This is to certify that the
dissertation entitled

Investigating the Effects of Rewards and Reward-Based Messages in Social Dilemmas

presented by

Kyle R. Andrews

has been accepted towards fulfillment
of the requirements for the

Ph.D. degree in Communication

Major Professor's Signature

7 July 2009

Date

INVESTIGATING THE EFFECTS OF REWARDS AND REWARD-BASED MESSAGES IN SOCIAL DILEMMAS

By

Kyle R. Andrews

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Communication

2009

ABSTRACT

INVESTIGATING THE EFFECTS OF REWARDS AND REWARD-BASED MESSAGES IN SOCIAL DILEMMAS

By

Kyle R. Andrews

Previous research has shown that rewards are effective incentives to encourage cooperation in social dilemmas. What happens to cooperation rates when those rewards are removed, however, has not been investigated. A study was designed to test the hypothesis that offering rewards for cooperation will undermine cooperation below control group levels when those rewards are removed. Messages that promote either the private gain or the public gain to be had from cooperation were also tested, with the former hypothesized to operate similarly to actual rewards. Results indicated that rewards and both message types increased cooperation rates above control levels when present. When the messages and rewards were removed, the reward condition decreased to control levels, while the message conditions remained at the same high level. Potential explanatory mechanisms are discussed.

ACKNOWLEDGMENTS

I would like to thank my advisor, Dr. Franklin Boster, and committee members, Dr. Charles Atkin, Dr. Norbert Kerr, and Dr. Timothy Levine, for their special assistance with this project and their guidance throughout graduate school. I am also very grateful to my parents, Sharon and Robert Andrews, and girlfriend, Erin, for their continual support.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Investigating the Effects of Rewards and Reward-Based Messages in Social Dilemmas

Social dilemmas are defined as situations in which it is more profitable for an individual to defect from a group than to cooperate, for example by contributing too little to a public good or withdrawing too much from a common resource. If everyone defected, however, everyone in the group would be worse off than if everyone cooperated (Dawes, 1980). Examples of social dilemmas are prevalent in society, and include energy use, pollution production, and contributions to public television.

There are two ways typically proposed to combat social dilemmas. The first way is regulations or "side payments" that make the situation no longer a social dilemma (Hardin's (1968) "mutual coercion mutually agreed upon"), and the second is to convince individuals to behave in a way consistent with the public good (Hardin's "appeals to conscience"). Another method, in a sense a hybrid of the two, is to incorporate side payments in the form of rewards for cooperative behavior, but to do so with small amounts that do not change dramatically the payoff matrix (so the situation remains a social dilemma). While there has been research conducted on rewards in social dilemmas (Komorita & Barth, 1995; McCusker and Carnevale, 1995; Parks 2000), many questions remain unanswered. The present experiment was designed to investigate three such questions. The first is what happens when rewards are removed, including the possibility that a side effect of rewards is an undermining of intrinsic motivation to cooperate, and thus a decrease in cooperation below control levels. The second is whether messages describing the private gains to be had from cooperation have the same effects as actual rewards. The third is whether rewards or message-based rewards interact with social

value orientations, or a person's predisposition to act cooperatively or selfishly in a social dilemma.

Rewards in social dilemmas

Research on rewards in social dilemmas has generally concluded that rewards lead to higher rates of cooperation. Komorita and Barth (1985) found cooperation rates to be higher in a condition in which subjects received a bonus for cooperation than in either a control condition or when receiving a penalty for defecting. McCusker and Carnevale (1995) found similar results, with a reward condition eliciting the highest cooperation, followed by a penalty condition and, finally, the control condition. Parks (2000) varied experimentally a number of features found in Komorita and Barth (1985) and McCusker and Carnevale (1995), and found that rewards that were competition-based (only the most cooperative participant received the reward), offered on each trial, and performance-contingent produced the highest rates of cooperation.

In previous research, rewards were present or not present for the entire experiment. Thus it is unclear what happens when rewards are taken away. If rewards are provided and then removed, cooperation rates could remain at the same level as when there were rewards, although this scenario is probably unlikely. Cooperation rates could return to previous, pre-reward levels. Or, cooperation rates could drop to levels below baseline. This last possibility, an undermining effect of rewards on cooperation, has supporting evidence from other areas of psychology. It is also of high practical importance, as most behavior change campaigns that use a reward structure end eventually, such as when funding expires.

Research on the impact of extrinsic rewards on intrinsic motivation has shown that rewards can undermine intrinsic motivation (see Deci, Koestner, and Ryan, 1999, for a review). Intrinsic motivation is defined as being driven to perform a given behavior because of the enjoyment gained from the behavior, and not from any external reward that may result from it. Ryan and Deci (2000)'s Self-Determination Theory (SDT) conceptualizes intrinsic motivation as "doing an activity for the inherent satisfaction of the activity itself" (p. 71) and proposes that two factors underlie intrinsic motivation: competence and autonomy (Deci and Ryan, 1985). Competence is the extent to which one feels able to complete a behavior or action (similar to self-efficacy), while autonomy is the extent to which one feels in control of one's actions. Extrinsic rewards can undermine intrinsic motivation to the degree to which they lower feelings of competence and autonomy. For example, rewards, particularly if given for successful completion of a task, often can increase feelings of competence, but tend to decrease feelings of autonomy. If the decreased feelings of autonomy (i.e., one feels one's behavior was driven by the anticipated reward) outweigh the increased competence, then the reward can lower levels of intrinsic motivation. Such an effect of extrinsic rewards on intrinsic motivation can also be explained by attribution theories such as self-perception theory. The external facilitative factor (reward) can lower the extent to which people attribute their behavior to internal causes (Bem, 1972). Within intrinsic motivation research, this is referred to as the overjustification effect (Lepper, Greene, & Nisbett, 1973).

The issue of rewards undermining motivation has been discussed in economics as well (Frey, 1993, 1994). Frey and Oberholzer-Gee (1997) asked Swiss citizens whether they supported the government's plans to build a nuclear waste repository in their towns.

After assessing endorsement of the facilities, the authors then asked for the residents' level of support if the government were to offer a monetary incentive. With the monetary incentive offered, support for the facility dropped dramatically (from 50.8% to 24.6%), an effect the authors interpreted as the monetary reward reducing the intrinsic motivation of the citizens to endorse the facilities out of a sense of public duty (although the results could also be explained as a shift in decision frame; cf. Messick, 1999).

Intrinsic motivation has also been discussed in the area of social dilemmas, as a possible explanation for the effect of surveillance and negative sanctioning systems. Surveillance and negative sanctioning systems, in which the subject is penalized for defection if caught, can lower rates of cooperation compared to control conditions, particularly when the chance of being caught is low or the fine is small (Tenbrunsel & Messick, 1999; Mulder, van Dijk, Cremer, & Wilke, 2006a). Tenbrunsel and Messick (1999), while mentioning the possibility of the intrinsic motivation explanation, tested and found support for the idea that sanctioning systems change the decision that subjects think they are making, from a decision with ethical implications to a business decision where the primary goal is personal gain (see also Messick, 1999). Mulder, van Dijk, De Cremer, and Wilke (2006b) found that the implementation and then removal of a negative sanctioning system led to an undermining effect on cooperation when compared to a control condition in which a sanctioning system was never implemented; they attributed the effect to an undermining of trust that others will cooperate.

A likely reason why the intrinsic motivation explanation has been proposed but never directly tested in the context of social dilemmas is because the desire to cooperate rather than defect is not entirely isomorphic with the definition of intrinsic motivation as

performing a behavior for the enjoyment gained from that behavior. In social dilemmas, a cooperative decision is probably made with reference to some desired outcome, whether personal gain, group welfare, or norms of fairness and equality. That being said, distinctions can be made between types of motivation to cooperate, some of which are more similar to definitions of intrinsic motivation, and some of which are more similar to definitions of extrinsic motivation. It is possible that rewards may undermine non-selfish motivations to cooperate in the same way that rewards have been found to undermine intrinsic motivation traditionally defined.

A useful typology of the various motivations to cooperate or act prosocially is provided by Batson (1994). Batson proposed four primary types of motivations for prosocial behavior: egoism, collectivism, altruism, and principlism. Egoism is prosocial behavior done because it aids in increasing one's own benefit, or because it is a side effect of pursing one's own benefit. Benefits may be in the obvious form of immediate resource acquisition, or they may be less quantifiable, long-term benefits. Semmann, Krambeck, and Milinski (2004) found that cooperative behavior increased in a public goods game when participants knew of each other's behavior in a concurrently-run dictator game, presumably because participants anticipated that cooperative behavior in one game would be rewarded in the other. In an example of anticipated benefits of cooperation, Hardy and Van Vugt (2006) found that altruistic behavior in an experimental game resulted in status gains and increased preference by other group members to interact with the altruistic person.

