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THE SELFISH HERO: A STUDY OF THE INDIVIDUAL BENEFITS OF SELF-SACRIFICIAL PROSOCIAL BEHAVIOR^{1,2,3}

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Summary.—Twenty-four same-sex, three-person groups (a confederate plus two naïve participants) completed a “group decision-making study” in which the success of the group depended upon the willingness of one of its members (the confederate) to endure pain and inconvenience. The ordeal that the altruistic confederate endured was judged to be more difficult and costly than the experience of other group members, and the altruists were ultimately awarded more money and accorded higher status. In a second study, 334 undergraduates read a description of the procedures used in Study 1 and made judgments and monetary allocations to the hypothetical people described in the scenario. The concordance of the data in the two studies support a costly signaling, rather than a reciprocal altruism explanation for such “heroic” behavior.

Altruism has always been a thorny issue for evolutionary theorists; an organism engaging in behavior that comes at a great personal cost and seems to solely benefit other individuals appears difficult for natural selection to explain (McAndrew, 2003). It was not until the introduction of the concept of inclusive fitness, also known as kin selection, by Hamilton (1964) that evolutionists had a satisfactory theoretical framework for discussing altruism. The concept of kin selection, however, cannot account for the many altruistic acts performed for individuals who are not genetic kin. An additional form of altruism, reciprocal altruism (Trivers, 1971), explains why these important and socially necessary behaviors occur so frequently. Reciprocal altruism is when one organism provides a benefit to another organism at a cost to itself because it has received, or is likely to receive, a similar benefit in return from the other organism. Since success at reciprocal altruism depends greatly upon the ability to quickly distinguish those who are cooperators from those who are freeloaders, it is not surprising that people are quite skillful at identifying cheaters (Cosmides & Tooby, 1992, 2008) and that people are hesitant to enter into interpersonal relationships with other individuals who are known to be highly ma-

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nipulative (Wilson, Near, & Miller, 1998). People also seem to be primed to quickly recognize true altruists who will be trustworthy partners in social exchange (Brown & Moore, 2000; Fetchenhauer, Groothuis, & Pradel, 2010; Schug, Matsumoto, Horita, Yamagishi, & Bonnet, 2010).

None of the aforementioned models of altruism, however, explain large philanthropic gifts, heroic self-sacrificial behavior, or handouts to beggars that will never be directly reciprocated. Costly signaling theory (Zahavi, 1977; McAndrew, 2002) attempts to deal with these types of altruistic behavior by proposing that such behaviors are a vehicle for individuals to advertise desirable personal qualities or resources. This may ultimately benefit the altruist by increasing the likelihood that he or she will be chosen as a mate or an ally and may also be a way of positioning oneself for greater access to resources through direct or indirect reciprocation during unforeseen times of need (Zahavi, 1977; Grafen, 1990; Boone, 1998; Roberts, 1998; McAndrew, 2002; Bliege Bird & Smith, 2005; Nowak & Sigmund, 2005). When the altruistic act is performed primarily for the purpose of advertising just how altruistic one is, it is referred to as competitive altruism because the signaler is effectively competing with others who are attempting to establish an altruistic reputation in the eyes of others. The main distinction between competitive altruism and reciprocal altruism is that reciprocal altruism requires that the altruist is reimbursed by individuals who directly benefited from the original altruistic act, whereas costly signaling and competitive altruism can lead to future rewards from individuals who may not have directly benefited from the original act of altruism.

As compelling as this explanation for competitive altruism may seem, there have not yet been enough studies to assess its value. Some experiments have demonstrated that charitable donations and other acts of generosity are indeed more likely to take place when the behavior is easily observed by others (Haley & Fessler, 2005; Bereczkei, Birkas, & Kerekes, 2010), and in a recent study Van Vugt and Hardy (2010) have even shown that people will make wasteful contributions in "public goods" situations, knowing full well that the contribution will not really make a difference, as long as the contribution is publicly observed. They reason that this occurs because the contribution is primarily a self-presentation strategy designed to increase the contributor's status and prestige, with other outcomes of the contribution being less consequential to the donor. Some researchers posit that conspicuous displays of philanthropy and benevolence can be triggered by romantic motives, possibly as a way of advertising prosocial personality traits that might be valued by prospective mates. For males at least, these triggers are most effective if the benevolence takes the form of risky heroism in which the male can display courage and strength

(Griskevicius, Tybur, Sundie, Cialdini, Miller, & Kenrick, 2007). Anthropological studies in traditional hunter-gatherer societies (e.g., Gurven, Allen-Arave, Hill, & Hurtado, 2000; Smith & Bliege Bird, 2000; Sosis, 2000; Smith, Bliege Bird, & Bird, 2003; Bliege Bird & Smith, 2005) provide numerous examples of exaggerated displays of public generosity and food sharing, but they cannot determine if any subsequent advantages enjoyed by the altruists are directly a function of their costly altruism.

