An Experiment Investigating the Effect of Anonymity on the Likelihood of Cooperation

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Abstract
This experiment is an investigation on the effect of anonymity on the likelihood of cooperation in a game among peers where each individual tries to earn maximum points. The research seeks to find whether knowledge of one's partner's identity influences the frequency of cooperation with the partner in a game situation called the Prisoner's Dilemma. The research hypothesis states that anonymous parents will cooperate less frequently than players who know their partners. The design uses independent known-partner and anonymous-partner samples. The independent variable was the anonymity of the partners; the dependent variable was the number of times that players cooperated. Participants were English-speaking teenagers who were a sample of opportunity. Our results supported the research hypothesis in that much less cooperation was seen in the anonymous-partner sample than in the known-partner sample. Using the Chi Squared test, we found that, with a 99.5% level of confidence, our results are significant. Players who know each other are significantly more likely to cooperate with each other, while anonymous players are significantly more likely to defect from each other in trying to earn maximum points. This implies that social interaction increases chances of cooperation in situation outside of the game. The results suggest that conflicts can be prevented by increasing social interaction between opposing groups and thus decreasing distrust between competing or conflicting parties.

Introduction

The "Prisoner's Dilemma" is a situation in which one must choose to cooperate with or defect from a partner without knowing that partner's similar decision. In a hypothetical situation, two individuals are captured by the police and interrogated about the extent of a crime the police know the) have committed. The two are interrogated in separate rooms, and both are told that by confessing the actions of their partner (defecting), they will be granted freedom while their partner will receive a very severe sentence. Should both choose to defect, however, both will receive a fairly severe sentence. If neither confesses, both will receive a light sentence. Thus, for the individual, it is best to defect granted that the other person does not. However, if both defect, both will be punished more severely than if both cooperate. A more specific payoff matrix can be found in appendix i.

Robert Axelrod became interested in the Prisoner's Dilemma as a way of observing the evolution of cooperation. He found the situation was often mirrored in international politics and resembled the threat of nuclear war, where each party concerned must try to predict the actions of the other. He proposed the idea of conducting a game made of a series of Prisoner's Dilemma situations to find what the most effective strategy for winning points in the long run is, and to observe how cooperation intrinsically develops between two partners (Axelrod). In 1979, his computerized testing of different strategies showed that the best strategy to maximize self-profit was the 'Tit for Tat' strategy: the player cooperates during the first round, and on all subsequent rounds acts as his partner did on the previous round. Axelrod then developed a mathematical analysis showing how reciprocal mutual cooperation (as seen in the 'Tit for Tat' strategy) emerges in a population of self-serving individuals.

Axelrod's theory was tested only in a situation where the competing partners are computerized - they consider only the mathematical benefit of each situation. In true social situations, variables like fear of the partner or social hierarchy may playa part in the decisions individuals make. Seyfarth and Cheney (1984) looked at mutual reciprocity in grooming among female vervet monkeys. They found that monkeys are likely to groom an unrelated monkey if that monkey has groomed them in the recent past (Seyfarth). Noe (1990) suggests, however, that hierarchical rank and other conflicting variables (such as reciprocity for one type of behavior by another type of behavior) make it difficult to quantify costs and benefits in nature the way Axelrod has done (Noe).

Bart Stewart (1998) argues that cooperation is the most rational choice players can make if several conditions are met. One of these is that the players not know the number of times they will be playing, because this may influence their choices to cooperate or defect. Another condition is that the players recognize one another. If interactions where cooperation is possible are repeated with anonymous players, the incentive to cooperate is smaller than if players recognize one another (Stewart). Axelrod calculated that there is a 90% chance that individuals who have interacted in this type of situation before will do so cooperatively again. Thus, players who recognize each other and have interacted socially before should have a higher rate of cooperation than anonymous players.

In this study, the aim is to find whether the incidence of cooperation is greater among partners who have seen each other and recognize each other prior to playing the game than among partners who play anonymously. If this is the case, then Stewart's claim that cooperation evolves naturally among rational individuals who know each other is supported.

Null Hypothesis (Ho): there will be no significant difference in the number of times cooperation was chosen among partners who recognize each other and those who play anonymously.

Research Hypothesis (HI): The total number of times individuals choose to cooperate rather than defect will be higher among partners who recognize and know each other before playing than among those who play anonymously.

Method

Design

This experiment required use of independent samples. One group of participants played against partners whom they knew; the other group played against anonymous partners. This was the best design because it prevented learning, which could have influenced the type of tactics the participants used to 'win' the game. Boredom in participants was thus also prevented. The independent variable was the anonymity (or lack thereof) of the partners playing the game. This was a single-blind experiment: the participants did not know the hypothesis but the researchers administering the experiment did. The dependent variable was the amount of times participants chose to cooperate with their partners rather than defect. Informed consent was obtained from participants and they were debriefed after the study.

