

Commons Dilemma Management: Recent Experimental Results

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Abstract

This chapter reviews the experimental literature that has accumulated in the last decade on common resource dilemmas and some related situations. It identifies major research topics as well as empirical findings. We provide a theoretical framework that focuses on studies of individual differences, contextual effects, and social structure as non-decision variables. Decision factors include those dealing with uncertainty and knowledge, the decision sequence protocol, and the payoff structure. Inferences are drawn regarding the implications of the results in creating a theory of individual behavior in commons situations.

This chapter reviews the experimental literature on commons dilemmas during the last decade. The tension between individual and group interests has often been highlighted using the “tragedy of the commons” metaphor. First described by Garrett Hardin in 1968, this phenomenon depicts a situation in which too many actors have privileges to use a common resource leading to overuse and collapse. The tragedy of the commons has been described as a type of social trap in that behavior that gratifies the individual in the short-term carries long-term collective costs (Cross & Guyer, 1980; Platt, 1973). For example, every fisherman has the incentive to maximize his current harvest, while the carrying capacity of the fish stock, in principle a replenishable resource, is limited. Therefore, if fishermen collectively harvest at a higher rate than the fish can reproduce, the resource will soon be exhausted.

Although all social dilemmas are situations in which individual and collective levels of rationality conflict, they are of different types. Commons dilemmas are resource dilemmas where overharvesting leads to a serious threat of depletion of future resources (Hardin, 1968; Van Lange, Liebrand, Messick, & Wilke, 1992b). Whereas this paper focuses primarily on commons dilemma (also referred to as resource dilemmas), other social dilemmas include, for example, the problem of public goods and the prisoner’s dilemma (for a review see Komorita & Parks, 1994; Messick & Brewer, 1983). Much research has been devoted to better understanding the parameters that influence choice behavior in social dilemmas and these phenomena have been experimentally scrutinized primarily in the social psychology and economics literatures. Although in certain ways commons dilemmas mirror the problem of public goods, we will discuss how these

phenomena are psychologically very different. To illuminate recent commons research we also draw on relevant findings in the context of public goods dilemmas and prisoner's dilemmas.

This review hones in on current research on commons dilemmas and identifies major theoretical topics, as well as empirical findings. In reviewing the literature we focused primarily on experimental work published in major peer reviewed journals in psychology and economics. Within these journals we searched for studies that dealt with different aspects of the commons dilemma. We then sorted the studies and categorized them according to independent and dependent variables and distinguished six main categories. These were first distinguished as individual differences or non-individual difference studies. The latter category was broken down into task and non-task related issues. The non-task issues related primarily to contextual factors such as perceived causes and cognitive frames on cooperation in resource dilemmas. Within task-related issues we distinguished between social structure and decision structure variables. Social structure included the role of communication, group size, as well power, status and leadership. Decision structure characteristics included knowledge and uncertainty, temporal sequence and protocol of play, and issues directly related to the payoff structure. See Figure 1. While this review does not provide an exhaustive review of the research our goal is to offer a comprehensive perspective on where the field has been focusing in the last decade.

In line with this theoretical framework, the first part of the review focuses on non-decision structure variables. We begin by discussing non-task related concepts such as individual differences and the contextual effects of causes and frames. We then proceed

to the task-structure and separately discuss elements related to the social structure of the task and those that more specifically relate to the decision structure itself. Finally, we draw inferences regarding the implications of the results to the creation of a theory of individual behavior in commons situations.

Individual Differences

In the last decade, a growing volume of research has addressed the dimensions along which individuals differ in commons-related behavior. Individuals may differ in how they perceive situations, and how they respond to them. In this section we will review studies that have examined stable individual differences such as social motives, emotional concerns such as fear and trust, gender, and cultural values and norms.

Social motives. A prominent dimension on which individuals differ that is relevant to social dilemmas concerns how they evaluate distributive outcomes for themselves and others in situations of social interdependence (Messick & McClintock, 1968). Although an infinite number of social motives (social value orientations) can be distinguished in principle (McClintock, 1976), a common classification identifies four major motivational orientations (McClintock, 1972). These motives are: (1) individualism – the motivation to maximize own gains; (2) competition – the motivation to maximize relative gains, the difference between one's outcome and that of another; (3) cooperation – the motivation to maximize joint gain; and (4) altruism – the motivation to maximize the other's gains. The first two (individualism and competition) are often grouped as 'proself' motives, while the latter two (cooperation and altruism) are

considered to be ‘prosocial.’ Thus, that individuals differ in preferences for allocation norms in interdependent social situations – social value orientations – has been established.

That these differences in social value orientations systematically influence choice behavior in a variety of social dilemmas and experimental games is also well established in the literature. Specifically, in the context of resource dilemmas findings consistently demonstrate that noncooperators harvest significantly more than cooperators (Kramer, McClintock, & Messick, 1986; Parks, 1994; Roch & Samuelson, 1997). Similarly, in scenarios that mirror ‘real-life’ social dilemmas, prosocial individuals exhibited a greater preference to commute by public transportation rather than private car and they were more concerned with collective outcomes vis a vis the environment than proself individuals (Van Vugt, Meertens, & Van Lange, 1995; Van Vugt, Van Lange, & Meertens, 1996). Recently, research has turned to examine more specifically how cooperators differ from noncooperators and how social values orientations may moderate the effects of other independent variables.

The ‘Might versus Morality Effect’ provides a clear example of how social value orientations influence not only choice behavior but also the interpretation of behavior in a commons dilemma. Liebrand, Jansen, Rijken, and Suhre (1986) extended research on social motives by examining the relationship between social values and interpretations of cooperative and competitive behavior. Their study suggests that the “cooperation-competition” dimension that characterizes situations of social interdependence can be interpreted in two distinct ways. One interpretation, *might*, relates to a potency-oriented interpretation of behavior that classifies behavior as strong or weak, effective or

ineffective. Another, *morality*, refers to the evaluation of the behavior as fair or unfair, just or unjust, good or bad.

Cooperators and individualists differ along the *might* and *morality* dimension. Cooperators tend to view cooperation and competition as varying on the moral dimension (morality), while individualists tend to view them in terms of effectiveness (might). It may be that people with different social value orientations hold different perspectives on rationality. Prosocial (cooperative) individuals view rationality in social dilemmas from the perspective of the collective, whereas individualists and competitors may view it more egocentrically, i.e. from a perspective of individual rationality. Van Lange, Liebrand, and Kuhlman (1990) argue that “if one accepts the idea that a perceiver’s own goal or predisposition affects his/her choice and also indicates the perspective (Collective or Individualistic) taken on rationality, it follows that attributions to intelligence should be determined by the combination of the target’s choice and the subject’s own choice” (p. 36). Thus, social values may relate not only to differences in choice behavior but also to different perceptions of the interdependence scheme of a given dilemma.

Van Lange, Liebrand, and Kuhlman (1990) confirmed that cooperators make larger distinctions between cooperative and noncooperative others when making attributions about their behavior on a scale that measures ‘concern for others’. Both cooperators and defectors agreed that cooperation is more related to ‘concern for others’ than noncooperation. In three N-Person Prisoner’s Dilemmas varying in the extent to which fear and greed could be the cause of noncooperation they compared causal attributions made by cooperative versus noncooperative individuals. Following each game, participants were asked to make causal interpretations of cooperative and non-

cooperative choices performed by two imaginary targets (one was cooperative and another noncooperative). Their findings suggested that cooperators (participants who made cooperative choices in the prisoner's dilemma) are more likely than defectors to attribute cooperation to intelligence while defectors are more likely than cooperators to attribute intelligence to noncooperators.

Van Lange & Liebrand (1991) specifically tested whether individual differences in social value orientations influence perceptions of rationality in social dilemmas. They manipulated the perception of another person in terms of intelligence. The findings supported their prediction that prosocial individuals, who adhere to collective rationality, expected more cooperation from an intelligent than an unintelligent other. In contrast competitors expected significantly more cooperative behavior from an unintelligent other than an intelligent one. Thus, social value orientations seemed to moderate the effects of perceived intelligence.

Van Lange & Kuhlman (1994) extended this line of research and evaluated whether social value orientations influence how information about interdependent others is weighted and interpreted in a broader context of social dilemmas. In this experiment people with different social value orientations made substantially different interpretations of the same social dilemma. Impressions of honesty or intelligence, as well as fairness and self-interest, fell in line with the *might* versus *morality* perspective as they influenced expectations regarding cooperation in different ways. The moderating influence of social value orientation on the expected level of cooperation from partners was perceived in terms of their level of honesty and intelligence. Cooperative individuals assigned greater

weight to honesty than did individualist and competitive participants, while individualists and competitors placed greater weight on intelligence than prosocial participants.

In related work, Hine and Gifford (1996a) focused on attributions of ignorance, 'concern for others,' fear, and greed to explain either depleting resource pools or efficiently managed pools. Actors made stronger attributions of ignorance, fear, and greed and weaker attributions of 'concern for others' in situations of rapid resource depletion. Furthermore, heavy harvesters made similar attributions to themselves and noncooperative others, whereas light harvesters made similar attributions to themselves and cooperative others. Similarly, Samuelson (1993) found systematic differences between cooperators and noncooperators in the importance they assign to dimensions of fairness and self-interest in resource dilemmas. Cooperators assigned greater weight to a fairness dimension, whereas noncooperators assigned greater weight to a self-interest dimension.

