COOPERATION, SOCIAL AXIOMS, AND PERSONALITY

IN THE PUBLIC GOODS GAME

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Jung Yul Kwon

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COOPERATION, SOCIAL AXIOMS, AND PERSONALITY

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ABSTRACT

COOPERATION, SOCIAL AXIOMS, AND PERSONALITY IN THE PUBLIC GOODS GAME

by

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The public goods game (PGG) has been a useful tool for providing insight into cooperation in social dilemmas. Heterogeneity in cooperation suggests that individual difference variables may have predictive value. I hypothesized that social axioms, defined as generalized beliefs about the social world, and the five-factor model personality traits would predict earlier contributions in an iterated PGG, while feedback about others’ contributions may become more important in the later rounds. Participants (n = 136) played ten rounds of PGG in three conditions – cooperative, selfish, or realistic – created by using false feedback. Participants also completed the Social Axioms Survey (SAS) and the Big Five Inventory (BFI). Results indicated that the ten-factor model best predicted cooperation in the early rounds of the realistic condition. Cooperation was a function of religiosity in the selfish condition.
Deliberate cooperation is a defining characteristic of the human species. Every day, virtually everyone achieves far more than they could on their own, simply by cooperating with others. However, cooperation is often a complicated choice because it incurs a cost to self. Even trivial cases of helping one another, such as holding a door open while someone carries in a large box, involves minor costs such as time, interruption of an activity, and physical exertion.

Cooperation has been studied extensively within the context of social dilemmas. A social dilemma is an interaction between two or more people with choices for actions that are either selfish or cooperative. These choices are defined by two contingencies – a selfish choice always yields the greatest personal benefit regardless of others’ actions, but if everyone in the group chooses selfishly, the collective outcome is worse than when all cooperate (Dawes, 1980). One of the classic examples of a social dilemma is known as the “public goods dilemma.” Public goods are resources from which everyone can benefit, even when an individual does not pay their share toward the availability of the goods (Olson, 1965; Samuelson, 1954). There are many real-world examples of this, such as the availability of working street lighting, sewer systems, or sidewalks and roads, which are paid from various tax revenues but used by everyone, regardless of direct contribution.
The experimental study of public goods dilemmas typically utilizes a laboratory game where participants contribute symbolic resources (e.g., game points) toward a public fund, which is then increased and returned equally to all participants, regardless of individual contribution. The dilemma arises from human tendencies to be both selfish and rational, which tempt people to free ride, or benefit from others’ contributions without contributing themselves. Unfortunately, as more and more people free ride, total contributions decrease, leading to under-provision of the public goods. This is referred to as the free rider problem. The strong free rider hypothesis (Olson, 1965) states that, in this situation, no contributions will be made. However, research has repeatedly shown that people actually do cooperate in public goods dilemmas (e.g., Dawes & Thaler, 1988; Isaac, Walker, & Thomas, 1984; Kim & Walker, 1984; Marwell & Ames, 1979). This has initiated a vigorous line of research on why people cooperate and what factors contribute to cooperation.

Many studies have explored structural solutions (e.g., payoff contingencies) to the free rider problem and situational factors influencing the level of cooperation (cf. Chaudhuri, 2011; Ledyard, 1995), however inherent heterogeneity in cooperative behavior has received relatively little attention. It is a simple fact that some people consistently cooperate more than others within the same public goods dilemma game. Some researchers (e.g., Pruitt & Kimmel, 1977) have suggested that these individual differences would have only minimal influences on cooperation compared to environmental factors. Furthermore, research on individual differences in social dilemmas has largely focused on inferring different types of social motives or preferences.
from dilemma game behavior (Van Lange, Joireman, Parks, & Van Dijk, 2013), rather than measuring stable individual differences as predictors of cooperation.

The present study examined social dilemma cooperation by exploring the predictive value of two specific sources of individual differences in experimental public goods games: (a) generalized, cross-situational social beliefs (social axioms), and (b) major personality domains (Five Factor personality traits). Additionally, these individual differences were examined in game environments which were structured to be cooperative, selfish, and realistic. The cooperative and selfish environments simulated high or low-contributing partners, while the realistic environment incorporated findings from previous research that, on average, people contribute around 50 percent in the first round and tend to free ride as the game progresses. Finally, the role of these beliefs and personality traits was examined at different stages of an iterated game.

A recently developed belief construct that may have meaningful insight into cooperative behavior in the public goods dilemma is social axioms. Social axioms are defined as “generalized beliefs about the social world” which state the relationship between social entities, events, or phenomena, as well as the physical and spiritual world (Leung & Bond, 2004; Leung et al., 2002). Social axioms comprise five dimensions: social cynicism, social complexity, reward for application, religiosity, and fate control. Social cynicism reflects a negative outlook on social interactions, and the expectation that people will take advantage of others. Social complexity assumes inherent variability in human behavior and the belief that there are many ways to reach the same goal. Reward for application includes the beliefs that hard work and careful planning will be rewarded
in the long run. Religiosity reflects a positive view of religion and acknowledges the existence of a supernatural being. Fate control encompasses the viewpoint that events are predetermined, but also that they are alterable.