Participants

Each independent sample had 16 participants. Participants were between the ages of 14-16 and of both genders. All spoke English fluently. Consent was obtained from their parents. The participants were a sample of opportunity - they were all in classes whose teachers had agreed to have students participate. This was done for the convenience of the researchers. Within each sample, groups were allocated through random pairing.

Materials

Standardized instructions for each group (see appendix ii)
Informed consent forms (see appendix iii)
Debriefing notes (see appendix iv)

Procedure

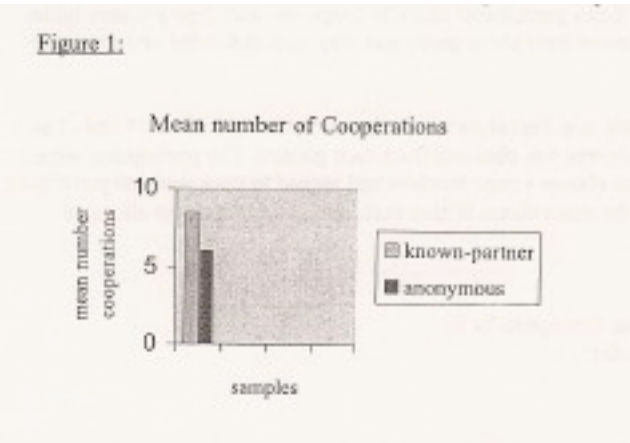
In the first sample, where partners were to know each other; the researchers divided the group of 16 into partners, giving each couple a representative letter. The standardized instructions (appendix ii) were then read and questions addressed. At this point, half of the group accompanied one of the researchers to another room, while their respective partners stayed with the other researcher. All the participants' initial decisions (to defect or cooperate) were collected, and researchers phoned each other to inform each other of the choices within their groups. The decisions were then written in each room on a board (thus, each person would see his partner's decision next to the letter that represented them on the board). This was repeated nine times. While participants recorded their own point-scores, researchers actually recorded only the cooperation and defections during each round. This procedure was repeated with the anonymous sample. The two researchers each randomly selected a group of 8 students from two different classes and gave them representative letters. The students did not know who or where their partners were. Once again, scores after each round were written on the board next to the letter that represented the partners. When communicating by phone researchers identified partners only by the letters given them, and not by name, thus preserving total anonymity. The

participants were debriefed a week later during the classes from which they were initially taken for the experiment.

Results

Raw data may be found in appendix v. In the group with known partners, after 10 rounds of the game the mean number of cooperations per known-partner group was 8.5; the modes were 9 and 10; the median was 9. To three significant digits, the standard deviation was 4.87. In the group with anonymous partners, after 10 rounds of the game the mean number of cooperation per partner-grou1= was 6; the mode was 6; the median was 6. To three significant digits, the standard deviation was 3.24. Figure 1 shows that the mean number of cooperations in the known-partner sample (indicated with purple) is 8.5 and the mean in the anonymous-partner sample (indicated in burgundy) is 6.

Figure I:



To test the significance of the results, a Chi2 test was used (see appendix vi). This was done because the results of the experiment are single-tailed, nominal data. At one degree of freedom for a 0.005 level of significance the result of the chi test must be 7.88. Since our result is 12.538, and consequently higher than 7.88, we can say with a 99.5 % level of confidence that our results are significant and not due to chance. Therefore, we reject the null hypothesis and can support the research hypothesis.

Discussion

Our results show that cooperation is greater in a group of people who know each other before playing a game for points than in a group of anonymous players. Since participants were not exposed to the Prisoner's Dilemma scenario prior to the experiment, they were not able to calculate the best stratagem to use. We can assume that their choices were based less on mathematics than on intuition. It is interesting that those who knew their partners, in trying to guess what choice the partner would make attributed him/her with greater intelligence or kindness than did the anonymous partners. By consistently choosing to defect, those with anonymous partners must have assumed that they would 'fool' their partner, who would choose to cooperate and stay silent every time. However, since their partner thought the same as they, they both chose to defect - and lose - more often than not. In the group with known partners, the partners assumed that their partners would play for the greater good of the partnership and cooperate, and thus each person ultimately earned more points.

Our research seems to support that classmates who are partners in a game show strong mutual reciprocity because they see their partnership as cooperative rather than a belligerently competitive. This is in accordance with Stewart's theory that to achieve maximum mutual reciprocity, players must know each other. As classmates, the members of the known-partner sample had definitely interacted socially with each other previously. This coincides with Seyfarth's observation about likelihood of mutual grooming in female vervet monkeys - those monkeys that had interacted socially previously were more likely to groom each other than those that had not.

