Kmax = 1.00).

Four initial strategy themes were identified: pool preservation, monitoring and adjusting, fairness and equality, and competition. These themes were not mutually exclusive (e.g., it is possible for a participant to have an initial plan that dealt with preserving the pool and distributing the resource fairly). Given that Kappa assumes that categories are mutually exclusive and exhaustive, separate reliability analyses were computed for each theme. Thus, the reliability indices reported here reflect the degree to which coders could agree about whether each theme was present in the protocols.

Participants who indicated that they intended to keep the resource pool at a high level and/or make the game last for as many trials as possible were coded as having pool preservation plans. Participants who indicated that they intended to adjust their harvests in response to feedback provided about pool size and others' choices were coded as having monitor and adjust plans. Those who indicated that they were concerned about equally distributing points among group members were coded as having fairness/equality plans. Those who indicated that they intended to acquire more points than others were coded as having competitive plans. The reliabilities associated with each of these subcategories are presented in Table E.1.

Table D.1

Inter-Coder Reliabilities for Initial Action Plans

Theme	% Agreement	Kappa	Kappa Max
Pool Preservation	94%	.86	.86
Monitor and Adjust	88%	.73	1.00
Fairness and Equity	94%	.77	.77
Competitive	94%	.64	.64

Monitoring

Monitoring was coded directly from the verbal protocols. To be coded as monitoring, a statement had to clearly refer to one or more of the types of feedback provided during the simulation. For example, statements such as: "So now there are only 10 points left." [2] "I see that there are only 6 to 10 points left." [6] were coded as monitors pool size. Statements such as "They took a high number" [15], and "OK. Green has taken 3, and Blue has taken 2" [10] were coded as monitors others' harvests. In all, six monitoring subcategories were identified: pool size, others' harvests (both Blue and Green), Green's harvest only, Blue's harvest only, self-other comparison: harvest, and self-other comparison: point totals. For the two self-other Comparison categories, comparisons had to be explicit to be coded as present (e.g., "I took 3 and Blue took 1." "Blue has 6 points, Green has 8, and I've only got 4."). Statements such as "Green took 3, therefore I'm going to take 1 again" did not meet the criteria for this category because the self-other contrast is implicit.

To assess reliability, a second coder re-coded eight cases selected at random (a different random selection was taken for each subcategory). For each trial, the coder indicated whether or not each type of monitoring had occurred. Given the subcategories were not mutually exclusive (e.g., a participant could engage in more than one type of monitoring on a single trial), separate analyses were conducted for each subcategory (see Table E.2). Participant 12's protocol could not be transcribed and was not included in these analyses.

Table D.2

Inter-Coder Reliabilities for Monitoring

	% Agreement	Kappa	Kappa Max
Pool Size	89%	.71	.71
Others' Harvest (Blue and Green)	97%	.94	.94
Others' Harvest (Green Only)	95%	.89	.89
Others' Harvest (Blue Only)	100%	1.00	1.00
S-O Comparison: Harvest	97%	.87	.87
S-O Comparison: Point Totals	91%	.74	.74

Expectancies

Harvester expectancies were coded directly from the verbal protocols for cases 1 to 8. For cases 9 to 16, participants were asked about their expectancies during the post-experimental interview. Participants who indicated that they did not know how Green or Blue would choose were coded as having no expectancy (E0). Statements such as "I'll take 2, and see how others react" were also coded as E0. Participants who indicated that they expected Green (Blue) to "take 3", "take a lot", "not cooperate", "increase its' harvest", etc. were coded as expects Green (Blue) to defect (EGD, EBD). Instances in which there were few points in the pool, and participants expected Green (Blue) to take 2 points were also coded as EGD (EBD). Participants who indicated that they expected Green (Blue) to "take 1 or 2", "take few points", "cooperate", etc. were coded as expects Green (Blue) to cooperate

(EGC, EBC). Instances in which it was unclear whether participants had expectancies were coded as unclassifiable.

Reliabilities were computed separately for cases 1 to 8, and cases 9 to 16, given only the latter group was explicitly asked about expectancies. A mutually exclusive categorization framework was developed based on all Blue/Green expectancy combinations observed in the data. For cases 1 to 8, five combinations were observed (no expectations about Blue or Green, Blue and Green both unclassifiable, expects Green to defect/Blue unclassifiable, expects Green to cooperate/Blue unclassifiable, expects both Blue and Green to cooperate). Two independent coders classified each harvest trial into one of the categories described above. The coders agreed on 37 of the 40 (93%) classifications made. K and KMax were both .88.

Five Blue/Green expectancy combinations were observed for cases 9 to 16 (no expectations about Blue or Green, Blue and Green both unclassifiable, expects Green to defect/Blue unclassifiable, expects both Blue and Green to defect, expects both Blue and Green to cooperate). The coders agreed on 35 of the 40 (88%) of the classifications made. K and KMax were both .83.

Simulated Possible Outcomes

Simulated possible outcomes were coded directly from the verbal protocols. To coded as a simulated possible outcome, statements had to be phrased in "if-then" (cause-effect) terms, or be easily translated into such terms without altering the statement's meaning. Furthermore, the statement had to refer to a specific actor or actors, an action, and a consequence. For example, the phrase "I think I'll only take 1 this time so the pool will get larger on the next turn" meets that criteria because it is equivalent to "If I take 1 this time, the pool will get larger" and refers to a specific actor (the self), action (taking 1 point) and consequence (the pool will get larger). On the other hand, the phrase "I'll take 3 and see what happens" does not meet the criteria. Although the phrase contains an actor and action, it does not contain a definite consequence.

Two independent coders reviewed the protocols and, for each trial, noted whether or not a mental simulation had occurred. If a simulation was identified, the coders also classified the actor(s) in the simulation into one of three mutually exclusive categories: self, others, or self and others. They also categorized the consequence of the simulated action into the following categories: consequence for resource pool, consequence for personal point total, and consequence for self's choice.

Three reliability analyses were conducted. The first addressed the issue of whether the coders could reliably identify trials on which simulations had occurred. The coders agreed on 89% (65 of 73) trials that they reviewed. Kappa was .76 and Maximum Kappa = .80. Two supplementary analyses were also conducted to determine whether the coders could reliably identify the actor(s) and consequence(s) referred to in the simulations. Percent agreement was 88% for the actor classifications (K = .78, Kmax = .78), and 96% for the consequence classifications

(K = .84, KMax = .84). Participant 12's protocol could not be transcribed, and was not included in these analyses.

Strategic Influence

Strategic influence was coded from the verbal protocols and the post-experimental interviews. Statements that unambiguously indicated that participants intentionally used their own harvests to influence the choices of others were coded as strategic influence. Two independent raters reviewed the protocols and interviews, and coded whether strategic influence attempt had occurred on each harvest trial. Overall, the raters agreed on 79 of 80 (99%) trials that coded (K = .92, KMax = .92).

Emotions

Pilot testing revealed that it was difficult to reliably code emotions directly from the verbal protocols. Thus, this category was coded from the post-experimental interviews only. The experimenter reviewed the simulation with the participants, and asked them whether they had experienced any emotions during each trial. To ensure that participants did not feel compelled to report emotions that they had not actually experienced, the experimenter prefaced his questions with "Some people experience emotions during the simulation, whereas others don't. So there are no right or wrong answers here, I'm just curious about what, if anything, you felt during the simulation." If emotions were reported, the experimenter asked the participant to label them, and identify possible eliciting factors. Many of the labels were idiosyncratic, thus some data reduction was required. The first column in Table

4.15 contains a list of the participants' original labels, as well as the meta-labels used to classify them.

APPENDIX E

Protocol and Interview Transcripts

Participant 1
Male
Social Values: Cooperative
Condition: PS Certain

Initial Action Plan

Well for maximizing my point total during the simulation, I'd probably start off with the maximum number of fish available, and then for the next round, depending on what the other players decided on taking, I would act accordingly, trying not to overfish and also trying to keep a decent pool size available for any other trials.

T1, 12 points

OK, so it's the beginning. I'll take 3 points. And confirm, yes. It's processing.

T2, 10 points

OK, it appears that they are not going to be quite as greedy as I am. I think I'll come back with 2 points to try and beef up the pool again.

T3, 6 points

And let's see it's going to be averaging... they took a lot out of that pool there... They're averaging fairly greedy amounts. So I'll come back with 2 again and see what happens. Perhaps if the players reduce their take...Whoa. The simulation is over...

Post-Experiment Interview

S: Well in the first round, I figured there's 12 in the pool size, so I might as well take 3, the maximum, and see what happens with the other guys. We came back with 5 left, so the pool size was still fairly high. I decided to drop down a bit, try not be as greedy, and it turns out that we were averaging about the same amount, but on the greedy side so we came back with 3 points left. Now at this point, I was teetering between 1 and 2, but the point of thing was to maximize my grab, so I went for 2 points. And as it turned out the cthers... one was fairly greedy and the other one wasn't, so...

E: When you started the task did you have a firm strategy?

S: Yes.

E: What was the basic idea?

S: Uh. Basically, initially taking as much as I can, and seeing... based on the response of the other people, deciding on my next round. And I did go down a bit, but obviously not enough.Participant 2
Female
Social Values: Cooperative
Condition: PS Certain

Initial Action Plan

I guess my strategy would be to take some points, but to make sure that there is enough left over so that when they double you're always at pool of somewhere around 12. I looked at it that way.

T1, 12 points

[Reads] OK so I'm going to take 2 points. So if we all take 2 points, that'll be six points and that it would still double to leave 12.

T2, 12 points

And they did it as well too. So now I'm on trial 2 and I'm going to do the same strategy. Taking 2, confirm, yes.

T3, 10 points

OK, so now there's only 10 points left. They've been taking 3 and 2 points, or 2 and 2 points. OK, I'll still take 2 and see what happens.

T4, 8 points

OK, there's only 8 points left. Let's see, how many should I take this time. I'm going to do it again. [Takes 2].

T5, 4 points

Oh my... only 4 points left, we're getting down. So if we keep going at this rate, we're going to run out of trials soon and that will really knock down the points for each of us in total. So this time, I'm only going to take one point.

Oh... and there's no points left. That's it. So I'm stopping it.

Post-Experiment Interview

S: So in trial 1, I figured that if there were 12 points and we each took 2, then there would be 6 points left and would go back up to it's maximum capacity. So that's what I did in round 1. And then in round 2...

E: So that seemed to work out pretty well.

S: Yeah, in round 1 it worked out really well, that's exactly what happened. Everyone took 2. Then in round 2, the Green guy took 3 points, and the other 2 of us took 2. And so that meant that we didn't go back to 12 points, we only had 10 points for the beginning of round 3.