Collectivism is induced when prosocial behavior is motivated by a desire to improve the welfare of a group (Batson, 1994). If the group is one to which the actor

belongs, then the behavior must not be done as an indirect way to benefit the self; this rationale would make the act egoistically motivated. Although few studies can rule out the egoistic motivation completely, there is some evidence that a collectivist motivation exists. For example, Kramer and Brewer (1984) primed participants with a superordinate group identity and found them to reduce consumption of a commons pool with dwindling resources when compared to those primed with a subordinate group identity.

The third motivation is altruism, which is action taken to aid one or more individuals. Although there is debate as to whether purely altruistic behavior is possible (Cialdini, Brown, Lewis, Luce, & Neuberg, 1997), some researchers argue that altruistic behavior can be induced via empathy (Batson & Shaw, 1991; Batson, 1994). Batson and Moran (1999) found that cooperation was increased by inducing empathy in a prisoner's dilemma; Batson and Ahmad (2001) found similar cooperative effects, even when the subject knew beforehand that their partner defected.

Batson's (1994) final motivation is principlism, which is invoked when someone engages in prosocial behavior because of a moral principle. For example, a person may cooperate because of feelings of fairness, equality, or justice. Research on those with a cooperative social value orientation has found equality to be a significant motivator (Eek & Garling, 2006, 2008).

Taken together, Batson's (1994) typology of motivations encompasses many if not the majority of motivations used to explain cooperative behavior in social dilemmas. As such, observing the impact of rewards on measures of prosocial motivations might be one way of assessing the veridicality of the undermining explanation, in addition to the more direct measures of autonomy, competence, and intrinsic motivation developed by

proponents of SDT (McAuley, Duncan, & Tammen, 1989; Ryan, 1982), which may or may not translate well in the context of social dilemmas.

Potential equivalence of rewards and messages

A second question regarding rewards and social dilemmas is whether the rewards need to be monetary. For instance, could messages promoting the private gain to be had from cooperative behavior substitute for monetary rewards? An example of such a private gain message might be one that highlights the fact that cooperation will lead to the common resource lasting longer, allowing for additional harvests. This could be contrasted with messages promoting the public benefits of cooperation, such as messages advocating cooperation for the group's welfare. Such messages do not change the payoff structure of a social dilemma like an actual reward does, but given how slightly actual rewards alter payoff structures, it is possible the decision process induced by messages will not be markedly different than the decision process induced by rewards.

If messages promoting private gain do in fact operate like rewards, it is also possible that private gain messages can undermine cooperation rates. Motivations to cooperate are numerous, and it is possible that consistently promoting an egoistic motivation can reduce the strength of a person's collectivist, altruistic, or principled motivation. This proposition would be similar to the norm of self-interest (Miller & Ratner, 1998; Ratner & Miller, 2001), the idea that self-interest is viewed as the proper motivation in society to such an extent that people do not feel justified in behaving in ways that contradict their self interest.

Research on intrinsic motivation has found that messages can operate similarly to rewards (although it should be made clear that the types of messages found to operate

similar to rewards are different in a number of ways from messages promoting the private gain to be had from cooperative behavior). Deci, Koestner, and Ryan (1999) distinguish between tangible rewards and verbal rewards. Tangible rewards typically are perceived as controlling; to the extent that they are perceived as providing much information regarding competence, it is overpowered by the perceptions of control (thus, they are apt to undermine intrinsic motivation). Conversely, verbal rewards (positive feedback) are viewed as high in information regarding competency and low in control, so they typically enhance intrinsic motivation unless the verbal reward is controlling in tone or implication. For example, Pittman (1980) found that informational verbal rewards led to higher task engagement in a free choice period when compared to controlling verbal rewards, and Osbaldiston and Sheldon (2002, 2003) found messages promoting autonomy (i.e., not controlling) led to higher levels of internalized motivation to perform environmental behaviors. Messages promoting the private gain resulting from cooperative behavior do not provide performance feedback like verbal rewards, so they are unlikely to affect perceptions of competence. It is possible, however, that private gain messages lower feelings of autonomy (i.e., the perception that one's behavior was controlled by the reward offer).

There is also evidence from the social dilemma literature that messages promoting either public or private gain could have the potential to affect behavior. A number of studies have found that how a social dilemma is described or labeled can have a dramatic influence on game behavior (Schwartz-Shea & Simmons, 1995; Zhong, Loewenstein, & Murnighan, 2007). For example, Liberman, Samuels, and Ross (2004, Study 1) had subjects play a prisoner's dilemma with the game labeled as either "Wall Street Game" or

"Community Game," and found cooperation rates were more than twice as high in the latter compared to the former.

The possibility of private gain messages acting as rewards, including potentially undermining intrinsic motivation to cooperate, is of practical as well as theoretical importance since these types of messages are used frequently in behavior change campaigns. A common example would be messages that emphasize the money saved from lower utility bills as a result of buying an environmentally-friendly appliance (an egoistic motivation for cooperation). A common variation of this message strategy promotes environmental action because it will benefit one's children or grandchildren; such a tactic would also be based in egoistic motivation. A competing message strategy is to promote the public benefits of cooperation. For example, such messages would emphasize the carbon reduction or cleaner air from using an efficient appliance. This type of message extolling group benefits would be an example of Batson's (1994) collectivism motivation. It could also be viewed as an example of Batson's principlism motivation, as it might make salient environmental beliefs or prime considerations of equality, morality or justice. If private gain messages undermine cooperation, environmental marketers may be encouraging short-term increases in environmental behavior at the expense of long-term intrinsic motivation. This is all the more troubling given that previous studies have found intrinsic motivation to be longer lasting and more stable than extrinsic rewards (Hornik, Cherian, Madansky, & Narayana, 1995).

Interaction with social value orientations

In addition to the possibility that different messages could undermine each other over time, it is possible that such messaging may interact with a person's social value

orientation. A person's social value orientation is his or her preference for a pattern of outcomes for self and other (Messick & McClintock, 1968). Social value orientations provide a more accurate picture of human behavior than do theories of rational self-interest, in that they accept and measure the extent to which people take into account the outcomes of others in their decisions. Those with an individualist social value orientation are those who only care about their own outcome, and do not pay attention to the outcome of others. Competitors care about their own outcome relative to the group; they would prefer a lower personal outcome if it meant a larger positive discrepancy between self and other (competitors and individualists are often combined into "proselfs"). Finally, cooperators (or "prosocials") are those who weigh outcomes for both self and other in their decisions, placing high importance on equality (Van Lange, 1999; Eek & Garling, 2006, 2008).

If private gain (egoistic) messages do undermine public gain (altruistic, collectivist, or principled) motivations, then it would be reasonable to expect this effect to be most pronounced with prosocials, as they have the most public gain motivation to undermine (that is, there might not be large undermining effects for proselfs due to a basement effect). This notion is supported by the results of Mulder et al. (2006), who found no difference in cooperation for those low in trust after sanctions were removed, but a significant decrease in cooperation among those high in trust after sanctions were removed.

Overview of present experiment

Four sets of hypotheses were advanced. The first entails the effect of rewards on cooperative decision making. It is expected that rewards will increase cooperative

decision making in line with previous research, but that rewards will also have an undermining effect once removed. That is, cooperative choices are expected to be lower after rewards are removed when compared to a control condition that never experienced rewards. Consistent with SDT (Deci & Ryan, 1985), self-reported autonomy and intrinsic motivation are expected to be lower, and self-reported competence is expected to be higher, in the reward condition versus control condition. Self-reported egoistic motivation is predicted to be higher in the reward condition versus control, while self-reported collectivist and principled motivation is predicted to be lower in the reward condition than control condition.

Second, private gain messages are predicted to behave similarly to actual rewards, both in terms of increasing cooperative decision making when present, and undermining cooperation rates when removed. The SDT and motivation measures are predicted to be the same as rewards as well.

Third, public gain messages are expected to increase cooperation when present, but are not expected to lead to an undermining effect when removed. Collectivist and principled motivation are predicted to be higher than control; egoistic motivation is predicted to be lower than control. The SDT measures are not predicted to be different from control.

Fourth, the effects of rewards and private gain messages are predicted to interact with social value orientation, with undermining effects being more pronounced with prosocials than proselfs, as the former have more intrinsic motivation to undermine.

Self-report measures of decision frame and trust were included as research questions because of their importance as mediators and competing explanations in previous research (Tenbrunsel & Messick, 1999; Mulder et al., 2006a, 2006b).

Method

Participants

Two hundred forty six subjects were recruited from communication courses at a large Midwestern university. All participation was voluntary, and subjects were compensated with course credit.

Design

The experiment was a between-subjects design with four conditions (induction: reward, private-gain message, public-gain message, or control). Subjects in all conditions completed 28 trials. The first seven trials included the experimental inductions, while the last 21 trials did not.

Procedure

The experiment had two parts. The first was an online survey, which had subjects answer pretest measures of social value orientation, collectivism, principlism, and egoism. The online survey was completed between three and fourteen days before the second part of the experiment, which was a laboratory session. The laboratory session was held in a classroom with eighteen computer terminals. Subjects were told they would be participating in a commons game (labeled a "group decision task") with seven other subjects. They were told that a computer server would place them into groups of eight after they logged into the system, and that the other group members would include people

participating from other computer labs on campus. In reality, the computers were not networked, and subjects received predetermined false feedback.

