Article

Group Processes & Intergroup Relations
G P I R

Cooperation through competition: Conspicuous contributions as costly signals in public goods

Group Processes and Intergroup Relations
XX(X) 1–11

DOI: 10.1177/1368430209342258
http://gpi.sagepub.com
SAGE

Mark Van Vugt[1] and Charlotte L. Hardy[2]

Abstract

Why do people persistently contribute to public goods and does it matter to them if their donation makes a difference? A costly signalling perspective suggests that donors might be more concerned about their reputation than the utility of their helping act. We report data on two step-level public goods experiments. We find that in public (vs. private) conditions, contributions go up even when the public good is already provided (Experiment 1) or is unattainable (Experiment 2). Furthermore, these conspicuous donations appear to enhance the status and prestige of the donor because they signal some hidden quality. This research suggests that a public good contribution can be a self-presentation strategy and that the benefits of these contributions to society are sometimes of secondary importance.

Keywords

competitive altruism, conspicuous cooperation, costly signalling, public goods, reputations, self-presentation, social dilemmas

Charitable donations to noble causes such as public broadcasting, child support, animal welfare, and the environment are common in our society (Van Vugt, Snyder, Tyler, & Biel, 2000). Does it actually matter to potential donors if their contribution makes a difference? This seems like an odd question to ask. Many economic and social psychological models assume that people will be more likely to contribute if it matters in achieving the good (Kerr, 1989; Olson, 1965). Yet a real-life example may suggest otherwise. After the 2005 Asian tsunami disaster, for instance, several charities (such as Médecins Sans Frontières) were so overwhelmed with pledges of financial help that they publicly announced that any extra money could not be used. Yet many people continued to give money. People also regularly vote in elections, sign petitions, and make contributions to save the global environment knowing very well that their personal contribution is most probably wasted (Andreoni, 1995).

[1] VU University, Amsterdam, the Netherlands
[2] University of Kent, UK

Corresponding author:
Mark Van Vugt, Psychology Department,
VU University, Amsterdam, the Netherlands
[email: m.van.vugt@psy.vu.nl]

Here we entertain the possibility that a public good contribution might be a self-presentation strategy.[1] Even if people realize that their donation is probably wasted, it might still pay to give because doing so will benefit their reputation. How do people know that their contribution makes no difference? Although this might be harder to establish in the real world, in our experiments, people decide whether to contribute to a step-level public good when it is either already provided by others (Experiment 1) or cannot be provided at all (Experiment 2). Our main hypothesis is that when people can gain a positive reputation—when donations are public—they are more likely to make a conspicuous contribution.

Costly signalling in public goods

We view public good contributions through the lens of costly-signalling theory. The concept of costly signalling was first developed in the field of animal behavior (Zahavi & Zahavi, 1997) although there have been parallel developments in economics (Spence, 1973). Costly signalling theory (CST) has attracted much attention recently in the anthropological and psychological literature to explain human phenomena (Griskevicius et al., 2007; Hardy & Van Vugt, 2006; McAndrew, 2002; Miller, 2000). CST posits that certain traits and behaviors of organisms have a signalling function as they convey important information about the organism to relevant others. According to the theory, the costlier a particular trait, the more reliable the signal which is why such traits are sometimes referred to in terms of *handicaps*.

A classic example from the animal world is the peacock's tail. There are substantial costs associated with growing and nourishing such an ornament which means that only healthy males can afford to bear these costs—the tail is a handicap because it restricts the peacock's movements and makes it vulnerable to predator attacks. The tail thus provides reliable information about the health status of the individual and this information is used by peacock hens to select mates.

In a similar vein, evolutionary-minded anthropologists and psychologists have recently proposed that certain conspicuous displays in humans such as the purchase of luxury goods, expensive gift-giving, and delivering artistic performances such as music and dance classify as handicaps (Bliege Bird & Smith, 2005; Griskevicius et al., 2007; Miller, 2000). Because these acts are costly, they reveal honest information about the underlying qualities of the actors and this information is being used to select allies, group members, and sexual mates. Our main argument here is that under the right conditions a conspicuous public good contribution can also be interpreted as a handicap.

Public goods

There is a rich tradition of public goods research in psychology, economics, and political science. Decades of research have identified many proximal factors promoting cooperation, including rewards and punishments, social norms, communication, social values, and social identities (Andreoni, 1995; Kerr & Tindale, 2004; Komorita & Parks, 1994). Social scientists have recently shown an interest in the ultimate, evolutionary causes of cooperation. Evolutionary-minded social scientists have come up with several viable accounts such as kin selection theory (Hamilton, 1964) and reciprocal altruism theory (Trivers, 1971). Yet these theories have limited applicability to situations in which humans help strangers or contribute to large-scale public goods (Van Vugt & Van Lange, 2006).