Only a few experiments have attempted to experimentally test the outcomes experienced by altruists (i.e., Hardy & Van Vugt, 2006; Bereczkei, *et al.*, 2010; Van Vugt & Hardy, 2010), and each found that people who engage in costly altruistic activities do in fact achieve elevated social status and recognition as a result of public generosity or cooperativeness. However, each of these studies examined individuals behaving in a generous and cooperative manner when sharing financial resources in experimental economic games. Since some studies (Kelly & Dunbar, 2001; Farthing, 2005, 2007) hinted that we may prefer heroic risk takers as mates and friends (especially if the heroic risk takers are males), it may be important to extend these findings to situations that focus on an individual's willingness to take physical and emotional as well as financial risks. Since no experiments have yet addressed this directly, we are still unable to say with great confidence exactly what benefits, if any, eventually come to the person who places him- or herself at this type of disadvantage for others' benefit. Although it may be a stretch to describe the behaviors of the confederates in the current studies as "courageous" or "heroic," this study focused on altruistic behavior in which a person displays a willingness to endure physically painful and potentially embarrassing ordeals for the benefit of the group. One of the goals was to establish a procedure for studying heroic behavior in the laboratory and, given the limitations inherent in this setting, to create a situation that is lifelike and engaging. Furthermore, the goal was to explore the dynamics of heroic behavior in small, same-sex groups with an eye toward assessing differences between male and female groups. Finally, these studies attempted to verify whether tangible benefits do in fact accrue to individuals who endure non-financial costs for the benefit of others. Specifically, it was an attempt to demonstrate experimentally that individuals who perform physically costly altruistic behaviors on behalf of a group will be rewarded with higher social status and a greater share of the group's resources.

In order to examine the outcomes associated with varying amounts of effort and self-sacrifice, Study 1 utilized a laboratory methodology in which groups of three same-sex members engaged in a series of three tasks: one with an essentially clerical function, one which required physical skill, and one which resulted in pain, inconvenience, and embarrass-

ment. This combination of roles resulted in a clear difference among the three group members both in the amount and costliness of the work done on behalf of the group. In an effort to assess whether reciprocal altruism or competitive altruism provides better explanations for effects that accrue to the altruist, a second study was conducted in which uninvolved observers read an account of the experimental situation and rated the three roles in terms of social status and resources they would accord to each group member.

STUDY 1

METHOD

Participants

Forty-eight undergraduate students (24 men, 24 women) participated in this study. Most were enrolled in undergraduate psychology classes at a liberal arts college in the American Midwest and received course credit for participation. Additional participants were recruited through flyers posted around the campus. The design was approved by the institutional review board of Knox College.

Procedure

Participants reported to a laboratory for a study on "Group Decision Making." In each session, there were three same-sex individuals participating as a group. Two of these individuals were naïve participants; one of them was a confederate of the experimenter posing as a naïve participant. The same male confederate participated in all of the male groups, and the same female confederate participated in all of the female groups. The confederates were typical of students at the college in appearance and dress, and they were trained to behave in a consistent manner across all experimental sessions.

The experiment was described as an attempt to study how people in groups organize themselves to carry out problem-solving tasks and how their feelings about each other influence the performance of the group. The participants were told that they would engage in a series of three tasks, and that if the group successfully completed the three tasks, they would receive \$45.00 to divide amongst themselves. They were also told that if the group failed to complete any of the tasks, each group member would receive \$3.00. Before participating in the group exercises, the group had to determine the role that each member would play. From this point on, these roles will be known as the "Astronaut," the "Diver," and the "Pitcher." The assignment of each person to a role was made after the group had been fully informed about the duties required for each role. The group was given 3 min. to discuss the division of labor, and the confeder-

ate always volunteered to be the Diver. The tasks were performed in the same order in all groups, and no communication among the group members between tasks was permitted.