In a commons game, each subject has to make a decision regarding how much of a common resource to withdraw for themselves, and how much to leave in the common pool. The resources remaining in the common pool accrue interest, while the resources taken by the participants do not. The commons game fulfills the requirements of a social dilemma, because it is in every subject's best interest to withdraw as much as possible from the group account. If everyone behaved in this way, however, the account would be depleted and everyone would be worse off than if everyone had cooperated. Subjects were told that the goal was to accumulate points for themselves, and that at the end of the experiment randomly selected subjects would get money in exchange for the points they earned.

Similar to Brewer and Kramer (1986), subjects were told that the commons pool would have an initial value of 2500 points, and that they would be permitted to withdraw between zero and twenty-five points per trial. In the reward condition, subjects were given a reward of two points if they withdrew fewer than twelve points, three points if they withdrew fewer than eight points, and four points if they withdrew fewer than five points. When the opportunity to earn bonus points stopped after the seventh trial (all inductions ceased after the seventh trial), subjects were told it was because the experimenter only had enough funding to offer bonus points for the first seven trials (subjects were not informed that rewards would stop until after the seventh trial ended).

Subjects were given ambiguous false feedback regarding the resource level after every third turn so that the feedback would not be viewed as directly caused by behavior

on any one trial. The feedback was additionally vague because subjects were told that the calculation of interest in the common account was at a randomly-selected variable rate (0-10%). As a result, the subjects were not able to discern the true extent of others' (fake) harvesting except in a very general sense. For the first 14 trials, the resource level fluctuated but remained relatively stable. For the last 14 trials, the feedback level dropped slowly but continuously until the experiment ended (see Appendix A for the complete feedback schedule). Subjects were not told that there would only be 28 trials; they were led to believe the experiment would continue as long as there were still points left in the pool. Negative feedback was provided because other investigations have found that certain mediating variables impact cooperation rates (such as group identity, Kramer & Brewer, 1984) only when there are dwindling resources.

Subjects in the non-reward conditions were told that previous participants were asked to provide messages regarding suggested strategies for game behavior, and that they would view these messages while participating in the game. All messages were described as unique, with none of the group members viewing the same message. Subjects were also told that they would be asked to provide their own message on suggested game behavior at the end of the experiment. The messages differed by condition. The public-gain message condition had messages that emphasized the public gains to be had from cooperation (e.g., *"Everyone will end up with more points if everyone only takes a few points per turn, because the pool will last"*). The private-gain message condition had messages that emphasized the private benefits of cooperation (e.g., *"You will make the most money by not withdrawing much per turn. That way the pool lasts longer"*). Both the reward condition and the control condition had messages

that just restated the rules of the game (*"The pool starts out with 2500 points in it"*). See Appendices B-D for all of the messages used in the experiment. When the messages stopped after the seventh trial, subjects were told this was because not many subjects had completed the experiment so far, and that as a result not enough subject-generated strategy messages had been collected to cover every trial.

During the experiment, the rules and guidelines of the game remained on the bottom of the screen for reference. After completing 28 trials of the commons game (game behavior being the primary dependent variable), subjects were asked to complete self-report measures of social value orientation, egoistic, collectivist, and principled motivation (specific to game behavior and thus different from the pretest versions), intrinsic motivation, competence, autonomy, perceptions of others' expected behavior, and decision frame. Altruistic motivation was not measured as it and collectivist motivation are functionally the same in an anonymous group social dilemma. Subjects were then asked to write a strategy message for subsequent subjects to view when playing the game. Subjects were then debriefed, thanked, and allowed to leave.

Message pretesting

The message inductions were pretested on perceived effectiveness and the extent to which the messages focused on either the personal or group benefits of point conservation. Perceived effectiveness was measured with three semantic differential items (*convincing-not convincing, sensible-not sensible,* and *persuasive-not persuasive*). After eliminating two messages, the remaining five messages had a mean of 3.71 in the public message condition and a mean of 3.81 in the private message condition, both on

seven point scales. The difference was not statistically significant, $t(48) = .48$, $p = .66$, $r = .06$.

Message focus was measured with three items. The items were *"This message focuses on the group or collective benefits of not taking too many points,"* *"This message promotes limiting the number of points taken so that the group won't be hurt,"* and *"This message focuses on the individual or personal benefits of not taking too many points"* (reverse coded). When considering the five messages retained in the perceived effectiveness test, the mean for the public messages was 4.86 on a seven point scale (with higher numbers indicating more public focus), while the mean for the private messages was 3.96. The difference was statistically significant, $t(48) = 5.06$, $p < .001$, $r = .59$.

Instrumentation

Game behavior

Game behavior was measured as the number of points subjects said they would withdraw from the pool on each trial (the question was phrased, *"How many points would you like to withdraw on this trial?"*). Withdrawal amounts ranged from 0-25 points.

Social Value Orientation

The Triple-Dominance Measure of Social Values (Van Lange, Otten, De Bruin, & Joireman, 1997) was used to measure social value orientation (see Appendix E). The measure uses nine decomposed games, each of which presents three choices for distributions between self and other, to assess whether a person is a prosocial, competitor, or individualist. Following Van Lange et al. (1997), participants were told that the other person was someone they did not know and would not meet, that the other person would

also make choices, and that the points should be interpreted as having value to themselves and the other person. Participants were classified as either prosocial, individualist or competitor if at least six of their choices fit the pattern for the respective classification. In the pretest data, 54.1% of the sample were prosocials, 24% were individualists, 6.1% were competitors, and 15.9% were unclassifiable. The posttest data was comprised of 55.7% prosocials, 23.2% individualists, 5.7% competitors, and 15.4% unclassifiable. In addition to the traditional categorical scoring method, a continuous measure of social value orientation was also created by subtracting the total number of proself (competitor or individualist) choices from the total number of cooperative choices. Using this continuous measure, the test-retest correlation was $r = .79$.

Egoism

A four item self-report measure was developed to assess subjects' egoism motivation in the pretest (Appendix F). Items asked about the importance of self-interest as a motivator in decision making. Example items included, *"My primary motivation is to make sure I have what I need,"* and *"If I do something, it's because I will benefit from it."* Confirmatory factor analysis (*CFA*) was used to assess the measurement model (Arbuckle, 2009; Hunter & Hamilton, 1992). To test internal consistency, factor loadings were estimated with a centroid estimation procedure. These factor loadings were then used to generate predicted correlations between all items. The predicted correlations were compared with the observed correlations to obtain the residual errors, which along with the factor loadings provided an indication of how well the model fit the data. Using this method, *CFA* found the four items to fit a unidimensional model. Cronbach's $\alpha = .75$.

A slightly different version of the egoism measure with five items was created to assess subjects' egoism motivation after participating in the social dilemma game (Appendix G). Example items included, *"When playing this game, my primary motivation was to make sure I had what I needed,"* and *"When I made decisions in this game, it was because I would benefit from the decision." CFA* found the four items to fit a unidimensional model. Cronbach's $\alpha = .84$.

Principlism

A four item, self-report pretest measure was developed to assess the degree to which principlism was a motivator in subjects' typical decisions (Appendix H). The principles of equality, justice, and morality were used, as they seemed most applicable to cooperation in a social dilemma. While arguably distinct constructs, they are most likely similar enough in their assessment as to be unidimensional for practical purposes. Example items included, *"When making decisions, I try to find the most fair and equitable solution,"* and *"Ideas of what is right and wrong factor strongly into my decision making process." CFA* found the four items to fit a unidimensional model. Cronbach's $\alpha = .79$.

As with the egoism items, slightly different versions of the principlism items were created for after the social dilemma game (Appendix I). Example items included, *"During this game, ideas of what is right and wrong factored strongly into my decision making process,"* and *"When making decisions in this game, I tried to find the most fair and equitable solution." CFA* found the four items to fit a unidimensional model. Cronbach's $\alpha = .87$.

Collectivism

A four item self-report measure was created to measure subjects' collectivism motivation in the pretest (Appendix J). Items focused on helping a group regardless of personal benefit. Examples included, *"I would go out of my way to help a group I'm concerned about, even if I don't benefit directly,"* and *"I often put group welfare ahead of personal outcomes." CFA* found the four items to fit a unidimensional model. Cronbach's $\alpha = .65$.

The version of the measure for after the dilemma game (Appendix K) included items such as, *"During this game, I went out of my way to help my group, even if I didn't benefit directly,"* and *"I often put group welfare ahead of personal outcomes in this game." CFA* found the four items to fit a unidimensional model. Cronbach's $\alpha = .85$.

Trust

Trust was measured with a three item self-report measure (Appendix L). Example items included, "*I think that others are primarily motivated to cooperate by not withdrawing too many points,*" and "*I trusted the other group members not to withdraw too many points from the common pool.*" *CFA* found the three items to fit a unidimensional model. Cronbach's $\alpha = .73$.

