

Original Article

Is Self-Sacrificial Competitive Altruism Primarily a Male Activity?

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Abstract: This study explored the basis of self-sacrificial prosocial behavior in small groups. Seventy-eight undergraduates (39M, 39F) filled out a thirty-item personality scale and then participated in a “group problem-solving study” in which the monetary success of a three-person group depended upon one of its members volunteering to endure pain (a cold stressor test) and inconvenience (being soaked in a dunk tank). There were 13 groups consisting of two females and one male, and 13 groups consisting of two males and one female. Across groups, the behavior of the altruist was judged to be more costly, challenging, and important and he/she was liked better, rewarded with more money, and preferred as a future experimental partner. Groups containing two males showed more evidence of competition to become altruists than groups containing two females, and personality traits were more effective predictors of altruistic behavior in males than in females. We conclude that competition between males and “showing off” are key factors in triggering self-sacrificial altruistic behavior.

Keywords: altruism, competitive altruism, challenge hypothesis, sex differences

Introduction

We love heroes - especially courageous ones who take risks and endure physical hardship. Old Testament stories such as David slaying Goliath, sagas of Beowulf and Odysseus, and the popularity of modern comic book superheroes testify to the durability of our heroes. We hold heroes in such high esteem because they act in a noble and virtuous manner, setting aside any thoughts of their own well being for the good of others (Allison and Goethals, 2011).

Or do they? Evolutionary psychologists believe that even apparently selfless impulses such as heroism must provide some adaptive advantage for individuals. There are several theoretical perspectives that may explain such behavior. *Inclusive fitness*, also known as *kin selection* (Hamilton, 1964), convincingly explains the probabilities of self-

sacrificing for kin (Burnstein, Crandall and Kitayama, 1994). However, self-sacrificial acts performed for close kin are usually not described in everyday life as being “heroic” or even as “altruistic.” Thus, we must turn to other theories for insight into self-sacrificial behavior that benefits non-kin. According to *reciprocal altruism* (Trivers, 1971), individuals who sacrifice for the benefit of unrelated others are gambling that they will reap the benefits of returned favors, assuming that the beneficiaries of their sacrifice are not cheaters. Similarly, *Costly Signaling Theory* (CST) (Bliege Bird and Smith, 2005; Boone, 1998; Grafen, 1990; McAndrew, 2002; Roberts, 1998; Zahavi, 1977) suggests that conspicuous self-sacrificial altruism may be a way for individuals to advertise desirable personal qualities that increase the likelihood that they will be chosen as a mate or an ally and be positioned for access to future resources, possibly even from individuals who were not direct beneficiaries of the altruist’s original actions (Nowak and Sigmund, 2005). Laboratory experiments (e.g., Berezkei, et. al., 2010; Hardy and Van Vugt, 2006; McAndrew, 2009a; Sylwester and Roberts, 2010; Willer, 2009) demonstrate that people who display concern for the group by engaging in costly altruistic activities do in fact achieve elevated social status, respect, and recognition as a result of their public generosity and cooperativeness.

Both reciprocal altruism and costly signaling imply that conspicuous self-sacrificial prosocial behavior can be a form of “competitive altruism” (Boone, 1998) through which individuals compete with each other to be seen as highly desirable sexual partners or as exchange partners who will be held in esteem by others and be well-positioned in terms of their status within the group. The available data are consistent with this way of thinking, as previous research utilizing experimental games demonstrates that financial generosity is most likely to take place when it is public and easily observable by others (Berezkei, Birkas and Kerekes, 2010; Haley and Fessler, 2005; Van Vugt and Hardy, 2010).

