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Empathy and Collective Action in the Prisoner's Dilemma

By John A. Sautter[1]

Economists guided by evolutionary psychology have theorized that in an iterated Prisoner's Dilemma reciprocal behavior is a product of evolutionary design, where individuals are guided by an innate sense of fairness for equal outcomes. Empathy as a pro-social emotion could be a key to understanding the psychological underpinnings of why and who tends to cooperate in a collective act. In short, why are some individuals more prone to participate in collective-action? The hypothesis that a pro-social psychological disposition stemming from self-reported empathy will lead to group-oriented behavior in an iterated Prisoner's Dilemma game is tested. Results suggest that an empathetic disposition does not lead to a higher rate of cooperation, but interacts with environmental conditioning to produce either a highly cooperative or highly uncooperative personality type.

Introduction

Most conceptions of the classic collective action problem imply that individuals have strong incentives to not cooperate in the face of a Prisoner's Dilemma like policy situation (Axelrod, 1984; Ostrom, 1998). The free-rider problem in this view applies to all people in society because each has an advantage to not cooperate, but to advance their own interests. Consequently, groups and institutions merely form on the basis of how well they serve the interests and goals of their members (Olson, 1965). In contrast to this rational-essentialist view it has been shown that individuals do "irrationally" cooperate in both a Prisoner's Dilemma game and in real life scenarios that are parallel to it (Axelrod, 1984; Ridley, 1996; Field, 2004).

One of the main problems with the rational-essentialist viewpoint is that it makes no room for the inherent differences that are found amongst ordinary people. Some individuals tend to be more other-oriented, while some individuals are more oriented

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toward their own self-interest (Fehr and Schmidt, 1999; Hibbing and Alford, 2004). These differences should not be overlooked. Most models of political decision-making, whether rational choice or behavioralist, essentially prescribe to the "black box" notion of political cognition, where stimuli are applied to an individual and certain actions are produced (Green and Shapiro, 1996; Alford and Hibbing, 2004; Smith, 2005). However, these basic arguments overlook the neurological structures of the brain and essentially suggest that they are unimportant, or in the least are merely novel bits of trivia that are not conducive to understanding the macro-level phenomenon that political scientists are accustomed to studying. This sort of assertion is wrong on many levels. First, understanding the complex motivations that lay behind the formation of preferences may help democratic theorists devise better institutional arrangements. Emotions are intuitive value judgments that emanate from the subconscious part of the cerebral system (Damasio, 1994). The investigation of the interaction of emotional or psychological dispositions with more accepted notions of cognition may lead to a better understanding of political preference formation and of the very *human* nature of collective action.

This study investigates the effects of an empathetic emotional disposition in decision-making by utilizing the Prisoner's Dilemma framework. It is theorized that an empathetic disposition is an important guide to an individual's decision-making process when faced with a collective action problem. Evolutionary theory posits that group level selection has endowed humans with a propensity for cooperative behavior in the absence of selective incentives by equipping the human mind with pro-social emotions (Bowles and Gintis, 2003). In short, individuals "do their part in society" because it makes them feel good. However, some people get more satisfaction than others out of political

participation or paying attention to civic issues. This is likely due to differences in behavioral traits that are genetically innate and socially conditioned (Alford and Hibbing, 2004). It is hypothesized here that a higher level of self reported empathy will lead to a more explicit demonstration of group-oriented egalitarian behavior in the iterated Prisoner's Dilemma.

Evolution and Empathy

Research in behavioral psychology and neuroscience suggests an alternative conception of the collective action problem in human interactions to the rationalist model. Instead of envisioning each individual as a rational being with merely different preferences from others, innate genetic and socialized personality differences are understood to be an ultimate cause of preferences for cooperative behavior. In other words, the Olsonian free rider is not just a theoretical concept but is a personality type with distinct characteristics (Hibbing and Alford, 2004). Evolution has cultivated a multitude of personality traits that vary amongst humans. This phenotypic variation allows for selective advantages on the group level (Wilson, 2002). Whether an individual is more of a rational calculator or an empathetic altruist, both would have played an important role in collective success in humans' distant past.

Geneticists and neuroscience researchers have given most of their attention to the sorts of personality traits and neurological conditions that result in the abnegation of cooperative behavior at the cost of overlooking the sorts of pro-social behavioral traits that positively lead to a cooperative psychological disposition (Davis, Luce and Kraus, 1994). Studies of autism, violent behavior and other asocial disorders indicate that

genetic inheritance, as well as environmental conditioning, is an important determinant of patterns of behavior (Ebstein, Benjamin, and Belmaker, 2003; Pericak-Vance, 2003).

Most important amongst *pro*-social personality traits is empathy. Empathy can be defined and interpreted under the auspices of three main sub-characteristics: concern for others, perspective taking (also called theory of mind empathy) and personal distress, or the ability to have emotional reactions to others in need. A study of 800 twin-pairs that compared monozygotic to dizygotic dyads estimated the combined inheritance of these three components of empathy to be estimated at 32% (Davis et al., 1994). In light of this sort of finding and those concerning anti-social behavior, it is likely that genetic inheritance of behavioral traits affects the preferences that individuals form for cooperative social behavior.

The study of the manner in which individuals attempt to understand and place themselves emotionally in the place of another is of great importance in contemplating how social groups and networks are motivated to carry out pro-social behavior. Thoits (1989: 328) states that "empathetic role-taking emotions, or vicarious emotions, result from mentally placing oneself in another's position and feeling what the other might feel in that situation." Empathy is arguably one of the most important socioemotional experiences because it provides the impetus and mental processes involved in "the effort to understand the internal mental and emotional events of other human beings" (Rosenberg, 1990:8). Indeed, this sort of emotional capacity has been important to researchers looking at what motivates moral and pro-social actions, finding that higher levels of empathy tend to make individuals more likely to be morally outraged or to take action to prevent unjust acts (Davis, 1996; Smith-Lovin, 1995). A heightened sense of

morality or an active vigilance in regards to justice are exactly the sorts of behavioral tendencies that evolutionary theory would suggest should be present in those individuals with an inclination for group-orientated outcomes.

There are three main evolutionary arguments for the development of empathy. First, is the well known theory of kin selection (Hamilton, 1964). This theory posits that there is a selective advantage in cooperating with those who share the same genetic code, or at least part of it. The empathetic bonds that are tightly woven between mother and child or, to a lesser degree, the general pattern of cooperation among extended families are both examples of how the empathetic disposition of the human species promotes kin advantage. The second evolutionary theory focuses more on the interaction with those who are not genetically related. Reciprocal altruism hypothesizes that the empathetic bonds that develop in friendships or working relationships evolved out of an iterated sequence of encounters where conspecifics mutually benefited from cooperation (Axelrod, 1984). The proverbial "I'll scratch your back if you scratch mine" line of reasoning summarily defines the manifestation of this sort of empathetic bond. Finally, the group-selection model of human evolution posits that inter-group conflict promoted the adoption of empathetic characteristics because natural selection would have rewarded those groups that worked together well over groups that would not have contained the frequency of individuals with cooperative dispositions (Sober and Wilson, 1998). It is probable that a combination of all three evolutionary modes contributed to the development of ubiquitous empathetic disposition in humans.

The Prisoner's Dilemma as Collective Action

The Prisoner's Dilemma has been invoked time and again in explanation of the evolutionary origins of human behavior. It represents in a simplified manner the continual problem of reciprocity, trust and collective action (Rapoport and Chammah, 1965; Axelrod, 1984; Ridley, 1996; Fehr and Schmidt, 1999) that is ever-present in iterated interactions between human beings. This makes the Prisoner's Dilemma framework ideal for a test of pro-social emotional disposition in an incentive based game because it is simple enough for those first exposed to it in an experimental setting to comprehend, yet theoretically sophisticated so as to allow a rich interpretation of the results.[2]

Many in political science have drawn upon this simple game as the basis for theory. In contrast to Olson's more traditional economic view of collective action, Hardin (1982) frames the free-rider problem as really an N-person Prisoner's Dilemma (PD) game. Much in line with the way that evolutionary theorists suggest that reciprocal behavioral situations may have evolved in humans some theorists, including Palfrey and Rosenthal (1983) as well as Axlerod (1984), suggest that if certain conditions are met cooperative behavior is a predictable outcome of the PD.

First, individuals need to have a low rate of time-preference, or in other words they should not discount the future too much. The second condition is that the game theoretic scenario needs to be repeated several times. This mitigates the standard one-shot strategy of defection. Similarly, the third condition requires there to be uncertainty among the players about when the game will end. Under rational choice assumptions players will always defect in the final round if information is available on when the game

[2] Originally designed by the Rand Corporation in the 1950's to test cold war nuclear exchange strategies, the incentive structure is such that mutual defection, or non-cooperation, is the rational choice, but cooperation is the mutually beneficial response for both participants (Poundstone, 1992).

will end. The final condition involves punishment. If each player is capable of punishing other players that defect over the course of the game then an incentive structure is created that discourages defection. Theoretically, these conditions work best when there is no central authority and agents are left to their own to decide whether to defect or cooperate.

Table 1 Payoff matrix for standard prisoner's dilemma, where, T- temptation, P-punishment, R-reward and S-sucker. The following inequalities must hold: R>P, T>S, and P>S (Axelrod, 1984).

		PLAYER II	
		Cooperate (C)	Defect (D)
PLAYER I	Cooperate (C)	R, R	S, T
	Defect (D)	T, S	P, P

Altruism in the prisoner's dilemma has been modeled in many different ways.[3] Most attempts to explain how and why people cooperate in situations when it seems as thought it goes against their rational interest have used game theoretic models. Andreoni and Miller (1993) find that altruists even exist in the finitely repeated PD, where individuals are aware of when the game will end. In their experiment they define two groups: those who can build reputations for altruistic acts and those who are not able to build reputations because of behavioral constraints. In the group that can not build reputations they find that after 200 rounds of single shot PD games there is a persistent pattern of cooperation that does not deteriorate. In the other group where reputation building is possible individuals also tend to cooperate. By separating the two groups

[3] In the classic rational choice rendition of the PD rational agents should theoretically not cooperate in this collective action situation, however it has been shown on many occasions that humans actually do. For example, Dawes (1980) has shown that individuals tend to cooperate about 50% of the time in one-shot PD games for money.

