# Sex, Fear, and Greed: A Social Dilemma Analysis of Gender and Cooperation*

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*Abstract*

*Results from previous studies have led many researchers to conclude that sex has no effect on cooperation in social dilemmas. This article reconciles strong theoretical expectations of sex differences in cooperation with the dearth of empirical evidence for such differences. I show that several theories of sex- or gender-related behavior suggest we should expect males and females to respond more strongly to greed and fear, respectively, in social dilemmas. I argue that previous research has failed to find differences because researchers have consistently used the Prisoner's Dilemma game (or its public goods variants) to investigate whether sex affects cooperation. Because Prisoner's Dilemma contains both fear and greed, the theories outlined in this article predict no sex differences in cooperation in Prisoner's Dilemma. A series of hypotheses about the conditions under which sex affects cooperation are proposed and tested against the results of two new studies. Results from both studies support two of the three hypotheses. I conclude by discussing some implications of the findings for collective action and inequality and by suggesting directions for future research.*

From international arms-control agreements (Bueno de Mesquita & Lalman 1992) to reciprocity in everyday exchanges between neighbors (Macy & Skvoretz 1998; Yamagishi & Cook 1993), conflicts between individual and collective interests are ubiquitous in social life. Situations involving such conflicts, or social dilemmas, have received much attention from social scientists in recent years.[1] One reason for such widespread interest is that many important social problems, such as political participation (Kanazawa 2000) and the mobilization of collective action (Heckathorn 1996), require the resolution of social dilemmas. Or as Kollock (1998:183) observes, "many of the most

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challenging problems we face, from the interpersonal to the international, are at their core social dilemmas." Arguably then, the importance of understanding the conditions that produce cooperation in social dilemmas cannot be overestimated.

While social dilemma research has generated many important insights about various structural and social psychological determinants of cooperation, clear answers to one question have eluded researchers for more than three decades. At least since Rapoport and Chammah (1965) researchers have asked whether sex or gender affects cooperation in social dilemma situations.[2] Despite strong theoretical expectations of sex differences in cooperation, however, empirical support for these theories has not been forthcoming.

The inability of social scientists to draw clear conclusions from previous research about the effects of sex on cooperation is well documented (Ledyard 1995). While some studies have found more cooperation from females (Bonacich 1972; Dawes, McTavish & Shaklee 1977), other findings suggest that males are more cooperative (e.g., Brown-Kruse & Hummels 1993; Sell & Wilson 1991). The majority of evidence, however, points to no differences (Caldwell 1976; Goehring & Kahan 1976; Sell 1997). The equivocal results led Ledyard (1995:161) to conclude that the question of whether sex affects cooperation in social dilemmas remains open.[3]

I argue that the inability to draw more definitive conclusions from past studies stems from the fact that previous investigations of sex and cooperation have focused almost exclusively on Prisoners' Dilemma. The problem with this focus, as discussed below, is that social dilemmas differ from each other in important ways. Furthermore, the theories I outline below suggest that an exclusive focus on Prisoner's Dilemma is particularly problematic when the independent variable of interest is sex. Specifically, these theories suggest that females are more likely to defect out of fear (the prospect that one's cooperation may be exploited) while males are more likely to defect out of greed (the temptation to free-ride on others' cooperation).[4] Because, as discussed below, Prisoner's Dilemma contains both fear and greed, the theories suggest that we should not expect to observe sex differences in it.

The goal of this article is to provide a more general treatment of the sex and cooperation question. To that end, the article is organized as follows. I begin with a brief description of social dilemmas and outline key differences between the various types. I then review several theories of gender/sex-related behavior, including social-role theory (Eagly 1987) and evolutionary psychology (Kanazawa 2001; Tooby & Cosmides 1992). Based on these perspectives, I outline a series of hypotheses, which are tested against the results of two new experimental studies. Results of both studies yield support for two of the three hypotheses. The article concludes with a discussion of the lack of support for one of the three hypotheses, some implications of the findings, and suggestions for future research.