It is not the goal of the present study to determine which broad theoretical perspective best explains competitive altruism, but rather to identify the situational triggers that release this behavior and to explore the personality and gender dynamics surrounding the phenomenon. Furthermore, we are specifically interested in the type of altruistic behavior that might be described as physically self-sacrificial in nature. Virtually all of the previous studies in this area have used laboratory public goods games in which individuals can make generous financial contributions (at a cost to themselves) for the “greater good” of the group. While these studies are important and useful, they do not capture the type of physical self-sacrifice (e.g., organ donation, risky or physically challenging acts of heroism) that we so often admire in everyday life. Thus, our goal was to study this particular brand of altruism to determine what benefits, if any, accrue to someone who “takes one for the team.”

The major obstacle to studying anything remotely resembling “heroic” behavior experimentally is establishing a procedure that is lifelike and involving, since one cannot study life and death situations in the laboratory. We acknowledge that it is hyperbolic to describe any costly, self-sacrificial behavior that might take place in a laboratory experiment as “heroic.” Having said this, however, it is our position that the willingness of an individual in an experiment to endure physical hardship and inconvenience so that his or her group can prosper is qualitatively similar to heroism and that it differs from the

behavior of real-life heroes only in the level of risk that the hero endures. Given this limitation, we arranged a laboratory situation in which three-person groups engaged in a series of three tasks. In order to complete these tasks, each member of the group volunteered for one of three roles prescribed by the experimenter. The role chosen by the subject had important consequences, as the participants understood that there was a clear difference among the three group roles in the amount of work done on behalf of the group and the costs associated with that work. The nature of the tasks required of each individual will be described later on in the paper.

Physically self-sacrificial altruism is commonly perceived as a stereotypically male, as opposed to female, behavior (Griskevicius et al, 2007; Iredale and Van Vugt, 2009; Lyons, 2005). If self-sacrificial altruistic behavior is in fact a “male thing,” it should be most likely to occur when males show off and compete directly with each other for status (and ultimately for mating opportunities). It has already been established that conspicuous displays of benevolence in males can be triggered by sexual motives, possibly as a way of advertising personality traits that might be valued by prospective mates (Hawkes, 1991; Iredale and Van Vugt, 2009), and that altruistic male behavior may indeed be most effective if it takes the form of risky heroism which displays courage and strength (Farthing, 2005; Griskevicius et al., 2007; Kelly and Dunbar, 2001; Sylwester and Pawlowoski, 2011). Also, males are more likely to display altruism in the presence of an attractive member of the opposite sex; the same does not hold true for females (Farrelly, Lazarus and Roberts, 2007; Iredale, Van Vugt and Dunbar, 2008). This idea has clearly been around for quite some time, as illustrated by a quote from the Sioux warrior Rain in the Face. In describing the effect that the presence of women in a war party has on the male warriors, he said “when there is a woman in the charge, it causes the warriors to vie with one another in displaying their valor” (Philbrick, 2010, p. 179).

The *Challenge Hypothesis* developed by Wingfield, Hegner, Dufty and Ball (1990) provides a framework for predicting the circumstances under which male “showing-off” via conspicuous self-sacrifice will be especially likely. According to this hypothesis, physiological changes such as a rise in testosterone occur in response to threats to a male’s status or the imminent threat of male-male competition, facilitating whatever competitive behaviors are necessary to meet the challenge. Although the theory was originally designed to explain aggressive behavior in animals, it appears to be applicable to human male behavior as well (Archer, 2006; Klinesmith, Kasser and McAndrew, 2006; McAndrew, 2009b). This theoretical perspective has never been used as an explanatory mechanism for altruistic or heroic behavior, and it is our position that the mere possibility of male-male competition will increase the likelihood of competitive altruism.

Thus, self-sacrificial altruistic male behavior should be most likely to occur when females are present *and* when another male is present. Consequently, the sexual composition of the groups was a key manipulation in our experiment. Half of the groups consisted of two males and one female and the other half consisted of two females and one male. Our hypotheses were as follows.

Hypothesis 1 is that experimental tasks that require self-sacrifice in the form of pain, inconvenience, and embarrassment will be perceived as a) more costly, b) more difficult,

and c) more important to the success of the group.