E. We're you surprised by Green's response at the time, or had you developed any firm expectations?

S: No I hadn't yet. What I thought was that I would do it again and then see on the behavior. So I did it again on round 3. And Blue went down and Green, however, stayed the same at 3, and so that lowered the points to 8. I was sure this time that Green would drop the number of points, but he or she, it didn't. And so in round 5 I decided that I had better decrease the number of points that I was going to do. I thought for a bit of taking 0, but then I decided that since I am supposed to try to maximize my points, I went for 1 instead. But obviously I should have gone for 0. And so I took 1 and Blue took 1 and Green took 3 and so there no points left for it to go into round 6.

E: Do you feel that Green's responses were unfair? Did you have any thoughts about equity?

S: I didn't really think to much about that at the time. A bit actually, I thought Green's responses were inappropriate and greedy. Capitalist.

Participant 3
Female
Social Values: Cooperative
Condition: PS Certain

Initial Action Plan

Well no... I don't have a strategy because I am torn at this point... I mean if this is just a game that is of no serious consequence for anybody, then I suppose I should be thinking of some way of getting the most. But then if it's just a game and of no particular consequence, then I don't really care if I get the most anyway because I'm not all that competitive as a rule, certainly not in this sort of a thing. On the other hand, if this is supposed to represent, you know, a real resource management issue and were talking about losing planetary resources here, then it is really important to me that I maximize my point total... I believe in the interdependence of us all and on the planet's resources and if I maximize my point count then someone else is going to be minimized and ultimately I believe that is going to hurt me. And if not me it's certainly going to hurt my children and grand children and people down the road. And so the whole notion of maximizing at someone else's expense is repugnant to me and has long be repugnant for me. I'm much more interested in maximizing for everyone; some sort of cooperative way of maximizing what everybody gets. I'm prepared to take a little less if I can be sure that other people get a fair share too. Mind you, on the other hand I'm not prepared to be walked on. So I'm not sure of if I have a strategy at this point. Well as a matter of fact, I don't.

T1, 12 points

Well I'm going to start out with 4 points. Simply because if we're going to divide this into 3, 4 is one third of 12 and so I'll start there and see what happens. So I want 4... nothing happened what do we do here. [Reads instructions again, tries again and gets experimenter who informs her that she can only take up to 3 points per trial.] So I can't take one third, I can only take... less than one third. That's fair enough.

T2, 10 points

OK now decide how many to take on trial 2 [Reads instructions]. Let's see, they each took 2, that leaves 5 left which means that there are 10 now. So to maximize you want to get that up to 12 next time, which means that we would want 6 left instead of 5. So if I took 2 and they continue to take 2... So I'll take 2 and see what happens.

T3, 6 points

OK so I took 2, one of those went up to 3. OK so... there's only 3 points left. How come... oh because there was only 10 to begin with. Oh I miscalculated. That was stupid. OK so now there are only 6. Oh... we want to get that to 12. If everyone took 0, that would work. Let's try. I'm going to try taking 0.

T4, 2 points

Hmmm... OK so one person continues to take the 3 and the pool size continues to decrease. 6... 8 [counting]. The green one who has been taking the 3 now has 8, I only have 5, and that other person also has 5. And were not getting anywhere because the pool size is decreasing at all times. OK there's only 2 points left. Well if there's only 2 points left... one person is dominating the whole show here. But that's no reason... it's a limited resource... so that's still no reason to increase what I'm taking with that limited resource. I wonder if I tried it one more time. Is that being foolish? Is that being a patsy or is that giving the other guys a chance to see the light? Why not? [Takes 0]

Post-Experiment Interview

S: And that's the end of that. [Reads instructions] OK, so... what I did wrong was start off taking too many points. Because I divided the 12 by 3, not remembering that what you want is a few points left over. So I started out wrong. Then I continued that error on the second trial because I miscalculated how many points there were, so I continued that. And, of course, I started first so I hogged the points, so therefore, presumably, the other people got what they could out of it and the game ended very fast. So the way... a better strategy would have been, if I hadn't had been so thick about understanding what was happening here, would have been to take many fewer points to start with. I started taking fewer points too late in the game for the other people to respond effectively. Because I think probably... well not necessarily, they still could have taken fewer points and increased the number. Let's see, if they had all taken 0 on that third trial, then there would have been 6 points left and we would have been able to get right up again. If they had taken 0 on the fourth trial, there would have been.... if they hadn't then... and then again on the fourth trial if they all taken 0 then we would have 8 points. So... And of course the person that grabbed the most is the winner. As usual... as often happens in this sort of thing. Hmm... which is why I guess is why I don't do well on these types of things. But I did grab the most on that first trial. But I was doing it stupidly, because I didn't realize that's what I was doing. But the fact is that was what I was doing. Very interesting.

So what I did wrong was to start off taking too many points. Because I divided the 12 by 3 not remembering that what you want is some points left over. So I started out wrong. Then I continued that error on the second trial because I miscalculated how many points there were. So I continued that. And, of course, I started first, so I hogged the points so therefore, presumably, the other people got what they could out of it and it ended the game very fast. So the better strategy would have been, if I hadn't been so thick about what was happening here, would have been to take many fewer points to start with. I started taking fewer points too late in the game for the other people to be able to respond effectively. Because I think probably they... well not necessarily. They still could have taken fewer points and increased the number. Let's see... if they all had taken zero on that third trial, then there would have been six points left and we would have been able to get right up again. If they would have taken zero on the fourth trial then we would have had eight points. And so... and of course the person that grabbed the most is the winner. As usual. As often happens in this sort of thing. Hmm. Which I guess is why I don't do well on these types of things. But I was grabbing the most on that first trial. But I was doing it stupidly. I didn't realize that was what I was doing, but that was in fact what I was doing. Very interesting.

When I started the thing my idea was that if it is serious... if it is a serious game, as I already said if it reflects something serious like resource management, then the only way that that is going to work long-term is if you maximize the resource use for everybody, not just one user, but for all users. Maximizing it for everybody means decreasing it for any one individual. So my notion when I went in was well 12 points, there's three of us, divided by three, we'll each take four points. Of course you couldn't even do that. I was so stupid then that I didn't even catch on. I had forgotten that, of course, you have to have points left in order to keep your pool size up through your ten trials.

E: So this whole recognition that sustainable use was a good strategy didn't kick in until after Trial 1?

S: No, it kicked in before. You'll hear it on the tape. It kicked in before. What I said on the tape was two things. I said if this is just a game, then I guess the way to do it is to go in and grab all you can. But if this is reflecting something serious, then I'm going to think about the resources on the planet and how we have to share them. So that's what I was trying to do. But it was just stupidity that I didn't... I forgot man you have to double that... you've got to have something left.

E: So your intentions were good...

S: My intentions were good, but my execution was lousy. Yes. Right. And then when I started to catch on it was too late. But by then it was much too late. Which is a nice little micro-explanation of a macro-problem if you will. Because people still aren't catching on. On the whole. People still aren't catching on. They aren't. I mean it's incredible. Did you hear what Kim Campbell said yesterday?

E: No.

S: Something about she's interested in new environmental technology and that was going to be the way that we can get more out of the environment. Right. Isn't that what I'm saying. That's not catching on yet. That's still not catching on. In my view. I mean there is no technology that's going to change the fact that that global ecosystem. It's all about sharing. It's not new technology, in my opinion. And... do you want me to continue the pontificating?

E: Let's get on to something new.

S: Yeah right.

E: You mentioned something about sharing. Was the whole idea of equity important to you in this situation?

S: Oh absolutely. That's why I took three points to start with... to try and get equity. Taking three... that would be the easiest way to divide the 12 points. I should only take three. I was thinking of that as equitable because the other part of the game had not penetrated yet. Equity is absolutely crucial. And equity, of course, is ultimately a goal that will never be reached. But it is a goal that we have to work towards.

E: Do you have anything more to add for this segment, or should we turn off the tape recorder and go onto something new?

S: I think I've pretty well said it all. OK. Well I already said it on there but I guess that I could say it again. It's really interesting that... the way the computer has responded. I took the first three to mean this person is trying to hog it... in hindsight not at the time... but when I look back on it now that this person was trying take as many... that was the maximum amount. So immediately the computer responded by taking near maximum. It gave me one more chance and I still took maximum, but it w as just playing that game. It was beating me at my own game in effect. And that will always happen. There will always be someone out there who is going to beat someone else at their own game. As long as you're in that type of a competitive game.

Participant 4
Male
Social Values: Cooperative
Condition: PS Certain

Initial Action Plan

OK, so the first question... [Reads strategy question] Well, obviously what you want to do is you want to, among the 3 people, take a total of 6 because that way you get the most regeneration over the next trial and you take the most that you can. So you want to take a total of 6. And since there are 3 people, obviously what you want to do is to take your maximum which is 3, and get the others to take like 2 and 1, or one another person to take 3. But obviously, they're going to want to take as much as they can too. So if you try and be equal, if you try to all take the same thing, then that would be 2. But if you wanted to take advantage then you would want to take 3, but then they're going to want to take 3 too, then there would only be 3 left and you would eventually loose your resource. So obviously is what you would try and do is to convince everyone to take 2, so that you take 6, you get back to 12, you take 6 each time. But then of course the problem is that you don't get enough for yourself because you only take 2 each time and you only get a total of 20. Then you can get into a competitive thing where everyone takes the most which is 3 and you won't get as many over the long run, so the idea is to get everyone to take 2. OK.

T1, 12 points

[Reads Instructions] OK, I guess what I'm going to do is I'm going to start off taking 2. That way I hope they'll get on to that and try to get everyone to take 2. But if they don't, then my only choice is to become as competitive as I can and get as many for myself as I can. So I'm going to put 2 in... confirm, yeah. Processing.

T2, 12 points

Good, they all took 2. So what I hope we can do is that if I take 2 again... confirm it... and hopefully what they'll be able to do is to do the same again. Hopefully, none of them will take 3.

T3, 10 points

OK, so Green took 3 and now we only have 10 left. And now the idea, I think, is for everyone to take 4, a total of 4 so that there are 6 left and we will be back to 12 again. And I think to do that I'm going to try... now I can't decide if I should take 1 or 2. Because if I take 2, then they all might take 2 and we would run our resource down eventually. I think I'm going to take... Oh boy... because if I take 2, then they might all take 1. So if they take 2 or 3 that would be 6 that would be 4 left and the pool would be down to 8, and they are just going to totally run it down. So I'm going to take 1 and hope that they follow.
Because eventually, if I take 1 and they follow that would be more for all of us.

T4, 10 points

Green's just being a pig, I see. I'm just going to take 2 this time to try to... I hope that they don't follow though, because that way we're just going to have nothing left.

T5, 8 points

Oh... I wish I could talk to Green and tell him that we could all get more if it only took 2. Because now we're down to 8. And the idea would be to only take 2 and then we could regenerate a whole bunch. I'm going to 1 again hope that we can regenerate our resource. But, I don't know. If Green keeps being that way, I think we are just going to run it down, and I'll take as much as I can for myself.