TABLE 1: Payoff Matrices for Three Social Dilemmas

Prisoner's Dilemma (Greed and Fear)

| | C | D |
|---|---|---|
| C | 3, 3 | 1, 4 |
| D | 4, 1 | 2, 2 |

$T = 4 > R = 3 > P = 2 > S = 1$

Fear (No Greed)

| | C | D |
|---|---|---|
| C | 4, 4 | 1, 4 |
| D | 4, 1 | 3, 3 |

$T = R = 4 > P = 3 > S = 1$

Greed (No Fear)

| | C | D |
|---|---|---|
| C | 2, 2 | 1, 4 |
| D | 4, 1 | 1, 1 |

$T = 4 > R = 2 > P = S = 1$

## Fear and Greed in Social Dilemmas

By far the most widely studied social dilemma is the two-person Prisoner's Dilemma, which confronts each player with two options, to cooperate and to defect (see Table 1). The intersections of these two choices result in four possible outcomes: $R$ (reward) and $P$ (punishment) are the payoffs for mutual cooperation and defection, respectively, while $T$ (temptation) and $S$ (sucker) are the payoffs for unilateral defection and cooperation.

In Prisoner's Dilemma, $T$ (unilateral defection) > $R$ (mutual cooperation) > $P$ (mutual defection) > $S$ (unilateral cooperation). This payoff structure is such that, if the game is played once, defection "dominates" cooperation. That is, no matter what she expects Player B to do, a *rationally self-interested* Player A will defect. If B cooperates, A gains more from defection than cooperation ($T > R$). Similarly A gains more from defection if B defects ($P > S$). Because exactly the same logic applies to Player B, two rationally self-interested actors are doomed to a poorer fate than if they had both cooperated ($P < R$).

The ubiquity of Prisoner's Dilemma in research designs likely stems from the fact that it simultaneously captures two motivations for defection, fear and greed.[5] Fear denotes the prospect that one's cooperation may be exploited (that is, that one may be "suckered"). The player who responds to fear asks "given the worst-case scenario [alter defects], how should I respond?" Thus, an uncooperative response to the fear component in social dilemmas may be thought of as social risk avoidance. For example, a person who does not show up for a protest rally because she believes others will stay at home is responding to fear. Similarly, the high bidder on an item auctioned on e-bay may not send payment out of concern the seller will not deliver the merchandise. More formally, the fear component in social dilemmas is given by the difference

between the payoffs for mutual defection and unilateral cooperation (*fear* = $P - S$). For the Prisoner's Dilemma given in Table 1, *fear* = 2 – 1.

Greed, on the other hand, corresponds to the temptation to free-ride on others' cooperation. The player who responds to greed asks "given the best-case scenario [alter cooperates], how should I respond?" Greed therefore denotes social competition. In the examples above, a person may avoid the protest, content to free-ride on the participation of those who do attend. Similarly, the seller of the e-bay item may keep the bidder's payment and the auction item for herself. Formally, the difference between the payoffs for unilateral defection and mutual cooperation captures the greed component in social dilemmas (*greed* = $T - R$). For the Prisoner's Dilemma game in Table 1, *greed* = 4 – 3.

Changes in the relative values of fear and greed produce different types of social dilemmas. For example, the Chicken Game reverses the two lowest payoffs in Prisoner's Dilemma ($P$ and $S$) such that $T > R > S > P$. As in Prisoner's Dilemma, because $T > R$, greed motivates defection. However, because $S > P$, fear does not. In fact, because the sucker payoff is higher than the punishment payoff for mutual defection, the expectation that alter will defect in Chicken leads to cooperation.

Compared to Prisoner's Dilemma, the game of Assurance reverses the two *highest* payoffs, $R > T > P > S$, thus presenting precisely the opposite problem of that posed by Chicken. In Assurance, because $R > T$, defection cannot be attributed to greed. Rather, defection results from the fear that others will defect (because $P > S$).

In sum, different social dilemmas embody very different types of cooperation problems. In the Assurance Game, for example, solving the trust problem (reducing the concern that one's partner will defect) greatly enhances the prospects for mutual cooperation. But solving the trust problem in Chicken should actually *decrease* the likelihood that a player cooperates. In short, behavior in one type of social dilemma is not necessarily indicative of behavior in social dilemmas in general. It follows that a research program restricted to Prisoner's Dilemma may fail to capture important aspects of cooperation. The section to follow shows that such a restriction is especially problematic when the independent variable of interest is sex or gender.