Hypothesis 2 is that individuals in the role that is more costly and difficult will be a) allocated more money by the group, b) accorded higher status, c) liked more, d) more likely to be perceived as group leaders, and e) will be preferred partners in a hypothetical future experiment.

Hypothesis 3 is that males will choose the role requiring self-sacrifice more frequently than would be expected by chance in groups of both sexual compositions, but will be even more likely to do so when another male is present.

Materials and Methods

Participants

Seventy-eight undergraduate students (39 men, 39 women) participated in this study. All were enrolled in undergraduate psychology classes at a liberal arts college in the American Midwest, and most received course credit for participation.

Apparatus, materials, and procedure

Subjects reported to a laboratory for a study on “Group Decision Making” where they were met by a male experimenter. The subjects were told that they would take part in a series of three tasks, and that if the group successfully completed the three tasks, it would receive \$45.00 to divide in any way it chose. They were also told that if the group failed to complete any of the tasks, each group member would receive \$3.00. Half of the subjects participated in a group consisting of two males and one female, and half participated in a group of two females and one male.

The participants first read and signed a consent form. They then filled out a 30 item personality scale. The items consisted of statements with which the participant expressed agreement on a 1 (strongly disagree) to 5 (strongly agree) scale. The construction and reliability of this scale has been described elsewhere (McAndrew and Perilloux, 2010), and it consists of six different factors: 1) *Social Inhibition* (9 items, e.g., “Does one feel self-conscious, embarrassed, and inhibited about being observed in public situations?”); 2) *Sense of Duty* (4 items, e.g., “Does one feel responsible for fulfilling obligations to others?”); 3) *Cynicism* (5 items, e.g., “Does one think the worst of other people and not trust them?”) 4) *Sensation Seeking* (5 items, e.g., “Does one seek out exciting situations?”); 5) *Glory Seeking* (4 items, e.g., “Does one fantasize about achieving fame, glory, and the recognition of others?”) and 6) *Activism* (3 items, e.g., “Does one often volunteer to perform behaviors when they are part of a group?”).

When all of the participants had completed the personality scale, they turned to the instructions for the problem solving part of the experiment. First, the group determined the role that each of the individuals 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 of each role. The group was given three minutes to discuss how they would divide labor between them.

This conversation was observed by the experimenter, although no recording was made of the conversation and there was no attempt to quantify or measure anything that transpired during the group's deliberation. The group was given no guidance by the experimenter, and it was completely up to them to get organized and figure out which of them would play each of the roles. The conversations invariably began with the participants asking each other about their preferences and whether anyone was particularly interested in playing a particular role. Situations in which more than one person was interested in the same role had to be resolved through group discussion within the allotted time. All groups easily reached a consensus within the three-minute time limit. After the role assignments were finalized, the participants then moved to a different laboratory room where the tasks would take place. The tasks were performed in the same order in all groups, and no communication among the group members was permitted between tasks.

Task One: The Astronaut was responsible for leading the group in a 12-minute decision-making task (the "Lost on the Moon" exercise developed by the National Aeronautics & Space Administration (NASA)). Participants pretend that they have crash-landed a spacecraft on the light side of the moon. Survival depends upon reaching the mother ship about 200 miles away, and their task was to rank order the importance of 15 salvaged items for their survival. At the conclusion of this exercise, the Astronaut was given 5 minutes to write up the arguments in favor of the top three ranked items. While the Astronaut was nominally the "leader" in this exercise, 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 forty seconds. No communication was permitted between the Diver and the other subjects during this time, so as "not to distract him/her from the pain." At the conclusion of the forty-second period, the experimenter remarked "that this hurts a lot more than people think it will, and (to the Diver) 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 emphasized the unpleasantness of the diver's task to the other subjects.