Task one.—The Astronaut was responsible for leading the group in a 12-min. decision-making task based upon the “Lost on the Moon” exercise developed by the National Aeronautics & Space Administration. In this exercise, the participants pretended that they have crash-landed a spacecraft on the lighted side of the moon. Their survival depended upon reaching the mother ship about 200 miles away, and their task was to rank in order of importance 15 salvaged items for their survival. At the conclusion of this exercise, the Astronaut was given 5 min. to write an explanation of the arguments in favor of the top three ranked items. While the Astronaut was nominally the leader in this task, it was very much a group activity and the Astronaut’s responsibilities were essentially clerical.

Task two.—The Diver engaged in a painful cold-stressor test by immersing his/her forearm in a tub of ice for 30 sec., which very quickly produces pain. No communication was permitted between the confederate and the other participants during this time, so as “not to distract the Diver from the pain.” At the conclusion of the 30 sec., the experimenter remarked that “this hurts a lot more than people think it will,” and (to the confederate) “you will probably notice that it hurts even more after you remove your arm from the ice and the blood rushes back into the arm.” These manipulations were employed to emphasize the unpleasantness of the confederate’s task to the other participants.

Task three.—The Pitcher was given 3 min. to hit a target with a ball. The throwing distance of 3 m was marked by a piece of tape on the floor. The Pitcher was given six balls to throw. If all of the balls were used up before the target was hit, the Pitcher had to scramble around the laboratory while the timing clock continued to run, collect the wayward balls, and return to the throwing line before resuming the task. The interesting twist to this task was that hitting the target punctured a large water balloon, which then drenched the Diver who was required to sit underneath it. The apparatus used was a Pitchburst, manufactured by WhirlWhims LLC. The Pitchburst functions like a dunk tank, except that it is portable and uses much less water. The apparatus is quite safe, as the Diver was seated and did not come into contact with anything except water. In this experiment, the Diver had to sit in a chair under the balloon for 3 min. or until the Pitcher successfully hit the target, which all Pitchers in this study eventually did. The Diver always got completely drenched, and the other participants were under the impression that the Diver would have to walk home soaking wet, no matter how cold it might be outside. It was clear that both the Diver and the Pitcher fully understood the nature of their respective responsibilities before they volunteered for these tasks.

At the conclusion of the three tasks, the participants were seated in separate areas of the laboratory where they completed a questionnaire about their experience. Each person rated all of the participants (including him or herself) on seven different items using Likert-type scales anchored by 1: Low and 7: High endorsement of the item. These items measured the perceived importance of each individual's contribution to the group, the willingness to work with each person again in a future experiment, the perceived difficulty and costliness of each person's tasks, the perceived status of each individual, the legitimacy of considering each individual as the leader of the group, and how much the participant liked each person. It was acknowledged by the experimenter that some of the questions seemed a bit silly when being answered about one's self (e.g., how likeable, willingness to work with the person again), but the participants were asked to respond to all of the items. This section also included four filler questions assessing reactions to the experiment.

When all of the participants had completed the first part of the questionnaire, they then turned to a page where they anonymously recorded how the \$45.00 should be divided among the three of them. They were told that they could allocate the money however they wished, with the restrictions that each person had to receive at least \$1.00 and that allocations had to be made in whole dollar amounts. They were told that the amount of money received by each person would be equal to the average of the allocations, rounded to the nearest whole dollar, made to that person by the three group members. It was emphasized, however, that decisions about how the money should be allocated would be kept confidential; each person would know how much he or she received, but would not know exactly how the other participants allocated their money. The confederate's allocation decisions did not enter into the calculation, although the naïve participants did not know this. The amount of money that each of the naïve participants actually received was equal to the average of the allocations made by the two naïve subjects. The confederate was paid \$10.00 for each experimental session.

After the allocation decisions were completed, the confederate and the two participants waited outside of the laboratory while the experimenter calculated their payments and prepared paperwork to be signed when the money was dispersed. During this time, participants interacted and confirmed that the Diver had no hard feelings or ill effects from the experience. Each individual was then brought into the laboratory singly to be paid so that compensation was confidential. It was explained that "the Diver always gets paid last, because he/she has to answer some additional questions and there is no reason to hold everyone else up while this takes place." The real reason was to insure that the naïve participants

would leave the laboratory before the Diver to protect the cover story. All participants were given the opportunity to meet with the experimenter at a later date for complete debriefing.