## Theoretical Accounts of Sex, Gender, and Cooperation

This section reviews perspectives relevant to the sex and cooperation question. The goal of the section is not to offer an exhaustive account of all theories that may have implications for the question; nor is it to offer a comprehensive explication of the theories that are reviewed. The goal is simply to demonstrate that several key theories suggest we should expect sex differences in social dilemmas, but not in Prisoner's Dilemma.

## Gender and Cooperation in Feminist Theory

Recent studies point to Gilligan's (1982) work on differences in the moral development of females and males as a basis on which to predict differences in cooperation in Prisoner's Dilemma (Brown & Taylor 2000; Stockard, van de Kragt & Dodge 1988). According to Gilligan's argument, females and males approach moral problems in distinct ways, with females emphasizing relationships and care. Similarly, in a critique of traditional rational choice models of decision making, England (1989) suggests that males are more likely to view self-interested behavior as natural, whereas females are more likely to place equal weight on their own and others' well being.

Based on these and other feminist writings, social dilemma researchers have concluded that we should expect females to cooperate more than males in social dilemmas (Brown-Kruse & Hummels 1993; Stockard, van de Kragt & Dodge 1988). But these applications of Gilligan's work to behavior in social dilemmas have focused only on the greed component of Prisoner's Dilemma. Brown-Kruse and Hummels (1993), for example, write "Gilligan's empirical links to gender indicate that males are more likely to free-ride" (257). An exclusive focus on free-riding (or greed), however, ignores the other important motivation for defection in Prisoner's Dilemma, the possibility that others will not cooperate (fear).

In fact, Gilligan (1982:73–74) suggests the way in which females respond to the possibility of being suckered varies with the stage of what she calls the "ethic of care." Following the second transition in this process, Gilligan argues, females do not engage indiscriminately in self-sacrifice. Instead, they tend to strike a balance between concern for others' outcomes and, in social dilemma terms, an avoidance of being suckered. In short, when the full range of motivations for not cooperating is considered, Gilligan's work does not suggest that females will be more cooperative than males. Social-role theory and evolutionary psychology offer more straightforward predictions about the conditions under which we should expect sex differences to emerge.

## Sex Roles and Cooperation

One of the most comprehensive statements on the effects of sex-role socialization is Eagly's (1987) social-role theory. Eagly views behavioral differences between males and females as a result of their performance of different sex roles, or "shared expectations (about appropriate qualities and behaviors) that apply to individuals on the basis of their socially identified gender" (1987:12). The theory maintains that actors "seek to accommodate sex-typical roles by acquiring the specific skills and resources linked to successful role performance and by adapting their social behavior to role requirements" (Eagly & Wood 1999:412–13). Sex roles are therefore assumed to affect behavior both directly, through role conformity, and indirectly, through

the skills and beliefs transmitted to individuals via repeated role participation. The acquisition of role-typical beliefs and skills implies that sex roles affect behavior even when the situation does not call for performance of sex-consistent roles (Eagly 1987:12).[6]

Eagly and associates have identified several features of sex roles relevant to behavior in social dilemmas. First, according to the theory, the male role includes norms that encourage competition and aggression (Eagly 1987:71–72; Eagly & Steffen 1986). In contrast, Eagly (1987:72–73) states that the female role not only deemphasizes aggression but also emphasizes an *avoidance* of aggression from others or harm to oneself. Applied to cooperation in social dilemmas, the argument that male roles encourage competition suggests that males will be more likely than females to defect out of greed. That female roles emphasize the avoidance of aggression from others suggests that females will be more likely to defect out of fear.

### Sex and Evolutionary Psychology

While social-role theory views sex differences as rooted in social norms of role-appropriate behavior, evolutionary psychology seeks to explain such differences with reference to the different adaptive problems faced by males and females over the course of human evolution. Males and females faced different adaptive problems primarily in the area of parental investment (Trivers 1972). Females typically invested vastly greater amounts of time in offspring than males and therefore benefited (reproductively) by being more selective in their mate choices than males (Buss 1996).