Task Three: The Pitcher had three minutes to hit a target with a ball. The throwing distance of three meters 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." (See Figures 1 and 2) The photographs in Figures 1 and 2 were promotional photographs provided courtesy of the manufacturer, WhirlWhims, LLC. These photographs do not depict any of the participants or experimenters in this experiment. Our study was conducted in an indoor laboratory and all subjects remained fully clothed, with the removal of shoes being optional. The apparatus is quite safe, as the Diver was seated and did not come into contact with anything except water. The Diver had to sit in a chair under the

balloon for 3 minutes or until the Pitcher successfully hit the target, which all Pitchers eventually did. 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 filled out a questionnaire. Each person rated all of the participants (including him/herself) on seven different items on a one (low) to seven (high) scale. These items measured the perceived importance of each individual's contribution to the group, the willingness of the subject 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 subject liked each person.

Figure 1. The Pitchburst.



When all of the subjects had completed the first part of the questionnaire, they then 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 one dollar, that allocations had to be made in whole dollar amounts, and that they were not allowed to simply divide the money equally among

the three participants. 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 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.

After the allocation decisions were completed, the subjects waited outside of the laboratory while the experimenter calculated their payments and prepared paperwork to be signed when the money was dispersed. Each individual was then brought into the laboratory one at a time to be paid so that the amount of money received by each would remain confidential. After receiving payment, the person was dismissed before the next individual was brought in. All participants were given the opportunity to meet with the experimenter at a later date for complete debriefing.

Figure 2: The Pitchburst in action.



Results

Analyses of interpersonal ratings

Our first prediction was that the Diver's experimental role would be perceived as more costly, difficult, and important to the success of the group. Our second prediction was that divers would be liked better, would be allocated more money by the group, be accorded higher status, and be more likely to be chosen as leaders and partners in future experiments. We will defer discussion of the allocation of money until a bit later, but to test our hypotheses about the ratings made by the subjects we analyzed five variables with a repeated measures ANOVA using a Greenhouse-Geisser adjustment [*df* will be reported in whole numbers] across the three group roles: ratings of the importance of the contribution

made by each person, ratings of how challenging each person’s task was, ratings of how legitimate it would be for each individual to be a leader of the group, ratings of the relative status of each person in the group, and ratings of how costly the behavior of each individual in the group was. Preliminary separate analyses for each of the two types of groups revealed the same patterns and effects, so the groups were combined for the analyses reported here. Following each ANOVA, Tukey tests were performed, but in the interest of readability, the numerical results of each of these Tukey tests will not be reported. Any differences described met the requirement of a .05 level of significance as determined by the Tukey analyses. The means and standard deviations for each of these variables can be seen in Table 1.

Our first prediction was supported. Divers were perceived to have made a greater contribution to the success of the group than did pitchers, who in turn made a greater contribution than the astronauts, $F(2, 145) = 23.30, p < .001, \eta^2 = .23$, and the tasks faced by divers were perceived to be more challenging than the tasks faced by pitchers, who in turn were thought to have a more challenging task than astronauts, $F(2, 152) = 73.21, p < .001, \eta^2 = .35$. The behavior of divers was perceived to be more costly than the behavior of pitchers, whose behavior was judged to be more costly than that of astronauts, $F(2, 140) = 128.18, p < .001, \eta^2 = .63$.

Table 1. Descriptive statistics for judgments made about each group role

Variable	GROUP ROLE		
	<i>Astronaut</i> M (SD)	<i>Diver</i> M (SD)	<i>Pitcher</i> M (SD)
Money Allocated	13.10 (4.36) ^A	17.72 (3.93) ^B	13.92 (3.53) ^A
Importance of Contribution	4.82 (1.33) ^A	5.83 (1.02) ^B	5.37 (1.27) ^C
Difficulty of Responsibilities	3.62 (1.22) ^A	5.50 (1.29) ^B	4.91 (1.21) ^C
Legitimacy of Leadership	4.95 (1.28) ^A	4.44 (1.25) ^A	5.03 (1.51) ^A
Status	4.60 (0.96) ^A	4.86 (1.11) ^A	4.83 (1.04) ^A
Costliness of Behavior	2.71 (1.47) ^A	5.83 (1.33) ^B	3.23 (1.70) ^C

Note: Ratings of Likeability and Willingness to Work with individual in future experiments was not included in this table, since the repeated-measures ANOVA was not an appropriate analysis for these variables. Means within rows with different superscripted letters are significantly different from each other at the $p < .05$ level.