Decision frame

In order to assess decision frame, participants were asked to rate to what degree their decision could be described as a personal decision, an ethical decision, or a business decision (Appendix M). In addition, the forced-choice procedure used by Tenbrunsel and Messick (1999) was adopted. Participants were asked, "*If you had to choose one*

description for this decision, how would you describe it?" Options were: a personal decision, an ethical decision, and a business decision.

Autonomy

To measure autonomy regarding pool conservation, items were adapted from the Intrinsic Motivation Inventory (McAuley, Duncan, & Tammen, 1989; Ryan, 1982; see Appendix N). Example items included, *"I believe I had some choice about conserving the pool,"* and *"I conserved the pool because I wanted to." CFA* found the measure to demonstrate little construct validity. Two items were retained primarily based on face validity, with a Cronbach's $\alpha = .45$.

Competence

To measure competence regarding pool conservation, items were adapted from the Intrinsic Motivation Inventory (McAuley, Duncan, & Tammen, 1989; Ryan, 1982; see Appendix O). Example items included, *"I felt pretty successful conserving the pool during the game,"* and *"I think I conserved the pool well, compared to other students." CFA* found the five items to fit a unidimensional model. Cronbach's $\alpha = .86$.

Intrinsic Motivation

To measure intrinsic motivation, items were adapted from the Intrinsic Motivation Inventory (McAuley, Duncan, & Tammen, 1989; Ryan, 1982; see Appendix P). Example items included, *"I thought conserving the pool was quite enjoyable,"* and *"Conserving the pool was fun to do." CFA* found the four items to fit a unidimensional model. Cronbach's $\alpha = .90$.

Results

Game behavior

A 4 (condition: reward, private-gain message, public-gain message, or control) x 4 (trials: 1-7, 8-14, 15-21, or 22-28) repeated measures ANCOVA was conducted with a continuous measure of social value orientation as a covariate and game behavior as the dependent variable. Game behavior was measured as the average withdrawal from the common pool for a given series of trials; the more points withdrawn, the less cooperative the subject. The main effects for time ($F(3, 723) = 25.38, p < .001, \eta = .17$) and condition ($F(3, 241) = 8.92, p < .001, \eta = .26$) were both significant, as was the interaction of time and condition ($F(9, 723) = 4.27, p < .001, \eta = .12$). The effect for the covariate, social value orientation, was also significant, ($F(1, 241) = 4.31, p < .001, \eta = .10$), but the interaction between social value orientation and time was not ($F(3, 723) = 2.06, p = .11, \eta = .05$). Descriptive statistics are reported in Table 1 and displayed graphically in Figure 1. Subjects in the control condition withdrew an average of 11.81 points from the pool during the first seven trials, then gradually increased their withdrawal amount over the remaining trials (i.e., the subjects became less cooperative over time). Reward condition subjects withdrew an average of 8.53 points during the first seven trials, but then drastically increased point withdrawal when the rewards were removed, with point withdrawal in trials 8-28 matching the levels of the control group. Both the public-gain and private-gain message conditions had point withdrawals matching the reward condition during the first seven trials (8.71 for public-gain, 9.10 for private gain), but unlike the reward condition, point withdrawals remained roughly the same for the

remaining trials (i.e., cooperation remained stable), despite the message induction having been removed beginning with trial 8.

One-way ANOVAs were conducted to assess differences between conditions on game behavior in the different time periods. The ANOVA for trials 1-7 was statistically significant, $F(3, 242) = 5.47, p = .001, \eta = .25$. Post hoc tests (Tukey HSD) indicated that the control condition was different from all three experimental conditions at the $p < .05$ significance level, while the three experimental conditions were not different from each other. The ANOVA for condition on game behavior for trials 8-28 was statistically significant, $F(3,242) = 10.08, p < .001, \eta = .33$ (collapsing trials 8-28 produces the same results as examining trials 8-14, 15-21, and 22-28 separately). Tukey HSD tests indicate the difference between the control and reward conditions was not statistically significant, but both were different from the private-gain and public-gain message conditions. Likewise, the private-gain and public-gain message conditions were not significantly different from each other, but were of course different from the reward and control conditions.

Interaction of condition and time on game behavior

To explore further the interaction between condition and time on game behavior, a contrast test was conducted using the method for analyzing repeated measures designs outlined in O'Brien and Kaiser (1985). Coefficients were assigned to the average withdrawal amounts for each condition in each time period (see Table 2). These coefficients were multiplied by each subjects' withdrawal average for each time period, and the resulting figures were summed for each subject. A one-way ANOVA was then conducted on the scores by condition. The test was statistically significant, $F(3,242) =$

16.74, $p < .001$, $\eta = .41$, providing strong evidence that the data fit the pattern specified in the contrasts.

Game behavior and SVO

To examine the effect of social value orientation on game behavior, a 4 (condition: reward, private-gain message, public-gain message, or control) x 4 (social value orientation: cooperator, competitor, individualist, or unclassified) ANOVA was conducted with game behavior in trials 1-7 as the dependent variable. The main effect for condition was statistically significant, $F(3, 230) = 3.61$, $p = .014$, $\eta = .21$. The main effect for social value orientation was not statistically significant, $F(3, 230) = .55$, $p = .65$, $\eta = .08$, nor was the interaction, $F(9, 230) = .92$, $p = .51$, $\eta = .18$. The pattern of means indicated that the reward was more effective in encouraging cooperation for individualists and competitors compared to cooperators, but that the two message conditions were more effective in encouraging cooperation for the cooperators when compared to individualists and competitors; these differences, however, were not statistically significant.

An identical ANOVA was conducted, except with game behavior in trials 8-28 as the dependent variable. The main effect for condition was significant, $F(3, 230) = 6.05$, $p = .001$, $\eta = .27$, while the main effect for social value orientation approached conventional levels of statistical significance, $F(3, 230) = 2.22$, $p = .086$, $\eta = .16$. The interaction term was not significant, $F(9, 230) = .22$, $p = .99$, $\eta = .09$. With the exception of the private condition, where individualists withdrew slightly less than cooperators, cooperators withdrew the fewest points across conditions, followed by individualists and then competitors. Cooperators withdrew slightly fewer points than individualists in the

public message condition, and slightly more than individualists in the private message condition, but these differences were not statistically significant. All means can be found in Table 3.

Effect of condition on motivation and trust

A series of one-way ANOVAs was conducted to assess the influence of the conditions on the SDT measures, the measures developed from Batson's (1994) motivations for prosocial behavior, the trust measure, and the posttest social value orientation measure. Tukey's HSD was used to test differences between individual means (see Table 4). A similar pattern emerged in all of the analyses, with the control and reward conditions producing similar means, and the public-gain message and private-gain message conditions producing similar means. As a result, contrasts were created and tested that grouped the control and reward conditions together (weighted as -1), and the public-gain message and private-gain message conditions together (weighted as 1). The contrast tests were significant for intrinsic motivation ($t(242) = 2.40, p = .017, r = .15$), competence ($t(242) = 3.02, p = .003, r = .19$), principlism ($t(242) = 2.29, p = .023, r = .15$), trust ($t(242) = 4.06, p = < .001, r = .25$), collectivism ($t(242) = 3.05, p = .003, r = .19$), autonomy ($t(242) = 3.14, p = .002, r = .20$), and the number of individualist choices on the social value orientation measure, ($t(242) = -2.04, p = .04, r = .13$. The contrast test approached conventional levels of significance for the number of prosocial choices made in the social value orientation task, $t(242) = 1.76, p = .08, r = .11$. The contrast test was not significant for egoism, ($t(242) = -.64, p = .53, r = .04$), or the number of competitive choices on the social value orientation measures ($t(242) = .15, p = .88, r = .01$).

Effect of condition on decision frame

One way ANOVAs were conducted to assess the influence of the conditions on whether subjects perceived the game situation as presenting an ethical, business, or personal decision. Tukey's HSD was used to test differences between means. None of the one way ANOVAs produced statistically significant results. For the ethical decision frame, $F(3, 242) = .88$, $p = .45$, $\eta = .15$; for the business decision frame, $F(3, 242) = 1.01$, $p = .39$, $\eta = .11$; and for the personal decision frame, $F(3, 242) = 1.32$, $p = .27$, $\eta = .13$. The means, which did not match the patterns of the other mediators, are reported in Table 4. Subjects were also asked a forced-choice version of the decision frame questions, where they had to choose which of the three frames (personal, ethical, or business) fit the situation best. Cell counts are provided in Table 5. Chi square tests were conducted within each of the decision categories to assess differences between conditions. None of the chi square tests were significant, indicating that the number of subjects who labeled the situation as a personal, business, or ethical decision did not differ based on condition. Similarly, a general log-linear analysis was conducted, which found that a model in which only the main effect for decision frame was included fit the data as well as the saturated model (which included the main effect for condition and the interaction term); the likelihood ratio for the reduced model was 7.03, $df = 9$, $p = .63$.