CST is one of several theories that offer an ultimate explanation for such conspicuous helping acts.[2] Following the logic of CST, a public good contribution may convey important and reliable information about the giver's qualities as a potential interaction partner, group member, or even sexual mate. Here is how it works. In a social environment in which individuals can choose who they form alliances with for different purposes (cooperation, mating), they might prefer to interact with people who have a reputation for being generous. In turn, this creates pressures on individuals

to be seen as generous or, at least, more generous than others. An obvious way to establish a positive social reputation is through helping others or contributing to valued public goods, and the more generous the better—hence this phenomenon has been described as *competitive altruism* (Roberts, 1998; Van Vugt, Roberts, & Hardy, 2007).

Public goods may offer an excellent platform to advertise one's qualities because such goods are costly to provide (which means that only people with the right qualities can afford to invest in them) yet they are extremely valuable (which means that there is a large audience interested in the signal; Van Vugt et al., 2007).

This reputation-based account of public good giving is consistent with various empirical findings. For instance, people contribute more when they are identifiable, accountable and high in self-monitoring (De Cremer, Snyder, & De Witte, 2001; Fox & Guyer, 1978; Hardy & Van Vugt, 2006; Jerdee & Rosen, 1974). Even a pair of artificial eyes displayed on the computer screen or on a donation box increases contributions (Bateson, Nettle, & Roberts, 2006; Haley & Fessler, 2005).

Conspicuous contributions

CST explains why potential donors might be more worried about the reputation benefits associated with their contribution than the produced benefits to others. According to CST, as long as someone's contribution reflects accurate information about the important qualities they possess such as their kindness, wealth, resourcefulness or intelligence, they will be less concerned about the impact of their contribution on the attainment of the public good. Paradoxically, a conspicuous wasteful contribution could benefit someone's reputation even more. If a contribution is critical in providing a public good—such as in a step-level good—the donation might be perceived as entirely selfishly motivated. After all, when givers profit personally from the good they help to create, they have a personal incentive to contribute (Kerr, 1989; Olson, 1965). Therefore, this might not be interpreted as a reliable signal of a person's generosity or resources because any rational individual would be expected to contribute under those circumstances. Yet when a person is essentially wasting their resources on a public good that is unattainable—paradoxically—this provides more reliable information about their underlying qualities. Thus, a counterintuitive implication is that people are perhaps extra motivated to contribute to public goods and charities that already have sufficient support (as in the example of the 2005 Asian tsunami relief fund) or are unlikely to be secured (as in tackling global warming), provided that these contributions are public rather than private.

A well-known ethnographic example of such conspicuous displays is the famous potlatch (Bliege Bird & Smith, 2005). The potlatch is a cultural practice among tribes of the North Pacific Coast of North America where chiefs organize parties where they give away huge numbers of items such as food, blankets, and ornaments. They are not interested in whether or not these goods are useful to recipients—sometimes these goods are even burnt—but in the prestige gains associated with these "showing off" displays of wealth. The more lavish the potlatch and the higher the value of the goods given away (or burnt), the greater the prestige of the chief. This prestige enables them to forge useful future alliances with other chiefs. Potlatches and other excessive public charitable displays suddenly begin to make sense when they are viewed as self-presentation strategies (DePaulo, 1992).

Method

To test these ideas we designed two experiments whereby we contrasted a condition in which someone's contribution was critical to the attainment of a public good with a condition in which this contribution was essentially redundant. In the first experiment, we examine a situation in which a public good has already been provided by other group members. In the second experiment, we compare conditions in which the step level of the good is either attainable or unattainable with the cumulative endowments of the group members.

We tested several hypotheses. First, consistent with other studies, it is predicted that public good contributions are overall higher in a reputation environment, thus when people's decisions are public (Hypothesis 1). More importantly, we expect that when their reputation is at stake, many people will still contribute even in conditions in which the good cannot be provided (Hypothesis 2). Finally, we predict that such conspicuous contributions increase the prestige of the donors disproportionally (Hypothesis 3) because it is a more reliable signal of someone's hidden qualities such as their kindness, resourcefulness or intelligence.