The term “axiom” was deliberately chosen to be analogous to an axiom in mathematics, which is accepted as true without proof or validation and serves as the basis of further propositions. Social axioms represent a subjective knowledge about how the social world operates based on the experiences accumulated over one’s life (Bond, Leung, Au, Tong, & Chemonges-Nielson, 2004). They are implicit beliefs about the social fabric and guide expectancies about the kinds of interactions and outcomes that are likely with other people.

The interdependent nature of social dilemmas requires that one’s decisions are at least in part based on the expectations of what other people will do. From early on, researchers have repeatedly noted a positive relationship between one’s own level of cooperation and the degree to which one expects the others to cooperate (Dawes, McTavish, & Shaklee, 1977; Kelley & Stahelski, 1970a; Marwell & Ames, 1979). To explain this correlation, Kelley & Stahelski (1970a) propose that competitive players and cooperative players expect different levels of cooperation according to their views about the world. Competitors expect less cooperation from others because they usually see more competitive individuals – selfish responding (i.e., defecting) eventually evokes defecting from anyone because people do not want to be taken advantage of. Repeated exposure to such experiences shapes a worldview that people are generally not cooperative. On the other hand, cooperators expect more variability in others’ behavior
because, in addition to their experience with competitors, they also experience sustained mutual cooperation when faced with other cooperators. This may solidify the view that the world is more complex. I suggest that this idea can be extended to the formation of a broad set of beliefs such as social axioms, and their influence on expectations of others’ behavior in social dilemmas.

Studies have already found some dimensions of social axioms to be related to factors that influence cooperation. For example, social cynicism has been found to be negatively related to interpersonal trust (Singelis, Hubbard, Her, & An, 2003), and it has long been suggested that trust is crucial factor in cooperation (Dawes, 1980; Edney, 1980). Goal-expectation theory (Pruitt & Kimmel, 1977), proposes that the emergence of cooperation requires not only “the goal of establishing and/or maintaining continued mutual cooperation”, but also the belief that the other person will cooperate as well. And there is no shortage of experimental evidence that trust is positively correlated to cooperation in social dilemma games (Dawes, 1980; Messick et al., 1983; Parks, Henager, & Scamahorn, 1996; Parks & Hulbert, 1995; Yamagishi, 1986; Yamagishi & Sato, 1986). Religion has also been studied in social dilemma research. The results are mixed, with some finding no relationship between cooperation and religious affiliation or attendance (Anderson & Mellor, 2009), and some finding more cooperation by students preparing to become priests (Ahmed, 2009) and by those placed in religious settings (Ahmed & Salas, 2013). Religiosity in these studies was operationally defined in various ways, but still relevant to the positive view of religion indicated by high social axiom religiosity.
The five-factor model (FFM) is the most widely used theoretical model explaining major domains of personality (McCrae & Costa, 1989). However, research examining its effects on cooperation, using actual behavioral outcomes, in an $n$-person social dilemma game is scarce. I have identified only three such studies. Koole et al. (2001) examined the effects of the five-factor personality traits in a resource dilemma game. Their focus was on extraversion and agreeableness, considered to be the “interpersonal” traits in the five-factor model (McCrae & Costa, 1989). Extraversion was negatively related, and agreeableness was positively related to cooperation. More interestingly, and relevant to the present study, those low in extraversion and high in agreeableness were more cooperative when faced with a resource crisis. Although they found no significant relationships with openness, conscientiousness, or neuroticism in their exploratory analysis, Koole et al. concluded that the three traits “may still have important interpersonal consequences,” especially in a public goods game, considering the decision framing effects.

Two other studies (Kurzban & Houser, 2001; Volk, Thöni, & Ruigrok, 2011) have utilized public goods games, but focused on player types rather than average contributions. Kurzban and Houser (2001) suggested that participants high in neuroticism were more likely to be cooperators while those high in conscientiousness were more likely to be free riders. Volk et al. (2011) identified high agreeableness as a characteristic of cooperators. The present study contributed to this body of research by investigating whether the five-factor personality traits can predict average contribution in the public goods game.
The present study also examined how the relationship between beliefs and cooperation changes as the game is repeated (an iterated game). This allows for the same participants to receive feedback about everyone’s choices and payoffs, then “replay the game” (make another choice) in light of this information. Over a series of such choices, participants are able to adjust their contributions in response to the perceived cooperation of the other participants. A consistent finding in iterated public goods games is that contributions are near 50 percent level in the first round and decay over several rounds to near free riding levels (Chaudhuri, 2011; Ledyard, 1995). Kelley and Stahelski (1970b) posited that, in an interdependence situation, individuals analyze the past behaviors of others in order to find a persistent pattern which allows them to infer others’ intentions. In other words, as information about the other players builds up, players develop a set of game-specific beliefs which apply only to that particular group. These beliefs are strategically important in that every group will have different types of players. However, in the earlier rounds, when there is virtually no information available about the other players, individuals may rely more on their own dispositions as a guide when making the decision (Balliet, Parks, & Joireman, 2009), since participants walk into the study each with their own “tastes for cooperation” (Andreoni, 1995) and “home-grown” (Fischbacher & Gächter, 2010) beliefs about others.