Andreoni and Miller are able to show that reputation is not as important to altruistic behavior as it might be thought. Indeed, their findings suggest that people probably have what they refer to as "homemade" altruistic preferences, or in other words, people tend to have individual dispositions making them more likely to cooperate.

Table 2 Payoff Matrix as devised by Fehr and Schmidt (1999).

		PLAYER II	
		Cooperate (C)	Defect (D)
PLAYER I	Cooperate (C)	2,2	$0-3\alpha$, $3-3\beta$
	Defect (D)	$0-3\beta$, $3-3\alpha$	1,1

Fehr and Schmidt (1999) look at the PD in an entirely different way. Somewhat similar in manner to Hibbing and Alford's (2002) notion of people as wary cooperators, they see individuals as being inequality averse. People in this conception of the PD have an evolved inclination toward seeing equal distribution of payoffs. Framing becomes the key in this case. If players are more optimistic about the other player's probability of cooperating then inequality-averse players will cooperate more often than the standard theoretical completely rational agent. They present this idea as a social utility function, where each player calculates their payoff in regard to how that payoff relates to the other player's payoff, thus making inequality-averse players conditional cooperators.

The alpha and beta terms in the table above reflect the relative disposition for fairness of each player. Under this scheme both players prefer equal outcomes, unless one of the players acts unfairly: the further the outcome from the equal pay-off, the more guilt or anger that each player will feel. If an inequality-averse player knowingly met a selfish player, then they would defect because the selfish player would not likely

reciprocate their cooperation. Therefore, the most equal payoff for both parties, in the eyes of the inequality averse player, would be the Nash equilibrium outcome (P,P). The inequality-averse player is not altruistic, but egalitarian.

Emotion and Cooperation

This notion of egalitarianism coincides with the way that evolutionary psychology theorizes that individuals have innate preferences for fairness. Absolute outcomes are not as important as relative outcomes. The process of how the game is played in relation to the other player becomes the most important aspect. Both evolutionary theories of multi-level selection and reciprocal altruism reflect this focus on relative outcomes. In the case of collective action, individuals should be disposed toward equal and fair outcomes that reflect an innate desire to achieve what is implicitly best for the group, not for the individual (Fehr and Gachter, 2000). This is in line with Hibbing and Alford's (2002) notion that people are wary cooperators, who want to be neither suckers nor leeches in their relations to others. Indeed, the very emotions that Fehr and Schmidt suggest are elicited (anger and guilt) when an individual receives or dictates what they perceive to be an unequal payoff are theorized to have evolved from a sort of reciprocal necessity over millions of years of proto-human existence. Evolutionary pressure equipped humans with emotions in order to guide their decision making in the group context (Bowles and Gintis, 2003). From this perspective it is not rationality *per se* that a researcher should be investigating, but the emotions that lead to intra-group rationality that are designed to deal with conflict and compromise.

Empathy becomes an important element in attempting to understand this innate and evolved group-related behavior. Most mammals, and certainly non-mammalian species, do not have the scope or breadth of complexity in emotion that humans demonstrate in their everyday interaction. At the base of this emotional temperament is a pro-social empathetic disposition that varies from individual to individual. As Sober and Wilson (1998) imply throughout their polemic, empathy is the veritable context with in which all choices are made.[4] Indeed, McCabe et al. (2001) found that different parts of the brain are used when a player is competing against a computer versus another human. When playing against another human a large part of the pre-frontal cortex becomes activated, while in contrast when playing a computer only a small area in the rear of the brain that is used in mental calculation, like arithmetic, becomes activated. This suggests that the empathetic context of another human actually provokes a completely different sort of "rationality" than when making decisions concerning non-human subjects.

These findings, along with the aforementioned studies on empathy and past experimental work using the Prisoner's Dilemma posed two hypotheses:

Hypothesis I: *A more robust empathetic psychological disposition will lead to higher rates of "punishment" or mutual defection in the face of an initial defection by another player.*

Hypothesis II: *Empathy will predict more forgiving behavior in a player during a period when the opposing player attempts to re-establish mutual cooperation.*

In short, it is hypothesized that more empathy will lead to a more explicit display of group-oriented egalitarian behavior. Empathy should heighten an individual's awareness of being the Hibbian/Alfordian leech or sucker.

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[4] See chapter three especially.

The Experiment

A twofold experiment was undertaken to test the hypotheses suggested above. The first part of the experiment involved replicating a PD situation where defection and cooperation are hypothesized to occur. The second part of the experiment involved gathering psychological information using a battery of self-reported empathy questions in order to measure each respondent's empathetic disposition.

Using 133 undergraduate students (57 females and 76 males) as participants, a fifteen round, three-stage game was utilized to test the hypothetical relationship between group-oriented behavior and empathy. Two separate groups of undergraduates participated. One group consisted of 81 students from a finance class and the other consisted of 52 College of Arts and Sciences students taken from a psychology and a political science class. The experiment incorporated the four conditions discussed that should make the game conducive to cooperation. Students made their decisions simultaneously with their opponent. They were given the impression that they were playing another person when in reality they were playing a computer programmed to either cooperate or defect. The first stage of mixed cooperation and defection by the computer was followed by a second stage of complete defection, which in turn was then followed by a final stage of complete cooperation. The experiment allowed the investigator to analyze how participants reacted to the complete defection in the second stage, as well as complete cooperation in the third stage.

Table 3 Payoff regime for proposed prisoner's dilemma experiment. Numbers indicate 'hypothetical dollars'.

	Cooperate (C)	Defect (D)
Cooperate (C)	2,2	0,3
Defect (D)	3,0	1,1

Participants with a higher level of empathy should defect at higher rates when the computer defects and restore cooperation with their computer opponent to a higher degree than those with lower levels. Students were not informed when the game would end, but were told that it would end randomly at some unknown round. Participants played for extra credit. At the beginning of the game students were told that the winner of the game would receive the full amount of extra credit, while the loser would only receive half of the amount of extra credit promised. At the end of the game students were debriefed and told that no matter the outcome all students would receive the full amount of extra credit promised.[5] The payoff regime followed the ordering presented in Table 3, where there is a collective benefit of 4 points, divided by both players equally to cooperate, but an individual incentive of 3 to defect.

<u>Stage 1</u>

Round	1	2	3	4	5
Computer	C	D	C	C	C

In stage one the computer was programmed to cooperate except for a single second round defection. The second round defection was felt necessary in order to imbibe into students a sense of randomness and uncertainty that should accompany player another human being. Complete cooperation followed by complete defection in the

[5] The instructions, rules and game protocol are presented in a Game Appendix at the end of this paper.

second stage of the experiment it was felt might induce a feeling in the participant that they were playing with an artificial opponent, which would of course pollute the results.

Stage 2

Round	6	7	8	9	10
Computer	D	D	D	D	C

In stage two of the experiment the computer was programmed to defect for four rounds, beginning in round six and ending in round nine. It was during this stage that it was expected that a strong majority of participants would begin to consistently defect on their computer opponent. However, the hypothesis for this experiment is that those with a higher level of empathy will defect at a higher rate than those with lower levels because of their group-oriented leanings. The final cooperation in round 10 was necessary in order to allow a full five rounds of informed decision making by the participant during the next and final stage. Cooperation in the tenth round should hypothetically begin to sway a participant toward mutual cooperation in the eleventh round.

Stage 3

Round	11	12	13	14	15
Computer	C	C	C	C	C

The third stage in the experiment is the most interesting part. According to Hibbing and Alford's (2002) theory of humans as wary cooperators that want to be neither leeches (take advantage of others) nor suckers (to be taken advantage of), when the computer begins cooperating individuals should feel as though they are being leeches on a cooperative person. If indeed empathy is motivating human participants' guilt (as Fehr and Schmidt might suggest) or motivation in cooperation, then individuals with

higher levels of empathy, should begin to establish mutual cooperation to a higher degree during the final stage of the experiment.

Dependent Variables

Four dependent variables were created for regression analysis. Respondents' decisions during each round were recorded as either: 1 = cooperation, or 0 = defection. In each case the number of times a participant cooperated during one of the three stages of the game was summed. In the first stage dependent variable, rounds 3 through 6 were included. Rounds 1 and 2 were not included in this dependent variable because in this first stage it was felt most important to gauge responses to the second round defection, which would begin in round 3. The round 6 decision was included because it was a decision based on the computer's cooperative play in round five. The second stage dependent variable included participants' decisions in rounds 7 through 10, with these rounds being included because each corresponds to a previous round of defection by the computer. As with the previous dependent variable the second stage variable summed participants' decisions. The third stage dependent variable included the summation of each participant's decisions during rounds 11 through 15. Finally, a dependent variable was created that summed up responses for the entire game so that a more general picture of how empathy and cooperation may have interacted on a larger level.

Independent Variables.

Independent variables used in regression analysis included age, gender, income, population of hometown, race and grade point average. It was felt necessary to control

for these differences in socioeconomic status in order to isolate the effects of empathy. As Schieman and Van Gundy (2000) show, empathy is a context specific phenomenon that is particular to one's socioeconomic status.[6] By documenting the relationship between education, age, income and gender over an entire community, they are able to demonstrate that empathy levels are relative to one's social position. For instance, Shieman and Van Gundy present evidence that empathy tends to decrease with age, but that increases in higher education, income and by being female can mitigate this general trend. If these factors were not taken into account it would lead to a misguided analysis of the role that a particular individual's relative level of empathy plays in their decision-making process. Therefore, controlling for these differences allows for a statistical analysis that looks for relative rates of empathy for an individual in their socioeconomic group. Factor analysis was used to create a factor score of empathy for each participant from the eight empathy questions that were asked in the post-experiment questionnaire. These are presented in Table 4 with their respective factor loadings.[7] Empathy questions were recorded on a seven point Likert scale. Items were coded in a manner such that higher scores reflect more empathy.