To summarize, prosocials tend to view rationality in collective terms, while proselves tend to view rationality in individual terms. Prosocials also tend to think of cooperation as moral and of competition as immoral, while proselves tend to think of competition as effective and cooperation as less so. Both prosocials and proselves tend to think that their own preferred strategy is more intelligent than the other and they expect 'intelligent' others to do what they would do.

Trust and fear. Several studies have evaluated whether social motives are related to other characteristics that may influence cooperation in social dilemmas. One such dimension is trust. Parks (1994) pitted the predictive ability of social value orientation

against trust in both resource dilemmas and public goods. Two different trust scales (Yamagishi's Trust Scale and the Fascism Scale) were compared with two different measures of social values (decomposed games and judgmental measurement techniques). Trust, as measured by the Yamagishi Trust Scale, was predictive of cooperation only in public goods dilemmas, but not in resource dilemmas. On the other hand, social value orientation (as measured with the judgmental technique) predicted behavior in resource dilemmas, but not in public goods. Trust and social motives were not predictive of cooperation in a similar context and furthermore the scales were not correlated one to the other.

One possible explanation for the difference between trust and social values is that trust involves perceptions and beliefs about the actions of others, whereas social values are independent. "Because one's payoff from public goods is determined by the actions of others, it is necessary to actively consider what others will do; such thoughts are unimportant in the resource dilemma" (Parks, 1994, p. 437). Parks argues that the role of trust in cooperation may also be contingent upon whether an element of fear is present in the social dilemma. Actors may fear that others will not cooperate and therefore they themselves will receive no payoff for a cooperative action. Indeed, trust was predictive of cooperation in resource dilemmas when an element of fear was present (Parks & Hulbert, 1995). In both public goods dilemmas and resource dilemmas, when fear of receiving no payoff was present, individuals assessed as having high trust in others cooperated more than those considered low trusters. On the other hand, in situations without fear there was no difference between high and low trusters.

In conclusion, it seems that trust and social motives represent distinct but complementary constructs. However, the relationship between trust and social value orientation is not simple.

Gender. In the context of resource dilemmas, not much research has invoked gender as a focal parameter. Experiments on gender differences have been more prominent in research on public goods, although findings are contradictory. Studies evaluated the influence of gender of participants as well as the gender composition of groups participating in social dilemmas. Gender may influence cooperation because men and women respond differently to one another in group interactions and discussions (Stockard, Van de Kragt, & Dodge, 1988), because they differ in understanding and reacting to each other's actions (Cadsby & Maynes, 1998), or because they respond differently to certain types of resources (Sell, Griffith, & Wilson, 1993). In one study, when participating in four person same-sex groups, men contributed to a public good at higher rates than women (Brown-Kruse & Hummels, 1993). In contrast, another study found all-female groups were more cooperative than either all-male groups or mixed-gender groups (Nowell & Tinkler, 1994). Similarly, Stockard, Van De Kragt, and Dodge (1988) found that in mixed groups women were more likely to cooperate than men, especially when discussion among group members was permitted. Yet another study found that women initially contributed significantly more than men, but that the difference disappear with subsequent trials (Cadsby & Maynes, 1998). Sell, Griffith, and Wilson (1993) found no influence of group gender composition on contributions to a public good, nor did they find a gender effect when money was the resource; however,

when the resource was changed to time with an expert, men cooperated significantly more than women. Thus, it seems that gender may have an influence on cooperation in social dilemmas but its effect is not straightforward. These mixed findings make it difficult to generalize how gender might have an impact on behavior in commons dilemmas. It is apparent that there are multiple interacting contingencies that have yet to be adequately specified.

Culture. Another aspect of identity that can produce stable differences between groups of people is culture. Researchers have devoted substantial attention to establishing that there are important differences between cultures (e.g. Hofstede, 1980; Schwartz, 1994; Triandis, 1989). Differences in cultural values and norms may influence an individual's propensity to cooperate or compete in certain situations. However, it is well known that people from collectivist cultures are more likely than people from individualist cultures to differentiate between in-group and out-group settings. Collectivists cooperate with an in-group person, but they are more likely to compete with an out-group member. Individualists are not as likely to differentiate between in-group and out-group members because they focus less on the social aspects of interdependence and are more task-oriented (problem solving). Thus, depending on the cultural context people from certain cultures may be more or less likely to cooperate in a commons dilemma, that is, culture may moderate the effect of cultural setting on harvest behavior.

An interesting question is whether cultural values correlate with individual differences in social value orientations. Gaerling (1999) found that social value orientation is related to some cultural values but not to others. Prosocial individuals

scored significantly higher on measures of universalism (a cultural value that relates to equality, social justice, and solidarity) but not to benevolence (a cultural value that relates to inner harmony, friendship, good relations, being liked, and security). Probst, Carnevale, and Triandis (1999) found that individual versus collectivism and social value orientations in part measured similar constructs in a study on intergroup prisoner's dilemma. However, the correlations between these measures were low and they caution against assuming complete overlap.

Few studies have examined the influence of cultural values and norms in resource dilemmas. Although some studies compared cooperation across samples from different countries they did not link behaviors to differences in cultural dimensions. For example no differences were found between U.S. and Dutch participants (e.g. Liebrand & Van Run, 1985; Van Lange & Kuhlman, 1994), however, these cultures do not differ on key cultural values. A study by Parks and Vu (1994) reported differences in levels of cooperation between American and Vietnamese participants. However, this study does not provide a strong case because it does not measure and therefore cannot link differing levels of cooperation to cultural attributes. Vietnamese participants, who had recently immigrated to the U.S., were found to have significantly higher levels of cooperation in both public goods and resource dilemmas. Being recent immigrants, however, the Vietnamese participants may have experienced demand characteristics to cooperate and prove themselves worthy of being in America. In part two of their study Park and Vu (1994) did find that the Vietnamese participants reacted differently than U.S. participants to various strategies encountered in the experiment. Future research needs expand in this direction in order to tease apart how culture influences cooperative behavior.

Contextual Factors

In this section we review recent studies that have questioned the effects of manipulating perceived causes and cognitive frames on cooperation in resource dilemmas. The general methodological structure of these studies is to hold the basic economic structure of the decision problem constant (or to manipulate it systematically) and to systematically change the reasons why things are as they are, or the framing, verbal description, or context for the problem. The goal is to determine if these non-economic and non-institutional variations influence cooperation in the social dilemmas and, if so, how.

Causes. Hoffman & Spitzer (1985) were perhaps the first researchers to show that the reason given for people's priority position with regard to access to a shared resource made a difference in how much of the resource they claimed for themselves. When they told their participants that they had "earned the right" to go first, to be the "controller," people took more of the resource than when they were told that they had been "designated" as the controller by the experimenter. This study was followed by Samuelson & Allison (1994) who systematically varied, among other things, the reasons participants were given for having been assigned a priority position with regard to a resource presumably shared with five other participants. All participants were told that they had been assigned to be the first of the six-member group to extract resources from a common pool. However, four different groups of participants were given different descriptions about how they achieved this position. The underlying idea of the experiment was that a "legitimate" method for assigning a privileged position would lead

the people to believe they were justified to take more than an equal share of the resources, whereas an “illegitimate” or questionable procedure would not support such justification. The better the “fit” between the means of getting the privilege and the justification, the more likely it is that people will depart from a “share equally” rule that allocation tasks evoke (Messick, 1993).

According to Samuelson & Allison (1994) this fit is maximal when the process resulting in the first position is a good example of a fair mechanism, which is to say when it is a good prototype of a selection process that leads to a “first come, first served” rule. Two such mechanisms, they propose, are flipping a coin and excelling on an achievement test. Roughly a quarter of their participants were told that they got first position by means of a coin toss, and a quarter were told that they got first position because they got the most correct answers on a test of general knowledge. Two other equally random, but less prototypical ways were used to putatively assign the first position for the other participants. One quarter were told that they had got the most answers correct on an achievement test but they had seen that one of the six tests was much easier than the other five. The lucky person would get first place, not the person who knew the most. As a test this was unfair, but as a random device it was fair since tests were assigned randomly (subjects were told). In any case, it was not a prototypical process. Neither was the fourth mechanism which involved calculating the distance of a participant’s birthday from a randomly selected day of the year. While participants rated this process as fair, they rated it also as unprototypical.

The results of the study showed that participants given the two prototypical justifications for their privileged position took nearly fifty percent more of the shared

resource than those given the less prototypical justifications. Moreover, the importance of the justification depended on the details of the decision problem. When over-use resulted in zero payoffs for everyone, the effect of the justification was non-existent; when people were allowed to keep whatever they had taken, the participants with prototypical justifications took nearly twice as much as those with unusual justifications.