The more fastidious mate selection of females, in turn, itself selected for greater intrasexual competition among males (Trivers 1972). That is, many females were likely to choose males who displayed signs of "good genes," such as abundant resources or physical strength, while males who did not display these indicators were chosen much less often. This asymmetry produced a greater "fitness variance" among males than among females (Campbell 1999). Males' greater fitness variance, in turn, tends to select for psychological mechanisms that dispose them to "risky competitive tactics, even those that might sometimes result in death, but that have paid off in reproductive currencies on average over human evolutionary history" (Buss 1996:17; see also Wilson & Daly 1985). Thus, males are predicted to be more risky and competitive than females.

In sum, despite their different points of departure, social-role theory and evolutionary psychology both imply that males will be more likely to defect out of greed while females will be more likely to defect out of fear. Because Prisoner's Dilemma contains equal parts of greed and fear, the theories agree that we should not expect it to show differences between males and females:

> *Hypothesis 1.* Given equal levels of greed and fear in a social dilemma, females and males will be equally likely to cooperate.[7]

*Hypothesis 2.* Given fear but no greed in a social dilemma, females will be less likely than males to cooperate.

*Hypothesis 3.* Given greed but no fear in a social dilemma, females will be more likely than males to cooperate.

The two studies outlined in the sections to follow provide tests of these three hypotheses.

## Study 1

Participants were undergraduates at a large university, recruited via flyers advertising the opportunity to earn money for participation in a "social decision making study." A total of 82 students (33 males and 49 females) participated.

### Settings and Procedures

Participants were scheduled in groups of four. Upon entering the laboratory, each participant was escorted to a private subject station equipped with a computer. Online instructions assured participants that they would not see other participants at any point during or after the study and that participants would be identified only via letters (e.g., person A). Participants were told that they would interact with other persons in surrounding subject stations and adjoining rooms but were given no other information about other participants (e.g., whether they were male or female). The procedure was described in detail and several practice sessions were administered. A series of questions assessed participants' understanding of the procedure.

In addition to sex as a between-subject block, there was a single within-subjects factor, Dilemma Type: fear–no greed (hereafter, Fear Dilemma), greed–no fear (hereafter, Greed Dilemma) and greed and fear (Prisoner's Dilemma). The payoffs associated with the three dilemmas used in this study are given in Table 1. Each point was worth $1.00.

The cell values were chosen in order to manipulate fear and greed without changing the overall incentive to cooperate or defect. The incentive to cooperate is given by the *K*-index (Rapoport 1967), and for the two-person dilemma: $K = (R - P) / (T - S)$. The index varies from 0 to 1 with higher values indicating a greater incentive to cooperate. Conversely, $1 - K$ denotes the incentive to defect and is the sum of the standardized greed and fear components of the dilemma,[8] where greed = $[(T - R) / (T - S)]$ and fear = $[(P - S)/(T - S)]$. For each of the Table 1 dilemmas, $K = .67$. The dilemmas differ according to whether the incentive to defect stems from fear, greed, or a combination of the two components. The Prisoner's Dilemma distributes the incentive to defect equally between the greed and fear components such that fear = greed = .33.

TABLE 2: Proportion of Cooperation by Sex and Game Type: Study 1

| | Males | Females | $\chi^2$ |
|---|---|---|---|
| Fear and greed | .45 | .45 | .002 |
| Fear–no greed | .55 | .61 | .362 |
| Greed–no fear | .33 | .57 | 4.482* |
| N | 33 | 49 | |

$p < .05$ (two-tailed)

In the Greed and Fear dilemmas, the incentive to defect stems purely from greed = .67 (fear = 0) and fear = .67 (greed = 0), respectively.