RESULTS

The first step was to ascertain whether there were any important differences between male and female groups or between Astronauts and Pitchers, as this would dictate subsequent analyses to be performed. A 2×2 multivariate analysis of variance (MANOVA) was conducted with sex (male/female) and group role (Astronaut/Pitcher) as the independent variables. There was no significant multivariate interaction between sex and group role (Wilks $\Lambda = 0.25$, $F_{3,21} = 1.26$, $p > .05$), indicating that males and females responded similarly to playing the roles of Astronaut or Pitcher. There was no significant main effect of sex (Wilks $\Lambda = 0.50$, $F_{3,21} = 0.86$, $p > .05$). Therefore, the data for men and women were combined in subsequent analyses. There was, however, a significant multivariate main effect of one's role in the group (Wilks $\Lambda = 0.25$, $F_{3,21} = 2.64$, $p < .01$, $\eta^2 = 0.75$). An examination of the univariate ANOVAs revealed that this effect was driven by a tendency for participants to perceive the other individual's role as more difficult and important to the success of the group than their own. Specifically, Pitchers perceived the contributions of Astronauts to be significantly more important than did the Astronauts themselves ($M = 6.00$, $SD = 0.83$ vs $M = 4.88$, $SD = 2.11$; $F_{1,47} = 5.71$, $p < .02$, $\eta^2 = 0.13$) and they also perceived the responsibilities of the Astronaut as being more difficult than did Astronauts ($F_{1,47} = 10.47$, $p < .002$; $M = 4.83$, $SD = 1.17$ vs $M = 3.58$, $SD = 1.56$). Conversely, Astronauts perceived the contribution of the Pitcher to be more important than Pitchers did ($F_{1,47} = 17.91$, $p < .0001$; $M = 6.46$, $SD = 0.88$ vs $M = 5.08$, $SD = 1.38$) and thought that the task of the Pitcher was more difficult than did Pitchers ($F_{1,47} = 14.82$, $p < .0001$, $\eta^2 = 0.13$; $M = 5.42$, $SD = 1.40$ vs $M = 3.92$, $SD = 1.53$). There were no other significant univariate effects in this analysis. Since these differences were not pertinent to the hypotheses being tested, and because they occurred similarly for both Astronauts and Pitchers, it was concluded that their responses could be safely combined for subsequent analyses.

The amount of money allocated to each person, the perceived importance of each individual's contribution to group success, the perceived difficulty of each individual's responsibilities, the legitimacy of that person as a group leader, the status of each person, and the perception of the costliness of each individual's behavior were analyzed with single-factor repeated measures ANOVAs and Tukey HSD Tests. A Bonferroni correction indicated that a significance level of .008 was a more conservative and appropriate guide to significance in these analyses. The means and standard deviations for each of these variables are presented in Table

TABLE 1
MEANS AND STANDARD DEVIATIONS FOR JUDGMENTS MADE ABOUT EACH GROUP ROLE IN STUDY 1

Variable	Role					
	Astronaut		Diver		Pitcher	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Money allocated	14.73 ^a	2.85	16.73 ^b	3.55	13.52 ^a	2.81
Importance of contribution	5.44 ^a	1.69	6.31 ^b	1.01	5.77 ^a	1.34
Difficulty of responsibilities	4.21 ^a	1.50	5.79 ^b	1.38	4.67 ^a	1.56
Legitimacy of leadership	5.71 ^a	1.01	5.00 ^b	1.35	5.10 ^b	1.19
Status	4.96 ^a	1.17	5.42 ^b	1.03	5.06 ^a	1.02
Costliness of behavior	3.15 ^a	1.58	6.04 ^b	1.24	3.46 ^a	1.90

Note.—Means with different superscript letters in rows were significantly different at $p < .008$ (Bonferroni-adjusted $p = .05$). Ratings of Likeability and Willingness to Work with individual in future experiments were not included in this table, since the repeated-measures ANOVA was not an appropriate analysis for these variables. All items were rated on a scale with anchors 1: Low and 7: High (4 was neutral).

1. The analyses revealed that Divers received significantly more money than Astronauts and Pitchers ($F_{2,94} = 8.82, p < .0001, \eta_p^2 = 0.16, \text{HSD} = 1.54$), and were thought to have made a more important contribution to the success of the group ($F_{2,94} = 5.74, p < .004, \text{HSD} = 0.63$). The Divers' responsibilities in the experiment were perceived to be significantly more difficult ($F_{2,94} = 14.76, p < .0001, \eta_p^2 = 0.39, \text{HSD} = 0.73$) and their behaviors more costly ($F_{2,94} = 58.91, p < .00001, \eta_p^2 = 0.69, \text{HSD} = 0.71$) as well. There were no significant differences between Pitchers and Astronauts in any of the aforementioned analyses. Although there was a trend for Divers to be perceived as having marginally more status than other group members, ($F_{2,94} = 2.90, \eta_p^2 = .06, p < .058$), this did not translate into the Diver being perceived as the leader of the group. In fact, Astronauts were perceived as more legitimate leaders than Divers and Pitchers, who were not significantly different from each other ($F_{2,94} = 9.52, p < .0001, \eta_p^2 = 0.17, \text{HSD} = 0.42$).