T6, 6 points

OK, so Green is going to be that way. So if there are 6 left, that means the idea is to take none. I'll try that... No Green wouldn't do that would it? Green would just take 3. I'm not going to take 0, because I still am interested in getting money, so I think maybe I'll... what am I going to do? I think I'll take 1 again. And hope that Green will notice that it's taking everything. Because 1 is a nice compromise between 0 and 2.

T7, 2 points

So Green is going to be like that. Well if there's 2 left, since I get to go first, I may as well take the 2. Otherwise I won't get anything and I may as well get as much for myself. Well... of course it doesn't have a choice. I don't know why it's processing when there's nothing left. Why are they all taking 2?

Post-Experiment Interview

S: Well I think what happened was, obviously, was that Blue tended to do pretty much like I did. And Blue probably had the same idea that I had... and that's that it should try and conserve it. But Green is just pigging out, it's just getting as much as it can in all but 2 trials. So... yeah what I was trying to do was to get everyone to take 2 each time which is most efficient. Then we'd all end up with 20 instead of now when we all end up with a lot less... I think. And Blue might have had the same thing in mind, but Green obviously didn't follow. [Reads instructions again] Anything else to say... yeah so obviously that's what I was trying to do. Green didn't listen. Green was just taking everything for itself. And Blue did the same thing as I did. It tried to take 2 and then did the same as I did. It tried to take 1 a few times to try and build up some resources. [Computes different possible outcomes, "If it doubles each time..."]. Yeah... so I think that would have been the best is if everyone took 2 each time, but some people wouldn't listen... like Green. OK, I think that's it, so I'll just hit stop now.

S: OK well basically, see the way I figured it was that you wanted to be left with six each time so that you could come back to 12. And that way you'd get the most... get the most kind of. And that's what I did at the start. I took two and they all followed. That's what I was hoping that they would do. But then it turned out that Green kept taking three. And Blue I think was trying to do the same thing that I was. He was getting one and two. But I kept trying to do two. On the second trial Green took 3 and Blue took 2. I decided to take one to try to get Green to size down it's harvest.

E: So you were actually trying to influence Green by modeling cooperation? OK that's a good strategy.

S: Yes, and obviously he wasn't following. I went back up to two and it didn't listen either. So I went down to one. And then when there was two left, I just took as many as I could. Cause that was it.

E: You were expecting Green to take three again, or the maximum amount on that particular trial?

S: If I took 1 it would take 1 [the one remaining point]. If I took zero it would take two. It was just interested in taking whatever it could.

E: OK. Do you have any thoughts about equity or fairness. Like with respect to Green did you find his responses unfair or...

S: Well obviously Green made more money that Red or Blue did. Obviously.

E: So you thought that was a good strategy?

S: Well it worked. Green ended up taking more than Blue and Red.

E: What was your initial goal when you came into the situation? Did you want to make more money than the others?

S: The thing I figured was that if I took three each time, I would make less money than if everyone took two each time.

E: That's correct.

S: So I tried to get everyone to take two. But not I think that if I did take three I probably would have made more money than Green and Blue. Than Green at least. I would have made more money if I took three each time. But I think maybe my total might have been less.

Participant 5
Male
Social Values: Cooperative
Condition: PS Uncertain

Initial Action Plan

No, I don't have a strategy for maximizing my points. Until I see what is exactly going on with the simulation, I have no idea of what to expect. So I don't have a strategy right now.

T1, 10-14 points

[Reads instructions]. I'll take, I don't know, 6 points. Oh type the number of points, OK here we go. Uh, nothing's happening. [Re-reads instructions again]. Something's not going right here... 3. Choice made 3, confirm, yes. OK, I took the maximum. [Reads.]

T2, 8-12 points

Oh OK. I got 3 and they got 2 each. OK, so I won. [Reads]. Well let's see, obviously I can't take 8 that's not allowed right, it's 1 to 3. So, I'll take 3 again. Obviously, if I can take 3, I'll take 3.

T3, 2-6 points

Green took 3 as well. OK, I don't know, I'll just take 3 again I guess. [Confirms choice]. Uh oh, the resource pool has been extinguished. [Reads.]

Post-Experiment Interview

E: OK. I just want you to give me sort of a trial by trial synopsis of what went on and what you were thinking when you made your choices on each trial, beginning at trial 1.

S: Well I just realized that most points I was allowed to take was 3 on each trial, so I just took that. I took three points for each trial.

E: OK, was there any reasoning behind your choices.

S: Well, it was the most you were allowed to take.

E: OK, did it ever occur to you that the game could last up to 10 trials, and that if you took fewer points on the first few trials that the resource would keep regenerating?

S: No, it never did. No, I was just trying to maximize my points which is what I was told. So... yeah I never even thought of that. I didn't really have it in my mind... I guess I really didn't clue in that I was dealing with resources. I wasn't thinking in that mode.

E: When you were playing, were you aware of the fact the number of points remaining in the pool would double?

S: Yes... yeah.

Participant 6
Male
Social Values: Noncooperative
Condition: PS Uncertain

Initial Action Plan

OK. [Reads instructions]. No particular strategy. I would like to start by accumulating a few points and then taper off depending on what the competition is doing. But other than that, my plans are very vague.

T1, 10-14 points

OK, first of all I'm gonna try to take the maximum, 3 points. And I'm confirming this and am standing by for the next...

T2, 8-12 points

OK, I took 3, they took 2... 7, so there's are 8-12. So on this trial, I'm going to go down and take 1 point and yes. Now at this point, I will see how many there are left, and if there's enough left in the pool I will take another 3.

T3, 6-10 points

But I see that there are only 6 to 10 points left. In which case I will only take 2 this time around instead of 3. The reason for that was because I did not think that there was going to be enough left for later on. We'll see how much is left at the end of this...

T4, 2-6 points

Oh... there's only 2 to 6. In that case, I don't want to jeopardize the pool, the total pool of points. So I will take 0 for this particular trial and wait for the next one see what my competitors do. Hopefully, they won't take any more, otherwise we won't be able get to the end of runs. OK, the resource pool has been extinguished.

Post-Experiment Interview

E: Can you give me a trial overview of what happened?

S: OK... on the first trial, I took 3 points because I knew that there was enough at the beginning. So I wanted to build a safety... a fund for later on.
As I saw that my competitors took a moderate amount and that there was still 8-10 points left, I decided to taper off and let the pool regain it's same number of points.
On the second trial...

E: On the second trial, you expected Green and Blue to stay the same strategy as on trial 1?

S: Exactly, yes that is what I expected. But, instead Green went up and Blue stayed at the same, which drained the pool even more. Now my strategy going into the third trial was again to get as much as I could, but without jeopardizing the pool size since I saw that we were getting low. So instead of taking 3, which was my original plan, I only took 2 hoping that Green and Blue would go down and take only 2 or 1 points. Then Green still took 3 and Blue took 1. That took us to the fourth trial in which I could see that the pool was getting very low in size and I didn't want to take any points at that point. And I expected my competitors to do the same, but....

E: I guess that expectation was not confirmed.

S: Exactly.

Participant 7
Female
Social Values: Cooperative
Condition: PS Uncertain

Initial Action Plan

My strategy for harvesting the fish or the trees is to not take too many trees the first couple times around, and try and keep the stock up
Or to alternate anyone with the other computer generated people taking... to alternate taking a little and a lot and a medium and a lot.

T1, 10-14 points

OK pool size 10 to 14. 2 is probably a good number to take. It's not the most and it's not the least amount I can take.
We'll see what the other people choose.

T2, 10-14 points

We all chose 2. That seemed to work out really well. So this time I'll take 2 again.

T3, 8-12 points

OK, so the Green took 1 more which puts our stock down. If I take 1 then it depends on what they take, if I take 3... if I take 2 then it might work out the same. But we need to build up stock for the next time around. So... I'll take 1 this time around I guess.
And hopefully the stock will build up.

T4, 8-12 points

OK, Green took a lot again, but Blue took 1 as well. So that leaves us with the same amount. If Green keeps taking more, then we're going to run out and not have much to take from. So I'll take 1 again this time, and the next time I'll take 2, if there is enough.

T5, 8-12 points

Oh... same amount. It would be a risk to take 2 if Green keeps taking more than Blue... the Blue is taking the same as I am. It would be a risk to take more than 1 if Green keeps doing that. So I'll take 1 again. I can't count on the Green taking less, if I take more.

T6, 8-12 points

Same again. Well I'm going risk taking 2 one time. See what happens when I take 2 once. If that doesn't work, I can always take less the next time.

T7, 6-10 points

Oh... Green took 3 again. OK well I took the chance, I took 2. So if we're going to get the stock back up, I'm not going to take any this time.

T8, 4-8 points

Oh... there's only 4 to 8 left. We're not doing too well in terms of points...
So I'll take 1, that's not being too selfish.

Post-Experiment Interview

E: Can you give me a trial-by-trial overview of what happened.

S: It started out really good. In the beginning, everyone took the same, everyone took 2, and the pool size remained the same at 10 to 14. In the second round, the Green took more than myself and the Blue did, so I took less. But Green continued to take 3, but Blue took less as well. So the stock, with 4 to 6 left, it only went up to 8 to 12. So I took 1 again, not wanting it to get too low. And Green continued taking 3, so on one round I decided to take 2 instead of 1 to see what would happen. Take a chance and maybe Green would go down, but that did not work. So the next time Green continued taking more. So with one person being greedy, the stock just depleted. That's about it.

Participant 8
Female
Social Values: Cooperative
Condition: PS Uncertain

Initial Action Plan

I think the strategy that I will use for maximizing the total points during the simulation would be to have it go over the 10 trials, and probably alternate between taking... to take 2 on the first one and then see what the reaction is, and then to either go up or down on the next one to keep a large pool in place.

T1, 10-14 points

OK so on the first trial, because I can take between 1 and 3, I think I'll take 2 just to see what kind of reaction that has across the total number taken.

T2, 10-14 points

OK so this time the pool is again at between 10 and 14. So I think I'll take 3. That should still leave 1, even if everyone else takes 3. So it shouldn't deplete the resource.

T3, 6-10 points

OK, so there are between 6 and 10. I think I'll only take 1 this time, so the pool will get larger on the next turn.

T4, 4-8 points

OK that depleted it even more than I expected. So now there are only between 4 and 8. So I don't think I'll take any on the next round.

T5, 2-6 points

OK... this Green participant seems really greedy, so the pool is going down instead of up. I don't know... let me see when I took 2 everyone took 2.....5 [mental math?]. I don't think I'll take any this time.

The resource is extinguished, it's over.

Post-Experiment Interview

S: Well it seems that the Green participant took a steady number every time and that depleted the resource more quickly than I expected. So the game ended sooner than I thought it would.

E: Can you give me a trial by trial overview of what happened?