Participants were told that no two players would interact with each other more than once. In fact, others' choices were simulated. This was done in order to ensure that all participants received roughly equal payments for their time (from $8 to $12). Before each dilemma was presented, participants were told that they would be randomly assigned to "interact" with a different player. (The dilemmas were presented in random order.) Finally, to avoid the possibility that others' choices would affect subsequent decisions, participants were told they would not be informed of others' choices until the very end of the study. It took about 20 minutes for participants to complete the instructions and three dilemmas.

### Results

Table 2 displays the proportion of males and females who cooperated in each dilemma and the associated $\chi^2$ values. Hypothesis 1 predicts no difference in the cooperation rates of males and females in Prisoner's Dilemma. Consistent with this hypothesis, precisely 45% of males and 45% of females cooperated in this dilemma.

Hypothesis 2 predicts that fewer females than males will cooperate in the Fear Dilemma. In this dilemma, 61% of females and 55% of males cooperated, a nonsignificant difference ($p = .55$). Thus contrary to the logic underlying hypothesis 2, males and females were equally likely to cooperate in the Fear Dilemma.

The final hypothesis predicts males will be less likely than females to cooperate in the Greed Dilemma. As shown in Table 2, this is exactly what happened. Whereas 57% of females cooperated, only 33% of males did. This difference is significant ($p < .05$). Thus hypothesis 3 is supported.

### Discussion

Consistent with the bulk of past research, the results presented above show similar levels of cooperation by males and females in Prisoner's Dilemma. However, in the Greed Dilemma, females were nearly twice as likely as males to cooperate. Previous studies (e.g., Marwell & Ames 1981) report less cooperation from economics majors than from other students, a pattern Frank, Gilovich, and Regan (1993) attribute to the tendency for economics students to be more familiar with the neoclassical economics model (and its assumptions of self-interest). Additional analyses, available from the author, show that the results of Study 1 cannot be explained by a greater tendency of males to major in economics.

Support for hypothesis 3 calls into question the conclusion of many researchers that sex has no effect on behavior in social dilemma situations. Nevertheless, in a research area that has generated as many equivocal findings as the literature on sex and cooperation, one study is a thin reed on which to hang much confidence. I therefore conducted a theoretical replication of Study 1.

## Study 2

Study 2 was conducted one semester after Study 1. Recruitment procedures and the physical laboratory were identical to those used in Study 1. Participants for Study 2 were told correctly that they would take part in two unrelated studies.[9] A total of 73 students were scheduled to participate. However, two students chose not to respond to the information for Study 2, and a third responded incorrectly, leaving 70 participants (32 males and 38 females).

### Settings and Procedures

Study 2 was similar to Study 1 with two exceptions. First, all information was presented to participants on paper, rather than via computer. This change was motivated by research that points to sex differences in computer-related behaviors and skills (see Lockheed 1985). To my knowledge, there is no reason to expect that sex differences in computer skills (if such differences exist) would have interacted with dilemma type in Study 1 to produce sex differences in one dilemma but not in the others. Nevertheless, use of a different instrument allows a test of whether the results obtained in Study 1 are robust across the medium of measurement.

The most important difference between Study 1 and Study 2 was that participants in the latter were not paid for their responses.[10] Stockard, van de Kragt, and Dodge (1988) suggest that social dilemma experiments should be

TABLE 3: Proportion of Cooperation by Sex and Game Type: Study 2

| | Males | Females | $\chi^2$ |
|---|---|---|---|
| Fear and greed | .34 | .37 | .046 |
| Fear–no greed | .41 | .42 | .016 |
| Greed–no fear | .22 | .47 | 4.92* |
| N | 32 | 38 | |

$p < .05$ (two-tailed)

conducted using resources other than money, because of the possibility that males and females evaluate resources differently. In a test of this argument, Sell, Griffith, and Wilson (1993) observed no sex differences in cooperation when participants were paid in money, but less cooperation by females than males when the resource was "time with an expert" (e.g., tutoring session or music lesson). Again, although there is no clear theoretical reason to expect resource type to interact with dilemma type, it is important to test whether the findings from Study 1 hold for resources other than money. To that end, participants were asked to define the resources in any way they wished. The instructions stated: "imagine the points represent something valuable to you and others. The points can represent *anything.* The important thing is that you imagine they are valuable." At no point was money or any other resource mentioned. All other aspects of Study 2 were similar to Study 1, including the values in each cell (Table 1).