Causal attributions are also important with regard to scarcity or abundance of the resource pool. Why there is a lot or a little has been shown to make a difference in how people treat the resource. In a field study of water use during the 1976-77 drought in California, Talarowski (1982) found that people who stayed within their water allocation limits tended to believe that the drought was caused by a natural shortage. Those who exceeded their allocation, however, expressed the view that the shortage was people-induced. In this type of study it is impossible to say whether the beliefs cause the behavior or the behavior causes the beliefs or whether both are being caused by some other factor.

Rutte, Wilke, & Messick (1987) tried to provide an experimental answer to this question. In this study, participants were told that they would be the fifth person of a six-person group to harvest from a shared pool. All subjects saw the harvests of the previous four (bogus) group members. Collectively, these first four members took 20 points (Dutch guilders—the experiment was conducted in the Netherlands). Half of the subjects were told that the pool initially contained 35 points (leaving 15 for the last two members to share) and half were told that it contained 25 (leaving just 5 for the last two members to share). Half of the people in these two conditions were told that all group members knew the size of the pool from the beginning, and the other half were told that the first

four were ignorant of the pool size. When everyone knew the pool size, the shortage or abundance would be attributable to the others, whereas it would be attributable to luck when the first four did not know.

When all group members knew the pool size, the behavior of the first four tends to establish a norm, either a norm of generosity (when there are 35 points) or a norm of greed (when there are 25). Thus the prediction was that when the group was seen as the cause, the participants would be more greedy (when the pool had 25 point) and less greedy (when it had 35) than the participants in groups whose first four members did not know the pool size. The data confirmed this pattern. People-caused shortages reflect a lack of restraint, whereas nature-caused shortages need not.

Samuelson (1991) showed that causal attributions were important in preferences for structural solutions to commons crises. Groups were given a chance to collectively manage an experimental resource pool and were given feedback that they had not done well in maintaining the pool. Roughly half of the people were told that most groups did well and that the task was rather easy, inducing an attribution that the people in the group were greedy. The other half were told that the task was a difficult one and that most groups did not do well, inducing the attribution that poor performance was due to the difficult environment. They were then told that they would be given a chance to do the task for a second time. At this point the subjects were told that they could do the task in the same way they had done it in the past, or, if they wished, they could elect a leader who would make a group harvest on each trial and allocate the resources to the members. Samuelson (1991) found that nearly twice as many subjects favored having a leader when they thought that the reason for the prior failure was task difficulty (57% favored having

a leader) than when they thought it was personal greed (30% favored the leader).

Frames. Framing, in the study of decision making, concerns the ways in which outcomes, options, and actions are described. Interest in framing can be traced to, *prospect theory*, the seminal work of Kahneman & Tversky (1979), which showed that people respond differently to decision problems in which the same outcomes are described either as gains or as losses. These authors introduced the concept of *loss aversion*, which refers to the empirical observation that people evaluate the loss of a given amount more seriously than they evaluate a gain of the same (absolute) amount in risky choices. Moreover, risk attitudes may change as a function of outcome framing. Kahneman & Tversky proposed that people tend to be *risk-averse* with gains and *risk seeking* with respect to losses. Monetary outcomes can be framed by changing the reference point by means of which they are evaluated. A salary of \$60,000 could be described as \$10,000 more than the average for an industry (a positive frame), or \$10,000 less than mean salary of people with a comparable education (a negative frame).

In the study of social dilemmas, the idea of outcome framing seemed to correspond to the distinction between *public goods* dilemmas and *common pool* dilemmas. In public goods problems, people must make a contribution or give money and hence experience a loss; in common pool problems, people will be making harvests from a resource and hence experiencing a gain (e.g. Brewer & Kramer, 1986). Thus there seemed to be a one-to-one correspondence between social dilemmas and outcome framing and many of the early experiments on framing were based on this correspondence. These early studies found inconsistent and puzzling results (see, for

instance, (Aquino, Steisel, & Kay, 1992; Brewer & Kramer, 1986; de Dreu, Emans, & Van de Vliert, 1992; Fleishman, 1988; McDaniel & Sistrunk, 1991). In these early studies it was not always clear whether the predictions being made were based on the loss aversion concept or on the assumed difference in risk attitudes for gains and losses.

A recent study of this type (Sonnemans, Schram, & Offerman, 1998) makes it clear that there is no simple way to apply prospect theory to social dilemmas. Prospect theory requires the specification of a clear reference point for the evaluation of prospects, and social dilemmas are complicated decision situations with a multitude of potential reference points. Moreover, these authors found that while there were no initial differences in cooperation between two versions of a game – one in which people *gave* money to create a public good and one in which people *restrained themselves from taking* to create the good – differences did emerge as the participants gained experience with the task. The authors argue that these results require a dynamic theory that can highlight the learning that takes place in the two different environments as participants explore the consequences of their choices.

While there is little doubt that framing effects occur, there is no consensus on the underlying cause or causes. Indeed, there may be many ways to frame social dilemmas and to influence rates of cooperation, and that fact may be the most important result of this line of experimentation. The following experiments will illustrate some of these framing manipulations and their consequences.

De Dreu & McCusker (1997) pursued the loss aversion concept by creating payoff matrices for a two-person prisoner's dilemma game that expressed payoffs either in terms of gains or in terms of losses. They then argued that framing outcomes as gains

or losses changes the *differences* in the utilities between cooperating and defecting as a function of the *social value orientation* of the person. On the assumption that choice frequencies are a direct function of the *difference* in payoff magnitudes, these authors argued that the incentive to cooperate should be greater in a loss-frame than in a gain-frame for cooperatively oriented people (who are trying to maximize the sum of the payoffs for the two parties). However, for individualists (trying to maximize their own payoff) and for competitors (trying to maximize the difference between what they get and the other's payoff), the incentive to defect is stronger in loss-frames than in gain-frames. Thus, they argue, framing can make some people more cooperative and others less so, depending on their utilities. These authors report a series of three experiments that provide impressive support for their hypothesis. Cooperative subjects cooperated more in loss-framed games than in gain-framed ones, while the reverse tended to be true for individualists and competitors. De Dreu and McCusker (1997) also reviewed more than a dozen previously conducted experiments to marshal suggestive evidence that the instructions in these studies determined if loss frames influenced cooperation and if so how.

Not all framing has to do with losses and gains. Batson & Moran (1999) conducted a prisoner's dilemma experiment in which the game was described either as a "Business Transaction Study" or as a "Social Exchange Study". The instructions for the former consisted of business examples, while the instructions for the latter referred to non-economic social exchange. The idea was that the description of the task could trigger different means of evaluating strategies for interacting in it. As expected, people made more cooperative choices when the task was framed as a social exchange study than as a

business transaction study. These authors also demonstrated that when empathy was created for the other participant in the experiment, the level of cooperation was increased regardless of the frame.

Frames can also be implied by institutions, as has been shown by Elliott, Hayward, & Canon (1998). In this experiment, subjects read a series of “news briefs” either about entrepreneurial business strategies or about cooperative business strategies. They were also asked to generate examples of successful business strategies that were, respectively, entrepreneurial or cooperative. Then, in the context of doing another experiment, they were given the chance to engage in a public goods social dilemma for a series of six trials. Unlike the Batson & Moran (1999) experiment, here there was no direct labeling of the game but the labels had been primed in the first part of the study. The results were very clear. The entrepreneur-framed people cooperated in about 39% of the trials, whereas the cooperatives-framed people cooperated in 75% of the trials.

Larrick & Blount (1997) have reported a related finding. They noted that the underlying structure of an ultimatum bargaining game and a sequential social dilemma were identical. Yet typically, social dilemma studies produce more cooperation than is reported with ultimatum bargaining games. In a clever series of studies, Larrick & Blount (1997) were able to show that the differences in cooperation rates were attributable to *procedural frames*; differences in the ways the actions were described. Specifically, second movers in ultimatum bargaining games are told that they may “accept or reject” the offer left by the first mover, while in sequential social dilemmas, the second movers are told that they can “claim” what is left by the first mover. It is of interest that the connotations of the verb “to claim” not only affect the second mover, who is more likely

to accept whatever is left, but also the first mover, who is more likely to leave more than in the “accept or reject” frame.

Van Dijk & Wilke (1997) have argued that the framing of property rights or the implied ownership of common or personal resources can influence cooperation. These authors contrasted a commons dilemma framework with a public goods dilemma framework. In the resource dilemma, participants were either told that they could harvest (up to 20 units) from a common pool of 80 (there were four people in a group) or they were told that they could harvest as many units as they wished from their own pool of 20. In the public goods version, they were told they could contribute up to 20 units of their own property, or they were told they could contribute up to 20 units from a common pool of 80. In this experiment, the framing of the pool as one’s own or as a common pool had an impact in the resource dilemma. People took more when taking from “their own” pool than when taking from the common pool. In the latter case, the authors speculate people were concerned about the others’ fate; in the former there was less need to think about the others. However, in the public goods context, the authors argue, since the goal of the contribution is to create a shared result, people will think about the others regardless of the contributions come from a private or public pool. Thus the authors did not expect nor did they find a framing difference in the public goods situation.

