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Reciprocation and altruism in social cooperation☆

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ABSTRACT

Altruistic behavior benefits other individuals at a cost to oneself. The purpose of the present experiment was to study altruistic behavior by players (P) in 2-person iterated prisoner's dilemma games in which reciprocation by the other player (OP) was impossible, and this impossibility was clear to P. Altruism by P could not therefore be attributed to expectation of reciprocation. The cost to P of altruistic behavior was constant throughout the study, but the benefit to OP from P's cooperation differed between groups and conditions. Rate of cooperation was higher when benefit to OP was higher. Thus altruism (not attributable to expectation of reciprocation) can be a significant factor in interpersonal relationships as studied in iterated prisoner's dilemma games, and needs to be taken into account in their analysis.

1. Introduction

Prisoner's dilemma (PD) games abound in everyday life. Any situation where the interests of a group run counter to those of each member as an individual is a form of PD. For example, voting costs time and effort. In elections where a single vote is almost surely not going to be decisive, there is no incentive for any individual to vote. But if all of the supporters of a particular candidate do not vote, the group suffers. Giving to charity, overfishing, overhunting, driving to work instead of taking public transportation, recycling, and many other real-life situations are all forms of PD. It is therefore important to know what motivates people to cooperate in these sorts of situations. One answer is that cooperation is strategic—that people cooperate because they expect others to reciprocate in the future ("I will help you so that you help me"). Another answer is that people are to some extent altruistic. That is, benefit to others, in and of itself, is valuable to people. Of course, the possibility of reciprocation may motivate PD-game cooperation in the absence of altruism. But it is not clear whether altruism can motivate PD-game cooperation in the absence of the possibility of reciprocation. The present study investigates this question by eliminating the possibility of reciprocation and measuring cooperation as a function not of reward to participants themselves, but reward to another person.

Players in a 2-player prisoner's dilemma game each choose between "cooperating" and "defecting." Both players may cooperate (in which case each receives a moderately high reward) or both may defect (in which case each receives a moderately low reward). Thus, if both choose identically, both are better off cooperating. However, if one cooperates and the other defects, the cooperator receives a very low reward, and the defector receives a very high reward. A player (P) acting purely selfishly would defect in this game since, regardless of the other player's (OP's) choice, P would earn more by defecting than cooperating. Thus (ignoring reciprocation), cooperation is costly. By cooperating, P loses what he would have obtained if he had chosen otherwise (economists call this an "opportunity cost"). On the other hand, a player acting purely altruistically (that is, with full regard for OP's earnings and none for P's) would cooperate because, regardless of OP's choice, OP would earn more if P cooperated than if P defected. In sum, ignoring reciprocation, a purely selfish P would defect and a purely altruistic P would cooperate in a PD game.

Altruistic acts have been defined, in behavioral terms, as ". . .costly acts that confer economic benefits on other individuals" (Fehr and Fischbacher, 2003). Cooperation in iterated prisoner's dilemma games (IPD), such as those used here and diagrammed in Fig. 1, is altruistic according to this definition. With the specific outcomes shown in Fig. 1 regardless of OP's choice, choice by P of cooperation (green) rather than defection (blue) cost P one unit; this was the case in both Game A (4-3 or 2-1) and Game B (10-9 or 2-1). [Screen items participants saw as green and blue appear in the print version of the figure as light gray and black, respectively.] However, again regardless of OP's choice, cooperation in Game A

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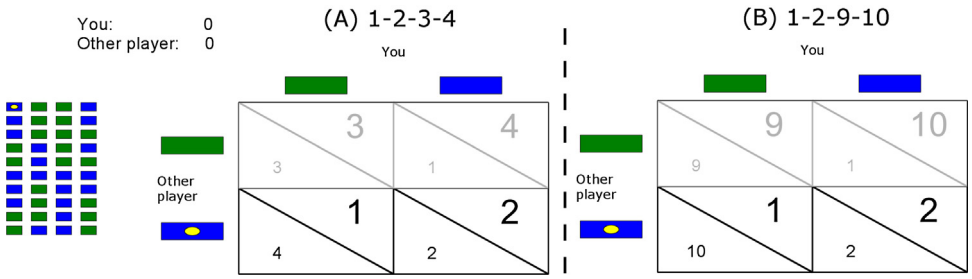

Fig. 1. Payoff matrices for the Partner-Reward groups. The two payoff schedules were presented in the form of matrices where the green (or light gray) blocks represent cooperation and the blue (or black) blocks represent defection. The 1-2-3-4 and 1-2-9-10 reward matrices for the Partner-Reward group are shown, where the large font is the reward to self and the small font is the reward to other player. The No-Partner-Reward group saw a similar matrix, but the spaces for other player's outcome (small font) were left blank.

gave OP two units (3-1 or 4-2) while cooperation in Game B gave OP eight units (9-1 or 10-2). Note that choosing a lower gain for oneself (cooperation) was an economic loss and thus a costly act (e.g., Fehr and Fischbacher, 2003; Safin et al., 2013). If altruism were a factor in these games, participants would be expected to cooperate more in Game B, where OP's gain was higher, than in Game A, where OP's gain was lower.