This experiment has several limitations. A confounding variable is that in both samples, players were put in a room with other players and results of rounds were written on the board. Thus, while none of the players were in one room with their partners, they were not prohibited from talking to others whose partners were also separated from them. In addition, decisions of action during each round were announced out loud by each individual to the researcher. This lack of discretion could present peer pressure as a strong confounding variable. If Noe's suggestion is correct, then implicit hierarchical rank within the class may influence whether partners defect or cooperate. Stewart lists that like anonymity, knowledge of the total number of rounds of the game could negatively impact cooperation. In our experiment, the number of rounds were announced and reiterated during the game. This may have been a confounding variable because participants may have tried to think of a stratagem that was influenced the number of rounds still remaining. It may be helpful to carry out an experiment in which known-partner and anonymous groups play for an unknown (to them) amount of rounds to see whether results remain significant. Ideally, participants should be picked more carefully. For instance, gender and culture may have an influence on how likely one is to cooperate. To eliminate this, the experiment should be carried out on people of one culture and one gender only. It may be interesting to carry out another study in known-partner groups where the differing variable is gender or culture to observe the effect of these on development of cooperation.

The implication of our findings is that social interaction or contact with others increases chance of cooperation with them in the future. Axelrod was interested in the Prisoner's Dilemma because he found it relevant to international politics and conflict. Our results suggest that any danger of conflict is reduced or at least mediated by social interaction between the opposing groups. The problem, then, is to allow for communication between opposing groups before conflict takes place. Even simple social

interaction may lead to greater cooperation and a lesser degree of violence or selfishness than if these groups stay isolated and interact with others of the same viewpoint only.

To conclude, the experimental hypothesis was supported. Cooperation is more likely to occur among partners playing a game for points if these partners know each other than if they are anonymous.

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Appendix I: Payoff Matrix for Prisoner's Dilemma

Payoff Matrix for Prisoner's Dilemma:

	Defect	Cooperate
Defect	0 0	9 3
Cooperate	3 9	5 5

Instead of the punishments that the prison scenario describes, this matrix uses a point-reward system. I
the range of rewarded points reflects the range of punishments in the prisoner's scenario, so the consequ
defecting or cooperating remains relational to all other choices. Thus the two systems are essentially the
the exception that fear of punishment may add a dimension of anxiety in decision-making that the rewa
does not). The point distribution is written [horizontal vertical). In other words, when one person defects
other cooperates, the defector receives 9 points and the cooperator 3. In defect-defect and cooperate-coop
situations, the same number of points is awarded to each individual.

Appendix ii: Standardized Instructions

The fol1owing standardized instructions were read aloud to the participants:

You and a partner have been arrested for robbing a bank and have been placed in separate isolation ceI1s. You may choose to confess to the crime or to remain silent. If you confess and your partner remains silent you receive 9 points and your partner receives 3. If you remain silent and your partner confesses you receive 3 point and your partner receives 9. If you both remain silent you each receive 5 points. If you both confess you each receive 0 points. Therefore, the best outcome for you as an individual is to confess to the police if you assume that your partner wiI1 remain silent to the police. The best outcome for both of you together is to both remain silent. You and your partner will play this game 10 times. After each round I will communicate with your partner in the other isolation ceI1 via cell phone and you wiI1 be told of the option your partner chose. Your decision the next round may be based upon this. Please keep track of the points you receive during the game.

Appendix iii: Informed Consent Forms

- I have been informed about the nature of the research
- I understand that I have the right to withdraw my child from the research at any time, and that any information/data about him/her win remain confidential.
- My child's anonymity will be protected, as his/her name will not be identifiable.
- The research will be conducted so that my child will not be demeaned in any way.
- My child will be debriefed at the end, and we win have the opportunity to find out the results at a later date

I give my informed consent in allowing my child to participate in this research.

Child's Name:

Date:

Contact Number:

Parental Signature:

Appendix IV: Debriefing Notes

Dear participants,

Thank you for taking part in our experiment. The aim of our research was to find how anonymity of the partners you played against affected the number of times you cooperated in the rounds of the game. As you will recall, every time you played you had a choice to either confess to the 'crime' or to remain silent. Remaining silent was regarded as an act of cooperation with your partner. It was in your interest to confess if you thought your partner would remain silent. But if you both confessed, you would both end up worse off. If you both remained silent, you were cooperating with each other and would receive more points that if both confessed. We were interested in whether you would choose to cooperate or not cooperate more often, depending on which of two groups you were in.