Experiment 1

Procedures and materials

We tested the first two predictions with 86 students from the University of Kent (70 women and 16 men; mean age 21.0 years), using a 2 (public good provided vs. not provided) x 2 (reputation vs. no reputation) between participants design. Each player signed up individually for a specific time slot to come to the laboratory and participate in an experimental session (there were five sessions each with up to 20 players). Upon arrival, participants were told that they were the third member of a three-person group and were given a group and participant number. We explained that the other two members of their group had attended a previous experimental session, and, supposedly, already made their game decision. (It was necessary to use this deception to ensure that the participant was exposed to a situation in which the other members of their group had either previously provided the good or not.)

Each participant received information about the public goods dilemma. At the start of the session, each received an endowment of £1 (approximately $2), any amount (0–100 pence) could be invested in a private fund or group fund. If the sum of contributions exceeded the step level, then each person would earn a £1.50 bonus, which was added to the amount in their private fund. If the sum was lower, then each person would receive their private fund earnings. Participants received written instructions about the step-level game and various outcome scenarios to illustrate the game pay-offs.[3]

Information about the step level was varied. All participants were told that the computer had randomly determined the step level for each group at the start of the experiment (the step level was anywhere between £0.50 and £4). For half of the participants, the step level had been fixed at £1.50. For the other half, the step level had been set at £2. Each person then received written information that the other two members of their group (who had attended a previous experimental session) had contributed £1.55 in total, which meant that in the *first* condition the good had been provided, whereas in the *second* the good had not been provided; however, the participant could provide it for their group (i.e., by contributing at least 45 pence).

They also received instructions about whether their decision would be anonymous or not. The "no reputation" condition read: "Your decisions in the game are anonymous. After this game you will play another monetary game with some of the players in this session." The "reputation" condition read: "Your decisions in this game will be revealed to the other individuals in this session. After this game you will play another monetary game with some of the players in this session."

All participants then played the game once. After answering several questions about the experiment, they received a debriefing. In the debriefing there were no suspicions raised regarding the experimental procedure. We asked various procedural questions (e.g., "Did you like the other players in your team?", "Did you think the feedback was genuine?"), but none of the participants openly expressed any doubts about this procedure. Afterwards, participants were debriefed, paid and dismissed.

Results and discussion

All the results are collapsed across sex, because on initial exploration of the data no significant sex differences emerged. There was a general trend for participants in the reputation condition to invest

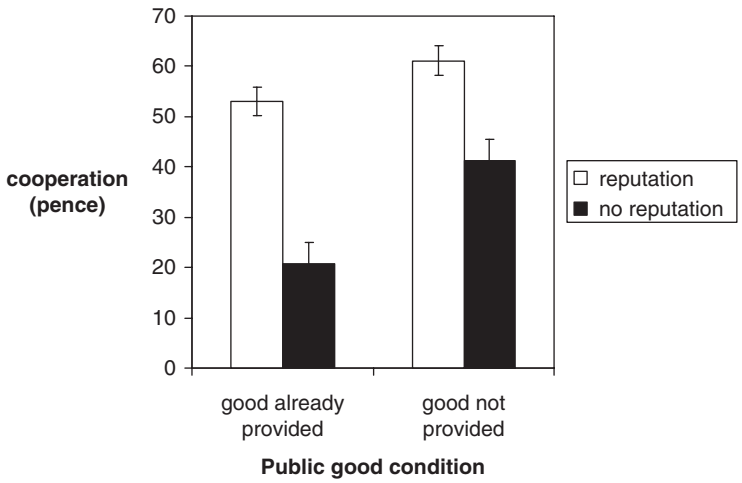

Figure 1. Mean amount (in pence) contributed to group fund in "Good provided" and "Good not provided" conditions (Experiment 1).
Note: Error bars: +/− 1 *SE*.

more in the group fund and there was also an effect of public good on the contribution (Figure 1). We employed a univariate analysis of variance (ANOVA) to analyse the contributions in each of the conditions, following a 2 (public good) x 2 (reputation) between participant design. This revealed a significant interaction between public good and reputation, $F(1, 82) = 5.94$, $p < .05$, $\eta^2 = .07$, which qualified the two significant main effects, respectively for public good, $F(1, 82) = 31.70$, $p < .001$, $\eta^2 = .28$, and reputation, $F(1, 82) = 15.08$, $p < .001$, $\eta^2 = .16$. The main effect for reputation showed that contributions were higher in the reputation ($M = 61.16$, $SE = 2.87$) than no reputation conditions ($M = 41.32$, $SE = 4.23$), supporting Hypothesis 1.