The second prediction concerning the perceptions of the divers was supported for some of the variables but not for all. There were no significant differences in the perception of the three roles in the tendency to be seen as a leader, $F(2, 150) = 1.83, p = .13$ or in the status attributed to each role, $F(2, 152) = 1.63, p = .20$. There were two dependent

variables, how likeable the individual was and how willing the subject would be to work with that person in a future experiment, for which it would not make sense to use a repeated measures ANOVA since individuals could not reasonably make these judgments about themselves. Therefore, these two variables were analyzed via paired samples *t* tests in which the ratings of two roles were compared by the people playing the third role. For example, the judgments that astronauts made of pitchers and of divers were compared. These analyses revealed that astronauts liked divers better than they liked pitchers, $t(25) = 2.34, p = .03, M(SD) = 6.08 (.935)$ vs. $5.54 (1.24)$, but were equally willing to work with both in a future experiment, $t(25) = 1.67, p = .11$ (although the near-significant trend was in the predicted direction, $M(SD) = 6.27 (0.78)$ vs. $5.92 (1.09)$). Conversely, pitchers did not like divers more than they liked astronauts, $t(25) = 0.53, p = .60$, but they showed significantly greater interest in working with divers than with astronauts in a future experiment, $t(25) = 2.52, p = .02, M(SD) = 6.12 (0.77)$ vs. $5.69 (1.05)$. Divers did not show a preference between astronauts or pitchers in regards to either liking, $t(25) = 0.80, p = .43$, or willingness to work together in a future experiment, $t(25) = 0.67, p = .51$.

Exploratory *t* tests were conducted to see if males and females within each role differed in the judgments that they made about each of the group roles on each of the interpersonal rating variables. There was only one significant difference in these analyses: Male divers thought that divers had more status in the group than did female divers, $t(24) = 2.30, p < .03, M(SD) = 5.47 (1.07)$ vs. $4.56 (0.73)$, but male and female divers did not differ in their status judgments of either of the other two roles or on any of the other interpersonal variables. Similarly, male and female astronauts and male and female divers did not differ from each other in any of the other status judgments or on judgments made about any of the other interpersonal ratings.

Table 2. Descriptive statistics for monetary allocations as a function of group role and sex of subject

Variable	GROUP ROLE		
	<i>Astronaut</i> <i>M (SD)</i>	<i>Diver</i> <i>M (SD)</i>	<i>Pitcher</i> <i>M (SD)</i>
Money Allocated by sex of subject			
To Astronaut			
Males	\$10.75 (5.91)	\$13.29 (3.50)	\$12.06 (2.26)
Females	\$14.50 (6.35)	\$13.56 (2.30)	\$11.88 (3.56)
To Diver			
Males	\$20.00 (3.74)	\$18.35 (4.70)	\$18.17 (3.60)
Females	\$16.82 (3.91)	\$17.11 (2.89)	\$17.37 (4.31)
To Pitcher			
Males	\$14.25 (2.63)	\$13.35 (2.71)	\$13.94 (3.89)
Females	\$13.68 (3.37)	\$13.78 (2.33)	\$15.75 (5.92)

Analyses of money allocations

The next step was to ascertain whether there were any important differences among astronauts, divers, and pitchers in allocating money to the different group roles and whether there were any differences between males and females in this regard. A 2 X 3 Multivariate Analysis of Variance (MANOVA) was conducted with the *sex of the subject* and the *group role* (astronaut/diver/pitcher) played by the subject as the independent variables, and the amount allocated to each of the three group roles as the dependent variable. There were no significant main effects or interactions in this analysis (all $p > .05$), indicating that there was no difference in how males and females allocated money, and that there were no differences in how astronauts, divers, and pitchers allocated money.