Respondents' round one decision to cooperate or defect was also used as an independent predictor. Because this decision was made in the absence of information on the other player, it was taken as an indication of each participant's general willingness to cooperate.[8] The round one decision was also used to create an interaction term with

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[6] The empathy questions used by Shieman and Van Gunday bear a strong resemblance to the questions used in this analysis.

[7] A reliability analysis was conducted on the responses to the empathy questions with a Cronbach's alpha score of $\alpha = .853$.

[8] Out of the 133 undergraduate students who participated, 79.7% cooperated on the first round and 20.3% defected.

empathy. It was felt that this interaction term would help shed light on the effects of empathy within the group of individuals that had a more cooperative disposition (as distinguished by a round one decision to cooperate) from the very beginning of the experiment.

Results

The experimental results are presented below in a statistical appendix. Two types of regression analysis were used in examining the data. The first consisted of a standard ordinary least squares regression. The second type used was a tobit regression model. Tobit (0,X) estimation models were used because of the truncated nature of each of the dependent variables. This statistical methodology can control for the two different types of theoretical participants in the experiment: those that defect all of the time (or, 0 cooperation) and those that cooperate to varying degrees (or, X cooperation).

The statistical analysis proceeded in three main parts. First, an analysis of each dependent variable with both regression methods was used to look at empathy when controlling for socioeconomic status and a participant's round one decision. Next, an examination of each dependent variable with both types of regressions was completed with the empathy-round one interaction term in each model. Finally, significance of difference in means tests were used to investigate how mean differences of empathy varied in each round in regards to those who cooperated and those who defected.

The statistical analysis of the first stage in regards to empathy is presented in Tables 5 and 6. The dependent variable in this case is the summation of cooperation from rounds 3 through 6, or just after the first defection by the computer. Both show

similar results. In the ordinary least squares (OLS) regression the first thing one should notice is that the F - statistic, or model fit test, is not significant, meaning that little to none of the variance present in the dependent variable is being explained by the independent predictors. What variance is explained is being predicted by the round one variable, which is significant at $p < .01$ level. The tobit model is not much different with the round one variable being the only significant predictor with significance at the $p < .01$ level. Though a tobit does not report a model fit test, it does report an adjusted R-square measure that is equal to .01 in this regression, meaning that with this model as well there is little to no variance being explained. However, when one compares the unstandardized beta coefficient for the round one variable of the OLS regression to the tobit, it is important to note that the coefficient is larger in the tobit model. This suggests that the theoretical difference between non-cooperators and partial cooperators, which is taken into account in the tobit because of the (0,X) treatment of the dependent variable, is manifest in the results. At the lower left hand corner of Table 6, as well with all other tobit estimation tables, the number of complete non-cooperators is presented as "Left censored observations," showing here that 26 participants did not cooperate once during this period.

The second stage results are presented in Tables 7 and 8. The dependent variable in both estimations is the summation of cooperative decisions between rounds 7 through 10 therefore each individual has a score between zero and 4. In both cases the empathy factor variable is significant at the $p \leq .10$ level with a negative coefficient. This indicates that as empathy increased participants were more likely to defect when the computer was defecting. Similar to the empathy variable, grade point average is also

significant at the $p < .10$ level with a negative coefficient. The gender variable is positively correlated and significant at the $p < .05$ level, showing that as the computer began consistently defecting women were more likely to cooperate than men. Again as in the stage one analysis the round one variable is very significant and positively correlated with cooperation. The tobit model once again shows stronger results in that the unstandardized coefficients on each significant variable are larger and the p-values are lower, most likely reflecting the differences between complete and partial non-cooperation.

Stage III results are present in Tables 9 and 10. The OLS estimation only has the round one predictor as a significant variable at the $p < .0001$ level. The tobit model renders only a slightly different picture with the addition of income as a significant predictor at the $p < .10$ level with a negative coefficient indicating that as participant's family income increased they were less likely to cooperate in the final rounds. Empathy is not significant in either of the estimations.

The final two tables, 11 and 12, in this first part of the statistical analysis uses a summation of all cooperative decisions over the entire experiment as a dependent variable. Not surprisingly, the round one predictor is a very strong indication that participants would cooperate during the entire experiment. However, in these regressions no other independent predictors, including empathy, were significant.

The next part of the statistical analysis involved creating an interaction term between empathy and round one. As discussed earlier, it was important to test the significance of empathy within the group of individuals that cooperated on the first round. These results appear in Tables 13 through 20. These results can be generalized by

saying that no relationship exists between cooperation in the various stages and the interaction of empathy with a round one cooperative decision. Indeed, as one will notice by perusing the estimations in this second part, the F – statistics on the OLS regressions and the R-square on the tobits are very low and not significant, indicating that the addition of the round one/empathy interaction is actually decreasing the ability of the model to predict the variance in each dependent variable.

Finally, Table 21 contains the significance of difference in means between those who cooperated and those who defected in each round. In each case Group 1 is composed of those that defected while Group 2 consists of those that cooperated in each round. Looking at the far right side of the table the numbers in the Group 1 Total (defectors) and Group 2 Total (cooperators) columns are the amount of participants that defected or cooperated in each round, respectively. There is a general pattern that follows the hypothesized reactions to the computer's decisions. In rounds 1 and 2 Group 2 is larger than Group 1, with more individuals cooperating with the computer in each round. However, notice that after the computer defects in round 2 there is a move toward greater defection during rounds 3 through 6 (Stage I). This defection becomes heightened during rounds 7 through 10 (Stage II) when the computer opponent is consistently defecting on the human player. In the final rounds 11 through 15 (Stage III) there is a tendency to move toward cooperation with the Group 2 Total being greater than the Group 1 Total once again.

The results are relatively mixed. The first hypothesis presented was that empathy would be a significant predictor of participants' defection in the second stage of the experiment. In both the OLS and tobit estimations a participant's empathetic disposition

was a significant predictor of defection in retaliation to the opposing player's second stage defections. For these two analyses, the null hypothesis can be rejected. Empathy was a factor.

The second hypothesis that an empathetic disposition would lead to higher rates of re-cooperation in the final stage of the experiment was flat out wrong. A null result occurred. Indeed, in looking closely at each of the third stage regression results one should note that the empathy factor variable carries a negative coefficient. Though not significant in any of the regressions, it indicates that even marginal levels of empathy led to more defection in the final rounds of the experiment. Truly, empathy was not a facilitator of restoring cooperation after reciprocal trust had been broken.

Empathy and the J-curve of Cooperation

Initially it was thought that because trust was broken during the second stage defections those with higher levels of empathy might have been more likely to feel as though they were playing with an unfair opponent who did not deserve to be cooperated with in the final stages, thus the null result for the second hypothesis. In this case it seemed that the preference for relative versus absolute outcomes when dealing with others likely promulgated more defection in the final stage of the experiment because "empathists," those with higher levels of empathy, were probably still upset about the consistent defection during the second stage. However, on closer examination of the entire experiment a completely different picture emerges on the role that empathy played as a facilitator of cooperation and defection.

In Figure 1 the number of individuals is compared with the number of times they cooperated during the entire experiment. The normal distribution of cooperative decisions over the course of the game is near ideal. Participants could have cooperated anywhere from 0 to 15 times (giving a total of sixteen possible sums) during the course of the experiment and the mean of this distribution is 7.78, or nearly 8 which would be the mean of a perfectly normal distribution across this sample of students. Indeed, in Figure 4 a line graph is shown with a single distinctive peak reflecting the normal distribution of the sample.

What is intriguing is the display of the mean factor score of empathy across this same sample shown in Figure 2. There is a bimodal distribution (two peaks) across the sample in regards to the mean factor score of empathy per incidences of cooperation during the experiment. Those individuals at the extremes of the distribution have on average very low empathy scores. Those in the middle of the distribution tended have higher scores than those in the tails, but on average were far lower than the individuals present in either peak, where the empathy scores were the highest. This indicates that there is a possible "J-curve" to empathy, or that high levels of empathy can produce either more defection or more cooperation depending on the individual, but that participants with a median level of empathy will converge toward cooperating about 50 percent of the time.[9]

In order to test this new J-curve hypothesis two significance of the difference in means tests were used in order to confirm what seemed evident in the graphs. The first

[9] The J-curve concept is aptly illustrated by a study regarding testosterone and depression. It has been found that testosterone levels conform to a J-curve in regards to depression in men (Booth, Johnson and Granger, 1999) where extremely high and low levels of testosterone correlate with depression while median levels of testosterone (which encompasses a majority of males) correlates with lower rates of depression.

test was aimed at investigating whether the individuals in the extreme tails of the distribution were in fact much lower on average than the rest of the sample. In most respects it would make intuitive sense that participants that cooperated either all of the time (15 cooperative decisions) or nearly all of the time (14 cooperative decisions) and those that defected all of the time (0 cooperative decisions) or nearly all of the time (1 cooperative decision) would have lower mean empathy scores because they were not actually engaging their opponent and did not care what the other player did. Whether their opponent defected or cooperated these individuals were indifferent. In this respect these participants can be seen as having adopted a strategy to use throughout the entire game and were not concerned about their opponent's fair or unfair actions, or in other words: egalitarian outcomes and behavior were not a factor in their decision making. Table 21 contains the results from a comparison of the mean score of empathy between these outliers and the rest of the sample. The "All Round-Tails" variable was coded to create two groups of participants out of the total distribution of cooperative decisions, with Group 1 being those in the tails of the distribution and Group 2 being every other participant. The difference in means was significant at the $p < .05$ level, indicating that those participants who cooperated or defected to the extreme actually had significantly lower levels of empathy.