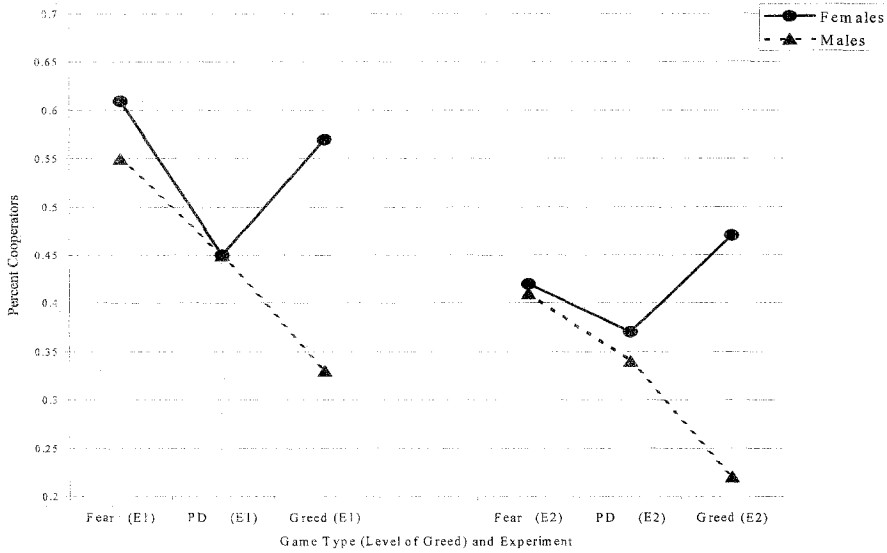
### Results

Table 3 gives the proportion of males and females who cooperated in each dilemma and the associated $\chi^2$ values. The results are remarkably consistent with those of Study 1. Hypothesis 1, which predicts equal rates of cooperation from males and females in Prisoner's Dilemma, is supported: 34% of males and 37% of females cooperated, $p = .83$.

Hypothesis 2 predicts less cooperation from females in the Fear Dilemma. As in Study 1, the results do not support this hypothesis. Cooperation rates of males (41%) and females (42%) were virtually identical ($p = .90$).

Finally, hypothesis 3 predicts that males will be less likely to cooperate in the Greed Dilemma. Again, the results are consistent with the results of Study 1 and with the hypothesis. Females (47%) were more than twice as likely as males (22%) to cooperate in the Greed Dilemma ($p < .05$), providing further support for the hypothesis. As in Study 1, additional analyses show the results cannot be attributed to a greater tendency for males to major in economics.

FIGURE 1: Proportion of Cooperative Choices by Experiment, Sex, and Game Type




## Discussion

The findings of Study 2 suggest that the Study 1 findings are quite robust. Hypotheses 1 and 3 received consistent support and, in both studies, the findings were inconsistent with hypothesis 2. To further illustrate the overall pattern of results, Figure 1 graphs cooperation rates for all conditions of both studies. The Y-axis gives the proportion of participants who cooperated and the X-axis corresponds to the study and dilemma type. Within each study, movement along the X-axis away from the origin corresponds to increases in the level of greed and decreases in the level of fear. An interesting detail is that, while the two studies yielded similar results, in terms of differences between dilemmas and between males and females, the absolute level of cooperation was lower in Study 2. Since participants were paid for their choices in Study 1, but not Study 2, the difference is counterintuitive. Shouldn't paying participants with real incentives like money motivate more self-interested responses than imaginary incentives like those used in Study 2? Orbell and Dawes (1981:57) seem to think so:

> It makes no sense to spend large amounts of money for summer salaries, secretaries, computer terminals and research assistants, and then motivate the subjects with microscopic amounts of money (quoted in Kollock 1998:207).[11]

Kiyonari, Tanida, and Yamagishi (2000) offer an explanation for the apparent anomaly. Briefly, they argue that motivating social dilemma participants with money, rather than less valuable incentives, leads to a "social exchange heuristic," the effect of which is to increase overall levels of cooperation. The implication is that *if* the goal of social dilemma research is to understand how to coordinate cooperation among "rational egoists," then *any* monetary payment to research participants may be too much. Of course, the important point for current purposes is that differences between males and females, and between conditions, did not depend on resource type, as previous work (Sell, Griffith & Wilson 1993) has found.