There were two variables for which it did not make sense to conduct a repeated-measures ANOVA, as the self-ratings of likeability would be highly suspect and the "willingness to work" question made no sense when applied to oneself. Therefore, these variables were analyzed via a paired-group t test in which the ratings of the two individuals other than the participant were compared. These analyses revealed that Astronauts did not find Divers and Pitchers to differ in likeability ($t_{23} = .44, p > .05$) and they were equally willing to work with both again in a future experiment ($t_{23} = 0, p > .05$). Pitchers, however, were significantly more willing to work with Divers than with Astronauts in future experiments ($t_{23} = 2.15, p < .04; M = 6.71, SD = 0.46$ vs $M = 6.38, SD = 0.87$), and showed a marginally significant tendency to like Divers more than Astronauts as well ($t_{23} = 2.0,$

$p < .06$; $M = 6.29$, $SD = 0.75$ vs $M = 5.96$, $SD 0.81$). However, feelings of guilt for soaking the Diver were not the only reason that the Diver fared well, since Astronauts ($t_{23} = 2.56$, $p < .02$) as well as Pitchers ($t_{23} = 2.38$, $p < .03$) gave more money to Divers than to the other naïve participant.

DISCUSSION

The results confirm that engaging in self-sacrificial, costly behavior that is not merely financial in kind can result in direct benefits. The ordeal the Divers had to endure was judged to be more difficult and costly, and these individuals were rewarded with more money and higher status. The Divers were not, however, perceived to be the leaders of the group; this honor was bestowed upon the Astronauts.

Although everyone had positive reactions to the Divers, this was especially true for Pitchers. The Pitchers were directly responsible for soaking the Divers, and accompanying feelings of guilt may have prompted stronger feelings of liking toward the Divers along with a desire to compensate Divers for their trouble. This need to restore equity may also be behind the interest that Pitchers had in working with Divers in future experiments. Thus, Study 1 conclusively demonstrated that self-sacrificial altruistic behavior does indeed lead to beneficial consequences for the altruist, but leaves open the question of whether reciprocal altruism or costly signaling best explains these results. It could be argued that because of the direct cost incurred by the Divers from the Pitchers, reciprocal altruism may be as viable an explanation for these results as competitive altruism. Study 2 was designed to distinguish these two explanations using a separate sample.

STUDY 2

A scenario study was conducted in which participants read a description of the procedure carried out in Study 1. The procedures that were described were exactly the same, except that all of the experimental participants in the scenarios were naïve subjects and there was no confederate. The participants then made judgments and allocation decisions about hypothetical people playing the roles in the original experiment. Since these were uninvolved observers who did not profit from the self-sacrificial behavior of the Diver, any benefits they bestowed on the Diver would be difficult to explain via reciprocal altruism.

METHOD

Participants

Undergraduate students ($N = 334$; 160 men, 174 women) from a large state university in the Southwestern U.S. participated in this study to fulfill a portion of a course research requirement.

Procedure

Participants signed up for the experiment online and were provided with a direct link to the survey site. The study was described as a study of "Person Perception in Group Problem-solving Situations." After reading and signing an online consent form and indicating their sex, each participant read the following set of instructions:

Thank you very much for participating in this study on person perception. In this experiment, we are interested in the judgments that you will make about people who participated in an actual experiment conducted at another university. We need your input to help us make sense of the data being collected in that study. In that experiment, the researchers were interested in finding out more about how groups organize themselves to successfully carry out problem-solving tasks. The personality and feelings of the people in that study were also examined, but we need to get judgments from impartial, outside observers as well, which is where you can be very helpful to us.

In the other experiment, three people reported to a laboratory where they were told that they would be working together on a series of three tasks. If their group successfully completed all three of these tasks, the group would receive \$45.00 to divide among the three of them any way they wished. The only restriction was that each person in the group had to receive at least one dollar, and allocations must be made in whole dollar amounts. If the tasks were not successfully completed, each individual received three dollars for participating. After reading about the tasks, the group members had to decide which person would play which role in the group. Thus, people had to volunteer and/or negotiate to determine which role he or she would play in the group. The group had no prior information about the experiment, and they came dressed as they ordinarily would for whatever other activities had been going on that day.