The next test examined whether the mean level of empathy in participants in the empathy peaks of the distribution of cooperation did in fact have a statistically significant higher mean level of empathy than other players in the sample. Table 21 presents the results of this analysis under the variable name "All Round Bimodal," where individuals in the peaks were coded different than other participants. The test reveals that the mean

empathy levels are significant at the $p < .05$ level, showing that the J-curve interpretation of cooperation during the experiment is supported.

In order to further investigate this relationship a binary probit regression was used to estimate the difference in empathy between the two groups when controlling for each independent variable used in previous regression models, where Group 1 = 0 (those present in the tails and in the center of the distribution) and Group 2 = 1 (those present in either of the bimodal peaks). The results appear in Table 22. The empathy factor variable is significant at the $p < .05$ level and positive. The probit estimation eliminates the possibility that another socioeconomic factor (like gender, age or race) that correlates with empathy could be causing the unique distribution of individuals with higher rates of empathy.

There were 36 participants that inhabited the bimodal high empathy peaks, with 18 participants in the less cooperative peak and 18 individuals in the more cooperative peak of the bimodal distribution, see Figures 5. In other words, 50% of those with high empathy levels that did not converge toward the median range of cooperation tended to be the highest defectors. Furthermore, recall that each decision was made in anonymity, where the identity of participants was unknown and a fear of personal reputation effects should not have affected their decisions.

Finally, an analysis of the possible differences between individuals with high levels of empathy residing in the more cooperative empathy peak and the less cooperative empathy peak was conducted. All possible variables that were gathered from the survey after the experiment were investigated. The size of a participant's home town and the level of their family income were found to be statistically significant predictors. Figures

7 and 8 show the results of the difference of means test for each variable. Essentially, those individuals with high levels of empathy present in the "more cooperative peak" tended to have been raised in smaller towns and come from families with a relatively lower level of income. In contrast, individuals present in the "less cooperative peak" were raised in a large city environment and came from families with a relatively higher level of income.

The results of this experiment suggest social conditioning could be very important to the manner in which an empathetic disposition manifests itself in social decision making. Being from a larger urban area during an individual's childhood would likely diminish the reputation effects of continued social interaction. In a large city it is less likely that an individual would cross paths with the same person again and again in an iterative manner where one's reputation would affect social interaction. On the other hand, growing up in a small town diminishes anonymity. Individuals would place a stronger emphasis on initial interactions because the likelihood of encountering the same person repeatedly is much greater due to a lower population density. Thus, these two opposite social environments may interact with high levels of empathy to create different other-regarding tendencies.

Conclusion

Higher rates of empathy tended to have two contrary effects by either making an individual more likely to defect or more likely to cooperate, but not to converge toward the median level of cooperation as the majority of participants in this experiment. The line graph presented in Figure 5 demonstrates the J-curve phenomenon with empathy and

cooperation over the entire experiment. Then, in Figure 6 the outliers (those who either always cooperated or defected) have been removed in order to isolate the J-curve. Indeed, these outliers present an interesting finding in that their low levels of empathy and lack of concern as to the decisions being made by others suggests that a shallow empathetic disposition leads to an absence of concern for outcomes relative to the other individual. However, the bipolar nature of cooperation that a high level of empathy leads to indicates a more complex, non-linear relationship between empathy and cooperation. Contrary to the hypotheses originally being tested, it is not that empathy has a simple positive linear relationship with a desire for egalitarian outcomes. Rather, an empathetic emotional disposition likely cultivates a sensitivity to social decisions, which depending on an individual's social conditioning, leads to a more intense display of cooperation and defection.

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Table 4 Empathy Scale Items and Factor Analysis Loadings.[10]

	Empathy Question	Loading
1.	I make people feel welcome.	.758
2.	I anticipate the needs of others.	.626
3.	I love to help others.	.769
4.	I am concerned about others.	.558
5.	I have a good word for everyone.	.628
6.	I am sensitive to the feelings of others.	.760
7.	I make people feel comfortable.	.798
8.	I take time for others.	.785

[10] Questions taken from Goldberg, L.R. 1999. "A Broad-Bandwidth, Public-Domain, Personality Inventory Measuring the Lower-Level Facets of Several Five-Factor Models." University of Oregon and Oregon Research Institute, 1999. In Mervielde, I. Deary, I., De Fruyt, F. & Ostendorf, F. (Eds.), *Pers. Psychology in Europe* 7: 7-28. Tilburg, The Netherlands: Tilburg University Press.

Table 5 OLS Regression of Stage I Responses.

OLS Regression – Dependent Variable: Stage I Responses

Variables	B (Unstand)	S.E.	Beta (Stand)	p-value
Constant	1.011	1.438		.483
Round One	.600	.218	.249	.007
Gender (0=M, 1=F)	.019	.190	.010	.919
Age	-.002	.042	-.004	.964
Income	-.038	.106	-.035	.722
Population of Home	-.040	.070	-.057	.571
Race (0=W, 1=E)	-.155	.347	-.043	.656
Grade Point Avg.	-.017	.224	-.007	.939
Empathy	.004	.015	.024	.801
F	1.320			.240
Adj. R-squ.	.02			
N	126			

Dependent variable is a summation of a participant's responses during the First Stage of the experiment, including responses during rounds 3 thru 6. Analysis was run on SPSS 12.

Table 6 Tobit Regression of Stage I Responses.

Tobit Regression – Dependent Variable: Stage I Responses

Variables	B (Unstand)	S.E.	Z-Score	p-value
Constant	0.975437	1.757248	0.555094	0.5788
Round One	0.775919	0.267043	2.905592	0.0037
Gender (0=M, 1=F)	0.096752	0.227919	0.424501	0.6712
Age	-0.009851	0.051094	-0.192795	0.8471
Income	-0.070237	0.126442	-0.555483	0.5786
Population of Home	-0.036598	0.083885	-0.436286	0.6626
Race (0=W, 1=E)	-0.228168	0.416176	-0.548248	0.5835
Grade Point Avg.	-0.065086	0.266867	-0.243890	0.8073
Empathy	0.006712	0.017863	0.375740	0.7071
Adj. R-squ.	.01			
N	127			
Left censored obs	26			
Uncensored obs	101			

Dependent variable is a summation of a participant's responses during the First Stage of the experiment, including responses during rounds 3 thru 6. Analysis was run on Eviews 5.

Table 7 OLS Regression of Stage II Responses.

OLS Regression – Dependent Variable: Stage II Responses

Variables	B (Unstand)	S.E.	Beta (Stand)	p-value
Constant	3.890	1.651		.020
Round One	1.043	.250	.350	.000
Gender (0=M, 1=F)	.445	.219	.184	.044
Age	.002	.048	.003	.973
Income	-.039	.122	-.029	.750
Population of Home	-.102	.081	-.117	.211
Race (0=W, 1=E)	-.015	.398	-.003	.970
Grade Point Avg.	-.444	.257	-.147	.087
Empathy	-.028	.017	-.144	.100
F	3.995			.000
Adj. R-squ.	.16			
N	126			

Dependent variable is a summation of a participant's responses during the Second Stage of the experiment, including responses during rounds 7 thru 10. Analysis was run on SPSS 12.

Table 8 Tobit Regression of Stage II Responses.

Tobit Regression – Dependent Variable: Stage II Responses

Variables	B (Unstand)	S.E.	Z-Score	p-value
Constant	4.119769	1.937391	2.126452	0.0335
Round One	1.385977	0.309427	4.479168	0.0000
Gender (0=M, 1=F)	0.582697	0.258025	2.258293	0.0239
Age	0.001580	0.055782	0.028324	0.9774
Income	-0.043706	0.143861	-0.303811	0.7613
Population of Home	-0.127309	0.094398	-1.348640	0.1775
Race (0=W, 1=E)	0.100366	0.461998	0.217244	0.8280
Grade Point Avg.	-0.522350	0.304390	-1.716055	0.0862
Empathy	-0.036118	0.020234	-1.785069	0.0743
Adj. R-squ.	.15			
N	127			
Left censored obs	25			
Uncensored obs	102			

Dependent variable is a summation of a participant's responses during the First Stage of the experiment, including responses during rounds 7 thru 10. Analysis was run on Eviews 5.

Table 9 OLS Regression of Stage III Responses.

OLS Regression – Dependent Variable: Stage III Responses

Variables	B (Unstand)	S.E.	Beta (Stand)	p-value
Constant	2.037	2.345		.387
Round One	1.425	.355	.351	.000
Gender (0=M, 1=F)	.078	.310	.024	.802
Age	.002	.068	.002	.979
Income	-.267	.173	-.147	.126
Population of Home	.112	.115	.095	.332
Race (0=W, 1=E)	.072	.565	.012	.899
Grade Point Avg.	.278	.365	.068	.447
Empathy	-.024	.024	-.089	.328
F	2.505			.015
Adj. R-squ.	.087			
N	126			

Dependent variable is a summation of a participant's responses during the Third Stage of the experiment, including responses during rounds 11 thru 15. Analysis was run on SPSS 12.

Table 10 Tobit Regression of Stage III Responses.

Tobit Regression – Dependent Variable: Stage III Responses

Variables	B (Unstand)	S.E.	Z-Score	p-value
Constant	1.548432	2.572608	0.601892	0.5472
Round One	1.698831	0.397330	4.275619	0.0000
Gender (0=M, 1=F)	0.120276	0.339581	0.354190	0.7232
Age	0.013140	0.074392	0.176636	0.8598
Income	-0.318235	0.190232	-1.672879	0.0944
Population of Home	0.118166	0.124831	0.946609	0.3438
Race (0=W, 1=E)	0.087511	0.618233	0.141550	0.8874
Grade Point Avg.	0.332231	0.399217	0.832207	0.4053
Empathy	-0.028035	0.026623	-1.053036	0.2923
Adj. R-squ.	.08			
N	127			
Left censored obs	16			
Uncensored obs	111			

Dependent variable is a summation of a participant's responses during the First Stage of the experiment, including responses during rounds 11 thru 15. Analysis was run on Eviews 5.