Van Dijk and Wilke (2000) took this a step further than their previous article and suggested that what is really happening with framing manipulations is that the decisions people are being asked to make induce the people to focus on one aspect or variable of the decision problem. For instance, one difference between cooperation in resource dilemmas and public goods dilemmas is that the decision in the latter is how much to

take, while the decision in the former is how much to give. The correspondence between the two games, however, in terms of measures of cooperation, is how much one *leaves* and how much one gives. The choice of the verb, either giving or keeping in public goods games, and taking or leaving in resource games, may frame the decision independently the consequences of the choice. Taking and keeping refer to what one will have oneself and leaving and giving refer to the collective component.

It may be that the actual decision (take, keep, leave, or give) causes one to focus on a quantity that determines one's strategy. For instance, in giving in public goods dilemmas, there is a tendency for people with different endowments to give equal proportions of their endowments. Perhaps this is not the result of the public goods dilemmas but rather because people are focusing on what is necessary to meet the criterion rather than what they have left. Likewise, in resource dilemmas, people typically focus on achieving equal final outcomes. Perhaps this is because they are induced to focus on what they get, rather than what they leave. To test this hypothesis, resource and public goods dilemmas were created in which the participants were either focused on what they ended up with (take, and keep) or on what they contributed (give and leave). Van Dijk and Wilke (2000) then calculated whether the person seemed more to be trying to achieve proportionality or equal final outcomes. The results indicated that a large part of the difference between the two types of games could be accounted for by decision induced focusing, by the quantity one was induced to focus on.

It is clear that cooperation in social dilemmas can be strongly influenced by framing effects, and it seems equally clear that these effects can be of a variety of types – framing outcomes as gains or losses, framing games as entrepreneurial or social

exchange, framing choices as taking, keeping, leaving or giving, for instance. What is less clear is the shape of the theoretical structure that will be needed to interpret these effects.

Social Structure of the Task

In the last 10 years, research on various elements of the social context of commons-related decisions has yielded a number of important clarifications to earlier findings, and charted worthwhile new territory. In this section, we will focus on three broad categories of research: (1) understanding the role of communication and communication-related factors in commons settings, (2) group size, and (3) power, status and leadership.

The role of communication. Among the most consistent findings in the experimental social dilemma literature is that a period of discussion among participants yields positive cooperative effects. In the face of an impressive and systematic research program on the effect of communication on cooperation all but two explanations of this phenomenon had been dismissed as insufficient explanations of the communication effect (Dawes, Van de Kragt, and Orbell, 1990): (a) Group discussion enhances group identity or solidarity, and (b) group discussion elicits commitments to cooperate. Still greater clarity regarding the causal mechanism at work was necessary to move forward and more effectively develop optimizing strategies for real-world dilemmas.

Kerr & Kaufman-Gilliland (1994) competitively tested the group identity versus commitment explanations in a step-level public goods task. In an elegant $8 \times 2 \times 2$

factorial design, they manipulated the self-efficacy of participants' cooperation, the presence or absence of discussion, and the anonymity or public nature of cooperation decisions after discussion. What they found was a clear pattern of results consistent with the 'elicitation of commitments' explanation. "Regardless of how inefficacious a cooperative act was for providing the public good, those who had previously discussed the public-good cooperated at a rate about 30% higher than those who had not participated in such a group discussion" (p. 521). While groups that engaged in discussion demonstrated a stronger, more positive sense of group identification, and group identification accounted for some variance beyond that accounted for by discussion condition, it was clearly not a "sufficient" explanation for the communication effect. Discussion resulted in commitments and, on average, people followed through with their commitments. These results are also consistent with the finding that, in a public goods dilemma, "a pledge with a certain degree of commitment may facilitate cooperative behavior" (Chen & Komorita, 1994).

Bouas and Komorita (1996) further confirmed Kerr and his colleague's finding that group identity enhancement is an insufficient explanation for the effect of group discussion. However, the structure of their study led them to a somewhat different conclusion about what constituted a *sufficient* explanation. Whereas Kerr & Kaufman-Gilliland's (1994) study tested the effects of a *universal* consensus (commitment), Bouas & Komorita (1996) found that a more generalized perception of a degree of consensus was also sufficient to elicit the communication effect. For those managing real-world resources, this stream of research suggests that finding ways to elicit commitments and maximize perceptions of cooperative consensus might be worthwhile pursuits.

A natural follow-up question flows from these studies: why do people follow through on their commitments? Do they fear social sanctions (social norm), or are they internally motivated (internalized or personal norm)? One of the interesting findings of Kerr & Kaufman-Gilliland's original study (1994) was that the anonymity of actual contribution decisions had no effect on the decisions. People honored their commitments even if there was no chance of getting caught "cheating." Kerr and his colleagues (Kerr, Garst, Lewandowski, & Harris, 1997) followed up with a more rigorous test of whether anonymity would moderate the effects of group discussion. While it was possible for participants in the original study to believe the *experimenter* might know whether they cheated or not, this follow-up study made it seem impossible for the experimenter to determine whether or not participants honored the commitments they made. In the "anonymous" condition, the videotape of each session was purportedly mangled and dangled in its damaged state before participants' eyes before they had to make their decisions. The results of this study suggest that the functioning norm in such situations is predominately governed by self-monitoring. It appears that for most people, the norm against violating their stated commitments is an "internal personal one" as opposed to a social one. This suggests that, paired with dialogue, a society's ability to instill well-internalized personal commitment norms among its citizens may be more effective in "managing" resource dilemmas in the long run than sanctioning systems. However, as Kerr and his colleagues make sure to point out, not everyone strictly adheres to such an internalized norm. Thirty-two percent of their participants failed to do so. This may simply underscore the value of developing better paradigms for moral education. This stream of research implies that further empirical study of "promising and committing in

groups,” and ways to encourage trustworthiness in those inclined to renege on commitments would be worthwhile pursuits.

Our increasingly electronic age is changing the kinds of communication that may occur in commons settings. Commons dilemmas often involve actors from a variety of institutions who are dispersed geographically and thus email communication may be commonly used to discuss and negotiate the use of a common resource. Comparing the efficacy of e-mail versus face-to-face communications is of both theoretical and practical interest. Frohlich and Oppenheimer (1998) compared the efficacy of these two types of communication channel in both a fairly complex and fairly straightforward setting. Their results suggest that face-to-face communication is more effective in eliciting cooperation in complex situations in which fleshing out nuances can be helpful. In their experiment, they found little difference between e-mail and face-to-face communication in a more straightforward task. The investigators also examined whether one form of communication had better outcomes for cooperation in later rounds when no further communication was allowed to occur. They found no differences in the “staying power” of the communication effect on cooperation as a function of communication channel. These results raise important issues. They suggest that there are subtleties worth exploring in the communication effect as a function of communication channel. For pragmatic and economic reasons, many researchers have adopted experimental techniques that offer e-mail (usually to a fictitious other) as the communication channel open to participants. The reported study raises a caution for such researchers regarding the generalizability of effect sizes as a function of computer-based or “live” methods.

Communication can vary not only in terms of the medium that is used but also with respect to directionality. One question that has been raised is whether the unidirectional flow of information can also yield a positive effect on cooperation? Using Prisoners Dilemma Game (PDG) and Dictator Game paradigms, Bohnet and Frey (1999) concluded that *two-way* communication is not always required to yield “solidarity” (cooperation). They found that one-way identification alone was sufficient for participants to personalize an anonymous stranger, reduce social distance, and positively affect participants’ behavior. (Mutual identification and communication generally still had more powerful effects.) The authors cite their study as supportive of Schelling’s (1968) claim that “the more we know, the more we care.” For the management of resource dilemmas, these findings suggest that actions diminishing social distance between “harvesters” and those who stand to suffer first or most from the depletion of a resource may have advantageous consequences.

Group size. Earlier research established the much-replicated tendency of small groups to achieve more cooperative outcomes than larger groups (e.g. Dawes, 1980). One recent study offers an interesting insight into a mechanism that may partly explain this tendency: self-efficacy. Self-efficacy is an individual’s belief that she is competent and capable of taking effective action to achieve a given outcome (Bandura, 1986). In a series of experiments Kerr (1989) demonstrated that even when group size was objectively irrelevant to the impact a participant could have on an outcome, members of small groups felt more “self-efficacious” than members of larger groups. In the last experiment in this series, the effect of group size on assessments of *collective* efficacy –

the perception that one's group can succeed at a given task – was measured. A largely parallel effect to the self-efficacy findings was found. When the provision point (proportion of group members demonstrating contributing behavior necessary to achieve the public good) was high (67%), group size had no significant impact on assessments of collective efficacy. However, when the provision point was low (33%), smaller groups were perceived to be more efficacious than large groups. “The striking thing is that this belief persisted even when exactly the opposite was objectively true” (p. 307). Despite Kerr's consistent finding across three studies that smaller group size resulted in judgments of greater self and collective efficacy to attain a public good, only in the last study were there significant group size effects on actual cooperative behavior. Kerr hypothesized that reductions in group size may increase assessments of the efficacy of *others'* cooperative behaviors, and therefore encourage free-riding. Kerr's experimental paradigm may have encouraged free-riding relative to other settings “by minimizing interaction and identifiability” (p. 310).