Supporting Hypothesis 2, decomposing the public good x reputation interaction revealed that when the good was already provided—when any contribution would be wasted—individuals contributed significantly more in the reputation condition ($M = 53.0$, $SE = 4.01$) than in the no reputation condition ($M = 20.71$, $SE = 5.87$), $F(1, 82) = 20.61$, $p < .01$—although surprisingly in the latter condition 58.1% of people still contributed something. However, when the good was not provided, contributions in the reputation ($M = 69.31$, $SE = 4.08$) and no reputation conditions ($M = 61.92$, $SE = 6.09$) were almost the same, $F(1, 82) = 1.02$, $p = .32$. Another way of looking at these results is that, in the reputation condition, the contribution difference between the public good conditions—in which contributions mattered versus mattered not—was significantly smaller (*Mdiff* = 16.31), $F(1, 82) = 8.56$, $p < .01$ than in the no reputation condition (*Mdiff* = 41.21), $F(1, 82) = 21.09$, $p < .001$.

These findings show that in a reputation environment people wasted, on average, more than 50% of their endowment on a public good already provided by others. We wanted to conceptually replicate this finding in a second experiment in which we also added status perceptions of the givers to test our third hypothesis.

Experiment 2

Procedure and materials

This was conducted with 72 students from the University of Kent (61 women and 11 men; median

age of 21.5 years) who participated in a step-level public goods game—much like the first experiment. There were two experimental sessions. To test our hypotheses, we used a 2 (public good attainable vs. unattainable) x 2 (reputation vs. no reputation) between participants design. Upon arrival in a large laboratory room, each player received a unique number and was then randomly assigned to a three-person group with the help of a random number generator. As in the previous study, each player received a £1 endowment to invest either in the group fund or the private fund.

The reputation manipulation was the same as in Study 1—people's contribution was either anonymous or revealed publicly—but the public good conditions differed. Similar to the first experiment, the computer randomly decided the step level for each group, which could be anywhere between £0.50 and £4 (any step level over £3 would just be "bad luck"). In the "Good attainable" condition, the step level was fixed at £1.50. In the "Good not attainable" condition, the step level was set at £3.50—this meant it was beyond the reach of the group. The remainder was identical to the first experiment.

Before being debriefed, each participant completed three questions measuring the status/prestige of each group member (including themselves), on 7-point scales, ranging from low (1) to high (7): "Please rate each member of your group (yourself included), according to your perception of their *status* within the group?"; "… your respect for them …" and "… their influence on the group ….". After this, the experiment finished and participants were carefully debriefed and paid out what they earned.

Results and discussion

Contributions As in the first experiment, the results presented are collapsed across sex. We employed a univariate analysis of variance (ANOVA) to analyse people's contribution in a 2 (public good) x 2 (reputation) design. This revealed three significant effects, two main effects and an interaction. A significant public good x reputation interaction was obtained, $F(1, 68) = 6.10$, $p < .02$, $\eta^2 = .08$, which qualified the main effects for public good, $F(1, 68) = 33.84$, $p < .001$, $\eta^2 = .33$, and reputation, $F(1, 68) = 9.85$, $p < .01$, $\eta^2 = .13$. Hypothesis 1 was supported: contributions were higher in the reputation ($M = 54.58$, $SE = 3.50$) than in the no reputation condition ($M = 36.63$, $SE = 4.53$).

The interaction effect revealed further that contributions to the group fund were affected by reputation only in the condition in which the good was unattainable. When it was *not* attainable, people contributed significantly more to the group fund in the reputation condition ($M = 45.0$, $SE = 5.11$) than in the no reputation condition ($M = 12.92$, $SE = 6.76$), $F(1, 68) = 10.70$, $p < .01$—although in the latter condition 50% of people contributed something. Yet when the good *was* attainable, contributions did not significantly differ between the reputation ($M = 64.17$, $SE = 4.78$) and no reputation ($M = 60.33$, $SE = 6.04$) conditions, $F(1, 68) = .20$, $p = .67$ (see Figure 2). Furthermore, the contribution difference between the two public good conditions (when contributions were critical versus wasted) was considerably smaller in the reputation condition ($Mdiff = 19.17$), $F(1, 68) = 6.62$, $p < .05$, than in the no reputation condition ($Mdiff = 47.41$), $F(1, 67) = 17.41$, $p < .001$.

Status Finally, a factor analysis was conducted on the three status questions which yielded evidence for a single factor model, explaining 75% of item variance. The mean ratings across the three items were used to create a status scale ($\alpha = 0.92$). Across participants, the correlation between contribution and perceived status was positive and significant, $r = .38$, $p < .01$. Split between conditions this correlation was obtained only in the reputation condition (when people knew about each other's contribution), $r = .60$, $p < .001$, but not in the no reputation condition, $r = .05$; $p = .81$, $z = 1.84$, $p < .05$.