Table 11 OLS Regression of All Responses.

OLS Regression – Dependent Variable: All Responses

Variables	B (Unstand)	S.E.	Beta (Stand)	p-value
Constant	7.291	4.218		.087
Round One	4.763	.639	.567	.000
Gender (0=M, 1=F)	.459	.558	.067	.412
Age	-.009	.123	-.006	.942
Income	-.491	.311	-.130	.118
Population of Home	.043	.206	.018	.836
Race (0=W, 1=E)	.220	1.017	.018	.829
Grade Point Avg.	-.053	.657	-.006	.935
Empathy	-.046	.044	-.083	.291
F	8.016			.000
Adj. R-squ.	.308			
N	126			

Dependent variable is a summation of a participant's responses during every round of the experiment, including responses during rounds 1 thru 15. Analysis was run on SPSS 12.

Table 12 Tobit Regression of All Responses.

Tobit Regression – Dependent Variable: All Responses

Variables	B (Unstand)	S.E.	Z-Score	p-value
Constant	7.253665	4.161975	1.742842	0.0814
Round One	4.909473	0.632493	7.762095	0.0000
Gender (0=M, 1=F)	0.509352	0.549863	0.926325	0.3543
Age	-0.007821	0.120775	-0.064754	0.9484
Income	-0.498216	0.306760	-1.624123	0.1043
Population of Home	0.043881	0.203092	0.216067	0.8289
Race (0=W, 1=E)	0.245790	0.999937	0.245806	0.8058
Grade Point Avg.	-0.094287	0.647523	-0.145611	0.8842
Empathy	-0.046667	0.043264	-1.078648	0.2807
Adj. R-squ.	.30			
N	127			
Left censored obs	3			
Uncensored obs	124			

Dependent variable is a summation of a participant's responses during every round of the experiment, including responses during rounds 1 thru 15. Analysis was run on Eviews 5.

Table 13 OLS Regression of Stage I Responses with Interaction Term.

OLS Regression – Dependent Variable: Stage I Responses With Interaction Term				
Variables	B (Unstand)	S.E.	Beta (Stand)	p-value
Constant	-.142	2.026		.944
Round One	2.076	1.836	.862	.261
Gender (0=M, 1=F)	.022	.191	.011	.907
Age	-.002	.042	-.004	.965
Income	-.043	.107	-.040	.687
Population of Home	-.039	.071	-.055	.584
Race (0=W, 1=E)	-.163	.347	-.045	.641
Grade Point Avg.	-.045	.227	-.018	.844
Empathy	.032	.038	.199	.401
Empathy*Round 1	-.033	.041	-.660	.420
F	1.243			.276
Adj. R-squ.	.02			
N	126			

Dependent variable is a summation of a participant's responses during the First Stage of the experiment, including responses during rounds 3 thru 6. Analysis was run on SPSS 12.

Table 14 Tobit Regression of Stage I Responses with Interaction Term.

Tobit Regression – Dependent Variable: Stage I Responses With Interaction Term

Variables	B (Unstand)	S.E.	Z-Score	p-value
Constant	-1.192688	2.581300	-0.462049	0.6440
Round One	3.439444	2.327283	1.477880	0.1394
Gender (0=M, 1=F)	0.096090	0.227277	0.422789	0.6724
Age	-0.009397	0.050948	-0.184437	0.8537
Income	-0.075738	0.126114	-0.600551	0.5481
Population of Home	-0.035588	0.083649	-0.425439	0.6705
Race (0=W, 1=E)	-0.238463	0.415503	-0.573915	0.5660
Grade Point Avg.	-0.107600	0.268395	-0.400901	0.6885
Empathy	0.058302	0.048284	1.207483	0.2272
Empathy*Round 1	-0.059180	0.051277	-1.154127	0.2484
Adj. R-squ.	.01			
N	127			
Left censored obs	26			
Uncensored obs	101			

Dependent variable is a summation of a participant's responses during the First Stage of the experiment, including responses during rounds 3 thru 6. Analysis was run on Eviews 5.

Table 15 OLS Regression of Stage II Responses with Interaction Term.

OLS Regression – Dependent Variable: Stage II Responses With Interaction Term				
Variables	B (Unstand)	S.E.	Beta (Stand)	p-value
Constant	3.514	2.332		.135
Round One	1.524	2.114	.511	.472
Gender (0=M, 1=F)	.446	.220	.184	.044
Age	.002	.048	.003	.973
Income	-.041	.123	-.030	.741
Population of Home	-.101	.081	-.117	.215
Race (0=W, 1=E)	-.018	.400	-.004	.965
Grade Point Avg.	-.453	.261	-.150	.086
Empathy	-.019	.044	-.097	.658
Empathy*Round 1	-.011	.047	-.173	.819
F	3.528			.001
Adj. R-squ.	.153			
N	126			

Dependent variable is a summation of a participant's responses during the Second Stage of the experiment, including responses during rounds 7 thru 10. Analysis was run on SPSS 12.

Table 16 Tobit Regression of Stage II Responses with Interaction Term.

Tobit Regression – Dependent Variable: Stage II Responses With Interaction Term				
Variables	B (Unstand)	S.E.	Z-Score	p-value
Constant	4.002937	2.864423	1.397467	0.1623
Round One	1.529141	2.604077	0.587211	0.5571
Gender (0=M, 1=F)	0.582804	0.258012	2.258828	0.0239
Age	0.001577	0.055780	0.028265	0.9775
Income	-0.044145	0.144070	-0.306417	0.7593
Population of Home	-0.127082	0.094484	-1.345012	0.1786
Race (0=W, 1=E)	0.099780	0.462096	0.215929	0.8290
Grade Point Avg.	-0.524549	0.306952	-1.708894	0.0875
Empathy	-0.033317	0.054484	-0.611498	0.5409
Empathy*Round 1	-0.003205	0.057884	-0.055375	0.9558
Adj. R-squ.	.14			
N	127			
Left censored obs	25			
Uncensored obs	102			

Dependent variable is a summation of a participant's responses during the First Stage of the experiment, including responses during rounds 7 thru 10. Analysis was run on Eviews 5.

Table 17 OLS Regression of Stage III Responses with Interaction Term.

OLS Regression – Dependent Variable: Stage III Responses With Interaction Term				
Variables	B (Unstand)	S.E.	Beta (Stand)	p-value
Constant	3.459	3.307		.298
Round One	-.395	2.997	-.097	.895
Gender (0=M, 1=F)	.074	.311	.022	.812
Age	.002	.068	.002	.980
Income	-.261	.174	-.143	.136
Population of Home	.110	.115	.093	.340
Race (0=W, 1=E)	.081	.567	.013	.886
Grade Point Avg.	.313	.370	.076	.400
Empathy	-.059	.062	-.217	.344
Empathy*Round 1	.041	.066	.482	.542
F	2.256			.023
Adj. R-squ.	.082			
N	126			

Dependent variable is a summation of a participant's responses during the Third Stage of the experiment, including responses during rounds 11 thru 15. Analysis was run on SPSS 12.

Table 18 Tobit Regression of Stage III Responses with Interaction Term.

Tobit Regression – Dependent Variable: Stage III Responses With Interaction Term				
Variables	B (Unstand)	S.E.	Z-Score	p-value
Constant	3.107997	3.670148	0.846832	0.3971
Round One	-0.256082	3.313475	-0.077285	0.9384
Gender (0=M, 1=F)	0.118041	0.339052	0.348149	0.7277
Age	0.013197	0.074269	0.177695	0.8590
Income	-0.312923	0.190114	-1.645975	0.0998
Population of Home	0.116654	0.124645	0.935885	0.3493
Race (0=W, 1=E)	0.095651	0.617211	0.154973	0.8768
Grade Point Avg.	0.364442	0.402315	0.905862	0.3650
Empathy	-0.065647	0.068681	-0.955821	0.3392
Empathy*Round 1	0.043653	0.073497	0.593940	0.5526
Adj. R-squ.	.01			
N	127			
Left censored obs	16			
Uncensored obs	111			

Dependent variable is a summation of a participant's responses during the First Stage of the experiment, including responses during rounds 11 thru 15. Analysis was run on Eviews 5.

Table 19 OLS Regression of All Responses with Interaction Term.

OLS Regression – Dependent Variable: All Responses With Interaction Term				
Variables	B (Unstand)	S.E.	Beta (Stand)	p-value
Constant	6.476	5.957		.279
Round One	5.806	5.399	.691	.284
Gender (0=M, 1=F)	.461	.561	.068	.412
Age	-.009	.123	-.006	.942
Income	-.494	.313	-.131	.117
Population of Home	.044	.207	.018	.833
Race (0=W, 1=E)	.215	1.021	.017	.834
Grade Point Avg.	-.073	.667	-.009	.913
Empathy	-.027	.111	-.048	.811
Empathy*Round 1	-.023	.120	-.134	.846
F	7.072			.000
Adj. R-squ.	.303			
N	126			

Dependent variable is a summation of a participant's responses during every round of the experiment, including responses during rounds 1 thru 15. Analysis was run on SPSS 12.

Table 20 Tobit Regression of All Responses with Interaction Term.

Tobit Regression – Dependent Variable: All Responses With Interaction Term				
Variables	B (Unstand)	S.E.	Z-Score	p-value
Constant	6.154972	5.935778	1.036928	0.2998
Round One	6.294812	5.373439	1.171468	0.2414
Gender (0=M, 1=F)	0.511410	0.549817	0.930146	0.3523
Age	-0.007721	0.120757	-0.063941	0.9490
Income	-0.502217	0.307091	-1.635402	0.1020
Population of Home	0.044868	0.203099	0.220915	0.8252
Race (0=W, 1=E)	0.239887	1.000063	0.239872	0.8104
Grade Point Avg.	-0.118483	0.654079	-0.181144	0.8563
Empathy	-0.020123	0.111019	-0.181256	0.8562
Empathy*Round 1	-0.030913	0.119061	-0.259640	0.7951
Adj. R-squ.	.01			
N	127			
Left censored obs	3			
Uncensored obs	124			

Dependent variable is a summation of a participant's responses during every round of the experiment, including responses during rounds 1 thru 15. Analysis was run on Eviews 5.