In order to test individual responses to a given pattern of cooperative behavior, false feedback is frequently used in experimental public goods dilemma games. In a false feedback study, participants are led to believe that they are playing against real people, but they are actually given manipulated responses that create different
experimental conditions (Fleishman, 1988; Kramer & Brewer, 1984; Messick et al., 1983; Schroeder, Jensen, Reed, Sullivan, & Schwab, 1983). For example, Messick et al. (1983) gave false feedback about the rate of depletion in an iterated resource dilemma game and found that, when placed in the resource crisis condition (rapid depletion), those who trusted other players to reciprocate tended to decrease their consumption, whereas those who expressed low trust increased their consumption. In the present study, I compared cooperation (contributions) across three game environments structured to be cooperative, selfish, and realistic, and examined the ability of social axioms and FFM personality traits to account for participant cooperation in these differing game environments.

The present study hypothesized that the five social axiom dimensions and the FFM personality traits could account for significant variance in cooperation (contributions) in the public goods game. I further expected that social axioms and personality would decrease in importance in more restrictive game environments (cooperative or selfish) compared to a realistic game environment. Finally, I hypothesized that social axioms and personality would better predict responses in the initial stages of an iterated game, compared to the later stages when feedback (albeit false) from the other participants is more available and can guide future responses.
CHAPTER II

LITERATURE REVIEW

Types of Social Dilemmas

Social dilemmas can be dichotomized into two-person dilemmas and multi-person dilemmas. The most extensively studied two-person dilemma is the well-known prisoner’s dilemma (Rapoport & Chammah, 1965), developed in 1950 by Merrill Flood and Melvin Dresher at RAND Corporation. A standard scenario involves two accomplices in a crime being interrogated in separate rooms. They are given a chance to testify against each other and the interrogator explains that if one testifies against his partner and the partner says nothing, then he will be sentenced to just one year in prison while the partner gets four years. If both choose not to say anything, then they will both be sentenced to two years. And if they both testify against each other, then they will both be sentenced to three years. This illustrates the dilemma in the simplest way. Whatever the partner decides to do, defecting always yields the better outcome. Therefore, both criminals are motivated to choose selfishly. However, if both end up testifying against each other, then the outcome is worse than if both keep silent. Defection, in this case, is referred to as the dominant strategy.

Dawes (1980) identifies two types of multi-person dilemmas, a *take some* and a *give some* dilemma. The commons dilemma, also known as the resource dilemma, is representative of take some dilemmas, involving a decision to take something desirable
from a common pool. The commons dilemma originated from the famous tragedy of the commons (Hardin, 1968). This metaphor involves a communal pasture open to unrestricted use. Each herdsman in the community is motivated to increase the size of his herd because the personal benefit of keeping another animal exceeds the cost of doing so, namely, the resulting effects of overgrazing dispersed among all herdsmen. However, when every herdsman acts in this way, the effects of overgrazing will accumulate leading to the ruin of the pasture. The tragedy of the commons has been so influential, perhaps, because it addresses salient issues such as overpopulation, resource depletion and pollution, and illustrates a situation in which cooperation is vital for collective wellbeing.

The public goods dilemma is a classic example of give some dilemmas. As described in the previous chapter, a public good is defined by non-excludability (Olson 1965) which means that no one can be excluded from benefiting from the good, regardless of whether or not one has contributed to it. A stricter definition (Samuelson, 1954) includes non-rivalry, meaning that benefiting from the good does not reduce its availability to others, however, most accept the first definition for research purposes (Ledyard, 1995).

These three types of dilemmas are conceptually equivalent in that their payoff functions are identical. In fact, the prisoner’s dilemma and the commons dilemma can be thought of as a special case of the public goods dilemma (Fehr & Fischbacher, 2004). For example, the payoff matrix for the prisoner’s dilemma game would look the same as the payoff matrix for a public goods game if the game was restricted to two players, and only two choices (i.e., contribute all or keep all). Similarly, a commons dilemma is essentially
a public goods dilemma in which the public goods are already provisioned and individuals decide how much negative contributions they want to make. Consequently, many findings from the prisoner’s dilemma research have been extended to n-person games. However, in many cases, the findings are inconsistent across the three types of games. This suggests that multi-person interactions involving decisions along a continuum differ in some fundamental ways from dyadic, binary choice interactions. It also does seem to matter in which way the decision is framed for the two n-person dilemmas. For example, Brewer and Kramer (1986) found that participants were generally less cooperative in the public goods dilemma than in an equivalent commons dilemma. Fleishman (1988) found that participants in a take some dilemma game were less cooperative than those in a give some game when they believed that others had contributed little.

Research on social dilemmas is interdisciplinary in nature, ranging from economics, psychology, sociology, and political science. As a result, the amount of literature is vast, and any reasonable review must severely limit its scope. The present review attempts to address some of the meaningful discoveries from the public goods game.