The pattern of means for the forced choice decision frame question, however, suggest that there was a difference between ethical and personal choices, particularly when combining the control condition with the reward condition, and the public message condition with the private message condition (see Table 6). A general log-linear analysis was conducted to investigate this possibility, excluding the business decision frame

category and combining conditions. A model with both main effects did not fit the data as well as the saturated model, indicating that the interaction term was a significant addition to the saturated model. The likelihood ratio for the reduced model was 6.20, $df = 1, p = .01$.

Effect of motivation and trust on game behavior

A multiple regression analysis was conducted to examine the effect of the SDT measures, motivation measures derived from Batson (1994), trust, and the three decision frame variables on the number of points withdrawn from the common pool in trials 8-28. Autonomy was a significant predictor of game behavior ($\beta = -.186$, $t(245) = -2.72$, $p = .007$), as was competence ($\beta = -.15$, $t(245) = -2.32$, $p = .021$), egoism ($\beta = .22$, $t(245) = 3.79$, $p = < .001$), and collectivism ($\beta = -.30$, $t(245) = -3.76$, $p < .001$). Intrinsic motivation approached conventional levels of statistical significance, ($\beta = -.11$, $t(245) = -1.75$, $p = .081$). Trust was not a significant predictor ($\beta = -.04$, $t(245) = -.75$, $p = .45$), nor was principlism ($\beta = .11$, $t(245) = 1.53$, $p = .13$), ethical decision frame ($\beta = -.02$, $t(245) = -.26$, $p = .79$), business decision frame ($\beta = .05$, $t(245) = .87$, $p = .39$), or personal decision frame ($\beta = .04$, $t(245) = .74$, $p = .46$).

Causal models

Causal models were constructed to test whether the variables proposed to be mediators actually mediated the effect of the conditions on game behavior. Because of the pattern of means exhibited by the mediators, the public and private message conditions were collapsed together, and the control and reward variables were collapsed together. There was no evidence that any of the self-report variables thought to be mediators actually mediated the effect of the inductions on game behavior (see Figure 2

for path model, Table 7 for correlations, and Table 8 for fit statistics). Models proposing that game behavior proceeded directly from condition, which then led to the mediating measures, however, did fit the data (see Figure 3 for path model and Table 9 for fit statistics). Variables that had ample and statistically significant correlations with the proximate (game behavior) and distal cause (condition), as well as small residual errors, included intrinsic motivation (e = -.03), competence (e = -.01), autonomy (e = -.05), principlism (e = -.05), and collectivism (e= -.04). Models with egoism and trust as the penultimate variables in the causal string produced larger errors (e = -.09 and -.18, respectively). Models with ethical decision frame, business decision frame, and personal decision frame produced small residual errors (e = .04, .00, and -.03, respectively), but had small, non-statistically significant correlations with either or both of the proximate or distal variables.

Discussion

Large differences in cooperation rates were found across conditions, indicating that rewards and messages emphasizing rewards operate differently. When rewards and messages emphasizing rewards (either by focusing on the private gain to be had from cooperation or the public gain to be had from cooperation) were presented to subjects, cooperation levels increased to levels significantly higher than control levels. When rewards were removed, cooperation decreased dramatically to levels equivalent to the control group, but did not drop below the control group (and hence do not provide support for the undermining hypothesis found in previous literature). When messages emphasizing either the public or private gain to be had from cooperation were removed, by contrast, cooperation levels remained relatively high.

The cause for this effect is not clear from the present study. All of the variables thought to be potential mediators did not mediate the effect. Rather, the mediators appeared to be driven by the game behavior itself. This makes sense, as it is hard to imagine subjects claiming to have high intrinsic motivation to cooperate, for example, if they just completed a decision making task in which they did not cooperate (and conversely, it is difficult to imagine someone cooperating in a task, and then claiming not to be motivated to do so). A number of the mediators measured were found to mediate similar effects in the previous literature. As a result, it is worth reexamining such studies to see if the reverse causal possibility was tested. The timing of the mediator measurement is also of interest; in the present experiment, all self-report variables were measured after the subjects had completed the social dilemma game, which might have contributed to their being driven by game behavior. Future experiments might measure suspected mediators during a break in the game, for example, instead of at the end of the game.

One potential explanation for the divergent cooperation rates is that the message conditions induced greater feelings of group identity. The public and private messages both discuss personal rewards in the context of the group, while the control and reward condition messages do not mention the other group members. Group identity was not measured, so this explanation could not be tested in the present experiment; however, the greater proportion of subjects who labeled the game an ethical decision in the message conditions (rather than a personal decision) could be interpreted as preliminary evidence that the message conditions framed the decision as one impacting not just the subjects, but the group as well.

Another potential, albeit similar, explanation is that the message conditions engendered more cooperation because they induced a long-term economic focus, while the reward and control conditions induced a short-term economic focus. It is important to reiterate that while the different conditions may have induced different foci, the social dilemma game was identical in all conditions, with it being in the subjects' best interest to conserve the pool so that it lasts longer and they can make withdrawals for a longer period of time; this facet of the game was described in the instructions, and remained on screen in all conditions. That being said, future research would benefit from utilizing more direct measures of short-or long-term focus as a potential explanation of the results.

Another area of future research relates to the comparative effectiveness of different types of messages for people with different social value orientations. While not statistically significant, the interaction between condition and social value orientation had a moderate effect size ($\eta = .18$) for trials 1-7, and the pattern of means made sense in relation to the study's hypotheses. For trials 1-7, the reward was more successful at inducing cooperation among individualists and competitors than prosocials, while the two message conditions were more effective at inducing cooperation among prosocials than competitors and individualists. For trials 8-28, the public message was more effective for prosocials than individualists and competitors, while the private message was more effective for individualists than prosocials (and least effective for competitors). Future research might examine the effectiveness of matching messages to a person's social value orientation as a persuasion strategy.

The present experiment has important societal implications, particularly for the ways in which campaigns are conducted to encourage cooperation in social dilemma

situations. The ability of rewards to increase cooperation rates is well known, but the ability of messages not only to match the cooperation levels of rewards, but continue that cooperation level once removed, would likely be surprising to most campaign designers. The fact that messages led to high cooperation levels even when removed is especially important. Every campaign ends at some point, and it is critical for campaign designers to consider the impact of strategies not just when they are implemented, but also their residual effect after the campaign ends.

Limitations

In the social dilemma game, the reward presented in the reward condition is given right away if a subject cooperates, but the benefit that accrues from the cooperation promoted in the message conditions is a benefit that manifests itself over the course of the game. As a result, the messages likely had a lingering effect on subject decision making even after the messages were removed (as they were still relevant). The experiment was designed in this manner to test the comparable ability of immediate rewards and long-term messages to promote cooperation. Other potential reward and message formulations exist, of course, and could be investigated in future research. Future studies might include a reward condition that delivers a reward at the end of a series of trials, for instance a tangible reward given to the player that exhibits the highest average level of cooperation over the course of the game. Similarly, messages might be constructed to highlight short-term benefits of cooperation, as opposed to the long-term benefits of cooperation highlighted by the messages in the present experiment. Such experiments will help provide additional information on the similarities and dissimilarities between rewards and messages that emphasize rewards.

Another limitation relates to the fit between the design of the present experiment and the intrinsic motivation literature. When undermining effects have been found in the intrinsic motivation literature, rewards separate from the task were offered to the subjects. For instance, a child might be offered candy as a reward for completing a puzzle. In the present experiment, the rewards were tied to the task itself: the reward was points, and the accumulation of points was the purpose of the game. This might be an explanation for why undermining effects were not found in the present experiment. Future research might examine the impact of rewards in social dilemmas when those rewards, while still perceived as valuable to the subjects, are separable from the game itself.