S: I'll tell you what I did as I went through it. On the first one, I decided to choose 2 to sort of see what would happen... how the other participants would line up and if that had any relationship to what I had chosen, and to keep the maximum number of points in the pool. And that strategy worked. So the next one, I thought that I would increase it by 1, because it seemed to have the room and it depleted it a little. So I thought that OK I would drop back. That's when I just chose 1 and the stock was depleted even more, which I found alarming. So I thought the next time I wouldn't choose any, hoping that it would increase and allow further harvesting. But it didn't, it continued to deplete.

E: So your strategy was to keep the pool alive for the full 10 trials, and hopefully that you would acquire more points that way?

S: Yes, that's right. And that's what I stated at the beginning. If I could keep the resource at its peak, then I could harvest for a longer period of time.

Participant 9
Female
Social Values: Individualistic
Condition: PS Certain

Initial Action Plan

OK... I don't have a strategy yet, so I'll just go on. OK I'm starting it up now.

T1, 12 points

OK... how many points should I take? Umm... I'm going to take 4. I'm going to take 4 points. It doesn't look like it's working... [gets experimenter]. OK, I know why it didn't work, I wanted to press 4 instead of the ones that I was allowed to take which were 1, 2 or 3. So I guess I'll take 3. And my choice is yes. And now I'll see what the other people are going to take. I guess I wasn't reading the directions.

T2, 10 points

OK so they took... Green took 2 and Blue took 2, so we took 7 and 5 were left. So the pool size is now 10. Umm... well since I'm a ... I'm just going to take 2 points. There we go. Let's see what the other people are going to take. Ahhh, I'm confused.

T3, 6 points

OK, now Green took 3, Blue took 2. We took 7 again, so doubled... OK so 3 points are left so they doubled to 6 points. Since I only have 6 points left, I guess I'll only take 1. I don't want to take too many because then there won't be anything left for the resources, and that wouldn't be very good.

T4, 2 points

OK, we only have 2 points left. Well I think I'm going to take them all for myself... because... it's a competitive business so I should take them all. OK. OK the resource pool is extinguished, the simulation is over. I have nothing left in my pool.
So I'll get the experimenter.

Post-Experiment Interview

E: OK the first thing that I want to know is whether you think that what was recorded on the tape accurately reflects your thoughts during the simulation?

S: Basically... I was really confused so...

E: And do you think that came across on the tape.

S: Yeah I think it did.

E: Do you think that was a problem with my instructions?

S: No I just... I don't know what it was. I think that it was because it was numbers, and I didn't have it right there so I knew I was Red, but I couldn't really distinguish exactly what was being done. Like I was trying to sit through it and think of myself as a logger or something and having to take things out of the pool... it was just confusing. Especially when I picked 4 instead of 3.

E: OK now let's just go through your decisions round by round. On the first trial, you decided to take 3 points. What were you thinking at that time? Did you have a basic strategy in place that you were trying to employ?

S: I don't... not really. I was just trying to see what would happen if I took all 3 points for myself. So I thought that I would do that. And when I saw that they only took 2, I decided to only take 2 the next time.

E: OK Umm... so during the initial trial, it didn't seem like you had developed any firm expectations about what Green or Blue were going to do.

S: No.

E: Did you experience any emotions or anything during that initial trial?

S: Emotions? Umm... just a...

E: Just a general sense of confusion?

S: Yeah... a general sense of confusion. It wasn't your fault though. It's just... me.

E: That's OK, I won't take it to heart... OK during trial 2 then you dropped down to 2 points. And was this just because you were following Green and Blue's lead?

S: Basically, I wanted to know if I only chose 2 what would they do.

E: Were you concerned that the pool was decreasing?

S: Yeah that's why I went down. I didn't want it to decrease too much. And then I only chose 1. I'm not sure why I chose 2 at the end. I think next time, I'd only choose 1 the whole way through.

E: And umm... as the simulation ended, did you experience any emotional response at that point or was this a very unemotional experience for you?

S: I felt like it ended too quickly.

E: Were you disappointed?

S: Yeah I was actually disappointed.

E: On a scale between 1 to 5, how disappointed were you.

S: Probably about 4.

E: Umm... as the game progressed and you noticed that the resource pool was depleting, did you feel like you had an ethical responsibility to preserve the pool or...

S: I felt bad... I kind of felt that I was taking too much, that's why I just took 1 on the third trial... I just took 1, but then I noticed that Green still took 3 so... I didn't know what to do.

E: Were you angry at Green at all?

S: I just didn't know why he would take 3 when I only took 1.

E: Do you think that uh Green and Blue's responses were related to your own at all?

S: Not really. At first I thought that they were but then I didn't think that they were.

E: Why was it important to you to preserve the pool?

S: Because I didn't want to run out of the resource.

E: Did you think that you could make more points by preserving the resource for the full 10 rounds?

S: Yeah, I thought that I could get more points if it lasted longer.

E: Did you ever find yourself wondering, as the game went on, why Green and Blue were making the choice that they were making?

S: Yeah I didn't know what it was based on so I was curious.

E: You were curious, but did you come to any conclusion or formulate any hypotheses in your head?

S: Umm... at first I thought that they were going to try to be better than I would be.

E: Better? As in taking more?

S: As in taking more. Especially Green, he seemed to be a little bit greedy.

E: Ummm... Anything else that you want to say about this.

S: It's confusing. It hard for me to see myself as a like a logger trying... to make what I can and stuff. It's just... weird.

Participant 10
Female
Social Values: Individualist
Condition: PS Certain

Initial Action Plan

Umm... I have no strategy at the moment. I think... that I would try and go for the most resourceful way to get information, and try to stay ahead of my competitors.

T1, 12 points

OK... in order to keep my pool size up, but also to stay ahead of my competitors, I am going to pick... 2 points on trial 1.

T2, 12 points

OK I noticed that my competitors have followed me in their choices, and... we have 12 points left. And I think that instead of doing what I did last time, I think that I am going to take a little bit of a risk and take 3.

T3, 8 points

OK Green has taken 3 and Blue has taken 2. We're left with 8. And I want to... make sure that my resources do not get depleted so I am going to take umm... 1.

T4, 6 points

Ummm... unfortunately we do not have many points left... we only have 6 left. And Blue seems to be rather conservative. Green is very competitive and does not seem to be using it resourcefully... so I think that I'll take 1 again.

T5, 2 points

It seems that Green is trying to tick me off by taking more, and Blue seems to be very reasonable. So... in order to counterbalance Green's... greed, I'm going to take 0. Umm... it appears that even though I tried to be resourceful, my other... Green wasn't too resourceful. Of course, I'm not too happy because I didn't win, but... I hope that Green does something to learn its lesson. However, it will probably get rewarded rather than taking away from the reward. It's disappointing that I only went through 5 trials before I lost all the points.

Post-Experiment Interview

E: OK the first question that I want to ask you is do you think that what was recorded on the tape recorder accurately reflects your thoughts during the resource management simulation?

S: I think so... but you know what happens with the subconscious so... Umm...

E: Everything that you consciously thought... do you think that's on the tape at least, or did you find yourself editing your thoughts somewhat?

S: They might have been edited somewhat.

E: Were the thoughts that were edited related to the simulation at all or do you think that they were mostly extraneous thoughts related to your social life or other things?

S: Umm... they were extraneous thoughts.

E: OK let's just go through this thing trial by trial. On the first trial, it looks like you took 2 points. Why did you decide to take 2?

S: Umm... I figured that it was a little above average and that... it wasn't being too greedy I guess.

E: What do you mean... above average?

S: Uhh... well I could have taken 0 or 1 so... and I anticipated that they would maybe go the same way... that they would either... be within the same range.

E: So you went into the simulation with the general expectation that others would act they same as you would act?

S: Either as I acted or a little bit better.

E: Better? Meaning more cooperative? Taking less?

S: Taking more.

E: Oh.. taking more. OK during that initial trial did you experience any emotion at all?

S: Confusion. I don't know if that is an emotion.

E: Yeah... that interesting, a lot of people mention that one actually. What were you confused about?

S: Umm... well I didn't realize that it would be that simple I suppose. I thought it was... I didn't think that I would have to choose... just a number. I thought that I would have to decide about how I would have to decide how I would go about using the resources or something. So I thought that it would be more of a game using your mental skills or whatever.

E: OK uhh... let's go down to trial 2. Now compared to trial 1 you increased your harvest slightly. Was there a reason for that?

S: OK the pool size was the same, and I saw that they Green and the Blue did the same as me. So I figured that I was safe to move up 1 and see the results that would occur.

E: OK were you trying to get more points than Green and Blue or were you trying to maximize your own total regardless of what the other people did?

S: I was trying to maximize my total, and at the same time using the pool size as a factor... it was still quite large so I didn't feel guilty about taking more.

E: Umm... after trial 1 where everyone took the same amount... did that provoke an emotional response from you? Were you pleased by that outcome or did you care one way or the other?

S: Umm... I don't think that it really affected me at that point. I think that it was more on the second trial when Green took the same as me and Blue took less... I figured that Blue would be a bit more conservative and I respected him a little more than Green. I treated Green more as competitor than Blue.

E: OK on trial 3 then... it looks like the total pool size declined by 4 units and there were only 8 points left in the pool, and you reduced your harvest. Can you explain that?

S: Yes. Umm... I saw how much was being taken out and I didn't want to deplete the resources any more than they already were so I decided to take 1 and see what the others would do in response to that.

E: Now why did you not want to deplete the resource?

S: Uhh... because resources are useful to us and if we do not have any resources we cannot grow economically or socially or whatever. And we need those resources to last as long as possible.

E: As far as maximizing your own personal point total though, did you think that it was wise to preserve the resource or did you think that you could have gotten more by taking as much as possible on each trial?

S: I could have taken more, but I suppose I wanted it to last as long as possible. And I thought that maybe if I took less, maybe the other competitors would take less and therefore increasing the pool... or maybe not increasing the pool size, but keeping it up for a longer period of time so that everyone can share it.

E: On trial 4, you took 1 point again. Why?

S: It was basically the same idea. I decided that it was getting less and less and that Blue was following my example... and I supposed I was starting to realize that it didn't really matter what we did because Green was going to keep taking as much as he wanted anyway.

E: If that's the case, how come you reduced your harvest down to 0 on the fifth trial, if you thought Green was just going to take everything anyway?

S: Umm... I'm not the type of person that is the one that uses up everything. What they had should be shared among everybody. I still believe that even though Green was as greedy as he was. But... I suppose I should have increased my score and taken more now that I think back on it.

E: Did you experience any anger towards Green for being so noncooperative?

S: Uhh... yes. Not anything violent, but I was a little bit annoyed with the fact that it was not cooperating.

E: And on what trial would you say that you first experienced that?

S: Probably trial 3.

E: On trial 4, as Green continued to take 3, did your anger or frustration increase or stay relatively stable?