The mean dollars allocated to each role broken down according to *sex of the subject* and the *group role* played by the subject are reported in Table 2. The other part of our second prediction was that divers would receive significantly more money from the group, and this part of the prediction was fully supported. As can be seen in Tables 1 and 2, divers received the most money on average from everyone, followed by pitchers and then astronauts. We compared the amount of money allocated to each role by each subject using a Repeated Measures ANOVA (again, using a Greenhouse-Geisser adjustment), with the amount of money allocated by the subjects to each of the three roles as the dependent variable. This analysis revealed a significant main effect of the role played by a person on the amount of money received, $F(2, 143) = 20.65, p < .001, \eta^2 = .21$. Tukey tests revealed that divers (\$17.72) on average received significantly more money than astronauts (\$13.10) and pitchers (\$13.92). The difference in the amount received by pitchers and astronauts was not significant. This same pattern held true when the analyses were done separately for male participants, $F(2, 67) = 21.50, p < .001, \eta^2 = .36$ and for female participants, $F(2, 63) = 4.50, p < .02, \eta^2 = .11$.

In summary, we found mixed support for our second prediction. The altruistic diver was monetarily rewarded for his/her actions, and the diver was generally liked better and more likely to be chosen as a partner in a future experiment, but this did not translate into higher status or being identified as a leader.

Exploratory regression analyses were used to determine if the amount of money allocated to each role could be predicted by the perceptions the subjects had of that person and his/her role responsibilities. These analyses revealed that the perceived costliness of the behavior was a significant positive predictor of money allocated to divers, $\beta = .85, t(78) = 2.52, p = .03$, and that the perceived importance of the contribution, $\beta = .99, t(78) = 3.08, p = .003$, was a positive predictor of the amount of money allocated to pitchers. Being thought of as a leader was a negative predictor of the amount of money allocated to Astronauts, $\beta = -1.27, t(78) = -2.64, p = .01$, and the difficulty of responsibilities, $\beta = -.72, t(78) = -2.18, p = .03$, and being thought of as a leader, $\beta = -1.07, t(78) = 2.52, p = .014$ were negative predictors of the amount of money allocated to pitchers.

Sex differences in role assignment

Our third prediction was that males would become the diver more often than females in both types of groups, and that this tendency would be significantly more pronounced in groups containing two males and one female. A chi-square analysis revealed

that the distribution of males and females across roles did not differ from what would be expected by chance in groups consisting of two females and one male, $\chi^2(2) = 1.62, p = .45$. However, in groups consisting of two males and one female, there was a pronounced deviation from chance, $\chi^2(2) = 30.69, p < .001$. In only one of the thirteen groups did a male become an astronaut, and in only one group did a female *not* become an astronaut. No female ever became the diver in a two-male/one-female group, and in only one case did a female become a pitcher (this occurred when a female subject self-identified as a pitcher on the college softball team). Therefore, our third prediction was only partially supported in that males were not more likely to become divers if they were the only male in the group, but the presence of two males caused males to attain the status of diver more often than would be predicted by chance. The frequency of males and females appearing in each role in the two types of group is displayed in Table 3.

Table 3. Number of males and females filling each role broken down by type of group

	GROUP ROLE		
	<i>Astronaut</i>	<i>Diver</i>	<i>Pitcher</i>
Group: Two female, one male			
Males	3 (4.33)	4 (4.33)	6 (4.33)
Females	10 (8.66)	9 (8.66)	7 (8.66)
Group: Two male, one female			
Males	1 (8.66)	13 (8.66)	12 (8.66)
Females	12 (4.33)	0 (4.33)	1 (4.33)

Note: Expected frequencies shown in parentheses, observed frequencies outside parentheses.