Kerr refers to his findings as “illusions of efficacy” which he attributes to “familiar judgmental heuristics, involving an overgeneralization of experience in groups of varying sizes” (p. 287). It would be interesting to test whether segmenting an affected population and highlighting sub-group goals or restraints encourages cooperative behaviors in commons dilemmas. For example, one might highlight water consumption behavior in a given apartment building or neighborhood rather than simply highlighting a statewide need for restraint. Other work (Allison, McQueen, & Schaerfl, 1992) suggests that small groups are more motivated to divide resources equally than are members of

large groups. This tendency might make it easier for members of smaller groups to make appropriate harvesting decisions.

An experiment that introduced a market mechanism for managing the commons provides a somewhat different perspective on group size (Blount White, 1994). Each participant represented a corporation that drew on a finite water supply. As it became apparent that the common resource was dwindling at a dangerous pace, half of the participant groups were given the option of buying out other participants. In the “transfer payment” condition, each participant could set a price for his or her right to consume water from the supply, and the other participants could make contributions to ‘buy a seller out.’ Once a participant was bought out by the others, they closed up shop. Therefore, the buy outs could reduce the number of participants drawing on the water supply – effectively reducing group size. Note that participants were not buying a right to a fixed quota of consumption, but simply a reduction in the number of enterprises drawing on the common resource. Blount White initially hypothesized that the act of paying compensation to remove a participant from the commons would make the true costs of overconsumption more salient for the remaining participants, and thereby reduce the speed with which they exhausted the remaining water supply. Interestingly, not only did the water supply of groups with the transfer payment option last no longer than the water supply of groups without the transfer payment option, but also those with the option consumed significantly more in later rounds than those without the option. “The market-based intervention hastened depletion” (p. 443).

The transfer payment option actually motivated greater self-interest, rather than greater attention to conservation. Why? In debriefing, participants commonly “cited the

strategy of trying to take out as much as possible for oneself and then trying to get bought out” (p. 443). Blount White suggested that “when participants pay compensation they may not cognitively interpret it as a cost of consumption but as the purchase of the right to consume more” (p. 453). She concluded, “... a self-regulated, market-based approach is not necessarily effective at controlling detrimental social choice patterns” (p. 454). Of course, any number of additional tests of this conclusion would be merited, but the finding is nonetheless interesting, and has relevance to real-world commons management.

Power, status, and leadership. In recent years, encouraged by Pfeffer (1981) and others, social scientists have become more interested in the ubiquitous role of power in governing and influencing human behavior. This lens is now being focused on social dilemma settings.

It is not uncommon for individuals to violate the expectations of others in ways that hurt other members of their group. Social dilemmas in general, and resource dilemmas in particular, offer a fertile context for this kind of betrayal of expectations. Someone is expected to contribute to a public good, or exercise restraint in harvesting a common resource, and fails to do so – causing negative outcomes for everyone else. In such circumstances, it is typical for the offending party to offer a justification for offending behavior. (A justification is defined as accepting responsibility for an act, but denying that it was wrong. It is distinct from an excuse, in which the offending party agrees that an act was wrong, but denies responsibility for it.)

A group of researchers examined the impact of power and status on the judgments people make about justifications that are offered in a resource dilemma setting (Massey,

Freeman, & Zelditch, 1997). A series of three experiments yielded four interesting findings. First, and perhaps least surprising, an offending act was judged to be less proper if the justification was invalid than if it was valid. (Validity of justifications was determined through extensive pre-testing with a random sample of a similar population.) Second, when an offending individual had higher status than other group members (i.e., a Ph.D. in resource management), it positively impacted on others' judgments of his offending act's propriety if his justification was also valid or at least ambiguous in terms of validity. The augmenting effect was greatest when the justification was ambiguous in terms of its validity. Strikingly, however, an offending individual's higher status was a *liability* if the justification was invalid. Third, an offending individual's greater level of power had a positive impact on others' *public* judgments of his offending act's propriety, but not on their *private* judgments. Finally, if an offending individual had both high status and greater power, the combination resulted in a positive impact on even others' *private* judgments about his act's propriety. Clearly, the power and status of actors in a commons dilemma context can have a significant effect on how both individuals and their actions are perceived. Further study of such variables is certainly merited.

Mannix (1991) compared the resource distribution strategies of organizational groups as a function of discount rate – of what the value of resources would be over time. The high discount rate condition was assigned a value of 12%, while the low discount rate condition was assigned a value of 2%. Groups in the high discount rate condition were more likely to adopt coalition strategies that involved fewer group members than groups in the low discount rate condition. This strategy resulted in lower individual and group outcomes. The low discount rate groups, by contrast, actually achieved growth in

their resource pool over time. Why the increased competitiveness and destructive behavior among those facing a high discount rate? Mannix offers a few hypotheses. First, she suggests that the rapid devaluation of the resource pool might have led group members to treat every round “as if it were the last” (p. 388). Second, she suggests that the rapid discounting of resource value might have seemed startling relative to anchoring on initial harvesting values, and that group members quickly shifted to short-term strategies to compensate. Finally, she suggests that deep discounting could also affect the value of relationships; “one defector in a high discount condition may generate more fear and defensive behavior than the same defector in a more stable environment” (p. 389). This study raises a number of largely unresolved questions regarding the effects of participants’ “valuations of future resources” on their harvesting decisions.

Mannix suggests that organizations can be framed as resource dilemmas, and that power imbalances between members of small groups increase the likelihood of coalition formation, “despite its often detrimental effect on individual and group outcomes” (Mannix, 1993, p. 2). Her argument is that when imbalances exist, individual group members have a harder time focusing on mutual gains, and instead focus on protecting their own interests. Coalitions can have significant negative effects on an organization’s overall outcomes since they can deprive individuals and divisions of the access to resources that they require to succeed or survive. Consistent with her hypotheses, Mannix found that relative to groups with equalized power relations, groups with power imbalances: (1) made less efficient use of available resources, (2) were more likely to begin the exercise distributing resources to a subset of the group, (3) included fewer people in resource utilization across multiple rounds, and (4) took more effort to reach

agreements on resource distributions. In addition, members of groups with power imbalances were more likely to see the group as competitive, be motivated by individual gains, and retaliate against those who omitted them from a coalition. It was evidently also easier for groups with power imbalances to form small coalitions than large ones.

Mannix (1993) concludes that power imbalance can be detrimental to group outcomes. “Power imbalance appears to encourage competitions and a focus on individual outcomes resulting in less integrative agreements” (p. 16). She does, however, offer a possible prescription for better functioning groups: “One of the ways to balance power is to assemble group members from the same position in the hierarchy who have various sources of expertise that are all necessary to the functioning of the group. This way, although the group members would still have their own interests and goals, they might not be as threatened by the positions of other group members” (pp. 18-19).

Wade-Benzoni, Tenbrunsel, and Bazerman (1996) offer some important findings on asymmetrical power distributions between actors in a commons dilemma and on the role of egocentrism in commons management. First, they found that levels of egocentrism affect individuals’ and groups’ perceptions of fairness in asymmetric dilemmas. Second, and more importantly, overharvesting behavior is positively correlated with levels of egocentrism. These two findings naturally lead to the question; can anything be done to decrease egocentric biases in dilemma settings? By examining egocentrism before and after discussion, the investigators learned that discussion appeared to decrease egocentric biases. This suggests that the reduction of egocentrism may be one of the reasons why communication has a positive effect on cooperation in social dilemmas (see section on communication elsewhere in this review). Further, the study’s results suggest that

overharvesting tendencies are greater in asymmetric than in symmetric dilemmas.

Finally, overharvesting behavior was related to participants' beliefs about what other participants were likely to do.

In 1991, the California water shortage offered Tyler & Degoey (1995) a natural commons dilemma to study. With complete survey data from 400 people directly affected by the shortage, they were able to pose a number of interesting questions about authorities and leadership in relation to the management of a resource dilemma. Their results replicated earlier experimental findings that people confronted with a severe resource shortage willingly endow authorities with additional control over the resource (e.g. Messick et al., 1983). They also found that the legitimacy of such authorities was determined in large part by the authorities' commitment to fair allocation and decision-making procedures (procedural justice). Perhaps most interesting was their finding that respondents' social identifications with their community moderated the relationship between authorities' use of fair procedures and the support of the authorities. Those who felt pride in their community and perceived procedures to be fair expressed particularly strong support for the regulating authorities. In fact, people who took pride in their community even cared less about their personal outcomes. Taken as a whole, Tyler & Degoey (1995) suggest that authorities' effectiveness is "primarily linked to the nature of their social bonds with community members" (p. 482). Social identifications with community are an important variable that should not be overlooked in future studies of resource dilemmas.

A number of recent findings speak to contingency issues related to leadership and administration in social dilemma settings. Wit and Wilke (1990), for example, examined

the role of *who* presented rewards and punishments in a social dilemma, and *to whom* they were presented. The experimental procedures placed participants in the role of chemical company managers concerned with making (a) waste storage vs. (b) waste treatment decisions. The former choice was in participants' short-term financial interests, while the latter choice was better for the community and promised greater long-term value. For 124 undergraduates they found no difference between the effectiveness of rewards or punishments on their choices, regardless of whether they were presented by the government or by their parent companies. In contrast, for 239 managers, rewards supplied by the parent company were highly effective, while those supplied by government were actually *counterproductive*. This finding suggests an interesting consideration for those attempting to manage dilemmas in the real world: what source of sanctioning is most likely to be embraced by the people who make the important decisions?