YOUR TASK: Imagine that you have just watched the experiment that you have been reading about. Also, assume that the group has successfully completed all of the tasks described below. Your task is to decide how to divide the money among the three group members and also to make some judgments about the group members. The three tasks that were completed in the experiment are described below.

The participants then saw an exact description of each of the tasks from Study 1. After reading about the tasks, the participants then rated each of the hypothetical group members (i.e., the Astronaut, Diver, and Pitcher) on the same seven items as in Study 1 using the same 7-point scale. An additional item asked them to estimate that if there were people of both sexes participating in the experiment, how likely they thought men and women would be to volunteer for each role on a scale with anchors 1: Male more likely and 7: Female more likely. Three more items required participants to indicate how interested they would be in playing the role of the Astronaut, the Diver, and the Pitcher using a 7-point scale. Finally they divided \$45.00 among the three roles according to the following instructions:

Because the group successfully completed each of the three tasks, pretend that you must now decide how much money should be allocated to each member of the group. Please remember that you have \$45.00 to divide among the three group members and that it must be divided in whole dollar values. Each person in the group must receive at least one dollar, and you MAY NOT simply divide the money equally among them; each person must receive a different amount of money. When you have finished making your allocations, please make sure that your numbers add up to 45.

RESULTS

The data were analyzed with 2 (sex) \times 3 (experimental role) ANOVA with experimental role as a repeated measures factor. All results significant at the $p < .05$ level are reported, but a Bonferroni correction indicated that an alpha level of .005 would be a safer, more conservative standard. A Greenhouse–Geisser adjustment was used in the repeated measures analyses to guard against violations of the sphericity assumption.

The results for the seven variables that reflected judgments made about each target person and the amount of money allocated to them by the participants indicated a consistent main effect for the sex of the participants on many of the variables, in that females gave higher ratings in general to target persons in the scenarios. This was true for judgments of the importance of the contributions made by individuals ($F_{1,332} = 3.83$, $p < .05$, $\eta_p^2 = 0.01$), how challenging the tasks were ($F_{1,334} = 4.98$, $p < .03$, $\eta_p^2 = 0.02$), the legitimacy of calling someone a group leader ($F_{1,329} = 4.73$, $p < .03$, $\eta_p^2 = 0.01$), perceived status within the group ($F_{1,332} = 5.02$, $p < .03$, $\eta_p^2 = 0.02$), and the likeability of the target persons ($F_{1,315} = 6.59$, $p < .01$, $\eta_p^2 = 0.02$). There were no significant main effects of sex ($p > .05$) on the amount of money allocated to each role, willingness to work with target persons in future experiments, or judgments of the costliness of behaviors. This general “leniency bias” on the part of female participants (or strictness bias on the part of males) was not relevant to the hypotheses of this study. For this reason, and because there were no significant interactions between the sex of the participant and the repeated measures variable, this general sex difference will not be discussed further.

The repeated measures ANOVAs revealed significant main effects for the role played by the target person on *all* of these variables. Tukey HSD tests were used for *post hoc* analyses. The means and standard deviations for each of these variables are displayed in Table 2, and the results of the repeated measure ANOVAs are displayed in Table 3. As can be seen in these tables, Divers received significantly more money, were thought to be more likeable, and their task was judged as more difficult than Astronauts, who in turn scored significantly higher on each of these variables than did Pitchers. Participants were also significantly more willing to work with Divers in a hypothetical future experiment than with Astronauts, who in

TABLE 2
 MEANS AND STANDARD DEVIATIONS FOR JUDGMENTS MADE ABOUT
 EACH GROUP ROLE IN STUDY 2 (REPEATED MEASURES)

Variable	Role					
	Astronaut		Diver		Pitcher	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Money allocated	14.09 ^a	5.94	20.12 ^b	6.19	10.80 ^c	4.20
Importance of contribution	4.91 ^a	1.50	5.79 ^b	1.60	4.75 ^a	1.67
Difficulty of responsibilities	3.91 ^a	1.58	6.02 ^b	1.33	4.43 ^c	1.53
Legitimacy of leadership	5.30 ^a	1.61	4.42 ^b	1.58	3.43 ^c	1.45
Status	5.17 ^a	1.39	4.88 ^b	1.57	4.07 ^c	1.45
Costliness of behavior	3.47 ^a	1.82	5.77 ^b	1.30	3.66 ^a	1.72
Willingness to work with person in future	5.09 ^a	1.41	5.39 ^b	1.41	4.42 ^c	1.34
Likeability	4.55 ^a	1.37	4.91 ^b	1.36	4.07 ^c	1.35