S: It increased because of the fact there was such a little pool size now and I knew that it didn't really matter anymore about how much I took because there wasn't going to be very much left for very long. Umm.. but on the last one I would say that I was the most upset because Green had taken that much and didn't seem to have learned anything from it or learned a lesson or...

E: On a scale of 1 to 5 how strong would you rate your annoyance? 5 being very annoyed.

S: 4.

E: OK as the game progressed and you realized the resource was declining did you feel an ethical responsibility to preserve the pool, or was preserving the pool just a means for increasing the total number of points that you could harvest from the pool?

S: Umm... I would say that it was more ethical than to just increase the pool size.

E: As the game progressed, did you ever find yourself wondering why the other players made the choices that they made?

S: Not initially. I wondered why Blue was being so much more conservative that even I. Umm... I anticipated that maybe he had a conscience too, and that Green just had no morals whatsoever.

E: Umm... as you made your choices, was there any conscience attempt to influence the choices of the other players. For example, on trial 3 when you took 1 were you trying to convey to the other players that hey I'm trying to cooperate here why don't you reduce your harvests also?

S: Yes.

E: OK do you have anything else to add? What I'm trying to do here is to develop a theory that accounts for cognitions, motives, and emotions that underlie your harvest choices in these types of situations. Is there anything that you could tell me that would help me develop such a theory?

S: From my point of view, I suppose, I would say that we all have a responsibility to our resources and keeping them continuous and that... hopefully by having more than one person, as indicated here by the Red and the Blue, will eventually convince the uncooperative partner to cooperate.

E. But what happens in a situation like this where even though two people in the group are cooperating the actions of one person leads to the depletion and ultimately the extinction of the resource? People seem to approach this type of situation in two different ways. Some people continue to decrease their harvests, like you did. Whereas other people end up getting fed up with Green and end up increasing their harvests say around round 4 or so and end up taking 3 every round. How come you didn't take 3?

S: Umm... I guess that I'm just going for consistency because I don't... I'm not going to take my frustrations out on the resource. I would rather take my frustration out on Green in a different way that would maybe affect his ability to collect resources and abuse them.

E: Oh OK... so for example if we were able to develop a new simulation in which you were able to penalizing Green directly for making a choice that you disagreed with... that type of sanction you would perhaps use in this case.

S: Yes.

Participant 11
Female
Social Values: Cooperative
Condition: PS Certain

Initial Action Plan

No I don't have a strategy because I don't really know what this is about yet. So I guess I'll just see as it goes along and try to think up a strategy. I don't really know.

T1, 12 points

OK... I'm going to take 3 points. Yes... I want 3 points.

T2, 10 points

OK... umm... there's 10 points in the pool. OK... I'm going to take... I'm going to take 2 points.

T3, 6 points

OK... there's 6 left in the pool, so I'll take 3. Since there's less numbers I want more points... so I just have a chance.

Oh there's no more points left. Oh no... OK... well I guess I don't really know what's going on in this experiment. Umm... I have no points left. Oh well... don't know. I really don't know what I was doing. Oh well...

Post-Experiment Interview

E: OK first question now... do you think what's recorded on the tape recorder accurately reflects your thoughts during the resource management exercise?

S: Probably not all of them.

E: In what way do you think it might be incomplete?

S: Some things you just don't say out loud... you just don't think about it... it just stays in your head. Usually you don't think out loud. I don't think out loud that much. So it's kind of... I guess I'm not used to it.

E: OK so the things that you weren't verbalizing, would you consider them to be unconscious processes, or were there some conscious things that you just weren't saying?.

S: Probably a mixture because like you just think of things and you don't think that they're important to say so you just don't say them out loud.

E: OK we'll try to access some of those processes as we go through this and talk about some of your decisions. OK on the first round here, you decided why to take three points. Can you give me an explanation of why you decided to take 3 on that trial?

S: Well I just figured that there were a lot of... amount in the pool size so I thought that I would take as many as I could.

E: Had you developed expectations about how Green and Blue would behave on that particular trial?.

S: Yeah. At first I thought that they would take the same amount...

E: The same amount as you?

S: Yeah, same amount as me.

E: So you expected everyone to take 3 on the first round?

S: Yeah.

E: OK. So were you kind of surprised when they ended up taking less?

S: Yes. Then I thought that they might take less for the whole thing then because I really didn't know... I really didn't know what was going on.

E: OK... were you confused by my instructions? I guess I'm interested in knowing why there was so much confusion.

S: I don't know. I guess I didn't really know what I was doing. Ummm...

E: Did you understand that the goal of the task was to maximize the number of points that you get over the course of the game?

S: Yeah.

E: Did you develop any sort of strategy to maximize those points?

S: Not really. No.

E: OK let's go to trial 2 here. It looks like you reduced the number of points you took down to 2. Was there a reason for that?

S: Ummm... I don't think so, I just kind of picked it. I don't know. I just saw that it was going down so I would pick 2 and see how long it goes... so I picked 2. I kind of wanted to see what would happen with the other group. Then next time I thought it would go down, I figured that the pool would go down in number... so the next time I would take a bigger number.

E: You realize that the pool size wasn't determined randomly. It was a direct reflection of the number of points taken on the previous trial, right?

S: Yeah.

E: So your taking 2 on the second trial... was it related to the fact the other group members took 2 on the previous trial?

S: Umm... no, I don't think so. I just looked at the number 10 and I don't know... I just picked 2 because on the next one I was going to pick 3. I kind of wanted to see what Green and Blue would take.

E: So you thought that perhaps your response would influence what the computer players would do?

S: Yeah.

E: That's interesting. And by taking 2 did you want them to...

S: I wanted to see if they would take less or more.

E: And you were hoping that they would take less?

S: Yes.

E: So you thought that if you dropped by one they would also drop by one and take 1 each?

S: Yeah, 1 or 2.

E: Did you ever think that you might want to keep the pool size around 10 or 12?

S: No I didn't, I wasn't thinking of that.

E: OK on trial 2 when you ended up taking 2 and Green took 3, how did you feel about that? Emotionally... did you feel betrayed by Green or anything?

S: No I just wanted to take more on the next one. I don't know why... I just wanted to see what those ones would choose... what the computer would put down.

E: And what were you thinking of on the final trial?

S: Well I just saw that pool size 6. I think I kind of got confused because I was looking at points left and then a pool size and I thought that I'm going to take 3 because I figured that because it always took 3 that it would probably take 3 again. I thought that I better get some points in here.

E: OK... so you thought that Green would probably extinguish the pool anyway so you thought that you might as well get as much as you can while...

S: Yeah.

E: And was there an emotional response when you found out that the simulation was over and that the resource pool had been extinguished?

S: I think I was... surprised. I thought that maybe I had done something wrong here.

E: Were you disappointed at all?

S: Well I just didn't understand. Like I didn't know... it's hard to explain. I just thought that it was weird that it was over so soon. I just thought that oh I guess I did something wrong.

E: I'm not sure that this question really applies to you or not but I'll ask it anyway. As the game progressed and you realized that the resource pool was depleting did you feel an ethical responsibility to preserve the pool?

S: Well it was kind of hard to tell what was going to happen but... umm... I don't know. I guess so in a way but... I don't know what I was thinking.

E: Umm... as you were going through the simulation did you ever find yourself wondering why Green and Blue made the choices that made on a given trial?

S: I just thought that it was kind of interesting like on the first one that they go less, and on the second one they'd go one less or the same. Then the third one they went the same then less. I thought that that was such a mixture.

E: So you were trying... to figure out the pattern, but...

S: Yeah

E: Unsuccessfully?

S: Yeah

E: Did you ever use your own harvest choices to influence the choices of others during the simulation?

S: Umm... I don't know. I didn't really know what those ones would come up... what numbers would come up on their's so I was just kind of experimenting at first because I thought that it might go longer... I was just... I don't know.

E: Yeah the simulation is set up to last 10 rounds if you guys don't overharvest in the early rounds. In this particular case you just ended up taking too much too early.

S: Yeah.

E: Umm... OK what I'm interested in here I want to develop a theory that accounts for why people make the choices that they do in these types of situations. Is there anything else that you could tell me about your choices that could help me develop such a theory?

S: Umm... I don't know. I think that most people would choose less to like save the harvest... unless some people are greedy and they want lots. I was just experimenting... because I was forgetting about how much they took and how much it would double on.

E: Right. Would you consider yourself to be a greedy person?

S: No I'm not very greedy, I don't think anyway...

E: It was almost an accident?

S: Yeah.

E: Anything else you want to add before we turn off the tape recorder?

S: Umm.... I don't think so.

Participant 12
Female
Social Values: Mixed (Individualistic/Cooperative)
Condition: PS Certain

Spoke too softly. Protocol not transcribed.

Post-Experiment Interview

E: First of all, the first thing that I want to ask is whether you think what is recorded on the tape recorder accurately reflect your thoughts during the simulation?

S: I didn't really talk that much, but... I was more interested in thinking. I don't know... I can't really... I was trying to play the game so that it would go on to 10 rounds... because when I played the first one... I only got through 2 rounds or 3 rounds so I just wanted to... I guess the whole thing was due to points... to get the most points. I wanted it to go on to see how many points I could get in the next rounds.

E: OK well let's look at your decisions round by round here. On the first trial you decided to take 2 [12 points in pool]. Why? What were you thinking?

S: Because it wasn't greedy with 3 and it was more than 1. I thought that it was a safe number to take.

E: Had you developed a strategy to follow?

S: Not really, I just wanted the game to last to see if I could win, but I didn't.

E: OK... during trial 1 did you have any expectations about what Green or Blue would do?

S: No... I had no clue what they were going to do. When they both put 2s up and I was curious. I was like hmmm... I didn't really know... the pool was back up to 12 so...

E: During trial 1 did you have any emotional responses?

S: I was glad that the pool size was 12, back to 12. So I didn't really mess up too bad.

E: Then during trial 2 you decreased your harvest down to 1 [12 points in pool]. What were you thinking when you did that?

S: I don't know. Then I went down to 0 also... I don't know. I guess I wanted the pool to last.

E: Well you did well on the first trial. You took 2 on the first trial and you went back and the pool size was as large as it could possibly be.

S: I don't no. Oh well.

E: Did you have an emotional response or... I'm sorry, did you develop any expectations about what Green and Blue would do on trial 2?

S: No I didn't really think about Green and Blue that much I was just more worried about what I was taking and the pool size so... until the end, until round 7.

E: Any emotional responses on trial 2? Were you happy that you maintained the pool again?

S: Yes. I wanted it to stay at 12 as long as I could.

E: On trial 3 you went down to 0 [10 points]. That's an interesting response.

S: I don't know. I just...

E: Again you were just trying to preserve the pool, that was your main goal?

S: Yeah... but then I got annoyed at Green because he took 3 again. Green kept on taking 3. That's why I went to three on the next round.

E: On a scale from 1 to 5, how annoyed do you think that you were with Green?

