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Short Communication

Patience is a virtue: Cooperative people have lower discount rates

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Abstract

Reciprocal altruism involves foregoing an immediate benefit for the sake of a greater long-term reward. It follows that individuals who exhibit a stronger preference for future over immediate rewards should be more disposed to engage in reciprocal altruism – in other words, 'patient' people should be more cooperative. The present study tested this prediction by investigating whether participants' contributions in a public-good game correlated with their 'discount rate'. The hypothesis was supported: patient people are indeed more cooperative. The paper discusses alternative interpretations of this result, and makes some suggestions for future research.

Keywords: Reciprocal altruism; Public-good game; Discount rate; Patience; Cooperation

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1. Introduction

Evolutionary theory has no problem explaining why organisms are impatient. Other things being equal, the sooner an organism can acquire the resources needed to reproduce the better (Daly & Wilson, 2005). It is a problem, however, for evolutionary theory to explain why organisms are ever 'patient' – that is, why they ever delay consumption of a resource. The solution involves identifying situations in which foregoing an immediate benefit creates a future benefit that is sufficiently large to compensate for the delay.

Reciprocal altruism provides one example of just such a situation. Reciprocal altruism involves foregoing a benefit (or incurring a cost) now – in terms of acting altruistically to benefit another – in order to receive a larger benefit in return at a later date (Axelrod, 1984; Trivers, 1971). For reciprocal altruism to evolve, the returned benefit must not only be greater than the cost, it must be sufficiently great to compensate for the delay (Axelrod, 1984, pp. 12–13, 126–7).

Axelrod used the terms 'discount parameter' or 'discount rate' to refer to the rate at which the objective value of a benefit declines as a function of the delay in its delivery; the same figure – when employed as an 'interest rate' – can be used to calculate the rate at which the value of a benefit must increase over time in order to be 'worth the wait'. Subsequent empirical research into temporal decision-making has used 'discount rate' to refer to the degree to which individuals subjectively discount the value of future rewards as a function of delay in their delivery. Studies have shown that, on average, people have a subjective discount rate of approximately 1% per day – but different individuals on different tasks exhibit "spectacular variation" in discount rates (Frederick, Loewenstein, & O'Donoghue, 2003, p. 14).

Given that individuals differ in the degree to which they value the future, we should expect such differences to be reflected in individual differences in the degree to which individuals engage in reciprocal altruism – in other words, 'patient' people should be more cooperative.

One previous study has indeed found such a relationship (Harris, 2001; Harris & Madden, 2002). Harris found a 0.4 correlation between discount rate and defections in a 40-round, two-player, prisoner's dilemma.

The present study looked at whether a similar effect could be found in a different game: a one-shot, variable contribution, four-player public-good game. In such one-shot games the payoff-maximizing choice is always to defect, or to contribute as little as possible. Nevertheless, people tend to play such games 'as if' they are repeated, and feel that they 'ought' to cooperate, and do so, albeit at a lower level (Ostrom, 1998; Trivers, 2004). Thus the present study provides a more stringent test of the hypothesis that patient people will be more cooperative.

2. Method

The study involved eight public-good game sessions at the Interdisciplinary Experimental Laboratory at Indiana University, Bloomington. Participants ($N = 96$; 56 male, 40 female) were undergraduates from economics and psychology classes who had volunteered their email addresses for inclusion in a participant recruitment database. In each session, twelve participants were randomly assigned into four-player groups. Participants received a US$5.00 show-up fee, and were told that they could earn additional cash by participating in the experiment. An instruc-

tional script was read aloud in each session. The experiment was 'double blind' in that all participants' decisions remained anonymous to both co-participants and to experimenters. No inter-participant communication was allowed, and participants could not identify their own group co-members. Final payments were made by means of numbered mailboxes located in a separate room, thus avoiding any face-to-face interaction between experimenter and participant.

Participants' cooperativeness was measured by their contributions in a standard public-good game. In the game, participants received ten tokens (worth \$0.50 each), any portion of which they could allocate to a 'group account'. These allocations were doubled and redistributed among all four group members, for a marginal per capita return of 0.5. Each player's non-allocated tokens became a part of his or her private earnings. Thus the game met the conditions for a classic free-rider problem: all else being equal, the highest net benefits will go to members who contribute the least, and each member has a private incentive to contribute the minimum. (Specifically, if allocations are multiplied by m and then redistributed equally to all n members, then when $1 < m < n$, each member can produce resources for the group by contributing, but can benefit more personally by free-riding.) Average earnings (including the show-up fee) were \$12.01 for about 40 minutes of participation.

Participants' evaluations of the future were measured using a version of the discount-rate test developed by Kirby and Marakovic (Kirby, 2000; Kirby & Marakovic, 1996). This test consisted of 21 questions of the kind: "Would you prefer \$33 today, or \$41 in 19 days?" The 21 questions, representing ascending discount rates, were presented in random order. Individuals' discount rates are calculated by finding the point at which they switch from choosing the sooner to the later reward. (A lower discount rate indicates greater patience.) To motivate genuine responses, in each session participants were told that one of them would win one of their choices. After the experiment, one answer from one of the answer sheets was selected at random in front of the participants. The selected participant received a voucher, redeemable for cash, for the amount chosen after the delay specified. Participants had to take the voucher to the departmental office in order to receive their reward; this was to ensure that 'transaction costs' were the same across different periods of delay. Average payment was \$36.88 per session. Five participants failed to complete the discount-rate test, and their data were removed from the final results.