Note.—Means with different superscript letters were significantly different at $p < .005$ (Bonferroni-corrected $p < .05$). All items were rated on a scale with anchors 1: Low and 7: High (4 was neutral).

turn were preferred over Pitchers as future experimental partners. The behavior of Divers was perceived to be significantly more costly than the behavior of Astronauts or Pitchers (who did not differ from each other), and they were perceived to have made a greater contribution to the success of the group than the Astronauts or Pitchers. When it came to being perceived as having status and being chosen as the leader of the group, however, it was the Astronauts who scored highest, significantly ahead of Divers who in turn scored significantly higher than Pitchers on these two variables.

In addition to these items, participants guessed whether men or women would be more likely to volunteer for each role and expressed their own interest in volunteering for each of the three roles. A 2 (sex) \times 3 (experimental role) ANOVA was run for each of these questions with experimental role as a repeated measures variable. A Greenhouse–Geisser correction was applied and Tukey HSD Tests were used to identify where significant differences occurred.

There was no significant main effect of rater sex when estimating whether men or women would be more likely to volunteer for different roles ($F_{1,320} = .41, p > .05$). There was, however, a significant main effect for the role played in the experiment ($F_{2,568} = 63.66, p < .0001, \eta_p^2 = 0.16$). Specifically, it was perceived that men would be most likely to volunteer to be Divers and that women would be most likely to volunteer to be Astronauts, with Pitchers judged to be significantly different from and in between the other two roles. These main effects were qualified by a significant interaction between sex and experimental role in that men thought

TABLE 3
RESULTS OF REPEATED MEASURES ANOVA (ASTRONAUTS VS DIVERS VS PITCHERS)

Variable	<i>F</i>	<i>df</i> *	<i>p</i> <	ES
Money allocated	160.82	1.70, 556.15	.00001	.33
Importance of contribution	46.24	1.82, 607.07	.0001	.12
Difficulty of responsibilities	179.39	1.96, 656.83	.00001	.35
Legitimacy of leadership	127.47	1.71, 564.20	.00001	.28
Status	51.05	1.89, 629.62	.0001	.13
Costliness of behavior	210.75	1.97, 649.98	.00001	.39
Willingness to work with person in future	49.87	1.98, 636.71	.0001	.13
Likeability	32.17	1.94, 613.25	.0001	.09

that women would be less likely to become Astronauts and more likely to become Pitchers and Divers than women themselves did ($F_{2,568} = 5.23$, $p < .008$, $\eta_p^2 = 0.01$).

When participants were asked about their own interest in volunteering for each of the experimental roles, a significant main effect of role emerged ($F_{2,653} = 16.47$, $p < .0001$, $\eta_p^2 = 0.05$) such that participants as a group would be most interested in being Astronauts and least interested in being Divers, with a desire to be a Pitcher falling in the middle; and each of the three roles was rated significantly differently from the others. A significant main effect of rater sex indicated that women expressed a significantly lower interest than men in being Pitchers or Divers ($F_{1,334} = 37.08$, $p < .0001$, $\eta_p^2 = 0.10$). There was also a significant interaction between rater sex and experimental role, due primarily to the men expressing relatively little preference for any experimental role, while females expressed a much greater preference for being an Astronaut compared to a Pitcher or Diver ($F_{2,653} = 9.98$, $p < .0001$, $\eta_p^2 = 0.03$).

DISCUSSION

As in Study 1, the Diver was perceived more favorably than the other two roles on most traits. The Diver received significantly more money, was liked the most, and was perceived to have made the greatest contribution to the group by engaging in the most costly and difficult behavior. The Diver was clearly being rewarded for "heroic" behavior, but in this case by individuals who were not direct beneficiaries of the Diver's behavior. This finding does not support the reciprocal altruism explanation and instead favors a costly signaling explanation for the treatment the Diver received. The Astronaut was once again perceived as being the leader of the group, and in this case also was perceived as having the highest status in the group. Although the means for the ratings of the Pitcher were all above the neutral point of 4, one thing that was quite different in Study 2 was the comparatively negative impression of the Pitcher, who was per-

ceived as being significantly lower on likeability and status than anyone else, and they were the least preferred partners in future experiments, and they were least likely to be thought of as leaders.