The Public Goods Game

In a typical public goods game, players are placed in a group of four or more. They are endowed with a sum of money and instructed to allocate their funds between a private account and a group account. It is explained that contributions made to the group account by each player will be summed, multiplied by a factor, and then evenly
distributed back to each private account. Here, the multiplier needs to be greater than 1, but less than the number of players, in order to create a dilemma. If the multiplier is less than or equal to 1, then there is no incentive at all to contribute to the group account. If the multiplier is greater than or equal to the number of players, then the rational decision is to contribute everything to the group account. The payoff from the group account can be more or less than one’s contribution depending on how much the other players have contributed. One’s total income is the amount kept in the private account in the first place plus the returns from the group account. The dominant strategy is to free ride, that is, to keep all of the money in the private account and benefit from others’ contributions to the group account.

The aforementioned strong free rider hypothesis (Brubaker, 1975) predicts that no one will contribute anything to the group account. Earlier research on public goods games have tested this hypothesis. Gerald Marwell and his colleagues were the first ones to systematically investigate this issue. They found that, although the mean contribution was well below what is needed to provide public goods at an optimum level, participants contributed between 40 to 60 percent of their endowments (Alfano & Marwell, 1980; Marwell & Ames, 1979, 1980, 1981). The results were consistent across different parameters such as participants receiving unequal endowments, benefiting unequally from the public good, and being in groups of different sizes (Marwell & Ames, 1979). It also did not matter whether the participants had experience with the game (Marwell & Ames, 1980). One interesting finding was that economics graduate students
were more likely to free ride, the mean contribution being around 20 percent (Marwell & Ames, 1981).

The above findings were clearly in support of a much weaker effect of free riding, but other researchers were motivated to discover under what conditions free riding occurs and examined what happens when the game is repeated with the same group of people (Isaac, McCue, & Plott, 1985; Isaac, Walker, & Thomas, 1984; Kim & Walker, 1984). These studies found that while the mean contribution in the first round was similar to that in a one-shot game, contributions quickly decayed in just several rounds. The rate of decay and the free riding slightly varied in these experiments. For example, Isaac et al. (1985) found a rapid decay from 53 to 16 percent while Isaac et al. (1984) found a slower decay all the way down to eight percent over ten rounds. This decay pattern is highly replicable and has sparked the curiosity of many researchers.

One possible explanation offered for the decay pattern was initial confusion about the game. This view suggested that participants contribute because they have not yet understood what the dominant strategy is, and that the participants learn to free ride as the game progresses. However, Isaac and Walker (1988b) noted that even those who had prior experience with the public goods game still cooperated in the first round. Andreoni (1988) tested this hypothesis by telling the participants after the tenth round, without their prior knowledge, that the game would restart. The reasoning was that, if participants had learned the dominant strategy, then the contribution level at round 11 would still be close to free riding as in round 10. Interestingly, round 11 contributions returned to the near 50 percent levels round 1, indicating that the decay was independent of learning.
In a later study, Andreoni (1995) explored the possibility that the initial cooperation was due to a form of altruism. A simple variation of the game in this study was that the participants were paid according to their income ranks in the group. This was supposed to remove any altruistic motivation to cooperate since the absolute value of the payoff did not have any direct relationship to one’s earnings in the end. Indeed, contributions were significantly lower when the participants were paid by rank. However, participants still contributed 33 percent of their endowment in the first round which was followed by a slow decay pattern. Andreoni concluded by the number of participants who decided to free ride that around 50 percent合作ed out of kindness, and confusion could still account for the other 50 percent.

Another explanation was proposed by comparing “partners vs. strangers” (Andreoni & Croson, 2008). Partners refer to those playing iterated games with the same group, and strangers refer to those playing repeated one-shot games with random re-matching so that the chances of being in same group more than once are very little to none. This comparison was used to explore the possibility that participants were playing strategically by trying to achieve a cooperative environment in the early rounds and then to free ride on it in the later rounds. This type of play would be possible only with partners. Andreoni & Croson (2008) present generally mixed findings in their review of partners/strangers comparison studies. In this case, Andreoni (1988) found higher mean contributions by strangers, failing to support strategy hypothesis while Croson (1996) later found opposite results.
Structural Influences on the Public Goods Game

Three factors have been identified as the strongest influences on cooperation in the public goods game (Chaudhuri, 201; Ledyard, 1995). Communication was the first to be studied (Dawes, McTavish, & Shaklee, 1977). Prior to a one-shot, binary choice public goods game, participants were either told to talk with each other for ten minutes or silently work on an irrelevant task. Percentage of cooperative choices was higher for the participants who were allowed to communicate than those who were not, but only when the communication was relevant to the task. Isaac and Walker (1988a) extended these findings to a standard iterated public goods game. Similar positive effects were found – relevant communication increased mean contributions over ten rounds. In fact, communication often led to and sustained almost full cooperation with over 99 percent contributions. In addition, when the game with communication was followed by a non-communication game, the high contribution levels were sustained. This suggested that the continued experience of mutual cooperation through face-to-face communication acted as a buffer against free riding for the subsequent rounds.