A repeated measures ANOVA was conducted with the ranking position of each member in the group (1= highest contributor (hc), 2 = mid

contributor (mc), 3 = lowest contributor (lc)) as the within groups factor, and reputation and public good as between groups factors. There was a significant three-way interaction between position in group, reputation, and public good, $F(2, 40) = 5.53$, $p < .01$, $\eta^2 = .22$, which qualified a significant interaction between position and reputation, $F(2, 40) = 30.94$, $p < .01$, $\eta^2 = .61$, and a main effect for position, $F(2, 40) = 26.34$, $p < .01$, $\eta^2 = .57$.

In the reputation condition, status scores increased the more people contributed to the group fund, $F(2, 19) = 64.32$, $p < .01$ (Status highest contributor: hc$M = 4.95$, $SE = .08$ vs. mc$M = 3.81$, $SE = .11$ vs. lc$M = 3.20$, $SE = .17$). In the no reputation condition, there were no significant differences between the mean status scores for each of the members, $F(2, 19) = .21$, *ns.* (across the two public good conditions: hc$M = 3.78$, $SE = .11$, mc$M = 3.73$, $SE = .14$, lc$M = 3.86$, $SE = .22$).

As predicted in Hypothesis 3, when the good was *not* attainable, the highest contributor per group received significantly more status ($M = 5.41$, $SE = .12$) than when the good was attainable ($M = 4.49$, $SE = .11$), $F(1, 20) = 7.21$ $p < .01$ (see Figure 3).

This experiment provides yet another demonstration of the importance of reputations in eliciting conspicuous public good contributions. In a reputation environment, people wasted, on average, more than 40% of their resources on a public good that simply could not be provided. Furthermore, the highest contributor in the group earned more prestige when the good was unattainable, suggesting an association between status and conspicuous cooperation (Hypothesis 3).

General discussion

Does it matter to potential givers if their contribution makes a difference? Contrary to various theories of public goods, our findings suggest this might not be the case when donations are public. In two studies we examined whether people would be prepared to waste resources on public goods which they were unable to (help) provide. As predicted by costly signalling theory and the competitive altruism hypothesis, our findings show that people engaged in conspicuous contributions when their reputation was at stake. Under public conditions, people's contributions increased even when the public good was

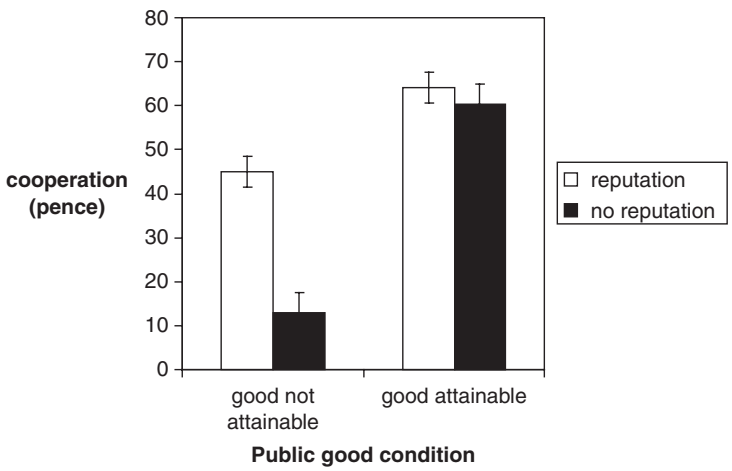

Figure 2. Mean amount (in pence) contributed to group fund in "Good not attainable" and "Good attainable" conditions (Experiment 2).
Note: Error bars: +/− 1 SE.

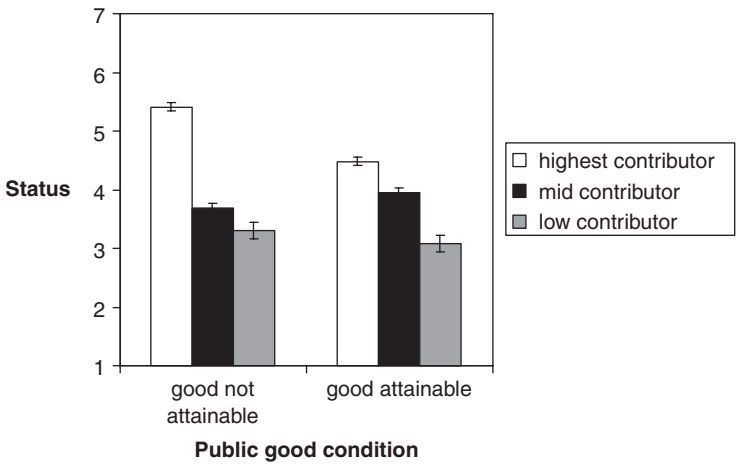

Figure 3. Mean status scores for both goods in reputation condition only (Experiment 2).
Note: The bars depict the status scores for each group member, contingent upon their contribution (ranked from highest to lowest). * = difference between conditions is significant, $p < .01$. Error bars: +/− 1 SE.