Summary and Concluding Discussion

Study 2 replicated the most important findings of Study 1 with two additional results of interest. In both studies, the Diver was perceived to have engaged in the most difficult and costly behavior, received the most money, was liked the most, and was most frequently chosen as a future work partner. In Study 1, the Diver also had the highest perceived status, but in Study 2 the Astronaut was awarded the highest status. The Astronaut was also indicated to be the group leader in both studies. This may be an artifact of the experimental tasks. Not only was the Astronaut first to perform his or her task, but was also the only person nominally responsible for directing the behavior of others, so in hindsight it seems only natural that this individual would be likely perceived as the leader. It is interesting to note that being a leader did not necessarily translate into greater monetary reward and higher status.

Although there was strong concordance in the results of the two studies, the fact that the participants were actively playing a role and had higher hedonic involvement in Study 1 presented the opportunity for interesting effects to emerge that simply could not happen in Study 2. For example, although everyone in both studies had positive reactions to the Diver, this was especially true for people playing the role of Pitchers in Study 1, and these tendencies were especially pronounced for female pitchers. Only occasionally did male Pitchers apologize to the Diver after drenching him, but female Pitchers almost universally did so, and sometimes kept up a stream of apologies even while throwing the balls at the target. Following the drenching of the Diver, female Pitchers usually expressed great concern about her well-being, often inquired about how far she had to walk to get home, and on two occasions attempted to hug her as well. This marked sex difference among Pitchers rests on more than just a subjective perceptual bias on the part of the experimenter; it was corroborated by the data. Because the MANOVA in Study 1 for the interaction between sex and group role was not significant, none of the univariate analyses were discussed. However, there were two significant univariate interactions which reflected female Pitchers exhibiting extremely positive responses to the Diver, such as a much stronger interest in working with the person in a future experiment ($F_{1,44} = 6.06, p < .02$) and a tendency for female Pitchers to allocate more money to Divers ($F_{1,44} = 6.13, p < .02$). When the amount of money allocated to the diver was broken down by sex and group role, male Astronauts allocated an average of \$16.67 to the Diver, male Pitchers allocated \$15.58, female Astronauts allocated \$15.50,

but female Pitchers allocated an average of \$19.17. The different reactions of male and female Pitchers may be an interesting issue to explore in future studies. It was very clear from Study 1 that a bond formed between the Pitcher and Diver, and future experiments could examine the underlying social psychology of this effect (e.g., misattribution of arousal, resolution of cognitive dissonance, restoration of equity).

Another interesting difference between the two studies was the strong negative reaction to Pitchers that was found in Study 2, something that did not occur in Study 1. In comparison to the other roles, Pitchers in Study 2 were judged much more harshly on interpersonally relevant traits. It may simply be that it was easier to form an impression from the scenarios of the Pitcher as an exploitative person who delighted in seizing the opportunity to humiliate a fellow participant, whereas the individuals who participated in the actual experiment saw that this was not how it usually played out.

To the extent that there was anything surprising in the results, it was the general lack of self-serving perceptions and selfish behavior in Study 1. The participants reliably claimed that other people had made greater contributions to the study group and had more difficult tasks than they did, and they were usually quite generous in their allocation of money. In fact, only one participant (a female Astronaut) stood out as being extraordinarily greedy, allocating \$30.00 to herself while allocating only \$10.00 to the Diver and \$5.00 to the Pitcher. In hindsight, it is also a bit surprising that such a strong effect was found for the allocation of money, since many participants in Study 1 took the most cognitively simple route of splitting the money evenly among the three group members (16 of 24 men and 12 of 24 women split the money evenly). This temptation was eliminated in Study 2, and future studies should prohibit participants from being able to split compensation equally.

The most important conclusion from these studies is the confirmation that costly altruistic behavior does in fact lead to direct rewards for the individuals who engage in them and that costly signaling seems to be a better explanation for this phenomenon than reciprocal altruism (although indirect reciprocity cannot be entirely ruled out as a viable explanation). Only same-sex groups were used in this experiment, but evolutionary hypotheses relevant to showing off (Hawkes, 1991) and male intrasexual competition could lead to interesting predictions about what might happen in mixed-sex groups. The focus could also be shifted from what happens to heroes to the issue of who becomes a hero. Personality variables might be used in studies of groups consisting entirely of naïve individuals to predict which types of people might be predisposed toward self-sacrificial behavior. One always risks sounding grandiose when discussing the

real-world applicability of laboratory findings, but the possibility that this avenue of research could ultimately enhance understanding of phenomena as disparate and extreme as suicide bombings and organ donations. For now though, it is clear that the idea of competitive altruism provides a useful framework for thinking about the dynamics of prosocial self-sacrificial behavior in groups.

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