Analysis of personality variables

The personality measures were included as exploratory variables to see if individual differences could predict behavioral outcomes in this situation. These measures were also included in an attempt to provide additional validation information about a scale that had been used in a previous study (e.g., McAndrew and Perilloux, 2010). Cronbach's Alphas for the sense of duty and activism subscales were so low that these variables will not be analyzed or discussed further in this paper. Cronbach's Alpha Coefficients for the remaining subscales were as follows: Social Inhibition = .725; Cynicism = .727; Sensation Seeking = .533; Glory Seeking = .671. A 2 (*sex of subject*) X 3 (*role played by subject*) MANOVA on Social Inhibition, Cynicism, Sensation Seeking, and Glory Seeking indicated no significant differences in scores among the astronauts, divers, and pitchers, $F(8, 140) = 1.15, p = .34$. There was, however, a significant main effect of *sex of subject*, $F(4, 69) = 6.80, p < .001, \eta^2 = .28$, and a significant interaction between the *sex of subject* and the *role played by subject*, $F(8, 140) = 2.50, p = .015, \eta^2 = .13$. The univariate analyses revealed that females scored significantly higher than males on social inhibition, F

(1, 72) = 7.13, $p < .009$, $\eta^2 = .09$, Means (SD) = 25.97 (5.35) vs. 22.85 (5.35), and that males scored higher than females on glory seeking, $F(1, 72) = 20.64$, $p < .001$, $\eta^2 = .22$, $M(SD) = 15.82(2.25)$ vs. 12.28 (2.75). There were significant interactions between *sex of subject* and *role played* for sensation seeking, $F(2, 72) = 4.11$, $p < .02$, $\eta^2 = .103$, and glory seeking, $F(2, 72) = 6.30$, $p < .003$, $\eta^2 = .149$.

Table 4 revealed somewhat different trends. For sensation seeking, male astronauts were the lowest scoring of the males, but female astronauts scored higher in sensation seeking than females playing other roles. For glory seeking, male divers and pitchers scored significantly higher than did male astronauts, but female glory seeking scores did not differ across roles. The means and standard deviations from these interactions can be seen in Table 4. These measures of sensation seeking and glory seeking have been used in one other study with all-female groups (McAndrew and Perilloux, 2010) where female divers scored higher than female astronauts and pitchers on glory seeking, but not on sensation seeking. Thus, glory seeking and sensation seeking distinguished males in different roles from each other more clearly than they distinguished females, but the effect was fairly modest.

Table 4. Descriptive statistics for self-rated sensation seeking and self-rated glory seeking broken down by role and sex

	ROLE PLAYED BY SUBJECT		
	<i>Astronaut</i> <i>Mean (SD)(n)</i>	<i>Diver</i> <i>Mean (SD)(n)</i>	<i>Pitcher</i> <i>Mean (SD)(n)</i>
<i>Sensation Seeking</i>			
Males	11.25 (2.75)(4)	12.64 (3.24)(17)	11.73 (2.85)(18)
Females	17.18 (3.05)(22)	15.89 (3.41)(9)	13.63 (4.31)(8)
<i>Glory Seeking</i>			
Males	12.25 (2.06)(4)	16.06 (1.82)(17)	16.39 (2.00)(18)
Females	12.82 (2.59)(22)	11.22 (3.35)(9)	12.00 (2.39)(8)

Discussion

This is a laboratory study in which no one's life was actually put at risk for others, so we must be careful about comparing too freely with the truly heroic behavior so often exhibited in the real world. Nevertheless, our results confirm that engaging in "self-sacrificial behavior" is in fact a profitable long-term strategy. The ordeal that divers had to endure was judged to be more difficult, costly, and important to the success of the group, and in the end these individuals were liked better, were rewarded with more money, and were preferred as future work partners. Moreover, self-rated personality traits that one might expect to be positively related to competitive altruism were more salient for males than for females, with males scoring higher than females on glory seeking and lower than

females on social inhibition.