3. Results

The results revealed a significant correlation, in the expected direction, between contribution and discount rate.

Overall, the mean contribution to the group account was 4.3 tokens (sd = 3.5). And the mean discount rate was 0.011 (sd = 0.005); in other words, the average participant devalued future rewards at the rate of 1.1% per day. Neither contributions nor discount rates were related to participant sex (Mann–Whitney and t-tests, two-tailed p values > 0.28). And neither contributions nor discount rates were normally distributed; 25% of participants contributed zero tokens, and participants tended to clump at the centre of the range of discount rates (mode = 0.0096). The nonparametric ($r_s = -0.21$) and parametric ($r = -0.27$) correlations between contribution and discount rate were both significant (two-tailed p values < 0.05). (Note that, in contrast to the Harris study, we are correlating contributions, rather than defections, with discount rates.

Hence we expect to find a negative correlation: the higher the contribution, the lower the discount rate.)

Also, discount rates correlated positively with earnings in the game (mean = \$7.01, sd = \$1.72; $r = 0.22$, two-tailed $p < 0.05$; $r_s = 0.16$, two-tailed $p = 0.14$), although the nonparametric correlation falls short of significance. This result is not surprising given that the game is designed such that higher contributions result in lower payoffs, and discount rates are negatively correlated with contributions.

4. Discussion

The results support the prediction that patient people are more cooperative, even in a one-shot public-good game.

The correlation between cooperativeness and discount rate was somewhat weaker than the 0.4 correlation between discount rate and defections that Harris (Harris, 2001; Harris & Madden, 2002) found in a repeated two-player prisoner's dilemma game. While there is reason to think that cooperativeness would have been higher in our game if it too had been repeated, or if anonymity had been reduced (Bateson, Nettle, & Roberts, 2006; Haley & Fessler, 2005), there is no strong theoretical reason for thinking that either of these conditions would affect the correlation between discount rates and contributions.

How should one interpret the correlation between patience and cooperation?

One possibility is that there is a general-purpose, domain-general ability to be patient – also referred to as the ability to 'delay gratification', or to exert 'will power' or 'self-control' – that stands apart from, and exerts an influence over, the mechanisms responsible for reciprocal altruism. Indeed, some theorists have suggested that the evolution of 'patience' preceded, and was a necessary pre-requisite for, the evolution of reciprocal altruism (Stevens & Hauser, 2004).

A second possibility is that there is no general-purpose ability to be patient; rather, there are numerous special-purpose, domain-specific psychological mechanisms (Tooby & Cosmides, 1992) each of which 'discounts the future' at a rate that reflects the different temporal distribution of goods in their respective domain. These various mechanisms might exhibit different discount rates for different goods – such as food, mates, favours, and punishment. If so, then the public-good game may measure cooperativeness (which is regulated in part by the discount rate internal to the mechanisms responsible for reciprocal altruism); and the discount-rate test may assess the discount rate internal to some other set of mechanisms, perhaps those responsible for foraging; and the discount rates of both sets of mechanisms may be correlated because they are influenced by some common third factor, perhaps age, life-expectancy or metabolic rate. In this sense, a person's overall discount rate ('*d*') would be like their general intelligence quotient ('*g*') in being a measure not of some distinct ability or mechanism, but rather an abstract measure that reflects the performance of a range of mechanisms. Incidentally, this domain-specific interpretation of discount rates has the advantage of being able to explain the "spectacular variation" in rates uncovered by experimental economists (Frederick et al., 2003, p. 14).

A third possibility, consistent with the domain-specific account, is that while the public-good game measures cooperativeness, the discount-rate test measures the discount rate internal to the mechanisms responsible for reciprocal altruism. It is possible, after all, that participants are

interpreting discount-rate questions like "Would you prefer $33 today, or $41 in 19 days?" as social exchanges (an immediate cost in return for a future benefit) that vary in terms of the delay of the returned benefit. Indeed, money itself may be interpreted as a form of social exchange – as Richard Dawkins has put it, money is a "formal token of delayed reciprocal altruism" (Dawkins, 1976, p. 188) – thus the discount rate exhibited for money may be the same as the discount rate exhibited for future cooperative interactions. If so, then the reported correlation is a measure of the relative importance of an internal regulatory variable – the evaluation of the future – to the decision to cooperate.

Further theoretical and empirical work – perhaps involving systematic variation in the 'currency' in which the discount rates are measured – will be needed to help decide between these alternatives.

5. Conclusion

The present study demonstrated that patience is a virtue, in the sense that participants who cooperated by contributing more to the public-good exhibited lower discount rates. The study also brought to light a series of deeper issues that have to do with the mechanisms responsible for decisions over time and the nature of patience.

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