Table 21 Independence of Means Tests on Empathy Factor Score and Decision Making.

Independence of Means Tests on Empathy Factor Score and Decision Making

	Group 1 Mean	Group 2 Mean	P – Value	Group 1 Total	Group 2 Total
Round 1	-.2006	.0511	.134	27	106
Round 2	-.0845	.0509	.435	50	83
Round 3	.0285	-.0273	.748	65	68
Round 4	-.0293	.0403	.705	77	56
Round 5	-.0613	.0793	.423	75	58
Round 6	-.0577	.0642	.257	70	63
Round 7	.0333	-.0370	.688	70	63
Round 8	.0433	-.0939	.459	91	42
Round 9	-.0746	.1280	.261	84	49
Round 10	.0530	-.0538	.541	67	66
Round 11	.0725	-.0736	.402	67	66
Round 12	-.0744	.0575	.444	58	75
Round 13	-.0253	.0152	.818	50	83
Round 14	.0682	-.0451	.419	53	80
Round 15	.0450	-.0317	.659	55	78
All Round-Tails	-.4956	.0677	.034	16	117
All Round Bimodal	.3233	-.1341	.021	36	98

Each round is presented above, with Group 1 = 0, or defection, and Group 2 = 1, or cooperation in PD game. Group Means are the mean level of Empathy Factor scores for each group. "All Round-Tails" represents difference in mean level of empathy between those in the extreme tails of cooperation (Group 1) during all rounds and all other participants (Group 2). "All Round Bimodal" represents difference in mean level of empathy between those with rates of cooperation in either peak (Group 1) of the bi-modal empathy distribution and all other participants (Group 2). In all cases Group 1 and Group 2 summed together total 133 participants. Analysis was run on SPSS 12.

Table 22 Binary Probit Regression of All Round Bimodal.

Binary Probit Regression – Dependent Variable: All Round Bimodal				
Variables	B (Unstand)	S.E.	Z-Score	p-value
Constant	0.395278	1.802669	0.219274	0.8264
Round One	-0.522978	0.301229	-1.736147	0.0825
Gender (0=M, 1=F)	0.169787	0.268907	0.631398	0.5278
Age	0.015265	0.058234	0.262126	0.7932
Income	-0.014955	0.148860	-0.100461	0.9200
Population of Home	-0.029947	0.102471	-0.292251	0.7701
Race (0=W, 1=E)	-0.002640	0.470379	-0.005613	0.9955
Grade Point Avg.	-0.256563	0.320598	-0.800263	0.4236
Empathy	0.305954	0.138090	2.215611	0.0267
McFadden R-squ.	.07			
N	127			
Obs with Dep=0	92			
Obs with Dep=1	35			

Dependent variable is a binary (0,1) variable. Participants with incidences of cooperation throughout the entire experiment that numbered: 2, 3, 4, 5; as well as: 11, 12, 13; were coded as "1". All other participants were coded as "0". Analysis was run on Eviews 5.

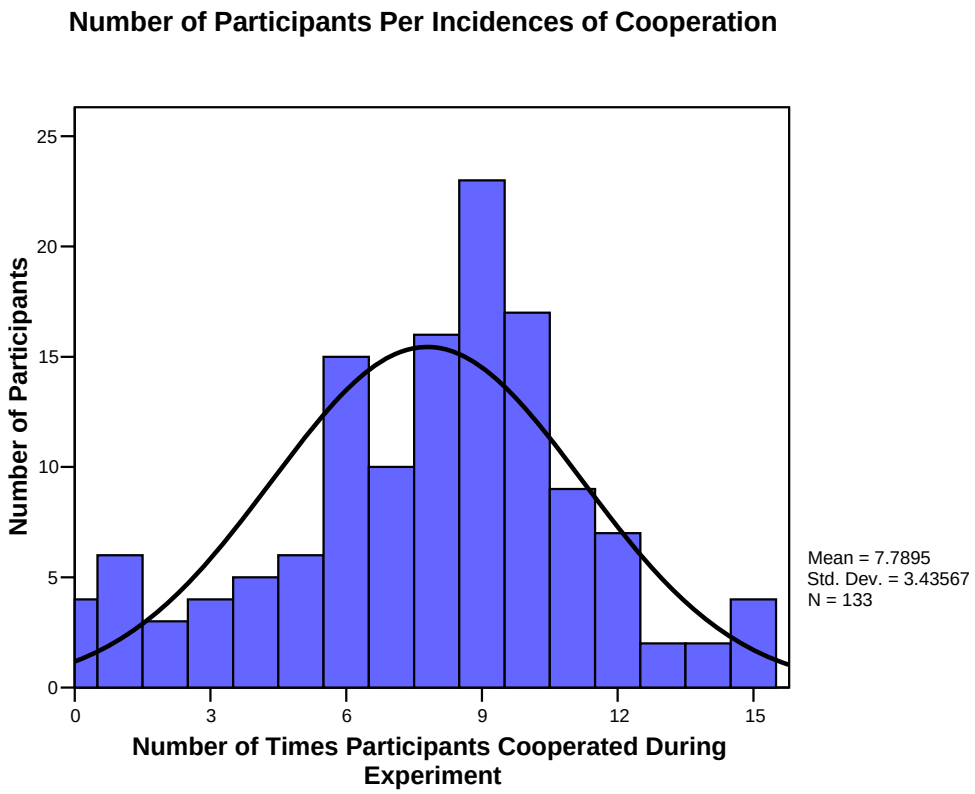

Figure 1 Number of Participants per Incidences of Cooperation.

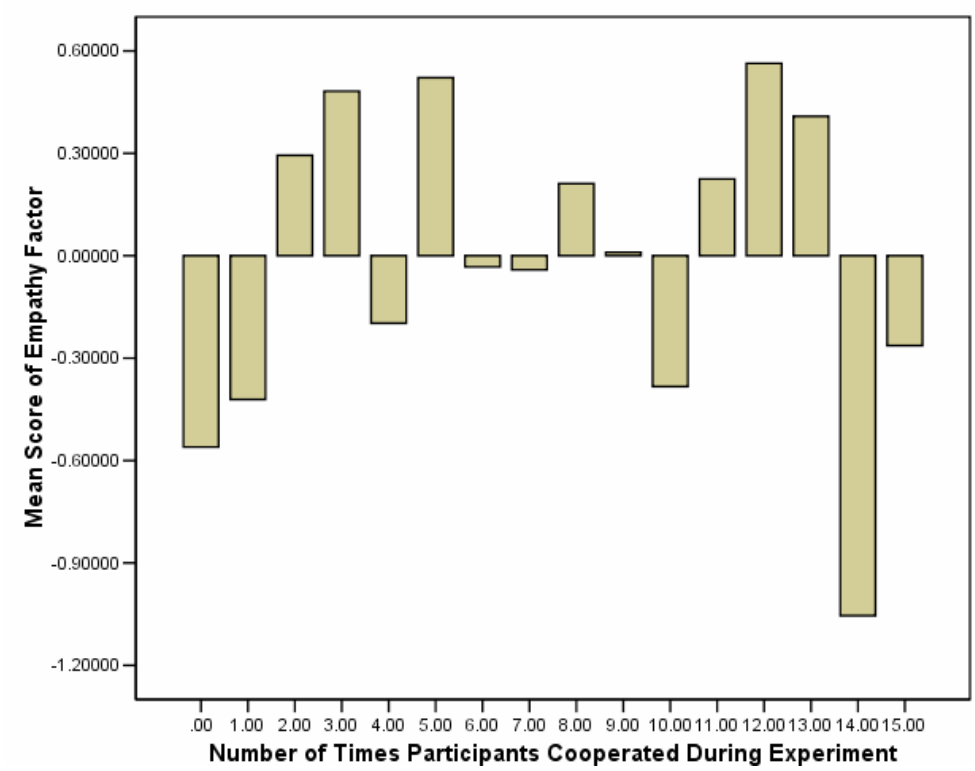

Figure 2 Mean Score of Empathy Factor per Incidences of Cooperation During Experiment.

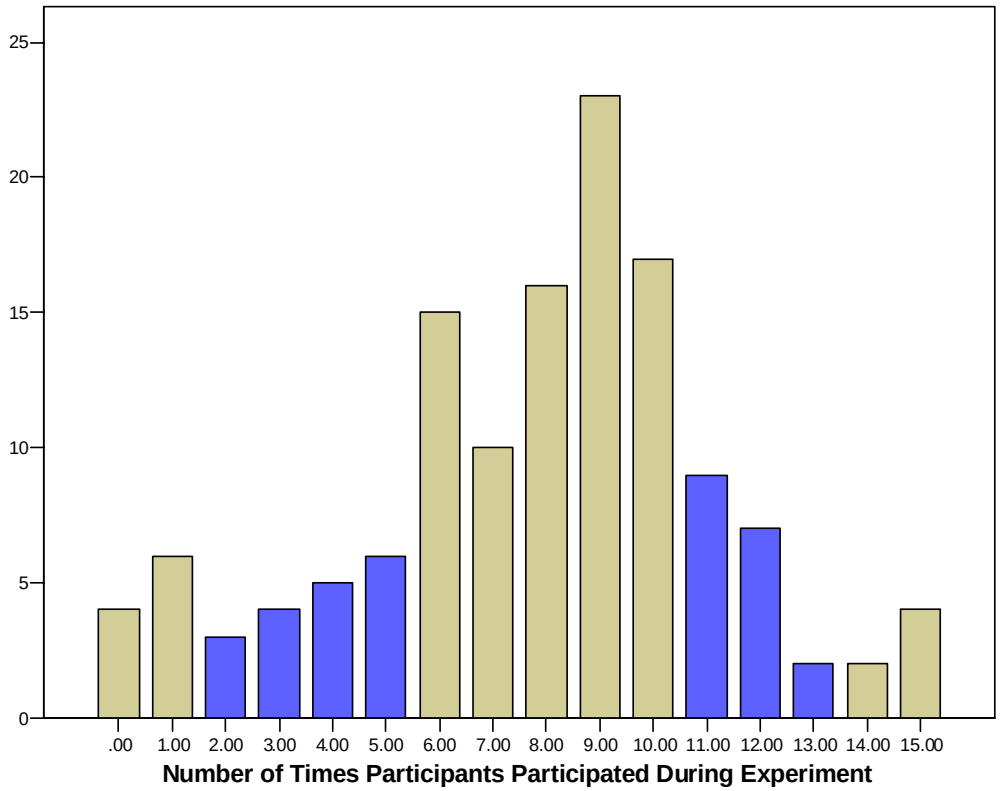

Figure 3 Number of Participants per Incidences of Cooperation with bimodal areas of high empathy darkened. Y-axis is number of participants.