In prior experiments, Stony Brook students, playing a one-shot 1-2-9-10 PD game (B in Fig. 1) with hypothetical rewards and anonymous OP, indeed cooperated at a higher rate than did those playing the 1-2-3-4 PD game (A in Fig. 1) (Locey et al., 2013); a corresponding result was found for Stony Brook students playing a face-to-face IPD game with real rewards (Safin et al., 2013). However, Safin et al. (2013) found a significant correlation in cooperation rates between partners in the IPD game, which suggests that reciprocation may have played a role in fostering cooperation or defection. The purpose of the present experiment was to eliminate the possibility of reciprocation by OP in an IPD game and to measure cooperation by P solely as a function of its benefit to OP. Because P could not influence OP's choices, strategic cooperation (i.e., to get OP to reciprocate) was removed as a motivating force in this experiment.

Social discounting (Jones and Rachlin, 2006), which proposes that people value rewards to others, but discount them based on social distance, can be measured to quantify the value of the reward to OP relative to the cost (or forgone reward) to P. Eq. (1) (Jones and Rachlin, 2006) expresses the discounted value of a reward to another person (v) as a function of the reward's undiscounted value (V), the social distance to the other person (N), and a constant, k:

$$v = \frac{V}{1 + kN} \tag{1}$$

Given a choice between receiving \$1 and receiving \$0, almost everyone would choose the former. If the offer is modified so the choice is between \$1 to oneself and \$2 to a friend, then the choice is less clear. In both situations one has the option to receive \$1 or receive nothing, but in the second situation one can benefit someone else by forgoing a reward to oneself. Although people may differ vastly in social discount rate (k), given a large enough V relative to v, and a small enough N, nearly everyone will forgo a reward in favor of a greater reward to another person. These prior experiments and others (e.g., Eckel and Grossman, 1996) show clearly that pure altruism (with no possibility of reciprocation) is not uncommon. The present study examines whether this will be the case in an iterated game where reciprocation normally has a very strong effect on behavior (Baker and Rachlin, 2001).

2. Method

2.1. Participants

Participants were 88 undergraduate students at Stony Brook University (52 female). The sample size was based on previous studies (e.g., Safin et al., 2013). They were compensated with course credit and \$5 to \$7 based on performance.

2.2. Materials and procedure

The participants arrived at the laboratory in groups of two, but after signing the consent form, they were taken to separate adjacent rooms. The experiment was administered on a personal computer with a 19" LCD screen and a standard keyboard, which were located in a small private room. Participants were randomly assigned to one of two groups, Partner-Reward and No-Partner-Reward (the control group). In random order, participants in both groups were shown a variation of the payoff matrices shown in Fig. 1 and told that they would be connected online to another participant who was compelled to make predetermined choices. All participants were told that they would be paid 2 cents for every point they earned, but those in the Partner-Reward group (49 total) were also told that the other player would be paid at the same rate. In contrast, the participants in the control group (39 total) were told that the other player did not receive points and would not be paid. Thus, the participants' choices affected the payoff of the other player only if the participant was in the Partner-Reward group, isolating reward to others as a factor in PD game cooperation. The experiment began after the participants were fully instructed on the prisoner's dilemma game task and had an opportunity to ask clarifying questions.

The task was an IPD game except that all of OP's choices were predetermined and revealed to participant as a grid of color-coded rectangles on the side of the screen (Fig. 1). The oval in one rectangle indicated OP's current choice. Thus, unlike the standard IPD, this task had no strategic component: OP could not respond to P's choices. In the Partner-Reward group, both P's and OP's points were updated in real-time on the screen. In the No-Partner-Reward group, OP earned no points so only P's cumulative points were displayed.

All participants completed two conditions of the IPD game, one with the 1-2-3-4 payoff matrix; the other with the 1-2-9-10 payoff matrix. The conditions were presented in random order, and each consisted of 40 trials. The sequence of OP's choices was displayed only for the current 40-trial condition and (unlike Fig. 1) only a single matrix (the currently active one) was shown. Participants were not told in advance that there would be a 40-trial condition with a different payoff matrix after the first. For each condition and