Another well-known effect is marginal per capita return (MPCR) (Isaac et al., 1984; Isaac & Walker, 1988b). MPCR is one of the important parameters of a voluntary contribution mechanism which refers to the amount of benefit one will receive from the public good. For example, if each of the players in a four-person group contribute one dollar, resulting in a total of four dollars in the public good with MPCR of 0.5, then the return would be 2 dollars. These studies found that higher MPCR led to
higher contributions, and this finding was replicated in studies that changed the MPCR in
the middle of the game (Brown-Kruse & Hummels, 1993; Kim & Walker, 1984).

The role of punishment has also been extensively studied. Yamagishi (1986,
1988) was one of the first to investigate this in the public good environment. In these
studies, a sanctioning system was implemented by giving the participants an option to
contribute to a “punishment fund”. Any amount contributed to this fund was subtracted
from the lowest contributor’s account and the presence of possible punishment did
significantly increase cooperation. Fehr and Gächter (2000) added to the richness of this
finding by giving the participants the option of choosing who they wanted to punish and
also by making the punishments costly to the punishers. The amount of punishment for
any individual was determined by how many “punishment points” were allocated to
them. Each point subtracted 10 percent from their earnings so that 10 points would mean
zero earnings for that round. However, in order to punish others, the punishment points
had to be purchased, each additional point being increasingly costly. The results indicated
that cooperation was higher when there was punishment present, most participants
punished others even though it was costly to do so, and more punishment points were
given for those whose contributions were below the average of other’s contributions.

Another interesting finding was that participants engaged in punishment behavior even
when they were reassigned to a different group every single round. Fehr and Gächter
(2002) called this “altruistic punishment” since after each round the non-cooperating
individual being punished is removed from the group and costly punishment does not
yield any benefit for the punisher in that it cannot have any effect on the cooperative
environment of one’s newly assigned group. In conclusion, they proposed that the motivation to punish can be attributed to the negative emotion elicited by the selfish behavior of the defector. Since then, many other studies have explored how punishment can be incorporated in public goods (Van Lange et al., 2013). Recent research has also found positive effects on cooperation of a reward system using similar designs (e.g., Rand, Dreber, Ellingsen, Fudenberg, & Nowak, 2009; Sutter, Haigner, & Kocher, 2010). A recent meta-analysis by Balliet, Mulder, and Van Lange (2011) compared the effect sizes of reward and punishment in social dilemma studies. The results indicated that the effect size for punishment was larger than reward, and costly punishment was more effective than free punishment.

Individual Differences in the Public Goods Game

As previously mentioned, a bulk of the research on individual differences in social dilemmas have been centered around social value orientations, also known as social values, motivational orientations, or social motives (Liebrand, 1984; McClintock, 1972; Messick & McClintock, 1968; for reviews, see Au & Kwong, 2004; Van Lange, Joireman, Parks, & Van Dijk, 2013). Social value orientation (SVO) refers to the degree to which one is concerned about one’s own outcome relative to the other’s outcome (Messick & McClintock, 1968). It assumes that there are systematic differences in how people understand interdependent situations such as a social dilemma which reliably influence their interactions. Various classifications of the SVO have been proposed, but the basic three are prosocial, individualistic, and competitive. Prosocial individuals are
concerned about maximizing outcomes equally for both parties. Individualism is motivation to maximize one’s own gain with no concern for the other’s outcome. Competitive individuals are motivated to do better than the other person. McClintock (1972) added a fourth orientation, altruism, which can be thought of as the opposite of individualism. There are several different ways proposed to measure SVO, however, they are all based on decomposed games, first developed by Messick and McClintock (1968). In decomposed games, participants are asked to choose among resource allocations that have various patterns of outcomes for oneself and a stranger. The idea is that people will choose the option that best represents their SVO. Participants are asked to not think about the consequences of the game or how the partner will choose. This isolates the social motivations from any strategic concerns of the game that may lead one to behave in a way that is inconsistent with one’s initial motivations (Balliet et al., 2009).

Researchers have studied the effects of SVO on behavior in more complex situations such as social dilemma games. Liebrand (1984) examined the effects of SVO in commons dilemma games and found that on average, competitors took the most resources while individualists took more than the overall mean, and the prosocials and altruists took the least. Kramer, McClintock, and Messick (1986) classified their participants into just two types, cooperators and non-cooperators. They used false feedback to create two environments, one in which there is a resource crisis due to excessive use, and the other where resource use was light enough to be counterbalanced by the replenishment rate. There is only one reported study that examined SVO in the public goods game (Au & Kwong, 2004). In a study that compared the effects of SVO in
take some and give some games, effects of SVO in the commons dilemma supported the previous findings, but there was no relationship in the public goods game (Parks, 1994).