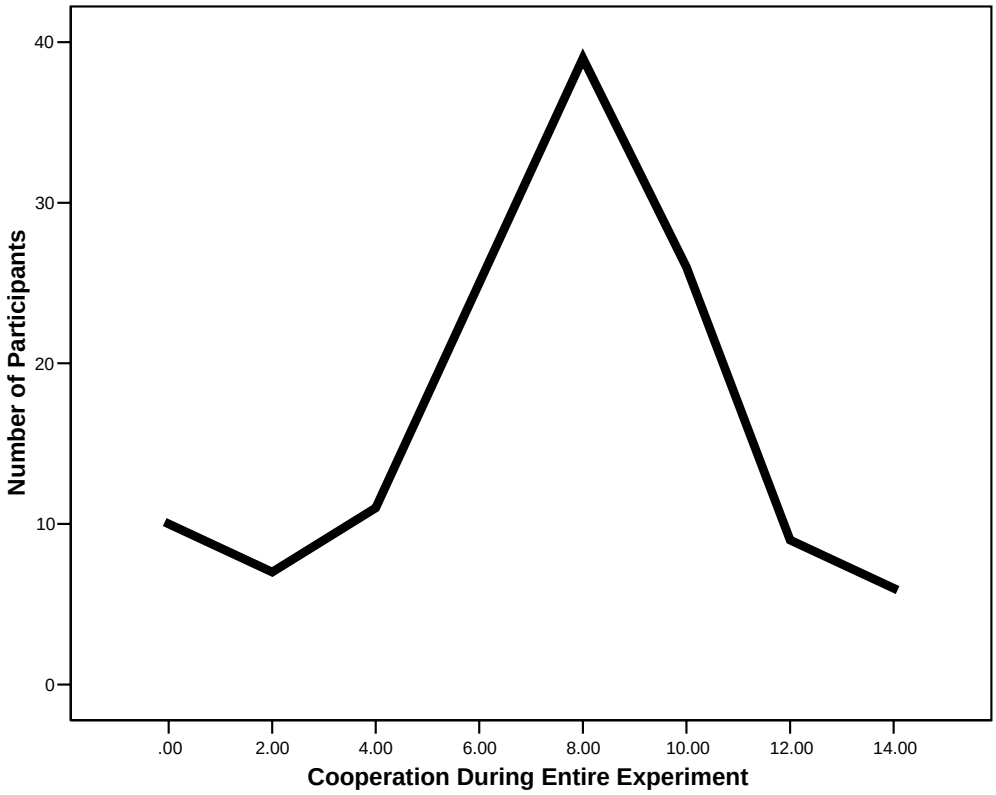

Figure 4 Number of Participants per Incidence of Cooperation During the Entire Experiment.

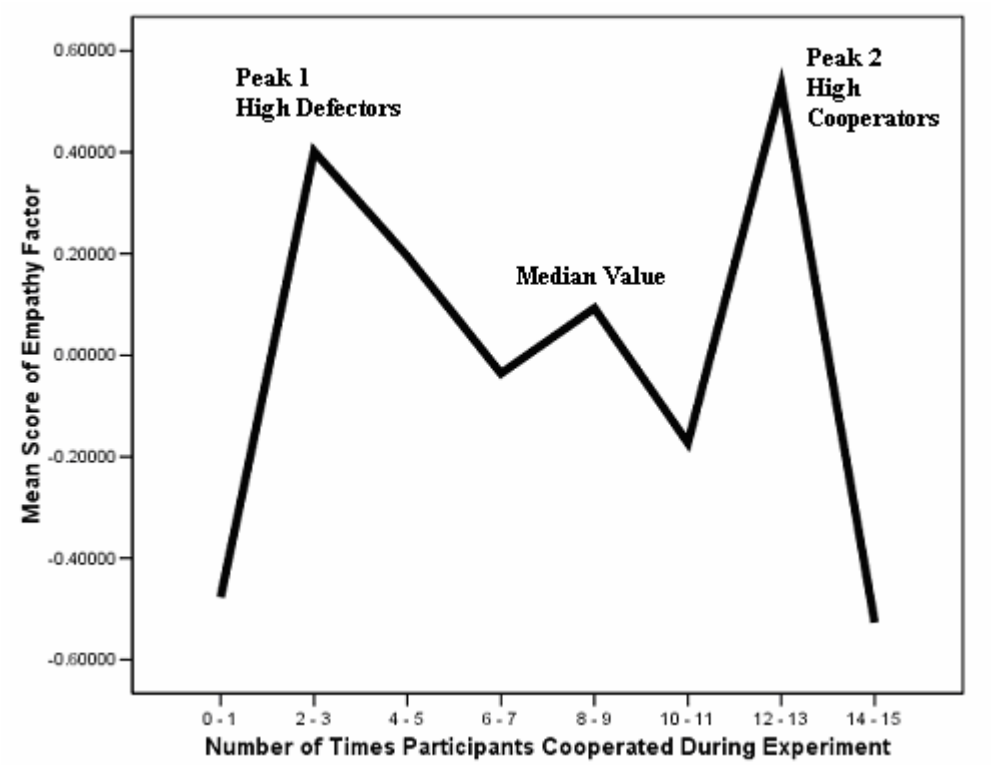

Figure 5 Mean Score of Empathy per Incidence of Cooperation During Entire Experiment. Each data point represents the mean value of the two incidences of cooperation indicated on the X-axis.

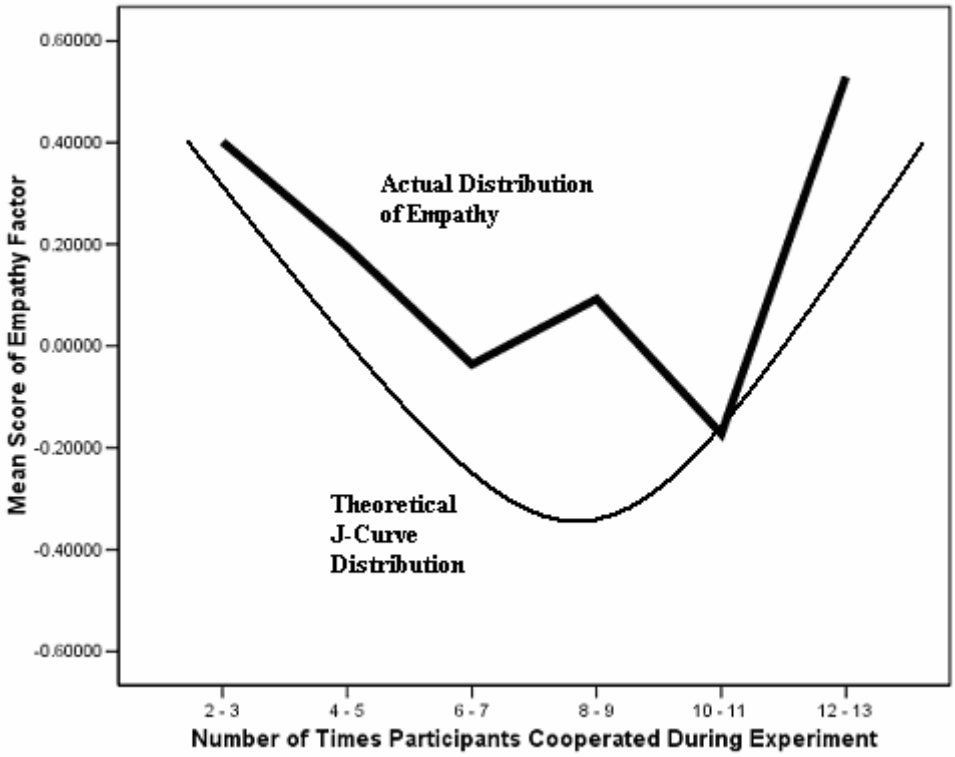

Figure 6 Mean Score of Empathy per Incidence of Cooperation During Entire Experiment. Each data point represents the mean value of the two incidences of cooperation indicated on the X-axis. No cooperation and one cooperative decision, as well as complete cooperation and fourteen cooperative decisions were removed from the graph in order isolate J-curve phenomenon.