There is a large existing literature that has explored the conditions under which group members opt to appoint a leader to aid them in achieving their goals in a commons dilemma (e.g. Messick et al., 1983; Samuelson & Messick, 1986). It indicates that groups will opt for a leader when they have failed to manage a resource efficiently and inequalities in harvesting outcomes emerge. Other studies have demonstrated that leaders will be endorsed by their followers when they are successful in maintaining the common resource (Wilke, Liebrand, & de Boer, 1986; Wit, Wilke, & Van Dijk, 1989).

More recently, Wit and Wilke (1988) examined the role of leaders' allocation decisions in determining whether or not their leadership is endorsed. Their experiment varied both the outcomes the leader allocated to him/herself (leader overpayment, leader

equal payment, leader underpayment) and his/her allocation to subordinates (participant overpayment, participant equal payment, participant underpayment). They found that leader “endorsement was weakest when the leader overpaid him/herself” (p. 151) and when the participant making the evaluation had been underpaid relative to other group members. Three more specific findings are also worth noting. First, the leader received his/her greatest endorsement when all allocations were equal. Second, when the leader paid him/herself less than his/her fair share, participants seemed to take little notice of differences between themselves and other subordinates. Third, when the participant was over paid, he/she took little notice of how the leader and the other subordinate were paid.

Decision Structure of the Task

Knowledge and Uncertainty.

A key factor in the decision structure of commons dilemma scenarios is task-related knowledge. Knowledge pertaining to the environmental criteria has become important in experiments that test the influence of environmental uncertainty on choice behavior. In addition to the social uncertainty about others’ choices, environmental uncertainty adds to the difficulty of solving social dilemmas. For example, in many environmental problems the size of the resource and its replenishment rate may not be known, or estimates may be contested. Environmental uncertainty has emerged as a focal issue in a variety of experiments.

Knowledge, or lack thereof, of crucial parameters can influence levels of cooperation in commons dilemmas. One general finding is that uncertainty about the size of a given common resource generally leads to overharvesting. In the face of increasing

levels of environmental uncertainty about the pool size, actors request more for themselves, expect others will also request more, overestimate the size of the resource pool, and display more variability in their requests (Budescu, Rapoport, & Suleiman, 1990; Budescu, Rapoport, & Suleiman, 1992; Budescu, Suleiman, & Rapoport, 1995). These experiments establish that pool size uncertainty impacts behavior in both symmetric and asymmetric payoff structures. The effects of pool size uncertainty were corroborated by Hine & Gifford (1996b) in an experiment that extended to situations of regeneration rate uncertainty. Implementing a computer-based interactive commons dilemma, FISH (Gifford & Wells, 1991), both types of environmental uncertainty led to greater probability of overharvesting.

Pool size uncertainty is often operationalized by independently and randomly drawing from a range of possible pool sizes that had a uniform probability distribution, while holding the mean constant. The greater the range of possible values around the mean, the greater the over-use. Likewise, when the distribution is normal, the effect is reduced or eliminated (Hine & Gifford, 1996b). The question is why increased variability about the pool size or uncertainty regarding the replenishment leads to increased over-use.

One explanation is that increased variability of the pool size increases expectations that others' requests will mirror the situation and also become more variable. Budescu et. al. (1990) suggested that depending on whether an individual actor is risk-seeking or risk-averse, environmental uncertainty may respectively lead to either increased or decreased requests from the commons. They found a main effect for risk attitudes where risk-seeking actors requested more from the resource pool than risk-

averting actors.

Work by Roch & Samuelson (1997) supports the hypothesis that different types of people perceive environmental uncertainty differently. Specifically, individual differences in preferences for allocation norms in interdependent social situations – social value orientation – moderated the effect of environmental uncertainty on harvesting behavior. They found that individualists and competitors (proselfs) increased their harvesting under situations of uncertainty. In contrast, prosocial individuals (cooperators and altruists) held their harvest constant, or harvested less.

Another possible explanation for increased harvesting in face of environmental uncertainty relates to the finding that in situations of uncertainty, actors overestimate the size of the pool. As uncertainty about the resource pool increases, both the mean estimate and their associated standard deviations increase (Budescu et al., 1990). On one hand, actors may in fact believe that the pool is larger because it can potentially be larger. However, this may be a justification for their overharvesting behavior. Uncertainty about pool size may provide a mask for asocial behavior. It may provide a stable external justification: it's not my greed; I simply assumed the pool was larger – who knew? Like the diffusion of social responsibility in large groups (Fleishman, 1980) uncertainty may also act to diffuse personal accountability.

Independent of the effect of uncertainty, the payoff structure in Budescu et. al.'s (1990) experiment also influenced choice behavior. In asymmetric designs the influence of uncertainty was supplemented by a main effect of payoff level, such that actors request more as the payoff they receive for each point decreases. Similarly, expectations about others' choices also fall in line with what seems to be an equity model, in that more

privileged players in fact expect those with lower exchange rates to take more from the common resource. Whereas equity theory would suggest that the mean harvest should be exactly inversely proportional to the manipulated exchange rate, the effect was more mild (results were inversely proportional to the square root of the exchange rate, rather than to the exchange rate itself).

As discussed earlier in this review, organizations can themselves be conceptualized as resource pools that may be subject to the same dynamics as the commons resource dilemma (Mannix & White, 1992). Mannix and White argue that under stable and consistent allocative decision rules, a group of individuals is less likely to suffer from the formation of detrimental coalitions. The absence of allocation norms decreases certainty and consistency and is more likely to trigger divergent fairness expectations and the occurrence of coalition formation as a defecting response. Coalitions are conceived as a coordinated form of defection on the part of a subset of group members. Results indicate that groups that lack an established distribution rule are more likely to form coalitions.

It is known that groups that learn that they have failed to efficiently manage a commons opt for a leader (Rutte & Wilke, 1984; Samuelson, Messick, Rutte, & Wilke, 1984). More recently, a study by Wit, Wilke, & Van Dijk (1989) evaluated how groups respond to a leader who promotes successful or unsuccessful management of a commons resource when there is or is not environmental uncertainty. Unsurprisingly, failing leaders receive weaker endorsement than successful ones. More interesting is the finding that endorsement of a successful leader is more positive in a predictable versus an unpredictable environment whereas there is no difference for unsuccessful leaders. This

work suggests that causal attributions mediate leadership evaluations in commons dilemmas.

Having accurate feedback about resource use is a way to reduce uncertainty. Van Vugt and Samuelson (1999) studied the impact of private metering on water consumption. Households with private meters, which tracked individual water consumption, consumed less than un-metered households when they perceived that a water shortage was severe. When the water shortage was perceived as mild, there was no difference in consumption between metered and un-metered participants.

Van Dijk, Wilke, Wilke, and Metman (1999) have questioned the dominant effect of environmental uncertainty on cooperation. They argue that environmental uncertainty has a complex influence on cooperation as it depends on the type of dilemma, the type of asymmetry, and the type of uncertainty faced by a group. Different behavioral norms develop in public goods dilemmas than in resource dilemmas. In asymmetric settings, proportionality coordination rules are evoked by the public goods dilemma, whereas equal distribution rules are evoked in resource dilemmas (Samuelson & Messick, 1986; van Dijk & Wilke, 1995). This can be explained by a differential focus argument where fairness is the main concern in resource dilemmas, whereas achieving the public good is the primary concern in public goods dilemmas. Van Dijk et. al. (1999) extend the research on concerns for fairness and coordination rules to situations of environmental uncertainty. Coordination rules are framed as “carriers of information.” They hypothesized that groups will avoid basing their decisions on environmental information that is uncertain. A more complex relationship emerges, in which the influence of

uncertainty was found to be contingent on both the positions group members occupy in a group and on the type of social dilemma they face.

Van Dijk et. al. (1999) studied two types of environmental uncertainty: uncertainty about endowments and access positions (experiment 1) and uncertainty about a bonus size (experiment 2). In their first experiment regarding endowment and position uncertainty, uncertainty influenced coordination rules in public goods dilemmas but not in resource dilemmas. The difference between the amount contributed to a public good under conditions of environmental uncertainty differed such that: (a) in situations of complete information a proportionality rule was invoked (high position members contributed more); whereas (b) in the incomplete information condition an equal contribution rule was invoked (there was no significant difference between contributions of high and low position members). In the second experiment this interaction was significant in the resource dilemma but not in the public goods dilemma. When the size of the bonus was certain, an equal final outcomes rule was employed, but when the size of the bonus was uncertain an inverse proportionality (inverse equity) rule was employed. It seems that uncertainty has a complex influence on cooperation in commons dilemmas. Knowledge, or lack thereof, of crucial parameters can influence whether actors over-harvest or not.

Temporal Sequence and Protocol of Play.