A different approach to classifying players into different types comes from the economics literature. Fischbacher, Gächter, and Fehr (2001) identified three types of players by asking participants how much they would contribute in response to hypothetical average contributions ranging from 0 to 20. Fifty percent of their participants were classified as “conditional cooperators” whose contributions were nearly the same as others’ contributions. About 30 percent were perfect free riders whose contributions were always zero, and 14 percent were “triangle cooperators” whose contributions were conditional up to about 50 percent contributions by others and then started decreasing for higher levels of contribution. One important finding was that the contributions by conditional cooperators were not perfectly conditional – they contributed a little less than the others’ contributions. This offered an alternative explanation to the cooperation decay in iterated games by suggesting that the repeated interactions of conditional cooperators and free riders were responsible for the decrease in each round.

Hypotheses

The purpose of the present study was to investigate whether the five social axiom dimensions and the five-factor model (FFM) personality traits could explain a significant amount of variance in cooperation (contributions) in the public goods game. Specifically, I hypothesized that social cynicism would be negatively correlated to cooperation while reward for application, religiosity, and agreeableness would be positively correlated to cooperation. I further expected that social axioms and personality
would be less predictive of the amount of contributions in the cooperative and selfish conditions compared to the realistic condition. Finally, I hypothesized that social axioms and personality would better predict the amount of contribution in the first three rounds of the game, compared to the last three rounds when the contribution history of others is the predominant influence on future contributions.
CHAPTER III

METHODOLOGY

Participants

A total of 136 undergraduate students (46 males and 86 females) from California State University, Chico, participated in the study in exchange for extra course credit. Mean age of the participants was 23 years, ranging from 18 to 47 years, with most being psychology majors (66 percent) followed by criminal justice (11 percent). Sixty percent of the sample were white and 25 percent were Hispanic. Participants played the iterated public goods games and completed the other measures in groups of 12 to 20 in a computer lab.

Materials

The experiment was conducted using the computer software z-Tree (Zurich Toolbox for Ready-made Economic Experiments) (Fischbacher, 2007). z-Tree is a versatile software that allows researchers to program a wide range of economic games and customize them according to their needs. Each participant interacts through a client computer which is connected to the experimenter computer through which the researcher can control the game as well as monitor the progress of each participant, and access the data file.

Participants also completed the short (40-item) Social Axioms Survey (SAS) (Leung et al., 2012) and the Big Five Inventory (BFI) (John, Donahue, & Kentle, 1991;
The short version of the SAS (Leung et al., 2012) was chosen to minimize the effects of fatigue on game decisions.

**Procedure**

The study was conducted in a computer lab on campus. Participants were required to complete the SAS prior to the game, after which they could start working on the BFI and some demographic items. Participants were told that they would be randomly grouped with three others in the room to play against who would all remain mutually anonymous. These same anonymous participants would play 10 rounds of each public goods game. At the beginning of each of the three games, participants were told that new random participant partners had been selected. The order of the three games (realistic, selfish, cooperative) was randomly assigned for each participant.

**The Public Goods Game**

The voluntary contribution mechanism of the public goods game closely followed the one used by Fischbacher and Gächter (2010). It was described in detail to the participants as follows. In each round, participants are given an endowment of 20 tokens from which they could make a contribution to a common project. The total amount contributed by the whole group is multiplied by 1.6 and then divided equally among the group members. The income for each round was the amount the participant chose not to contribute plus the returns from the project. In the game, the first screen asked for a prediction of how much the mean contributions by others will be, and a contribution decision. The next screen showed participants how much the other three players had contributed, the income for that round, and the total income for that game.
To ensure that each participant understood the game completely, and to familiarize them with the game interface, the dilemma aspect of game was explained in detail by the experimenter, followed by four hypothetical scenarios emphasizing the interdependent nature of the outcomes in each round. Participants completed two control questions before they could begin. Participants were not allowed to communicate during the experiment.

The amount of tokens acquired by the end of the game was tallied, and a leader board was created so that the participants could find out how well they performed compared to the others in the session. Participants were instructed to do their best in the game, as their results, identifiable by their identification number and initials would be posted on the bulletin board in a high-traffic area of the building.

**False Feedback**

The number of participants ranged from 12 to 20 per session. Participants were told that in each game they would play against three others in the room and that they would not be grouped with the same person twice. In reality, participants played against preprogrammed responses, with contribution levels set to reflect three separate conditions – cooperative, selfish, or realistic. The mean contribution rate was 75 percent for the cooperative condition and 27 percent for the selfish condition. In the realistic condition, the mean contribution rate started at 52 percent in the first round and linearly decreased to 27 percent by the tenth round. Each game consisted of ten rounds. However, the participants were kept unaware of how long the game would last in order to avoid any drastic strategy changes in the last rounds of the game. They were simply told that at
random points in the game they would be reassigned to a new group and a then a new game would start.
CHAPTER IV

RESULTS

Bivariate correlations between the social axiom dimensions, the five-factor model personality traits, and the total contributions in each of the conditions, as well as the internal reliabilities are shown in Table 1.