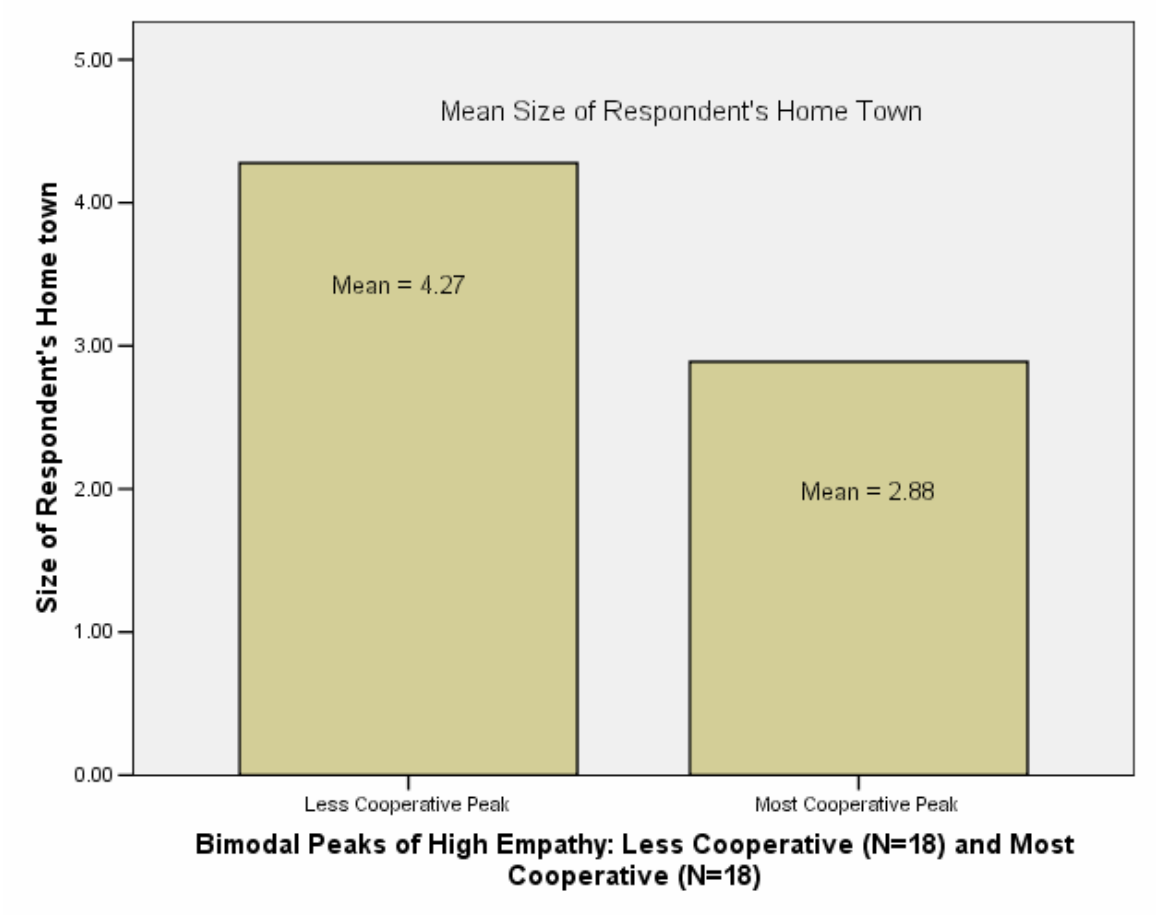

Figure 7 Difference of Means Test Comparing Size of Home Town for Participants Falling into the "Less Cooperative Empathy" Peak and those in the "Most Cooperative Empathy" Peak. Where, 1= Rural Area; 2= Village (Population of Less Than 1,000); 3= Town (From 1,000 to 10,000); 4= City (10,000 – 100,000); 5= Large City (Great than 100,000). Mean for Entire Sample: 3.73 (N=133).

Bimodal Empathy Peaks (N=36)

$t = 3.32$, $p < .01$

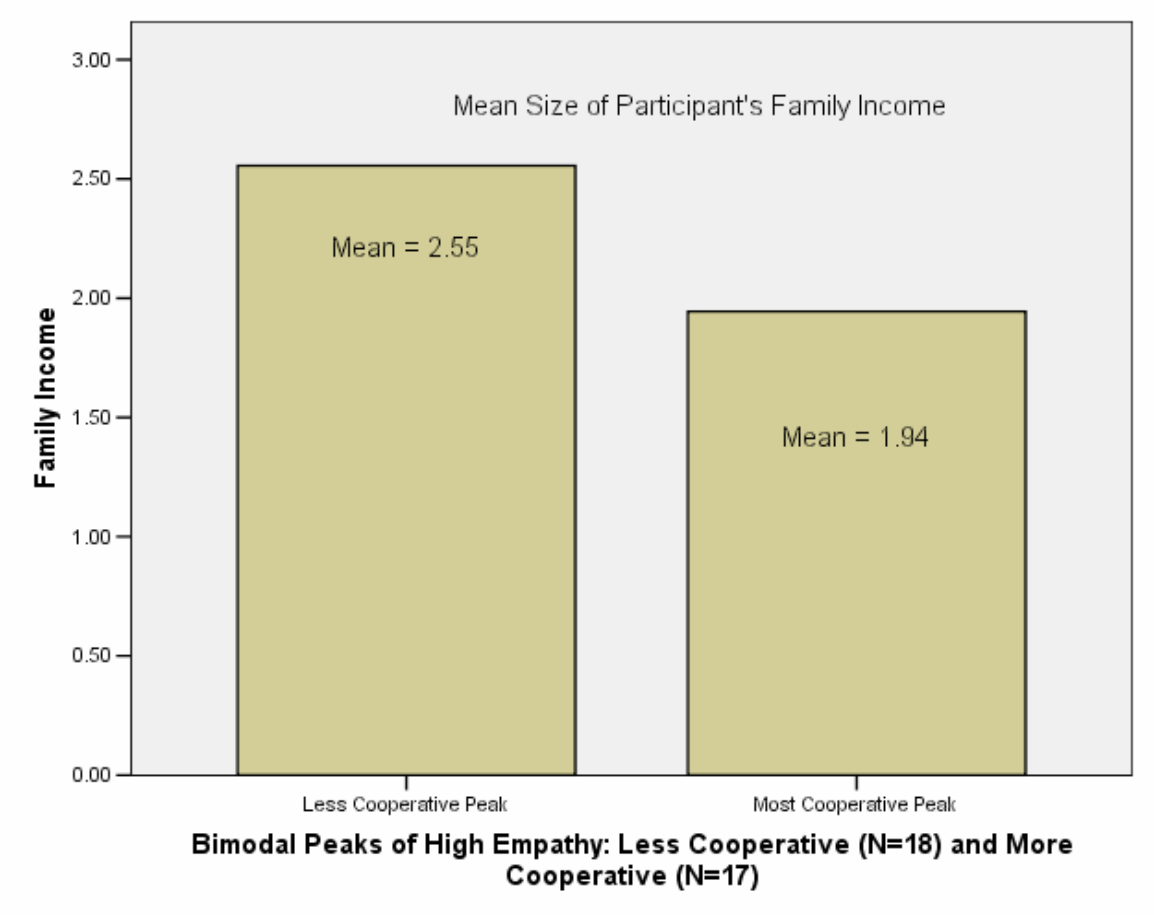

Figure 8 Difference of Means Test Comparing Size of Family Income for Participants Falling into the "Less Cooperative Empathy" Peak and those in the "Most Cooperative Empathy" Peak. Where, 1= Less than $40,000; 2=$40,000 - $80,000; 3=$80,000 - $120,000; 4= Greater than $120,000. Mean for Entire Sample: 2.32 (N=133).

Bimodal Empathy Peaks (N=36)

t = 1.908, p < .10

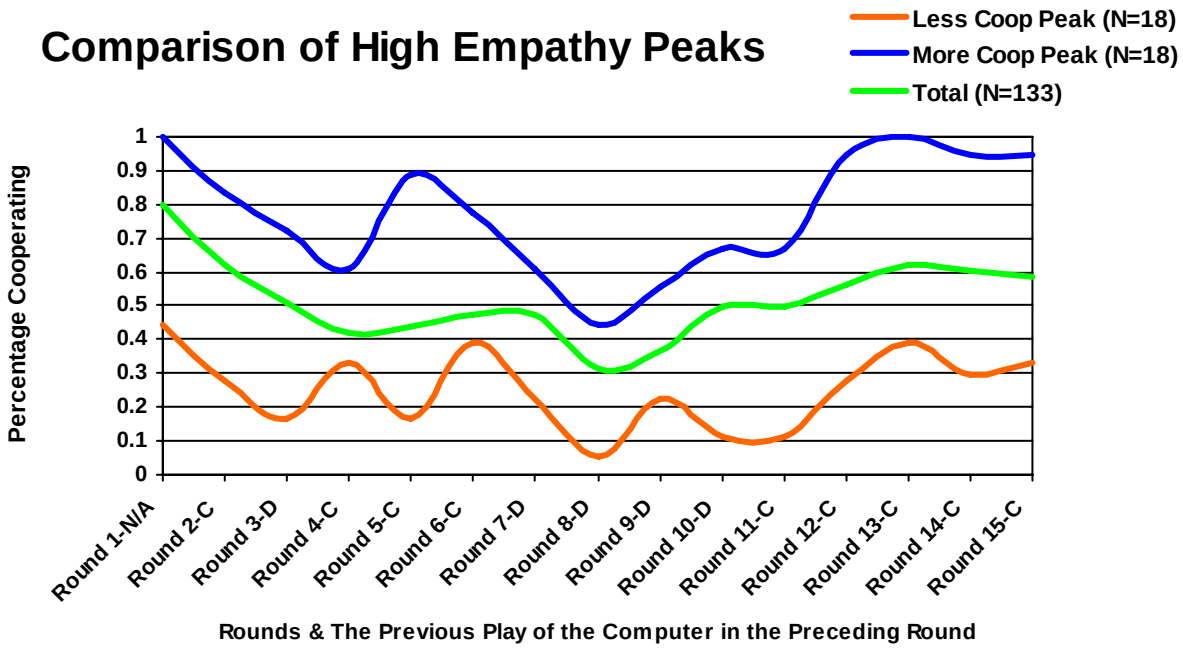

Chart 1 Comparison of Percentage Cooperating in Each Round Between High Empathy Peaks and Total. Y-axis: Percent of group cooperating per round. X-axis: Round and the Previous Play of the computer in the preceding round, C=Cooperation & D=Defection.