already provided (Experiment 1) or could not be provided at all (Experiment 2). Across the two experiments, people wastefully donated on average between 40–50% of their money when they were publicly monitored and those who gave more received greater status. This indicates that people are sometimes more concerned about their reputation than about the efficacy of their helping act. Self-sacrifice is therefore sometimes just self-presentation.

What does a conspicuous contribution signal? One possibility is that it conveys information about a person's kindness and generosity which are very desirable traits in social interaction partners (Van Lange & Kuhlman, 1994). Another possibility is that it signals people's wealth, the argument being that only individuals with considerable resources can afford to be so wasteful. A third explanation is that it provides information about a person's intelligence—intelligent people behave more altruistically in economic games (Millet & Dewitte, 2007). However, we did not collect any personality traits or judgements of the donors, thus this remains an open question.

Conspicuous cooperation has striking similarities with the concept of conspicuous consumption, first introduced by the sociologist Thorstein Veblen ([1899] 1973), stating that people purchase goods for status rather than utility purposes. Similarly, conspicuous helping acts may be primarily driven by prestige needs rather than by the benefits to recipients as indicated by the competitive altruism hypothesis. Anthropologists have documented various examples of excessive public philanthropy in areas such as big-game hunting, funeral ceremonies, and excessive feasts like potlatches (Bliege Bird & Smith, 2005). Such wasteful displays enhance the reputation of the givers (and their families), turning them into attractive coalition partners for future needs. In modern society, examples of wasteful helping can be found in some public displays of charity (such as galas, music concerts, and other charity fund-raising events) where people seem to care more about being noticed than about whether the event makes a difference. Not surprisingly, charity donations go up when sponsors are publicly named (Harbaugh, 1998), a finding that is entirely consistent with CST.

Interestingly, a conspicuous helping act might also be a strategy that men use to impress potential sexual partners. Iredale, Van Vugt and Dunbar (2008) recently obtained evidence that men are more likely to contribute to a public good when

they are being observed by an attractive female. Furthermore, they also find that women find generous men sexually more attractive (Iredale et al., 2008). Griskevicius et al. (2007) found that, when primed with romantic motives, men were motivated to engage in costly heroic helping acts (e.g., jumping into icy water to save the life of a stranger). Finally, Sozou and Seymour (2005) developed a model to show that in facilitating courtship, it is more effective to give an expensive gift with little utility (e.g., a diamond ring) than a useful expensive gift (e.g., a car). The rationale is that an uncommitted partner could simply take the useful gift and "do a runner".

Strengths, limitations, conclusions and implications

Before closing, we should note some potential limitations of our research. The experimental game paradigm has certain limitations. For instance, the amount of money in the experiments was small, with participants receiving endowments of as little as £1. Nevertheless this amount seems to have mattered because if the stakes were deemed trivial, everyone would have given away their entire endowment. Instead group members contributed around 60% of their endowment, and many contributed nothing at all. Furthermore, contribution differences were consistently related to opportunities for self-presentation, suggesting that participants behaved as if the money were valuable to them. Furthermore, the step-level paradigm made it possible to create a situation in which contributions were wasted—which is harder to enact in the real world.

Why did some people still donate in the anonymous condition when their contribution was wasted? Perhaps they responded to subtle reputation cues such as the presence of the experimenter (Haley & Fessler, 2005). Yet others may have been simply confused by the experimental instructions. Andreoni (1995) found that between 10–30% of public good contributions occur because people do not fully understand the game pay-offs. Our baseline contribution rates in the no reputation condition when the good was not attainable (10–20%) were quite similar to Andreoni's results. Needless to say, this argument applies across all conditions, and therefore it cannot explain differences between them.

Our findings are consistent with both social psychological and evolutionary accounts. According to normative models, people help either because they see evidence of other people helping or expect to gain social approval (Cialdini, Kallgren, & Reno, 1991). Perhaps public settings elicit a prescriptive social norm in which making a public good contribution is desirable even if such a contribution appears irrational; however, many people still help, based on either a strong personal conviction or, as we have seen here, to impress others. Reputation-based cooperation might also be greater in groups with highly identifying members as they might be particularly motivated to impress their group mates (De Cremer & Van Vugt, 1999).