One interesting experimental finding that has attracted research attention has to do with the temporal order in which people harvest from a shared resource pool. Budescu, Au, & Chen (1997) have called this aspect of the decision problem the “protocol of play”.

One protocol, that was the standard one in many of the earlier studies, is the *simultaneous* protocol. All players make their harvest decisions simultaneously and with no knowledge of the requests of the other players. What the players know is the pool size, possibly with some uncertainty, and the number of persons with whom the pool will be shared. A second protocol of play is that the players are assigned (in some way) sequential positions--first, second, and so on—and they make their decisions sequentially, knowing what position they occupy and also knowing what the size of the remaining pool is when they make the harvest decision. This is the *sequential* protocol. In the sequential protocol, there is a clear position effect. The requests of those who come earlier in the sequence are larger than those of the players who come later (Budescu et al., 1992; Rapoport, Budescu, & Suleiman, 1993) It is as if there is an advantage associated with being one of the earlier players to withdraw resources from the pool. The interpretation of this effect is that those who play first feel “entitled” to take more than they would if they came later. (In another section we discuss factors that influence this feeling of entitlement.) Players who come later must make allowances for the decisions that were made by those who came earlier.

An interesting variant of this phenomenon comes from the *positional* protocol. In this protocol, players are assigned sequential positions in which they will make their decisions, but they will have no knowledge of the size of the remaining pool. In this case, first movers cannot depend on those who come later to adapt to larger initial harvests since the magnitude of the early harvests will not be known. This protocol permits three hypotheses about decision making. First, since sequential pool size information is unavailable, there should be no position effect—the results should look like the simultaneous protocol. Second, if players all expect the position effect to exist, then they

will act in accordance with it and create the effect and the results should look like the sequential protocol. There may be ambiguity and uncertainty about the early players, even for the early players, with some thinking that the appropriate model is the simultaneous protocol and others thinking that the appropriate model is the sequential protocol, and the results then should fall somewhere between the two “pure” benchmarks. Budescu, Suleiman, & Rapoport (1995), Budescu, Au, & Chen (1997), and others have confirmed this third hypothesis.

Finally, Budescu, Au, & Chen (1997) describe a *cumulative* protocol in which a player knows only how much of the resource remains, but does not know his or her serial position. (Since players know the total group size and the average pool size they can make an inference about their serial position from the pool size.) With the methodology used in this study, there was little difference between this protocol and the sequential protocol.

The interesting empirical riddle posed by research on protocols of play is this: Why does the positional protocol, which is formally identical to the simultaneous protocol, show a position effect like the sequential protocol? Two suggestions have been offered (e.g. Budescu et al., 1997). First, the knowledge of position may provide a “coordinating device” that allows players to share expectations and deal with the dilemma effectively. The second suggestion is that the effect reflects the operation of a “social decision heuristic” of the sort discussed by Allison and Messick (1990). A heuristic of this sort is a cognitive rule that is evoked by a social situation. In the simultaneous protocol, where there is no way to differentiate among players, the heuristic that is likely to be evoked is an “equality” heuristic (Messick, 1993). This heuristic

requires that one divide the likely pool size by the number of participants to calculate an “equal” share. The sequential protocol may evoke a different heuristic like the “first come, first served” rule that governs social behavior in queues. People early in the queue get better options than people later in the queue. The positional protocol is ambiguous in that it could evoke either or both of these heuristics. If this interpretation is correct, variables that accentuate one interpretation over the other should also have an impact on the size of the position effect with the positional protocol. Some of the factors that have been shown to influence (at least the first mover’s) behavior are group size (Allison et al., 1992; Budescu et al., 1995), the divisibility of the resource (Allison & Messick, 1990), the reason behind the position assignment (Samuelson & Allison, 1994), the name associated with the first mover (Samuelson & Allison, 1994), and the degree of uncertainty about the size of the pool (Budescu et al., 1995).

There is no incompatibility between viewing the position effect as a “coordinating device,” on the one hand, and as a social decision heuristic on the other. Many heuristics do coordinate to the extent that they are shared. Traffic on the right has priority. Take turns passing through intersections. These are commonly held rules or heuristics that effectively coordinate action.

Payoff Structure.

Historically, experimental research on social dilemmas of all kinds has demonstrated significant effects attributable to changes in the “payoff structure” underlying a situation. What are the payoffs associated with cooperation or defection? What are the risks associated with different choices? The influence of payoff structures

has been demonstrated not only in the laboratory, but also in the field (Van Lange, Liebrand, Messick, & Wilke, 1992a). While emphasis has most often been placed on the monetary payoff structure in experimental games, the present review considers a broader array of structural factors that affect individuals' choices. Central to popular and psychological understandings of behavior is the notion that behaviors are generally more likely to be exhibited when rewarded, and less likely to be exhibited when punished. The central question in any domain is what combination or form of rewards and punishments (sanctions) will yield optimal or at least desired results. A number of recent studies have offered new insights that may be productively applied to the development of better commons management techniques.

Gächter and Fehr (1999) moved beyond the familiar experimental manipulation of material economic rewards or punishments to examine the value of "social" rewards on people's willingness to contribute to public goods. They were specifically interested in whether social rewards alone could overcome free-rider problems. First, the investigators conducted a questionnaire study. The questionnaire results confirmed that participants "expect [to] receive more approval if they contribute more, and less approval if others contribute more. In addition, they expect higher marginal approval gains if others contribute more" (p. 346). In the main study, participants faced a public goods dilemma in one of four conditions: (1) an anonymous condition in which participants never knew who they were playing with; (2) a "social exchange" condition in which participants had an opportunity to interact after the game; (3) a "group identity" condition in which participants met one another before playing, but knew they would not see one another afterwards; and (4) a combination of conditions 2 and 3 in which participants met ahead

of time, *and* had a chance to interact afterwards. Neither social familiarity (condition 3) nor the opportunity to receive social rewards (condition 2) improved the level of cooperation relative to the baseline anonymous condition. *However*, the combination of the two (condition 4) resulted in significantly higher levels of contribution.

Gächter and Fehr conclude that “social approval has a rather weak and insignificant positive effect on participation in collective actions if subjects are complete strangers. Yet, if the social distance between subjects is somewhat reduced by allowing the creation of a group identity and of forming weak social ties, approval incentives give rise to a large and significant reduction in free-riding” (pp. 361-362). They go on to suggest that group identity effects may act as a facilitating “lubricant” for social exchange. It is important to note that there remained, even in the combined condition 4, a minority of participants who seemed unmotivated by social approval, and very willing to exploit the end-game round. Nonetheless, consistent with findings described elsewhere in this chapter, the effectiveness of social rewards in reducing free-riding and increasing cooperation is enhanced by reductions in social distance and the facilitation of group identity.

Bell, Petersen and Hautaluoma (1989) offer a unique solution to the problem of overconsumption: let consumers steal from one another. The investigators ran an experiment with a 3 (probability of punishment for stealing) x 3 (probability of punishment for overconsumption) design. The levels of probability for each factor were 0% (control), 25% (low) and 75% (high). In each round of play, participants could harvest from the common resource pool, or they could steal from the other players. The results suggest that increasing the probability of punishment for a behavior has a

significant deterrence effect; there were main effects for punishment of both behaviors.

However, “punishment of one behavior increased the occurrence of the selfish alternative” (p. 1483). If the probability of punishment for overconsumption increased, so did the likelihood of stealing from neighbors. If the probability of punishment for stealing from neighbors increased, so did the likelihood of overconsumption. “To summarize, in the commons simulation, punishment for overconsumption reduced overconsumption, helped preserve the commons, but increased stealing. Punishment of stealing deterred stealing, promoted depletion of the commons and increased overconsumption” (p. 1495).

Of course, in the real world more than one kind and level of reinforcer is operational at any given time. “Poaching wildlife, for example, may involve perceived rewards of food and hides, perceived thrill of the hunting experience, risk of being caught and punished, potential inconvenience, as well as depletion of the resource, among other consequences.” Understanding the interplay of such factors is clearly a complex task that is, at least to some extent, unique to any given context.

The Bell et. al. (1989) findings should also be read with an understanding that their experimental framework made stealing a highly public act. While there are real-world analogues (e.g., parking in a handicapped parking spot), clearly the majority of resource theft is done under the assumption that detection is improbable. Although their experiment fixed the probabilities of punishment regardless of an offense’s public nature, whether the potential for “secret” theft under the same probability conditions would yield different behaviors is an open empirical question. Certainly, given the findings reported earlier on the motivating influence of social approval or disapproval (Gachter & Fehr,

1999), one could reasonably anticipate greater willingness to offend if offered the opportunity to do so more discretely.

In another interesting commons study, Martichuski and Bell (1991) crossed three levels of reinforcement (reward, punishment, or no reinforcement) with three different game structures (territoriality, “golden rule” moral suasion, and a basic structure). Rewards were affirmations for making commons-sustaining harvest choices (i.e., “Good choice, player X”), and punishments for commons-depleting harvest choices were simply the inverse (i.e., “Bad choice, player X”). The “territorial” structure involved splitting the larger pool so individuals essentially managed their own access to a personal resource pool. The “golden rule” moral suasion structure involved an initial suggestion that when participants made harvesting decisions they could make “a lot of points” by making their decisions “... exactly the way that [they] would want other people to make their choices.” The basic structure was a straightforward commons dilemma (Edney & Harper, 1978).