Table 1

Game behavior (mean number of points taken) with standard deviations by trial and condition

	Trials 1-7	Trials 8-14	Trials 15-21	Trials 22-28	Trials 8-28
Control	11.80	13.9	14.13	15.17	14.40
	(6.34)	(7.56)	(7.88)	(7.93)	(6.93)
Reward	8.53	13.07	13.76	14.71	13.85
	(4.74)	(6.70)	(7.50)	(7.99)	(6.39)
Public	8.71	8.48	8.74	10.72	9.31
	(4.66)	(5.62)	(6.97)	(7.84)	(6.20)
Private	9.10	10.42	10.21	10.35	10.32
	(4.48)	(5.92)	(6.25)	(6.83)	(5.46)

Table 2

Contrast coefficients used to test differences in game behavior

	Trials 1-7	Trials 8-14	Trials 15-21	Trials 22-28
Control	-1	0	0	1
Reward	-4	1	1	2
Public	-1	-1	-1	3
Private	-3	1	1	1

Table 3

Game behavior means and standard deviations by social value orientation, condition, and trial

	Prosocials		Individualists		Competitors		Unclassified	
	T1-7	T8-28	T1-7	T8-28	T1-7	T8-28	T1-7	T8-28
Control	11.18	13.12	11.79	15.27	11.10	18.21	14.17	15.67
	(6.93)	(7.71)	(6.00)	(6.10)	(3.06)	(5.23)	(5.98)	(6.18)
Reward	8.97	12.87	8.25	14.22	5.14	16.22	8.60	15.83
	(5.39)	(6.26)	(4.00)	(6.16)	(1.51)	(10.55)	(5.39)	(6.34)
Public	7.69	8.55	9.47	9.95	13.82	13.82	8.78	9.04
	(4.70)	(6.18)	(3.44)	(5.84)	(8.07)	(8.84)	(3.72)	(5.85)
Private	8.81	10.06	9.25	9.67	10.46	12.17	9.39	10.94
	(4.14)	(5.72)	(3.26)	(4.06)	(6.83)	(6.31)	(5.75)	(5.54)
Average	9.12	11.05	9.80	12.76	10.42	14.63	10.12	12.63
	(5.39)	(6.66)	(4.61)	(6.18)	(6.19)	(7.32)	(5.29)	(6.47)

Table 4

Mediator means and standard deviations by condition

	Control	Reward	Public	Private
Intrinsic motivation	2.92[a]	3.08[a]	3.39[a]	3.38[a]
	(1.37)	(1.23)	(1.45)	(1.22)
Competence	3.93[a]	4.11[a]	4.42[a]	4.44[a]
	(1.25)	(1.17)	(1.21)	(1.15)
Autonomy	4.58[a]	4.66[ab]	5.04[ab]	5.24[b]
	(1.48)	(1.28)	(1.29)	(1.12)
Principlism (posttest)	4.02[ab]	3.58[a]	4.12[ab]	4.30[b]
	(1.37)	(1.39)	(1.51)	(1.32)
Egoism (posttest)	4.22[a]	4.29[a]	4.14[a]	4.13[a]
	(1.56)	(1.45)	(1.35)	(1.09)
Collectivism (posttest)	4.02[a]	4.06[a]	4.74[b]	4.46[ab]
	(1.22)	(1.33)	(1.34)	(1.39)
Trust	3.29[a]	3.34[a]	3.85[ab]	4.11[b]
	(1.26)	(1.24)	(1.42)	(1.17)
Ethical frame	4.17[a]	3.98[a]	4.25[a]	4.48[a]
	(1.58)	(1.73)	(1.79)	(1.70)
Business frame	4.58[a]	5.08[a]	4.83[a]	4.95[a]
	(1.91)	(1.37)	(1.66)	(1.58)
Personal frame	5.08[a]	4.75[a]	5.03[a]	4.62[a]
	(1.56)	(1.43)	(1.46)	(1.57)

Note: Numbers not sharing superscripts are different at $p < .05$, using the Tukey HSD test.

Table 5

Cell counts of decision frame by condition

	Ethical decision	Personal decision	Business decision
Control	7	28	25
Reward	7	27	27
Public	16	22	26
Private	12	21	28

Table 6

Average cell counts for ethical and personal decision frame, combining conditions

	Ethical decision	Personal decision
Control/Reward	7	27.5
Public/Private	14	21.5

Table 7

Correlations between condition, game behavior, and mediating variables

	1	2	3	4	5	6	7	8
1. Condition	1.00							
2. Game behavior	-.33	1.00						
3. Intrinsic motivation	.14	-.34	1.00					
4. Competence	.17	-.48	.43	1.00				
5. Autonomy	.20	-.45	.46	.55	1.00			
6. Principlism	.15	-.31	.44	.45	.42	1.00		
7. Collectivism	.21	-.53	.44	.58	.53	.67	1.00	
8. Trust	.25	-.20	.13	.21	.29	.26	.26	1.00

Note: all correlations are significant at the 0.05 level. Game behavior is the average withdrawal of trials 8-28.

Table 8

Statistics for path model in Figure 2 (self-report variables as mediator)

Self-report variable	P_{yx}	P_{zy}	P_{zx}	R_{xz}	e_{xz}
Intrinsic motivation	.14	-.34	.05	-.33	.38
Competence	.17	-.48	-.08	-.33	.25
Autonomy	.20	-.45	-.09	-.33	.24
Principlism	.15	-.31	-.05	-.33	.28
Collectivism	.21	-.53	-.11	-.33	.22
Egoism	-.04	.38	-.02	-.33	.31
Trust	.25	-.20	-.05	-.33	.28
Ethical decision frame	.08	-.35	-.03	-.33	.30
Business decision frame	.02	-.07	-.001	-.33	.33
Personal decision frame	-.03	-.01	.0003	-.33	.33

Note: P_{yx} is the path from condition to the self-report variable; P_{zy} is the path from the self-report variable to game behavior (average withdrawal of trials 8-28); P_{zx} is the predicted path from condition to game behavior; R_{xz} is the obtained correlation between condition and game behavior; e_{xz} is R_{xz} subtracted from P_{zx}.

Table 9

Statistics for path model in Figure 3 (game behavior as the mediator)

Self-report variable	P_{yx}	P_{zy}	P_{zx}	R_{xz}	e_{xz}
Intrinsic motivation	-.33	-.34	.11	.14	-.03
Competence	-.33	-.48	.16	.17	-.01
Autonomy	-.33	-.45	.15	.20	-.05
Principlism	-.33	-.31	.10	.15	-.05
Collectivism	-.33	-.53	.17	.21	-.04
Egoism	-.33	.38	-.13	-.04	-.09
Trust	-.33	-.20	.07	.25	-.18
Ethical decision frame	-.33	-.35	.12	.08	.04
Business decision frame	-.33	-.07	.02	.02	.00
Personal decision frame	-.33	-.01	.003	-.03	-.03

Note: P_{yx} is the path from condition to game behavior (average withdrawal of trials 8-28); P_{zy} is the path from game behavior to the self-report variable; P_{zx} is the predicted path from condition to the self-report variable; R_{xz} is the obtained correlation between condition and the self-report variable; e_{xz} is R_{xz} subtracted from P_{zx}.

Figure 1

Game behavior (mean number of points taken) by trial and condition

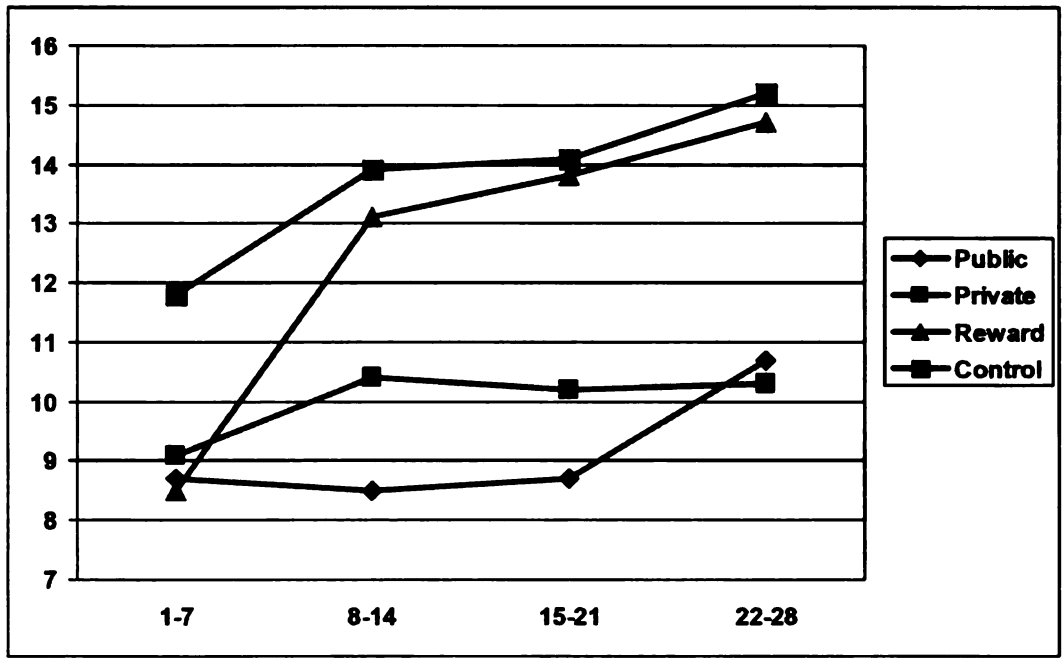
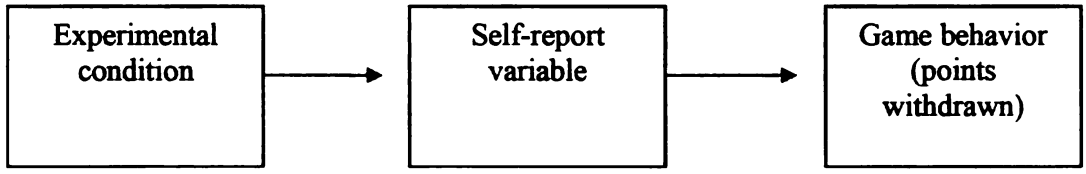


Figure 2

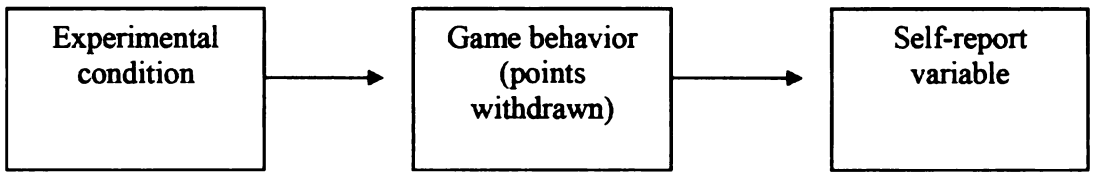
Original path model with self-report variables as mediators



Note: Self-report variables tested as potential mediating variables were intrinsic motivation, competence, autonomy, principlism, collectivism, egoism, trust, ethical decision frame, business decision frame, and personal decision frame.