S: I was a 3 and a half.
I didn't like some of the things that Green did.

E: On trial 4, you went up to 3, from 0 to 3 [12 points], now was that a direct response to Green?

S: Yes it was. I was mad at Green.

E: So you tried to get some pay-back. So umm... you were trying to get back at Green but you were...

S: I wasn't even too close to Green before anyway.

E: I'm just curious. On the first 3 trials your primary concern was to preserve the resource pool...

S: I know...

E: Then on round 4 you take 3 points to get back at Green. Did you temporarily forget about preserving the resource pool?

S: Yeah and because it was still at 12 also.

E: OK on round 5, the pool size is down to 10 points and you reduced your harvest slightly down to 2. Was there a reason for that? What were you thinking?

S: Because it was back down to 10.

E: So you saw that the pool size went down...

S: Yeah when I took the 3, I got a little upset because it went back down... it went down to 10, so I thought that I'm not going to take 3 anymore... because if he takes 3 again which he did...

E: So did you expect Green to take 3 again?

S: I thought that he might have. But I was more concerned with Green than I was with Blue, because Blue I didn't really mind... Blue was a fair player. Blue looked like he was kind of concerned kind of like I was about the pool size because he kept on going taking 1s.

E: Right... OK so when you found on trial 5 that Green took 3 again, did your anger increase or decrease?

S: Yeah... it's like he didn't care about the pool size. He was more worried about his points than extending the game or the pool size.

E: Relative to the anger that you had on the previous round, how intense was it?

S: It was getting... I was expecting him to just blow me away with points. Green was going to beat me, I could tell right there when I took 0 and he took 3.

E: Was winning that important to you?

S: No, I wanted to keep this pool size. That's why I took 0 on the last round.

E: OK let's not get ahead of ourselves. How about trial 6, you continued taking 2 even though the pool size was declining [8 points left].

S: I thought that it was a safe bet.

E: And you expected Green to take 3 again, did you?

S: I didn't know what he was going to do. It seemed like he was getting cheeky. He just kept on taking points. And then I actually... by the time I was down here on the 6th round, I was going 6, 6. 4, 7 [referring to points taken per trial], I thought that it was going to go 6, 6, 4, 7 all the way. I was looking at total points...

E: So you were looking for patterns?

S: Yeah.

E: Interesting.

S: I thought that it was going to develop a pattern, but it didn't.

E: This computer program is far more sophisticated than that. Not really. On trial 7 you decided to take 0... [4 points left].

S: Just so I could hold on to the pool size and... if I took 3 the pool would be over because Green was going to take points also.

E: Did you expect Green to take 3 again?

S: Yes. and thought... I didn't understand how you can take 5 points when there were only 4 points to be taken.

E: Because they don't know how points the other players are going to take. So you busted anyway...

S: It looks like Green cheated to me.

E: It was kind of unfair you think?

S: I thought so. Blue was steady, pretty mellow about it

E: As the game progressed and you noticed that the resource pool was depleting did you feel that you had an ethical responsibility to preserve the pool?

S: Yeah... well not really. I did at first. . but then when Green took two 3s in a row, that's when I wanted to take a 3... that's when I wanted to take a 3 to get back at Green. Then it went down to 10 and that's why I decided to take less because the pool was dropping.

E: I just want to know if the primary motive behind preserving the resource pool was ethical responsibility for preserving the pool or did you realize by preserving the pool you could get more points in the long-run.

S: I thought that by preserving the pool I could get more points in the long-run.

E: So it was kind of a strategy, or perhaps a bit of both.

S: A bit of both I think because I didn't like the way Green played.

E: As you went through the simulation did you ever find yourself wondering why Green and Blue were making the choices that they made?

S: I was more concerned with Green. Blue did not really phase me that much. Because if he had taken 3s too, I would have been really mad. Green... I can't believe took all those points.

E: OK... any emotional reactions when the game ended.

S: Yeah, I was bummed out. I was trying to preserve the pool and Green and Blue both wiped the pool out. I thought that I was being responsible by not taking any points that round.

E: Is there anything else that you can tell me.

S: About the game?

E: Yeah.

S: I thought the other players would be more concerned about preserving the resource. Blue certainly was a little concerned you know, but Green... Green got me mad. I didn't like Green.

Participant 13
Female
Social Values: Cooperative
Condition: PS Uncertain

Initial Action Plan

I thought that I had a strategy last time by starting with a big amount at first then... and so I could build down from it. I could take like one less each time. But it didn't work so I'm going to start with something lower and then work my way up instead of working my way down. So instead of having a big chunk at first and working with that big chunk, I'll work with a small chunk of fish or trees or whatever so I can plant more or get more.

T1, 10-14 points

So I'm going to start taking 1, and I don't know what the other people are going to do.
But hopefully they'll take a few more than me so that it gets larger and we will have more to work with so I can get a higher amount next time.

T2, 10-14 points

And that worked well. So I'm going to take... I going to keep with one, so I'm not being too selfish... and we'll keep taking one and maybe I can get a bigger chunk next time.

T3, 10-14 points

OK... I think I'll move up to the big 2 I guess... And hopefully, they'll go low because I'm going high. I don't know why I want that, but it seems like there's more for me.

T4, 10-14

OK... and I'll stick with 2 again. Stay consistent. We'll do this gradually.

T5, 10-14

And it worked out the same. Maybe I'll move down to 1 again before I move up to 3... Hoping that they'll stay up. I'll move to 3 next time... if you want to know my strategy right now...

T6, 10-14 points

Ummm... OK we'll take the big plunge and take 3. Umm... hopefully this isn't going to ruin the numbers here.

T7, 8-12 points

Oh... OK I want... I think I'll maybe stick with 3 again to stay up there. We've only got three more rounds left so I might as well take a lot.

T8, 2-6 points

Umm... how is this going to work. Maybe I'll take 0. Yeah... I'm trying to figure out... if there's 2 to 6, that means that if they take 3 each... that'll leave 0, but I'll just try to do that rather than lose it all now. And please don't take 3 and 3 or I'll cry.

Uhh... it's over. OK that's too bad. Better than I did last time though.

Post-Experiment Interview.

E: OK first of all... do you think what was recorded accurately reflects your thought processes as you worked through the task?

S: Umm... no. Just because... I don't know... it's just hard for me to think when I'm thinking out loud because I'm thinking and it doesn't come out the same way. But I guess that it was pretty accurate...

E: Do you think if I had you to do this again and I told you to slow right down and not rush through the task that perhaps the thoughts on the tape would more accurately reflect what you were thinking?

S: Yeah after the first couple of rounds, cause then I would know more about what was going on I think.

E: We'll try and get at that anyway... but sort of after the fact. OK we'll go through this trial by trial. On the first trial, you only took 1 point [12 points]. Tell me what you were thinking.

S: I think that I was pretty much thinking of staying low so that I could go farther. I was kind of like thinking in terms of nature here... sort of like taking the whole chunk at first and then after taking one I could grow more with that one kind of thing.

E: OK so you wanted to be conservative to start off?

S: Yeah, just in case.

E: Did you have any expectations about what Green or Blue would do on that initial round?

S: No.

E: No... OK... when you saw that both Green and Blue took 2 did you have an emotional reaction to that?

S: I think that I was glad that they didn't take 3. So I was thinking that they were pretty much staying medium low as well. I thought that I would just stay low until they really started going low, so that I could go up high.

E: At the beginning of trial 2, did you notice that the pool size hadn't depleted relative to the previous round?

S: Yeah.

E: And given that it didn't deplete, you decided to stay with the same strategy?

S: Yeah... because you wanted it stay high right?

E: Well that would be completely up to you. Why do you think that it would be important to keep the pool size high?

S: I just thought so that there would be more to keep taking because I didn't want it to go down to 0. I wanted it to stay high so I could keep taking.

E: Did you ever think umm... think about what would be the most efficient strategy to use to maximize your point total in the long-run?

S: No.

E: Never really crossed your mind. OK in trial 2... the Green player took 3 points. Did you have an emotional reaction to that?

S: Uhh... no... I think was concentrating more on the pool size for some reason.

E: That's useful for me to know. Anything else you can tell me about trial 2 before we get to trial 3?

S: Not really.

E: On trial 3 you ended up taking 2 points this time. Was there a reason why you increased your harvest?

S: Well I was going to gradually move up. So I was thinking that the pool size had not changed and they were taking more so I thought that I'd move up to 2 hoping that they wouldn't take more and the pool size would go down.

E: OK did you have any firm expectations about what Green and Blue would do on trial 3?

S: No.

E: Did you have an emotional reaction to Green's response on trial 3?

S: No.

E: Ummm... On trial 4 you took 2 again. Can you tell me what you were thinking when you took 2?

S: I think that I was just thinking about pool size again. It worked for just taking 2 and Blue took 1 so that means that I was getting a little ahead. and gradually move up to 3, so I decided to take 2 again.

E: OK on the next trial, on trial 5 though, you went down to 1 again, but things really hadn't changed... I mean the pool size was still the same size. Can you explain to me why you would do that?

S: Ummm... I think that I was planning on going down low and then going right up to 3, but I don't know why... I think that I just wanted to come down a little bit and then go up to 3.

E: OK by this point, we're on trial 5 now, Green has taken 3 for the last 4 rounds, did that influence your response?

S: I don't think that I was focusing on that very well.

E: OK were you developing expectations that Green was going to take 3 on every round or were you paying attention to that?

S: I wasn't really paying attention to that. That was really dumb.

E: OK so you were focusing primarily on pool size and it was remaining quite high... so you were satisfied with your strategy. OK on trial 6 you went way up to 3, what were you thinking?

S: I think that I just wanted to go up high...

E: Was it a competitive thing? Did you feel that you were competing with Green at all?

S: Yeah I think I did. Yeah I was thinking more that it was time to move up, none of this ???? anymore... take 3.

E: And this time was there an emotional reaction to Green or were you still not paying much attention?

S: Still not paying much attention.

E: OK were you developing any expectations about Green and Blue, had you developed anything, or were you focusing on your own?

S: I think that I was focusing on my own and I was worried about the pool size by me taking 3, I thought it would go down.

E: Well you took 3 and it did go down, so on trial 7 there's only 8 to 12 points left in the pool. But you decided to take 3 again, what were you thinking then?

S: Because it was 7, I knew that I only had 3 left so I thought that I should start getting points to get more.

E: Sort of get points while you can since the pool is declining and your running out of time, so you better get it while you can?

S: Right.

E: But then on trial 8 you went down to 0. That seems to be inconsistent with your strategy on trial 7.

S: I think it was because I noticed that it was 2 to 6 and I thought... I don't know... I was thinking that they would take... I didn't want it down to 0... I didn't want the pool size... so I thought that I should not get any so the pool size would maybe move up. Hoping that they wouldn't take 3 and 3... but Green had taken 3 every time...