Finally, our findings are broadly consistent with evolutionary models of reputation-based cooperation, inspired by costly signalling, such as competitive altruism (Roberts, 1998; Van Vugt et al., 2007) and indirect reciprocity (Milinski, Semmann, Krambeck, & Marotzke, 2006; Nowak & Sigmund, 1998; see note 2). In a social world (such as ours) in which individuals and groups freely select interaction partners, it pays to be seen as kind, generous, intelligent and resourceful. Although our experiments could not examine the long-term benefits, conspicuous cooperators received more prestige in our second study. Anthropological data suggest that in traditional societies such prestige is often paid out in status and reproductive success (Bliege Bird & Smith, 2005) and it remains to be seen whether this applies to modern society.

Finally, our research holds a practical implication. It seems that philanthropy and charity giving can be promoted by encouraging public displays, for example, naming people who give and shaming those who don't. Yet our findings also suggest that people can be easily persuaded to give wastefully to worthless or undeserving causes. Hence, it is important for communities and societies to decide which causes are in need of help, and how much help is needed.

Notes

1. Strategy does not imply a conscious activity. People are often unaware of the reasons for doing certain things and self-sacrifice and helping are probably no exceptions.
2. Other candidates are indirect reciprocity and multi-level selection theories. Indirect reciprocity is perhaps most relevant here, because it argues that there are reputation benefits associated with helping: when A helps B and C observes this, A's reputation goes up, and C is more likely to help A in return. Whereas in indirect reciprocity models, the pay-off of a helping signal is always in cooperation this is not a requirement in costly signalling models. The latter therefore applies to a wider variety of situations.
3. The step-level public good game is a cooperative game with a coordination element. The game has multiple equilibria. For example, in the first study: if players i = 1,2,..,n, v_i denotes the investment of player i (between 0–1), c^* denotes the step level, and b denotes the bonus (£1.50), then pay-off of player i is: $1- v_i$ if $\Sigma v_i < c^*$ or $1-v_i + b$ if $\Sigma v_i \geq c^*$. If $c^* > 1$, there is an equilibrium where $v_i = 0$. If $c^* <$ n, then there are many equilibria where $\Sigma v_i = c^*$.

References

Andreoni, J. (1995). Cooperation in public goods experiments: Kindness or confusion? *American Economic Review*, *85*, 891–904.

Barclay, P. (2004). Trustworthiness and competitive altruism can also solve the "Tragedy of the Commons". *Evolution & Human Behavior*, *25*, 209–220.

Bateson, M., Nettle, D., & Roberts, G. (2006). Cues of being watched enhance cooperation in a real-world setting. *Biology Letters*, *2*, 412–414.

Bliege Bird, R., & Smith, E.A. (2005). Signaling theory, strategic interaction, and symbolic capital. *Current Anthropology*, *46*, 221–248.

Boyd, R., & Richerson, P.J. (1988). The evolution of reciprocity in sizeable groups. *Journal of Theoretical Biology*, *132*, 337–356.

Cialdini, R.B., Kallgren, C.A., & Reno, R.R. (1991). A focus theory of normative conduct. In L. Berkowitz, *Advances in experimental social psychology* (vol. 24, pp. 201–234). New York: Academic Press.

De Cremer, D., Snyder, M., & De Witte, S. (2001). The less I trust the less I contribute (or not)? *European Journal of Social Psychology*, *31*, 93–107.

De Cremer, D., & Van Vugt, M. (1999). Social identification effects in social dilemmas: A transformation of motives. *European Journal of Social Psychology*, *29*, 871–893.

DePaulo, B. M. (1992). Nonverbal behaviour and self-presentation. *Psychological Bulletin*, *111*, 203–243.

Fox, J., & Guyer, M. (1978). Public choice and cooperation in n-person prisoner's dilemma. *Journal of Conflict Resolution*, *22*, 469–481.

Griskevicius, V., Tybur. J.M., Sundie. J.M., Cialdini, R.B., Miller, G. F., & Kenrick, D.T. (2007). Blatant benevolence and conspicuous consumption: When romantic motives elicit strategic costly signals. *Journal of Personality and Social Psychology*, *93*, 85–102.

Haley, K.J., & Fessler, D.M.T. (2005). Nobody's watching? Subtle cues affect generosity in an anonymous economic game. *Evolution and Human Behavior*, *26*, 245–256.