The total amount of contributions was summed for each participant over the ten rounds of each game. A repeated measures ANOVA and post-hoc Bonferroni comparisons indicated significant differences in the amount of contributions across the three game environments in the expected order: $F(2, 276) = 138.23, p < .001$; selfish ($M = 63, SD = 3.86$), realistic ($M = 85, SD = 4.41$), and cooperative ($M = 111, SD = 5.32$) (all $p < .001$).

Using simultaneous multiple regression analysis, the five personality traits and five social axiom dimensions were used as predictors of total contributions separately for each game. The ten-predictor model was not significant for the responses in the cooperative condition. Total contributions in the realistic condition were predicted by agreeableness ($\beta = .266, p = .005$), neuroticism ($\beta = .306, p = .001$), openness ($\beta = .245, p = .006$), and religiosity ($\beta = .195, p = .027$), $R = .49, R^2 = .24, F(10, 135) = 3.91, p < .001$. Contributions in the selfish game condition were solely a function of religiosity ($\beta = .224, p = .015$), $R = .41, R^2 = .17, F(10, 135) = 2.50, p < .01$. 

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Table 1.

Bivariate Correlations between Social Axiom Dimensions, Five Factor Model Personality Traits, and Total Contributions

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Note. * p < .05. ** p < .01. Values along the diagonal are Cronbach’s alpha coefficients.

CC = Cooperative Condition; SC = Selfish Condition; RC = Realistic Condition

The predictors in the model were then compared for the first three and the last three responses. In the realistic condition, the same predictors were found for the first three responses, agreeableness (β = .211, p = .03), neuroticism (β = .223, p = .013), openness (β = .243, p = .008), and religiosity (β = .246, p = .007), R = .44, R² = .20,
$F(10, 135) = 3.08, p = .002$. However, the last three responses were predicted just by neuroticism ($\beta = .295, p = .001$), and openness ($\beta = .245, p = .008$), $R = .44, R^2 = .19, F(10, 135) = 2.95, p = .002$. In the selfish condition, the model was not significant for the first three responses, but religiosity was a predictor for the last three responses ($\beta = .215, p = .02$), $R = .40, R^2 = .16, F(10, 135) = 2.39, p = .012$.

The model was also tested for only the first response of each game. In the cooperative condition, openness ($\beta = .295, p = .002$) and fate control ($\beta = -.284, p = .002$) predicted the first contributions, $R = .40, R^2 = .16, F(10, 135) = 2.37, p = .013$. In the realistic condition, neuroticism ($\beta = .252, p = .007$) and openness ($\beta = .198, p = .037$) were significant predictors, $R = .37, R^2 = .14, F(10, 135) = 2.00, p = .039$. The model did not predict the first response in the selfish condition.
CHAPTER V

DISCUSSION

General Discussion

As expected, the ten-predictor model accounted for a significant amount of variance in contributions in the realistic condition. The results also indicated that in a cooperative environment, contributions were not predicted by the model. However, in the selfish condition, the model was significant, although religiosity was found to be the only predictor.

This supports the hypothesis that the relative importance of personality and social axioms on decisions in a public goods game depends on the game environment. In other words, participants’ perceptions of the composition of their group and the ease with which their contribution preferences or intentions are inferred affects how much they rely on their dispositions for making contribution decisions. For instance, when a participant encounters consistently high contributions by others, it is likely that a pattern can be more readily perceived meaning that the participant is able to form stable, game-specific strategies earlier in the game. Further evidence for this is that openness and fate control did predict the first contribution in the cooperative condition.

By contrast, in the realistic condition, participants observed a greater variability in others’ behavior. When faced with a more complex pattern of contributions by others, one’s decisions may be directly influenced by his or her dispositions their
their associated cooperative preferences or indirectly by their influence on strategy formation through affecting the perception and interpretation of other’s intentions.

In the realistic condition, individuals with high agreeableness contributed more to the public good across the ten rounds, as well as in the first three rounds. This is consistent with findings from previous research (Koole et al., 2001). The results are not surprising since conceptual definitions of agreeableness include altruism, kindness, trust, and desire to maintain positive relations with others. It is interesting, however, that in the last three rounds of the game, agreeableness ceased to be a predictor. This suggests that agreeableness was not a relevant guide in decision-making for the terminal stages of the game when strategic considerations specific to the current partners are the primary source. This finding is consistent with Andreoni’s (1995) explanation of decay in cooperation that some of the initial cooperation is due to kindness, and the decay pattern is a result of frustrated attempts at kindness.