Those in the privatization condition were more effective in preserving the commons than those in the moral suasion condition, who were in turn more effective than those in the basic structure condition. Reward and punishment improved the life of the commons in the moral suasion and basic structure conditions, but had no appreciable impact on the privatized condition. Further, reward and punishment had equivalent effects.

The authors suggest that, “... it seems that a privatized resource maximizes individual harvests while preserving the slowly regenerating resource, and that rewards and punishments do not add to these maxima.” This raises a number of interesting questions. For example, would an elaborate system of metering and rationing (with

limits or tiered pricing) be a simpler and more effective mechanism for managing certain resources (e.g., water) than elaborate reward and punishment systems? Where it is difficult to affect a system akin to privatization, moral suasion combined with a reinforcement system seems to be a strategy worthy of consideration.

This final point is particularly interesting in light of the rather weak manipulations of this study. The statement “Good move” flashing up on your computer screen is hardly a powerful reward. There is, however, at least one problem from our perspective with the moral suasion condition: it appears to confound what the morally right thing to do is (golden rule) with maximizing personal utility (“Here is a way to make a lot of points...”). This is problematic given that, unlike the typical understanding of social dilemmas, the manipulation seems to suggest that participants’ short-term gains can be improved by considering community issues. Further testing of these findings in a context where moral suasion is less confounded, and in which more powerful and realistic rewards and punishments are utilized, could be both interesting and worthwhile.

The value, necessity, and effectiveness of sanctioning systems can vary across cultures. Yamagishi (1988) found that American participants in a public goods experiment “cooperated more strongly than Japanese subjects when no sanctioning existed” (p. 271). He explains his finding in terms of Taylor’s (1976) argument that the existence of a “a strong external system of sanctioning destroys the basis for voluntary cooperation; thus the existence of such a system ‘exacerbates the conditions which are claimed to provide its justification and for which it is supposed to be the remedy’ (p. 134)” (p. 271). He suggests that Japan’s more collectivist culture and the culture’s tendency towards mutual monitoring and sanctioning results in a decrease of trust in the

absence of such control mechanisms relative to America's "more individualistic society."

This was further supported by questionnaire findings that indicated a lower level of interpersonal trust among Japanese participants than their American counterparts. This finding poses at least two challenges for those interested in researching and executing commons management. The first is to give careful consideration to cultural factors when making statements about resource dilemma strategies. The second is to consider the long-term consequences of sanctioning systems and authorities on trust and general cooperative tendencies in communities. This is a difficult balance. As other research reviewed in this paper indicates, sanctioning systems offer potential benefits to the management of common resources. On the other hand, sanctioning systems may undermine the intrinsic motivations for cooperation and other generally helpful factors for community life like interpersonal trust.

Conclusions

This review surveys current research on common resource dilemmas and identifies major theoretical research topics. We review empirical findings in the framework of task related and non-task related categories. This theoretical structure enables us to differentiate between different clusters of studies in a comprehensive approach that evaluates differences between people who are involved in a commons dilemma, the situational factors that may influence how any group of people view the dilemma, and how the specific criteria of the dilemma structure may influence cooperation.

We began by considering how individual differences could influence assessment

of situational factors and consequent levels of cooperation. Much of this research relates to social motives that underlie allocations in distributive settings. In general, prosocial individuals are more cooperative in social dilemmas than individualist or competitors. Interestingly, research suggest that this may be driven by different perspectives on rationality held by individuals; cooperators take a collectivist approach to rationality, whereas individualists and competitors view social dilemmas through a lens of individual level rationality. Each judges the perspective they hold as the more intelligent one. Social value orientation may be independent of, or relate to, other psychological variables such as fear or trust, as well as broader identity categories such as gender and culture.

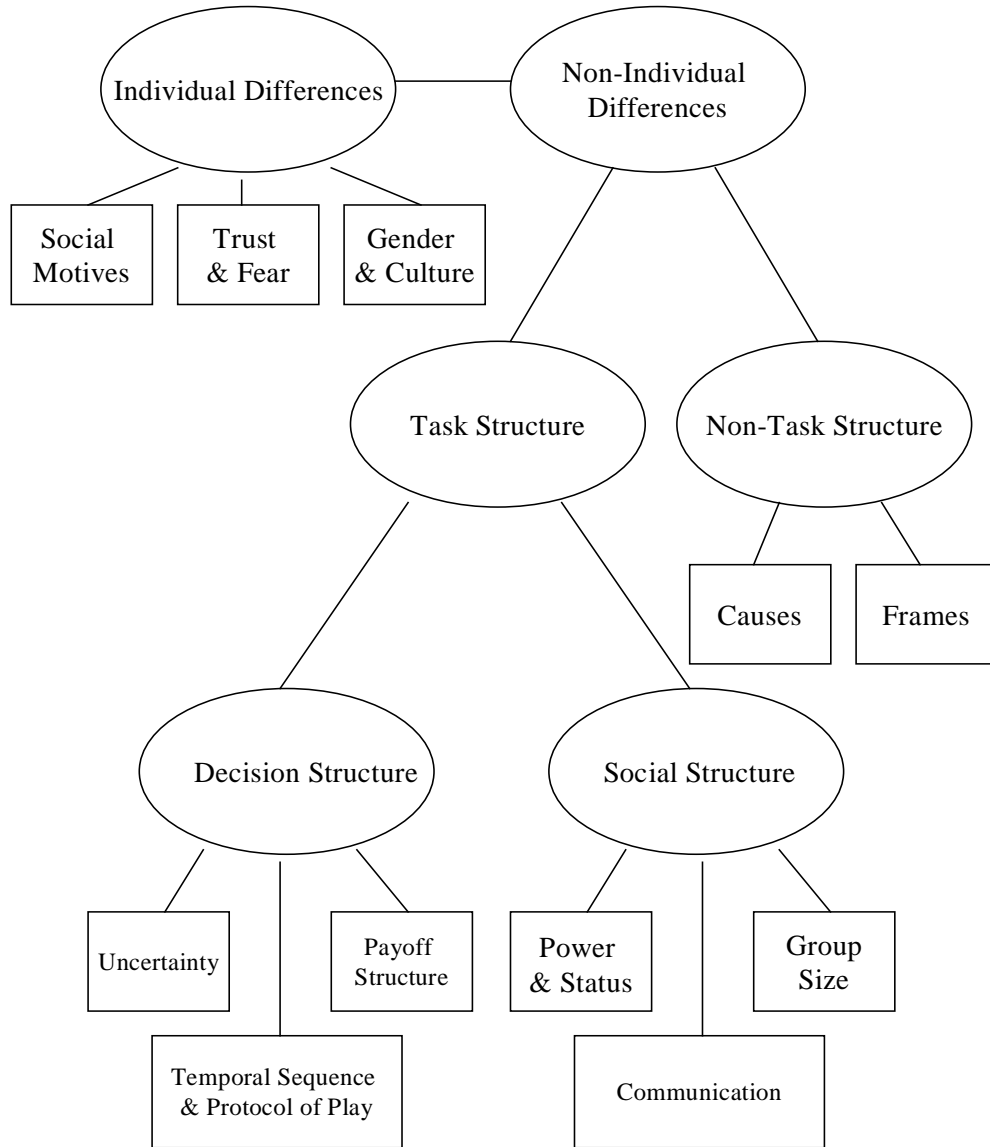
Contextual factors such as attributions regarding causal explanations and cognitive frames were then evaluated in respect to their influence on cooperation. Causal attributions – the reason given for people’s decisions – influence how much of the resource they claimed for themselves. This was evident with respect to the priority position with regard to access to a shared resource, with regard to scarcity or abundance of the resource pool, in preferences for structural solutions to commons crises. We also distinguished among a variety of framing effects that influence cooperation in social dilemmas - framing outcomes as gains or losses, framing games as entrepreneurial or social exchange, framing choices as taking, keeping, leaving or giving. The idea of outcome framing seemed to correspond to the distinction between *public goods* dilemmas and *common pool* dilemmas.

Finally we examined factors relating to the task-structure itself and separately discussed elements that relate to the social structure of the task and those that explicitly relate to the decision structure. Key elements of the social context include understanding

the role of communication in enhancing group identity and in eliciting commitments to cooperate, as well as the influence of different mediums of communications. Cooperation may be higher in small group because actors may feel a greater degree of self-efficacy. Beyond the size of the group social structure implies different levels of status and power, which invariably was found to influence the justifications people make regarding judgments of offending acts. Power imbalances influence the probability of coalition formation and lead to egocentric evaluations both of which lead to overharvesting and defection. The endorsement of leaders also varies in respect to their allocation decisions and whether the commons were successfully managed, or not. Key elements of the decision structure factors include resource uncertainty and task knowledge, the decision sequence protocol, and the payoff structure, and the payoff structure.

We suggest that this theoretical framework of individual behavior in commons situations is helpful in understanding the advances made in the field over the last decade and point out directions for future research.

Figure 1



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