Figure 3

Post hoc path model with game behavior (points withdrawn) as mediating variable



Note: Self-report variables tested were intrinsic motivation, competence, autonomy, principlism, collectivism, egoism, trust, ethical decision frame, business decision frame, and personal decision frame.

Appendix A: Point Feedback Schedule

Trial	Points at beginning of trial
1	2500
4	2331
7	2402
10	2298
13	2381
16	1996
19	1583
22	1062
25	483
28	291

Note: After completing Trial 28, subjects were told the pool had been depleted.

Appendix B: Public-Gain Messages

1. The longer the pool lasts, the longer everyone can withdraw from it. So, don't take too many points.
2. The group will make the most money by not withdrawing much per turn. That way the pool lasts longer.
3. If you take lots of points the pool will dry up and everyone will lose out.
4. Take a little each turn, that way everyone benefits because the pool will grow.
5. Everyone will end up with more points if everyone only takes a few points per turn, because the pool will last.

Appendix C: Private-Gain Messages

1. The best thing for you is not taking too many points at once. The pool will get bigger and you'll be able to withdraw points longer.
2. If you take lots of points the pool will dry up and you'll lose out.
3. Take a little each turn, that way you benefit because the pool will grow.
4. The longer the pool lasts, the longer you can withdraw from it. So, don't take too many points.
5. You will make the most money by not withdrawing much per turn. That way the pool lasts longer.

Appendix D: Control Messages

1. If you have questions, you can ask the experimenter.
2. When you're done with your decision hit the continue button at the bottom.
3. Remember the instructions are at the bottom if you get confused.
4. After you make your decision and press the button at the bottom, a new screen will come up in about 30 seconds or so.
5. The pool starts out with 2500 points in it.
6. If you have a question about something you can ask the researcher.
7. When the computer's thinking between trials, wait for it to say finished before going on.

Appendix E: Triple-Dominance Measure of Social Values (Van Lange, Otten, De Bruin, & Joireman, 1997)

In this task we ask you to imagine that you have been randomly paired with another person, whom we will refer to simply as the "Other." This other person is someone you do not know and that you will not knowingly meet in the future. Both you and the "Other" person will be making choices by circling either the letter A, B, or C. Your own choices will produce points for both yourself and the "Other" person. Likewise, the other's choice will produce points for him/her and you. Every point has value: The more points you receive, the better for you, and the more points the "Other" receives, the better for him/her.

Here's an example of how this task works:

	A	B	C
You get	500	500	550
Other gets	100	500	300

In this example, if you chose A you would receive 500 points and the other would receive 100 points; if you chose B, you would receive 500 points and the other 500; and if you chose C, you would receive 550 points and the other 300. So, you see that your choice influences both the number of points you receive and the number of points the other receives.

Before you begin making choices, please keep in mind that there are no right or wrong answers—choose the option that you, for whatever reason, prefer most. Also, remember that the points have value: The more of them you accumulate, the better for you. Likewise, from the "other's" point of view, the more points s/he accumulates, the better for him/her.

Continued on next page.

Appendix E (cont'd)

For each of the nine choice situations, circle A, B, or C, depending on which column you prefer most:

		A	B	C
1.	You get	480	540	480
	Other gets	80	280	480

		A	B	C
2.	You get	560	500	500
	Other gets	300	500	100

		A	B	C
3.	You get	520	520	580
	Other gets	520	120	320

		A	B	C
4.	You get	500	560	490
	Other gets	100	300	490

		A	B	C
5.	You get	560	500	490
	Other gets	300	500	90

		A	B	C
6.	You get	500	500	570
	Other gets	500	100	300

		A	B	C
7.	You get	510	560	510
	Other gets	510	300	110

		A	B	C
8.	You get	550	500	500
	Other gets	300	500	100

		A	B	C
9.	You get	480	490	540
	Other gets	100	490	300

Appendix F: Egoism (pretest)

My primary motivation is to make sure I have what I need.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

My own well-being isn't something I think about very often.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

If I do something, it's because I will benefit from it.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

When I'm presented with a choice, I decide based on whether I'd gain anything from either of the options.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

When making decisions, I usually don't consider whether I'd benefit.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

Before I act, I calculate carefully what I will get out of it.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

Appendix G: Egoism (posttest)

Instructions: Please answer the following questions in the context of situations similar to the game you just played.

When playing this game, my primary motivation was to make sure I had what I needed.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

My own well-being wasn't something I thought about very often when playing this game.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

When I made decisions in this game, it was because I would benefit from the decision.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

When I was presented with a decision in this game, I decided based on whether I'd gain anything from any of the options.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

When making decisions in this game, I usually didn't consider whether I'd benefit.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

Before I acted in this game, I calculated carefully what I will get out of it.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

Appendix H: Principlism (pretest)

Ideas of what is right and wrong factor strongly into my decision making process.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

When making decisions, I try to find the most fair and equitable solution.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I care a great deal about whether a situation is handled in a just manner.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

My primary concern in interpersonal interaction is to do what is right.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

Ideas of justice and equality have little role in my everyday decisions.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

Morality doesn't have much impact on the way I handle myself.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

Appendix I: Principlism (posttest)

Instructions: Please answer the following questions in the context of situations similar to the game you just played.

During this game, ideas of what is right and wrong factored strongly into my decision making process.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

When making decisions in this game, I tried to find the most fair and equitable solution.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

During this game, I cared a great deal about whether situations were handled in a just manner.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

My primary concern in this game was to do what is right.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

Ideas of justice and equality had little role in my decisions in this game.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

Morality didn't have much impact on the way I handled myself in this game.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

Appendix J: Collectivism (pretest)

If there is a group I care about, I will factor their well-being into my decision making.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I often put group welfare ahead of personal outcomes.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

Whether a group I belong to benefits isn't something I consider when making decisions.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I would go out of my way to help a group I'm concerned about, even if I don't benefit directly.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I don't really care about what happens to the groups I belong to.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I'm very concerned about the fate of collective groups I belong to.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

Appendix K: Collectivism (posttest)

Instructions: Please answer the following questions in the context of situations similar to the game you just played.

During this game, I factored the well-being of my group into my decision making.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I often put group welfare ahead of personal outcomes in this game.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

Whether others in the group I belonged to benefited wasn't something I considered when making decisions in this game.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

During this game, I went out of my way to help my group, even if I didn't benefit directly.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

In this game, I didn't really care about what happened to others in my group.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

During this game, I was very concerned about the fate of others in my group.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

Appendix L: Trust

Instructions: Please answer the following questions in the context of situations similar to the game you just played.

I trusted the other group members not to withdraw too many points from the common pool.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I think that others are primarily motivated to cooperate by not withdrawing too many points.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I think others are primarily motivated to defect and withdraw too many points.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I think others are likely to withdraw too many points from the common pool.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

In these types of situations, most people cooperate and don't withdraw too many points.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

Appendix M: Decision Frame

Instructions: When answering the following questions, consider the decisions you made while playing the game earlier.

To what extent would you describe the decisions you made as ethical decisions?

Not at all 1 2 3 4 5 6 7 Very much

To what extent would you describe the decisions you made as business decisions?

Not at all 1 2 3 4 5 6 7 Very much

To what extent would you describe the decisions you made as personal decisions?

Not at all 1 2 3 4 5 6 7 Very much

If you had to choose one description for your decisions, which would you choose? Please circle only one of the following:

Business decision Ethical decision Personal decision

Appendix N: Autonomy

Instructions: Please rate your agreement with the following statements. For each question, "the pool" refers to the common pool of points that you withdrew from in the game you just played. "Conserving the pool," then, means not letting the pool dry up by taking too many points.

I believe I had some choice about conserving the pool.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I felt like it was not my own decision to conserve the pool.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I really didn't have an alternative when it came to conserving the pool.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I felt like I had to conserve the pool.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I conserved the pool because I had no choice.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I felt like I had to conserve the pool.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I conserved the pool because I had no choice.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

Appendix O: Competence

Instructions: Please rate your agreement with the following statements. For each question, "the pool" refers to the common pool of points that you withdrew from in the game you just played. "Conserving the pool," then, means not letting the pool dry up by taking too many points.