It was surprising that neuroticism and openness were the two predictors that remained significant throughout the realistic game. These two dimensions, along with conscientiousness, are not often considered to be interpersonal in nature (McCrae & Costa, 1989), and may not be considered as relevant in social interactions (Koole et al., 2001). However, neuroticism and openness have been found to be related to cooperation in prisoner’s dilemma studies (Hirsh & Peterson, 2009; Lönnqvist, Verkasalo, & Walkowitz, 2011), and studies using questionnaire measures of cooperation (Ashton, Paunonen, Helmes, & Jackson, 1998; Lu & Argyle, 1991). Hirsh and Peterson (2009) were the only ones to find that high neuroticism was related to cooperation using the Big
Five Aspects Scale (BFAS) (DeYoung, Quilty, & Peterson, 2007). More specifically, cooperation was related to withdrawal, which includes traits such as being easily worried, fearful and susceptible to negative emotions. This offers an interpretation for the present findings that participants contributed more because they were concerned about possible adverse consequences of free riding, such as negative effects on reputation and the tense atmosphere of competition in the group. McCrae (1996) argued that openness is more relevant to social interactions than commonly thought, because it represents the structure and functioning of one’s mind. Cooperating in a situation where the rational decision is to not cooperate, and persistently suggesting mutual cooperation as a solution to the dilemma in an atmosphere of declining cooperation does require a certain way of thinking. Openness has been related to flexibility in thinking and social behavior (McCrae, Costa, & Piedmont, 1993) as well as divergent thinking (McCrae, 1987). It seems reasonable that being open to the possibility of cooperation is itself a predictor of actual cooperative behavior.

The social axiom dimensions, with the exception of religiosity in the realistic and selfish conditions, did not predict cooperation. One immediate explanation for this is lack of mundane realism. The experimental procedure, with its roots in economics, was first developed to explore completely rational behavior, and thus strives to control as many variables as possible. The public goods game, in particular, may emphasize the economic side of the dilemma, as opposed to a commons (resource) dilemma game, especially when it is framed as an “investment” with varying returns. It may also be the
case that interactions via computer screens creates a sense of artificiality that may reduce the “social” aspect of the social dilemma.

Religiosity deserves some attention since it was the only significant predictor in the selfish condition as well as a predictor in the realistic condition. The interesting thing about the religiosity dimension of social axioms is that it is not a self-report of religiosity, rather it is a measure of one’s beliefs about the positive function of religion as well as an acknowledgement of spiritual existence in the world. It is likely, however, that people who hold these beliefs are religious themselves, and have, to a certain extent, internalized the religious doctrine of helping and being kind to others. Supporting this claim, religiosity was found to be positively related to agreeableness (Leung et al., 2012).

Overall, the hypothesis that social axioms and personality would differentially predict cooperation seems to be supported in the realistic condition. While neuroticism and openness predicted cooperation throughout the whole game, agreeableness and religiosity predicted contributions only in the initial stages of the game. The decrease in the number of predictors from the first to last three rounds seems to support the hypothesis that social axioms and personality are more important in the early rounds of the game.

Limitations

One of the ostensible limitations to this study was the lack of financial incentives. It is possible that the use of a leader board and the resultant increase in interest and sense of competition provided sufficient motivation. However, one cannot
discount the effect of actual monetary earnings in a social dilemma study (Lönnqvist et al., 2011).

There may be a possible ordering effect due to formation of beliefs about the participants in the same room. It has been found that contributions rebound to the initial first-round level with the start of a new game, even when it is with the same group (Andreoni, 1988). However, it is possible that experiences in the previous game affected subsequent contribution decisions by establishing a certain cooperative or non-cooperative atmosphere in the room. It is also not clear whether there were sufficient breaks between games to ascertain that participants perceived the process of regrouping.

Although participants were instructed not to communicate during the study, non-verbal communication can still affect others’ decisions. For example, a few participants expressed frustration and/or disbelief through sighs or chuckles, especially during the selfish condition of the game, which can convey a wish to cooperate. Further isolation may be requisite for future studies.

Future Research

Social axioms and personality may have more predictive value under different circumstances. Some parameters in the voluntary contribution mechanism could be changed to investigate this. One such parameter is group size. In a larger group, one individual’s actions are generally less noticeable (Yamagishi, 1986). Therefore, it may be more difficult to form a strategy based on individual characteristics of the group members. For example, suppose that there is a particularly uncooperative member in a four-person group. This is quite noticeable given that the participants are shown how
much each person has contributed, not just the average. One’s strategy may now be to either induce cooperation in that individual by signaling a willingness to cooperating through maintaining a certain level of cooperation, or to free ride even more in order to avoid being taken advantage of. This reduces the effect of general beliefs about others by causing one to focus on that particular situation with that particular player. In an experiment where only the average contributions are shown to participants, or in larger groups in which it is relatively difficult to notice any individual patterns of behavior, players may rely more on context-free, general guides to behavior.

The level of impersonality in the game is another parameter that could be changed. Interacting with faceless others referred to as “Player n” may elicit more analytic, income-maximizing strategies, rather than taking into consideration prediction of their behaviors as social entities.

As suggested above, give some games and take some games may significantly differ in how the players interpret the dilemma situation. For example, a commons dilemma game is easily associated with societal issues that are more salient and, perhaps, more startling, such as air pollution, water shortage, and fossil fuel depletion. On the other hand, a public goods game may be viewed simply as a financial investment decision. Research involving different types of games may shed more light on the circumstances under which social beliefs are elicited and utilized, and add to our understanding of framing effects in social dilemmas.
REFERENCES
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