You were either in a group in which you knew who your partner was before playing, or in a group where you were told you had an anonymous partner. Ultimately, we noted the number of times the anonymous group cooperated compared to the total number of cooperations in the group in which all players knew their partners.

Our hypothesis was that in the group were players played against anonymous partners; there would be less total cooperations than in the group with known partners. We felt this would happen because the anonymous group would be more competitive and aggressive toward the partners and see the partners as trying to 'outwit' them. The players that knew their partners would see the game as more of a cooperative one, and, knowing that they would have to face their partner after the game, would not act as harshly and would cooperate more often.

The results strongly supported our hypothesis. In the group where people knew their partners, the average number of times a person chose to cooperate (to remain silent) during ten rounds was 8.5. In the group with anonymous partners, the average number of times that cooperation was chosen was only 6. Thus, cooperation was much more likely to occur in a group where players know their partners before the game.

Thanks again for participating,

Appendix v: Raw Data

C - cooperate D - defect

Known-Partner Group

Group:	A	B	C	D	E	F	G	H
Round 1	*D/D*	*C/D*	*D/D*	*D/D*	*C/C*	*D/C*	*C/C*	*D/D*
Round 2	*D/D*	*C/C*	*D/D*	*D/C*	*D/C*	*D/C*	*C/C*	*D/C*
Round 3	*D/C*	*D/D*	*D/D*	*C/D*	*D/D*	*D/D*	*C/C*	*C/D*
Round 4	*C/D*	*C/D*	*C/D*	*D/D*	*D/C*	*D/C*	*C/C*	*D/C*
Round 5	*D/D*	*C/D*	*D/C*	*D/D*	*D/D*	*C/D*	*C/C*	*C/D*
Round 6	*D/D*	*D/D*	*D/C*	*D/D*	*D/D*	*C/D*	*C/C*	*D/C*
Round 7	*C/D*	*D/C*	*C/D*	*D/D*	*C/C*	*C/C*	*C/C*	*C/D*
Round 8	*C/D*	*C/C*	*D/D*	*D/D*	*C/C*	*C/C*	*C/C*	*D/C*
Round 9	*C/D*	*D/D*	*D/D*	*D/D*	*D/C*	*D/C*	*D/C*	*C/D*
Round 10	*D/D*	*C/D*	*D/D*	*D/D*	*C/D*	*D/D*	*C/C*	*D/C*
Total Cooperations	5	9	4	2	10	10	19	9

Total Cooperations in all groups: 68

Anonymous Group

Group:	A	B	C	D	E	F	G	H
Round 1	*D/C*	*C/C*	*D/D*	*C/C*	*D/C*	*C/C*	*C/C*	*C/D*
Round 2	*C/D*	*D/C*	*D/D*	*D/C*	*C/D*	*D/D*	*D/C*	*C/D*
Round 3	*C/D*	*C/D*	*C/D*	*D/D*	*D/D*	*C/C*	*C/D*	*D/D*
Round 4	*D/C*	*D/D*	*D/D*	*D/D*	*D/C*	*C/C*	*D/C*	*D/D*
Round 5	*D/D*	*D/D*	*D/D*	*D/D*	*C/C*	*D/D*	*D/C*	*D/D*
Round 6	*D/D*	*D/D*	*D/D*	*C/D*	*C/C*	*D/D*	*C/D*	*D/D*
Round 7	*D/C*	*C/D*	*D/D*	*C/D*	*C/D*	*D/C*	*D/D*	*D/D*
Round 8	*D/D*	*C/D*	*D/D*	*C/D*	*D/C*	*C/D*	*D/D*	*D/D*
Round 9	*D/D*	*D/D*	*D/D*	*D/D*	*D/D*	*C/C*	*D/D*	*D/D*
Round 10	*D/D*	*D/D*	*D/D*	*D/D*	*D/C*	*D/D*	*D/D*	*D/D*
Total Cooperations	5	6	1	6	11	10	7	2

Total Cooperations in all groups: 48

Appendix vi: Chi2 Test Calculations

	Cooperation	Defection	Row Total
Anonymous Group	(0) 48 (E) 58	(0)32 (E) 22	80
Known-Partner Group	(0) 68 (E) 58	(0) 12 (E) 22	80
Column Total	116	44	160

E= (row total x column tota1)/samp1e size

Degrees of freedom for these values: (R-1)(C-l)=(2-1)(2-1)= 1 To be significant at 1 degree of freedom, x must be 7.88 or higher.

Cell	0	E	O-E	(0_E)2	(0-E)2/E
1	48	58	-10	100	1.724
2	32	22	10	100	4.545
3	68	58	10	100	1. 724
4	12	22	-10	100	4.545

$X^2=\sum(0-E)^2/E) = 12.538$