The fact that the Diver was not perceived to be the leader of the group is probably an artifact of the experimental tasks. The Astronaut was the only person nominally responsible for directing the behavior of others, so in hindsight it is only natural that this role may have offset tendencies to identify the Diver as a leader. The fact that the altruists in our experiment were not accorded higher status is more perplexing. It is especially curious in that previous studies using this exact procedure with sexually homogenous male and female groups found that divers in these groups did acquire status as a result of their actions (McAndrew, 2009a; McAndrew and Perilloux, 2010), which is consistent with findings from laboratory studies that used other procedures (Berezkei, et al, 2010; Hardy and Van Vugt, 2006). There may be something about the interaction of the gender dynamics and the nature of the tasks that made the concept of status more ambiguous to our subjects, but there is no way to know for sure.

Despite this finding, a quest for status does seem to be part of our altruists' motivations, at least for males. Male divers perceived their role as higher in status than did female divers, and "glory seeking" was the personality trait that most clearly distinguished males in the active roles (diver and pitcher) from those in the more passive astronaut role. Clearly, the relationship of status seeking to self-sacrificial altruism needs to be examined closely in future studies.

The presence of more than one male triggered competitive altruistic behavior, completely shutting females out of the "heroic" role in these groups. In the groups with two females, females played the role of the diver at a rate that would be expected by chance. However, in the two-male groups, this never happened. The group deliberation process through which roles were determined was described in the Method section of this paper, and during these conversations it was not unusual for females to express an initial willingness to be the diver in these groups. However, when the dust settled after the group negotiated its role assignments, no female divers materialized.

One of the shortcomings of our study is that we must infer the motivations of the participants indirectly from their behavior under different experimental conditions. Future studies might attack this more directly by studying the role negotiations that take place at the beginning of the study. Assuming that the subjects are conscious of their motives, getting self-report measures of what individuals are trying to accomplish through playing different roles might be illuminating. It may be that groups with multiple males were simply assigning women to the "female-typical" clerical role, but without tracking the negotiations that occurred, it is impossible to say for sure. Looking at whether the roles were actively sought or passively acquired and asking people to rank order their role preferences prior to group discussion and then comparing this to what actually transpires would clearly be of interest.

To the extent that there was anything surprising in the results, it was the general lack of selfish behavior in the allocation of money. Only six pitchers out of 26 and only one astronaut out of 26 (a female who allocated 42 of the available 45 dollars to herself) allocated more than \$15.00 to him/herself. On the other hand, 19 out of 26 divers allocated more than \$15.00 to themselves, apparently feeling that their costlier behavior merited higher compensation. Even in these cases, however, the allocations were not unduly greedy

and only once exceeded an allocation of \$21.00 (a male who allocated 30 of the available 45 dollars to himself).

In summary, our study makes a number of contributions to the literature. First and foremost, it demonstrates the validity of a new experimental paradigm for studying altruism, and it demonstrates that rewards do indeed come to those who sacrifice for the common good. Our results are also in line with the Challenge Hypothesis in showing that such behaviors are more likely to occur when competition between males is imminent. In groups with only one male, that male did not behave altruistically more often than would be expected by chance. This suggests that the presence of a second male was the trigger for the self-sacrifice and also suggests that competitive altruism might be a more compelling explanation for the males' behavior than reciprocal altruism, although this is admittedly still an open question. This is the first time that the Challenge Hypothesis has been used to predict and explain altruistic behavior rather than aggressive behavior, and it would be an interesting and logical next step to see if male competitive altruism is mediated by testosterone in the same manner as male aggressive behavior is in "challenge" situations (Klinesmith, Kasser and McAndrew, 2006; McAndrew, 2009b).

At least one previous study has indicated that self-sacrificial behavior is most likely to occur if it benefits kin or those with close social ties to the altruist (Harrison, Sciberras and James, 2011), but our study clearly demonstrates that it freely occurs among strangers as well, given the right circumstances. Our results are also consistent with the contention of previous researchers (Griskevicius et al, 2007; Hawkes, 1991; Iredale and Van Vugt, 2009) that "showing off" and risky heroism are behaviors more likely to be displayed by males, and that the challenge hypothesis offers a viable framework for understanding this type of altruistic behavior.

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