I think I am pretty good at conserving the pool in games like this.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I think I conserved the pool well, compared to other students.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I felt pretty successful conserving the pool during the game.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I am satisfied with my performance at conserving the pool.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I was pretty skilled at conserving the pool.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

Conserving the pool was an activity that I couldn't do very well.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

Appendix P: Intrinsic Motivation

Instructions: Please rate your agreement with the following statements. For each question, "the pool" refers to the common pool of points that you withdrew from in the game you just played. "Conserving the pool," then, means not letting the pool dry up by taking too many points.

I enjoyed conserving the pool very much.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

Conserving the pool was fun to do.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I thought conserving the pool was a boring activity.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

Conserving the pool did not hold my attention at all.*

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I would describe conserving the pool as very interesting.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I thought conserving the pool was quite enjoyable.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

While I was conserving the pool, I was thinking about how much I enjoyed it.

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

References

Arbuckle, J. L. (2006). Amos (Version 17) [Computer Program]. Chicago: SPSS.

Batson, C. D. (1994). Why act for the public good? Four answers. *Personality and Social Psychology Bulletin, 20,* 603-610.

Batson, C. D., & Ahmad, N. (2001). Empathy-induced altruism in a prisoner's dilemma II: What if the target of empathy has defected? *European Journal of Social Psychology, 31,* 25-36.

Batson, C. D., & Moran, T. (1999). Empathy-induced altruism in a prisoner's dilemma. *European Journal of Social Psychology, 29,* 909-924.

Batson, C. D., & Shaw, L. (1991). Evidence for altruism: Toward a pluralism of prosocial motives. *Psychological Inquiry, 2,* 107-122.

Bem, D. J. (1972). "Self-perception theory". In L. Berkowitz (Ed.), *Advances in Experimental Social psychology*, Vol. 6, 1-62. New York: Academic Press.

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

Cialdini, R. B., Brown, S. L., Lewis, B. P., Luce, C., & Neuberg, S. L. (1997). Reinterpreting the empathy-altruism relationship: When one into one equals oneness. *Journal of Personality and Social Psychology, 73,* 481-494.

Dawes, R. M. (1980). Social dilemmas. *Annual Review of Psychology, 31,* 169-193.

Deci, E. L., Koestner, R., Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin, 125,* 627-668.

Deci, E. L., and Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior.* New York: Plenum Press.

Eek, D., & Garling, T. (2006). Prosocials prefer equal outcomes to maximizing joint outcomes. *British Journal of Social Psychology, 45,* 321-337.

Eek, D., & Garling, T. (2008). A new look at the theory of social value orientations: Prosocials neither maximize joint outcome nor minimize outcome differences but prefer equal outcomes. In A. Biel, D. Eek, T. Garling, & M. Gustafsson (Eds.), *New Issues and Paradigms in Research on Social Dilemmas.* New York: Springer.

Frey, B. S. (1993). Motivation as a limit to pricing. *Journal of Economic Psychology, 14,* 635-664.

Frey. B. S. (1994). How intrinsic motivation is crowded out and in. *Rationality and Society, 6,* 334-352.

Frey, B. S., & Oberholzer-Gee, F. (1997). The cost of price incentives: An empirical analysis of motivation crowding-out. *The American Economic Review, 87,* 746-755.

Hardy, C. L., & Van Vugt, M. (2006). Nice guys finish first: The competitive altruism hypothesis. *Personality and Social Psychology Bulletin, 32,* 1402-1413.

Hardin, G. (1968). The tragedy of the commons. *Science, 162,* 1243-1248.

Hornik, J., Cherian, J., Madansky, M., & Narayana, C. (1995). Determinants of recycling behavior: A synthesis of research results. *Journal of Socio-Economics, 24,* 105-127.

Hunter, J. E., & Hamilton, M. A. (1992). *CFA – A Program in Basic to do Confirmatory Factor Analysis.* East Lansing, MI: Michigan State University.

Komorita. S. S., & Barth, J. M. (1985). Components of reward in social dilemmas. *Journal of Personality and Social Psychology, 48,* 364-373.

Kramer, R. M., & Brewer, M. B. (1984). Effects of group identity on resource use in a simulated commons dilemma. *Journal of Personality and Social Psychology, 46,* 1044-1057.

Lepper, M. R., Greene, D., and Nisbett, R. E. (1973). Undermining children's intrinsic interest with extrinsic rewards: A test of the "overjustification" hypothesis. *Journal of Personality and Social Psychology, 28,* 129-137.

Liberman, V., Samuels, S. M., & Ross, L. (2004). The name of the game: Predictive power of reputations versus situational labels in determining prisoner's dilemma game moves. *Personality and Social Psychology Bulletin, 30,* 1175-1185.

McAuley, E., Duncan, T., & Tammen, V. V. (1989). Psychometric properties of the Intrinsic Motivation Inventory in a competitive sport setting: A confirmatory factor analysis. *Research Quarterly for Exercise and Sport, 60,* 48-58.

McCusker, C., & Carnevale, P. J. (1995). Framing in resource dilemmas: Loss aversion and the moderating effects of sanctions. *Organizational Behavior and Human Decision Processes, 61,* 190-201.

Messick, D. M. (1999). Alternative logics for decision making in social settings. *Journal of Economic Behavior and Organization, 39,* 11-28.

Messick, D. M., & McClintock, C. G. (1968). Motivational basis of choice in experimental games. *Journal of Experimental Social Psychology, 4,* 1-25.

Miller, D. T., & Ratner, R. K. (1998). The disparity between the actual and assumed power of self-interest. *Journal of Personality and Social Psychology, 74,* 53-62.

Mulder, L. B., van Dijk, E., De Cremer, D., & Wilke, H. A. M. (2006a). When sanctions fail to increase cooperation in social dilemmas: Considering the presence of an alternative option to defect. *Personality and Social Psychology Bulletin, 32,* 1312-1324.

Mulder, L. B., van Dijk, E., De Cremer, D., & Wilke, H. A. M. (2006b). Undermining trust and cooperation: The paradox of sanctioning systems in social dilemmas. *Journal of Experimental Social Psychology, 42,* 147-162.

O'Brien, R. G., & Kaiser, M. K. (1985). MANOVA method for analyzing repeated measures designs: An extensive primer. *Psychological Bulletin, 97,* 316-333.

Osbaldiston, R., & Sheldon, K. M. (2002). Social dilemmas and sustainability: Promoting peoples' motivation to "cooperate with the future." In P. Schmuck & W. P. Schultz (Eds.), *Psychology of Sustainable Development.* Boston: Kluwer.

Osbaldiston, R., & Sheldon, K. M. (2003). Promoting internalized motivation for environmentally responsible behavior: A prospective study of environmental goals. *Journal of Environmental Psychology, 23,* 349-357.

Parks, C. D. (2000). Testing various types of cooperation rewards in social dilemmas. *Group Processes and Intergroup Relations, 3,* 339-350.

Pittman. T. S., Davey, M. E., Alafat, K. A., Wetherill, K. V., Kramer, N. A. (1980). Informational versus controlling verbal rewards. *Personality and Social Psychology Bulletin, 6,* 228-233.

Ratner, R. K., & Miller, D. T. (2001). The norm of self-interest and its effects on social action. *Journal of Personality and Social Psychology, 81,* 5-16.

Ryan, R. M. (1982). Control and information in the intrapersonal sphere: An extension of cognitive evaluation theory. *Journal of Personality and Social Psychology, 43,* 450-461.

Ryan, R. M., and Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55,* 68-78.

Schwartz-Shea, P., & Simmons, R. T. (1995). Social dilemmas and perceptions: Experiments on framing and inconsequentiality. In D. A. Schroeder (Ed.), *Social Dilemmas: Perspectives on Individuals and Groups.* Westport, CT: Praeger.

Semmann, D., Krambeck, H., & Milinski, M. (2004). Strategic investment in reputation. *Behavioral Ecology and Sociobiology, 56,* 248-252.

Tenbrunsel, A. E., & Messick, D. M. (1999). Sanctioning systems, decision frames, and cooperation. *Administrative Science Quarterly, 44,* 684-707.

Van Lange, P. A. M., Otten, W., De Bruin, E. M. N., & Joireman, J. A. (1997). Development of prosocial, individualistic, and competitive orientations: Theory and preliminary evidence. *Journal of Personality and Social Psychology, 73,* 733-746.

Van Lange, P. A. M. (1999). The pursuit of joint outcomes and equality in outcomes: An integrative model of social value orientation. *Journal of Personality and Social Psychology, 77,* 337-349.

Zhong, C. B., Loewenstein, J., & Murnighan, J. K. (2007). Speaking the same language: The cooperative effects of labeling in the prisoner's dilemma. *Journal of Conflict Resolution, 51,* 431-456.