E: So it's almost as if... uh on trial 7 there were between 8 and 12 points in the pool... you noticed that it was declining but it still seemed like there were a lot of points in the pool so it wasn't a big deal. But when it was done to 2 to 6 that sort of set off an alarm in your head saying hey the pool is in danger here and this game is going to end fairly quickly.

S: Yeah that and I wasn't thinking of myself... I was thinking that they would take the 3 and then there wouldn't be any points left so I might as well...

E: So finally by trial 8 you developed some sort of expectation about what the other people were doing?

S: Yeah.

E: It's interesting that it took so long to develop. OK... as the game progressed and you noticed that the resource pool was depleting, did you feel an ethical responsibility to preserve the pool or was preserving the pool just a means to increase the number of points you could harvest from the pool?

S: Yeah I think it was a little ethical... but I wanted to keep the pool up more so I could have more so it was...

E: Would you say that it was a combination?

S: Yeah it was a combination. I want to keep it up but because I wanted to have more for myself. But it didn't work.

E: Did you ever feel that hey this is a natural resource and if I extinguish it I extinguish it? Did that cross your mind?

S: That's what I was thinking at the beginning I think. I was thinking I'll start off with 1, keep it low and not extract too much.

E: By trial 8 it was more of an economic thing?

S: Yeah.

E: Did you ever find yourself wondering why Green or Blue made the choices that they made on a given trial?

S: No.

E: You didn't give it much thought.

S: No.

E: Did you ever use your own harvest to try to influence the choices of the other players?

S: Yeah on the last one when I did 0 I was hoping that they would too.

Participant 14
Female
Social Values: Individualistic
Condition: PS Certain

Initial Action Plan

I don't have much of a strategy at this point because I'd like to see what others are doing.

I think I'll start out in the middle of things and see how the other players go and adjust my scores accordingly. So it's pretty vague and incomplete at this point.

T1, 12 points

OK I'm going to start with 2 because I'm just going to go in the middle to see how the others react to my points. Confirm your choice... yes OK... just reading the instructions. OK good right on, so I'll take 3 then, just because I'd like to see the response for that.

T2, 12 points

Oh great... copy cats dammit. All right... OK I think what I'll do is try the 3 now... the reason being again just to see what they're doing and to maximize my points. It may not hurt if they duplicate what I do... that would give us 3...9 ...3 double... oh maybe I won't do that because then if they copy me then that gives us 3, 6, 9....3 that would be 3 points left... double that would be 6 and that's decreasing our pool size. So I think I'm going to stick with 2 [Experimenter interrupts and explains that computer players don't know what S takes until after it makes its own choice.] Oh OK so it's not ahead of me.

T3, 8 points

OK... 3, 2... total is 8...4 ....8 left. Oh gosh. 6 Umm... I think what I'll probably do is probably take 1... just because I'm even up on score right now and the Blue is still behind and that way... since we only have 8 left, that way if they go for higher numbers that way.... that way we'll have more points left at the end if I stick low. That way our pool size won't decrease. So I think I'll probably stick with 1.

T4, 6 points

Shoot... greedy bastard. OK hang on... OK 6...8. OK I'm a bit unsure right now because I don't know whether... if I stick high then what that's going to do if they stick high... then our pool's going to go down really really low. But if I stay low there is now guarantee that they are going to stay low with me. Hmmm.... and right now I'm down by 2 and up on one. Ummm... if I go 2 and he goes with 2 and Blue goes with 2 that would be 6 and that would give us with nothing. That Green guy is taking so many. Umm... OK so I'm thinking that if the Green guy is high he is probably going to stay high no matter what I do... so he's going to take at least a 2. The Blue guy will probably stay reasonably low so the most would be 2, 4, 0... double that would give us 4... if I went in with 2 that would be 6 and we'd have nothing left. I think I'll... but then we go 1 he's going to go 2 which is 3 4 double 2 which would be 4. Wow I guess I shouldn't have done that 3 in the beginning. OK I'm going to try 1... that's probably the safest.

T5, 2 points

Shoot... I'm just thinking that there is really no way that I can combat this Green guy because he seems to be going high, and even if I go low or high, he's still going to stick high. And the Blue guy seems to be sticking fairly close to me, if not just under.
So now I only have 2 left, there's no way that I can win. I've basically lost it because the pool size is 2 and there's no way that they're going to do 0... Is 0 an option? [Experimenter says yes] 0 is an option... Oh geez...[counts]. Holy smokes... he's probably going to go 3 or 2... well he can't go 3 because that's depleting so he's probably going to stick with 2. But if I choose 1, then he's probably stay with 1, the Green guy, which would deplete our resource. OK I'm going to press 0 because from the indication here the Green guy is always going to be scoring high and if I put in 1... mind you if he puts in 1 then that would be nothing left... but he doesn't seem to be considering that... uhhh... I think probably that I'll... shoot... uhhh the Blue one will probably stick at 0 like me because he seems to be a little concerned. The Green guy wouldn't go for 2, he'd go with 1 which would leave us with just one in the thing... Oh shoot... OK I'm going to go with 0.

OK my reaction is that sucks. The Green guy wasn't taking into any consideration how much we had left in the pool. Whereas I was thinking about the reactions of others and considering how much we had left in our pool and how many of us there were to share the resources. And ummm... my reaction was that the Green guy wasn't taking anything into consideration except for the points that he wanted for himself. The Blue person seemed to have a better understanding of the situation.... stuck by me but... but also ummm ended up taking a point... he ended up taking a point that actually wasn't even there... because the pool size was 2 and he ended up taking 1 out of that, so I'm don't quite understand how that works. Umm... but yeah so I guess that's about it.

Post-Experiment Interview

E: Umm... first question. Do you think that what was recorded on the tape recorder accurately reflects your thoughts during the simulation?

S: Yeah I think so.

E: You think that it's fairly complete account?

S: Yeah I think that it's fairly complete because I basically said as much as I was thinking. Yeah when I thought it, I said it basically.

E: OK now we'll go through this trial by trial. On the first trial there were 12 points in the pool and you decided to take 2, what were you thinking?

S: OK I... first of all I wanted to see what the other 2 were choosing... what they would choose after me. I thought 2 would be good because it's right in the middle. It's not too much to start off with but it's not too little and... I also just thought... I like being middle of road so... not being too extreme and I thought for starting out that would be the best way to get a general idea of how others would play compared to me and not being too extreme cause I didn't really know how the game was going to work.

E: Sure... so at this point you hadn't developed any firm expectations about how Green and Blue were going to respond?

S: No, none at all.

E: At the end of that round when you found that everyone did exactly what you did... and there were 6 points were taken and pool replenished back to 12... did you have an emotional reaction to that at all?

S: Yes... I basically thought OK they are probably thinking along the same lines as myself and ummm I actually wanted to gamble at this point. Since the object of the game was to make more points... I thought since this is the beginning of the game I'll gamble here and see what would happen if I plugged in a 3 because the more points I get the it would be for me.

E: OK that sounds great, but let's not get ahead of ourselves here. As far as an emotional reaction goes... were you pleased with what happened or did you care either way?

S: I didn't really care to be perfectly honest because I didn't have any expectations of what would happen. So I thought we'll see what happens and then take it from there. So therefore I wasn't really excited or disappointed or anything... I was just sort of Oh... That was the extent of my reaction.

E: OK that's good to know. So at the beginning of trial 2 then, you decided to gamble a bit and go up to 3. Now what was behind that?

S: Uhh... the reason being that because I wanted to get more points for myself because that was the object of the game and I wasn't quite sure how the others would play... umm if they would copy me or whatever... and I thought that well seeing that we have 12 in the pool already... its the same, it's replenished, I thought that I might as well go for 3 and see what happens cause with 2 I was able to replenish so I might as well go for more and see what happens to the pool.... if it decreases or whatever... basically.

E: During trial 2 did you have any expectations about Green and Blue, or were you still experimenting?

S: I was still experimenting to a certain extent... umm... yeah I think I was hoping for them... for Green not to come up to 3 as well. I was hoping that they would stay a little bit lower than me.

E: So that you could sort of take advantage of the situation?

S: Yeah sort of... but ummm... yeah so I was hoping that they wouldn't go up to 3 because if they both did 3 then we would be in real trouble for our pool and umm... well not real trouble but enough trouble... and so I thought... I was hoping that they would be a bit more sensible than myself and go for 2, which one of them did...

E: When you saw that Green took 3, did you have an emotional reaction?

S: Yeah I was a bit ticked off... I was a bit disappointed because I wanted him to be lower and now I felt that I had to adjust mine and that I'd have to go lower because what ended up happening was that our pool ended up decreasing, it was now at 8, and now I couldn't take advantage of the situation now I had to think more about OK how am I going to balance the resource.

E: On a scale of 1 to 5 how disappointed were you?

S: Ummm... on a scale of one to 5 how disappointed... probably between 2 and 3.

E: OK on trial 3 the resource pool decreased down to 8 points and you also decreased your harvest down to 1.

S: Yes I decreased it... because at this rate I was thinking... OK I think that Green was going to stick high because that was his trend, and I was thinking that Blue has either been the same and stuck low, so I was thinking that he'll probably be low. So I was thinking since there's 8 left if I go 1, Blue will go 1 or 2 so that will be 3 at the most. I was thinking that Green will go either 3 or 2 which would be either 6 or 5 which would leave us... which now that I look at it was how it happened... which would leave us low with not very many in the thing so I was hoping... so I decided that OK I'll stick low and I was hoping that Green would actually be lower than he turned out to be.

E: At this point were you just trying to maintain the pool at 8 or were you trying to increase it back to 12?

S: Umm... I thought that 8 was a good number, but I was always thinking of replenishing it as well. I was thinking that it would be nice to keep... because the longer I can sustain it the better so I'm always thinking of getting it back up to 12 at the same time.

E: As far as emotional responses go...

S: I thought that Green was pretty damn inconsiderate... because I was disappointed in Green because I was thinking that perhaps he would consider what was going on.

E: Just disappointed or was it bordering on anger?

S: Not really angry I don't think. Perhaps a little frustrated that he didn't... uhhh either understand the situation or he didn't care and that bothered me.

E: On a scale of 1-5 rate, your frustration.

S: 2.

E: OK on trial 4 then you stuck at 1 and the resource pool was still declining. What were you thinking?

S: I was thinking that I'd better stick low because Green... from the trend... he is still going to be high and I have stick low to make up for Green's greediness or whatever you want to call it. So I decided to stick low and I knew... had a feeling that Blue would stick low with me because of the trend that Blue was going... Blue seemed to be more concerned as I was... stuck down. And I was still at that point I was still hoping that maybe Green has some sense and would go down as well, so I decided to stick with one.

E: And an emotional reaction when you found that Green took 3 again?

S: I gave up on Green... no hope from this point on. You know I gave him some chances but that was about it.

E: So relative to the last round would you say that your frustration increased, stayed the same or...