Hamilton, W.D. (1964). The genetical evolution of social behavior, I, II. *Journal of Theoretical Biology*, *7*, 1–52.

Harbaugh, W. (1998). The prestige motive for charitable transfers. *American Economic Review*, *88*, 277–282.

Hardy, C., & Van Vugt, M. (2006). Nice guys finish first: The competitive altruism hypothesis. *Personality and Social Psychology Bulletin*, *32*, 1402–1413.

Iredale, W., van Vugt, M., & Dunbar, R.I.M. (2008). Showing off in humans: Male generosity as mate signal. *Evolutionary Psychology*, *6*, 386–392.

Jerdee, T.H., & Rosen, B. (1974). Effects of opportunity to communicate and visibility of individual decisions on behaviour in the common interest. *Journal of Applied Social Psychology*, *59*, 712–716.

Kerr, N.L. (1989). Illusions of efficacy: The effects of group size on perceived efficacy in social dilemmas. *Journal of Experimental Social Psychology*, *25*, 287–313.

Kerr, N.L., & Tindale, R.S. (2004). Group performance and decision-making. *Annual Review of Psychology*, *55*, 623–655.

Komorita, S. & Parks, C.D. (1994). *Social dilemmas*. Madison, WI: Brown & Benchmark.

McAndrew, F. (2002). New evolutionary perspectives on altruism: Multi-level selection and costly signaling theories. *Current Directions in Psychological Science*, *11*, 79–82.

Milinski, M., Semmann, D., Krambeck, H., & Marotzke, J. (2006). Stabilizing the Earth's climate is not a losing game: Supporting evidence from public goods experiments. *Proceedings of the National Academy of Sciences*, *103*, 3994–3998.

Miller, G. (2001). *The mating mind*. London: Vintage.

Millet, K., & Dewitte, S. (2007). Altruistic behaviour as a general sign of intelligence. *Journal of Research in Personality*, *41*, 316–326.

Nowak, M.A., & Sigmund, K. (1998). Evolution of indirect reciprocity by image scoring. *Nature*, *373*, 573–577.

Olson, M. (1965). *The logic of collective action*. Cambridge, MA: Harvard University Press.

Roberts, G. (1998). Competitive altruism: From reciprocity to the handicap principle. *Proceedings of the Royal Society, London, B*, *265*, 427–431.

Sozou, P.D., & Seymour, R.M. (2005). Costly but worthless gifts facilitate courtship. *Proceedings of the Royal Society, London, B*, *272*, 1877–1884.

Spence, M. (1973). Job market signalling. *Quarterly Journal of Economics*, *87*, 355–374.

Trivers, R. (1971). The evolution of reciprocal altruism. *Quarterly Review of Biology*, *46*, 35–57.

Van Lange, P.A.M., & Kuhlman, D.M. (1994). Social value orientations and impressions of partner's honesty and intelligence: A test of the might versus morality effect. *Journal of Personality and Social Psychology*, *67*, 126–141.

Van Vugt, M., Roberts, G., & Hardy, C. (2007). Competitive altruism: Development of reputation-based cooperation in groups. In R. Dunbar & L. Barrett (Eds.), *Handbook of evolutionary psychology*. Oxford: Oxford University Press.

Van Vugt, M., Snyder, M., Tyler, T., & Biel, A. (2000). *Cooperation in modern society: Promoting the welfare of communities, states, and organizations*. London: Routledge.

Van Vugt, M., & Van Lange, P. (2006). Psychological adaptations for prosocial behaviour: The altruism puzzle. In M. Schaller, D. Kenrick, & J. Simpson (Eds.), *Evolution and social psychology* (pp. 237–261). New York: Psychology Press.

Veblen, T. ([1899] 1973). *The theory of the leisure class*. Boston: Houghton Mifflin.

Zahavi, A., & Zahavi, A. (1997). *The handicap principle: A missing piece of Darwin's puzzle*. Oxford: Oxford University Press.

Biographical notes

MARK VAN VUGT is currently Professor of Psychology at the VU University Amsterdam and has visiting positions at the University of Oxford and Kent. His research publications on group processes and human evolution have appeared in all the major outlets in psychology and he is a regular contributor to the popular science media on issues concerning human evolutionary psychology. He currently serves as Associate Editor for the *Journal of Personality and Social Psychology*.

CHARLOTTE L. HARDY completed her PhD on the psychology of status and public goods at the University of Kent in 2006 under the supervision of the first author. Earlier portions of her PhD research appeared in an article, entitled "Nice guys finish first" in the journal *Personality and Social Psychology Bulletin* in 2006.