S: Umm... it probably stayed the same but I didn't have that element of hope as well... after that I just thought that he's going to be like this forever. Obviously there's no changing the pattern.

E: On the last trial there were only two points left, after a lot of deliberation I must say, you decided to take 0.

S: Yes... well because I was still thinking that OK I have to maximize my points so I was thinking do I go 0 or do I go 1. And then I was thinking there's only 2 left and you can bet your life that Green's going to not really care so I thought that he would stick high because he's never gone lower than 2. So he's going to go at least 2. I guess in retrospect I should probably to maximize my points have taken 1 cause he didn't know what I was going to do.

E: I'm very interested in why you didn't decide to take 1. Can you tell me why you didn't take 1?

S: No... actually I can't. In retrospect I think that yeah I just should have taken advantage of the situation and taken 1 point. Just because I was still interested... I wanted to work up that... the pool size again and yeah... I was a bit stupid actually now that I think about it more.

E: You didn't really expect Green to cooperate then?

S: No I didn't at all. I don't know why I took 0. Perhaps that's some indication that I had some vague hope that he would only take 1. So... and that Blue wouldn't take any as well. In retrospect, I probably should have taken 1 to maximize my points.

E: Did you have an emotional reaction when the game ended?

S: Yes I was a bit disappointed that it ended so quickly that all of a sudden we started out with 12 and it only took 5 rounds for us to deplete our resource. That's pretty sad, that's not a very good indication, I don't think. But I don't feel to blame for that cause I felt that I tried to balance it as much as possible.

E: Who do you think was to blame?

S: Green.

E: Green and Green alone?

S: Yeah... I would say that if I had to choose one that it would be Green. Obviously I can't put all the blame on him because I used the resource as well, and there's a sign of my greediness there when I chose 3. I should have been more considerate at the beginning. I look at Blue and I think Blue is the least to blame because Blue always took into consideration how much it seems and always stuck low. Even if he had to maximize his own points he still stayed low which shows that he was really aware of the pool size and was concerned about that. Whereas Green didn't care at all umm... It's kind of funny, I'm sort of thinking in environmental terms here where Green is sort of like this corporate exploiter and Blue is like a conservationist and here's me who starts out as a conservationist and then starts to exploit a little bit and then starts to realize that hey wait a minute we have a resource here that we have to really look after and then started to play it really careful almost... then it only took me a short period to learn. But Green never learned and Blue seemed to know all along and managed it right all along. And right now I feel sort of bad that I didn't act more like Blue. Because I like to think that I'm quite environmentally conscious and like to balance and sustain resources.

E: I know that you are not very sympathetic to Green, but I mean what do you have to say about he fact that Green was, economically speaking, the most successful of the three players in the game?

S: OK right now he is economically satisfied OK and he's better... he's done well economically, but there's nothing left of the resource now so he is going to be just as poor as we are at the end. Again I'm putting this in terms of the situation nowadays especially I guess the forestry industry is the easiest... where you see these logging companies totally exploiting because they are very very short-sighted and then all of a sudden their resource is going to be completely depleted and they're going to have anywhere to go. So they're not going to... he's not going to be any better off than we are now. Now he is but uhhh a little down the road he's going to be just as poor as we are basically.

E: As the game progressed and you noticed that the resource pool was declining did you feel like you had an ethical responsibility to preserve the pool?

S: Yeah, that's why I stuck low and that's one of the reasons why I took 0 too, because I was hoping that they would be low as well and that we could build our pool back up. And I felt that I was somewhat to blame especially because it decreased after I went greedy... so I felt like I should stay low. In fact, I decided that after I saw the results here that I wouldn't take 3 again... that 2 would be the greatest that I would take again.

E: Did you also feel that preserving the resource pool was a means for you to increase the total number of points that you could get?

S: Yeah sure. The more pool size you get then eventually your points will start building up. You look at that in terms of money or in terms of well-being. The greater your pool size... if you are able to sustain that and keep a steady flow of income coming in then the better you are.

E: Of the two considerations, profit motive and ethical responsibility, what do you think the stronger one was for you?

S: For me? That would probably be ethical.

E: Ethical. Ummm.... as you went through the simulation did you ever find yourself wondering why Green and Blue made the choices that they did on a given trial?

S: Yeah I actually putting it into the context of today's society now, and I sort of, as I mentioned earlier, started to label it that Green was the person who was always wanting to exploit and Blue was always taking consideration and wanted to sustain the resource. So that's what I was thinking basically.

E: [Explains study] Knowing that, is there anything else that you can tell me?

S: Just in looking at my own actions I think that there is a little bit in all of us... that desire to succeed and be financially to be well off and to not be incredibly long-sighted to think of me me me, which is perhaps why I chose 3 right of the bat. At that point I was thinking... OK let's maximize the points. Let's play with it and see what I can do. But after that sort of realizing OK wait a minute I can't be like that, that's silly, I'm going to mess it up for myself and others, so that's why I stuck low. So perhaps that's an indication for me anyway that even me who likes to claim that I'm all for sustainable resources and will talk about that until I'm blue in the face, but even in me you can see that there is that little indication there that it is important for people to be I don't know financially well off so there's probably a little bit of that in me also.

Participant 15
Female
Social Values: Individualist
Condition: PS Certain

Initial Action Plan

Umm... I think that I won't start off with 3 points right away, but I won't start with 0. I'll kind of like go in between and maybe just see what the other 2 are picking and kind of work from there.

T1, 12 points

I think I'll start with 2 first. I didn't want to start off with 3, but like I don't want to start too low. I kind of want to see what the other 2 choices are.

T2, 12 points

2 and 2... OK. Umm... well I'll try 3 now and just see what they say. Well if they take low...

T3, 8 points

No they didn't... they took the high number. I think I'll try 3 again just to see... because they took high ones too, so if I took a lower one I'd be behind, so...

T4, 2 points

3 and 1... I think that I'll try 2 this time.

Post-Experiment Interview

E: OK... on trial 1, there were 12 points in the pool and you decided to take 2 points. And the reason why you decided to take was that because you didn't want to start off by taking too many too soon or...

S: Yeah I didn't want to start off with 3, yeah to take too many, but I also didn't want to like to start off low so the Green and the Blue would be ahead of me.

E: I see, so would you say that one of your goals was that you were trying to get more points than the Green and Blue?

S: Yeah, yeah.

E: On trial 2 you took 3 points. You increased your harvest up to 3. Can you explain to me what you were thinking when you did that?

S: Well I had noticed that the Green and the Blue had also taken 2, so I thought that maybe I could kind of get a jump on them and then see what they would do. Then I saw that the Green took the same... took 3 too. So I was just thinking maybe they would take a lower number, but the Green actually didn't.

E: Why do you think that they might have taken a lower number? Did you think that they would have stuck with what they had done on the previous trial?

S: Yeah, that's what I thought.

E: And why did you think they may have done that?

S: Ummm... well I don't know. I just thought that because I had taken kind of an in-between number in the first trial that they might do the same thing, but then I kind of... I don't know... I took a higher number and I thought that they would stick with what they had done in the first place. I thought they might just kind of like remain the same.

E: OK. So on trial 3 the pool had decreased down to 8 points and you decided to take 3 again. Can you tell me why?

S: I kind of wanted to wipe it out... kind of just finish off. I thought that since the Green had taken a higher number as well I thought that I would take a high one again and just see if I could finish it faster.

E: Now why did you adopt that strategy?

S: Umm... well on the second trial I was kind of trying to kind of umm maybe just get ahead and see what they would do. And then I saw that the Green had also done that, so I thought that I would do it again, because I wanted to stay ahead and maybe just see what the other ones did. And I guess the Green was trying to stay up too so...

E: OK... on the last trial, you took all the points remaining in the pool. Did you realize that there were only 2 points left?

S: Actually I didn't. I just thought that I should that maybe I should just lower it a little because I noticed that there were less left, but I didn't notice that I took them all.

E: So you weren't really paying too much attention to pool size in this particular case.

S: No not really.

E: If you played this game again do you think that perhaps you would, or are you happy with the way things turned out.

S: Yeah, I think for the forth one I wouldn't have taken all of it. I probably would have maybe taken a 1. Because I wouldn't have wanted to just wipe it all out then I think.

Participant 16
Male
Social Values: Individualistic
Condition: PS Uncertain

Initial Action Plan

Ummm... I don't have a strategy as of yet for maximizing my points. But I'll see how the game goes and maybe I will.

T1, 10-14 points

I'm just going to take 1 point and see what the others do.

T2, 10-14 points

OK they each took 2 points. Umm... This time... I'm not too sure why they're taking that many points. Maybe I'll just take 2 this time.

T3, 8-12 points

Whew! Green took 3. OK pool size is getting a bit smaller. Umm... I think that I'm going to stay with 2 because it's in between.

T4, 6-10 points
Green seems to be taking high points and Blue seems to be taking lower ones. The pool is still getting smaller. Ummm... I going to take 1 point this time because the pool is getting too small.

T5, 4-8 points

Green still seems to be taking 3 points. Ummm... the pool is getting really small, but if Green takes 3 again ??? then I'm going to take 3.

Oh it's over, that's the end of the game I guess. OK total taken was 7. Ummm... I didn't like it. I would rather have had more than Green. But I do have more than Blue so... that's it.

Post-Experiment Interview

E: In the first round there were 10 to 14 points in the pool and you decided to take 1. What were you thinking when you made that decision?

S: Ummm... I don't know what I was thinking... I wasn't too sure. But now that I look at it, it probably would have been smarter to take more than 1 point.

E: Why do you think that you might have been cautious?

S: I just wanted to see what... I wasn't too sure how Green or Blue were going to start, what they were going to take. So basically...

E: And then on trial 2, you bumped it up to 2 points. What were you thinking when you did that?

S: Well I was looking at how they both had put 2 points and then I thought well I had better start increasing if I wanted to get more points. That's basically it.

E: OK... then on the next trial you took 2 points again.

S: Ummm... I just wanted to stay in the middle and I thought that Green might take a lower number of points because the pool was getting smaller. And Blue was just sort of staying cautious too so...

E: OK... so the pool was getting smaller so you didn't want to take 3 and you thought that Green perhaps might decrease as time went on?

S: Yeah.

E: OK then on the next one you went down to 1.

S: Umm... basically the reason I did that was just to get the pool back up to a higher size. I didn't think that Green would take 3 again.

E: OK then on the final one, you bumped it way up to 3.

S: Uhh... I thought that the pool was getting really small and if I didn't do it now, I would lose my chance.

E: OK did you think that it was inevitable that the resource pool was going to be extinguished?

S: On that trial or the one after, I thought it would.

E: So it was get your points while you can.

S: Yeah.

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Tom Perry Environmental Award	1992
University of Victoria President's Research Scholarship	1990-1993
SSHRC Doctoral Fellowship	1990-1993
University of Victoria Fellowship	1988-1990

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