Figure 1 also shows that, as greed increased (from nonexistent in the Fear Dilemma, to intermediate in Prisoner's Dilemma, to the maximum in the Greed Dilemma), fewer and fewer males cooperated. Although the present focus is on sex differences within dilemmas rather than differences in the behavior of males (or females) across dilemmas, a reader may question why more males cooperate in Prisoner's Dilemma (where defection *strongly dominates* cooperation) than in the Greed Dilemma (where defection *weakly dominates* cooperation). The arguments outlined above anticipate this pattern: Males are expected to respond more strongly to greed than fear. Thus, we should expect more defection from males in the Greed Dilemma, which has twice the level of greed that Prisoner's Dilemma has.

On the other hand, the results did not support the argument that females would respond more strongly than males to the fear component. The findings are therefore only partly in line with the reasoning of social-role theory and evolutionary psychology outlined above. At issue for the remainder of this section are possible explanations for the consistent lack of support for the fear hypothesis. The links drawn earlier between responses to the fear component in social dilemmas and social risk suggest that the literature on risk aversion may offer insight into this issue, and the results of a recent metanalysis (Byrnes, Miller & Schafer 1999) seem especially suggestive.

Byrnes and colleagues' (1999) analysis included previous investigations of a wide range of risk-taking behaviors. As expected, where sex differences were present, males were more likely to engage in risk-taking than females. For current purposes, however, the most important finding was a main effect for publication date, with earlier studies yielding larger sex differences in risk-taking than more recent studies. From this pattern, the authors concluded that sex differences in risk taking are declining. Moreover, they suggest, the greatest differences between males and females occur for those risk-taking behaviors that also entail competition. These findings are important because they suggest that while sex differences in some domains related to social dilemmas (fear) are disappearing, differences in other domains (greed) remain intact.

The results of their review led Byrnes and colleagues to call for more qualified evolutionary psychological statements on sex differences in risk taking.

More specifically, they argued that while much evidence supports evolutionary psychology's predictions for male/female differences in competition, the same is not true for risk: "if risk taking is, in fact, 'an attribute of the masculine psychology' as [evolutionary psychologists] Wilson and Daly (1985) suggest, it does not ... manifest itself in a simple way across . . . contexts" (1999:377). If this reasoning is sound, it should also apply to the logic on which the above hypotheses are based and thus may help to explain the absence of sex differences in the Fear Dilemma.

It is also possible that the findings from the two studies reported above (as well as those summarized in Byrnes et al.'s review) might be best explained not by a modified evolutionary psychological approach, but a sociological approach that offers an account of large-scale changes in sex role beliefs and behaviors (e.g., Kimmel 2000). Of course, such an explanation would need to account for the decline of sex differences in some domains of social dilemmas (responses to fear and risk) and persistence of differences in others (greed).

I argued earlier that both social-role theory and evolutionary psychology offer important insights into the problem of sex differences in cooperation. The results of this article do not allow us to conclude whether a social-role theory, evolutionary psychology, or an altogether different approach, best explains sex differences in cooperation. Certainly, the results suggest that if social-role theory and evolutionary psychology are to guide our understanding of the issue, alternative specifications are needed. For current purposes, the value of these approaches is that they point to the importance of the fear-greed distinction in understanding whether and when we should expect sex differences in cooperation.

## Implications and Future Research

As noted earlier, social dilemmas codify a wide range of situations that pose conflicts between individual and collective interests. Thus, observed sex differences in cooperation should have import for a variety of social issues. Consider, for example, how these findings might inform research on the mobilization of collective action. A key insight of collective action theorists is that mobilization is characterized by a third-order (or "*S*-shaped") production function (Marwell & Oliver 1993). Heckathorn (1996) shows that each of the three segments of the production function (accelerating, linear, and decelerating) confronts potential contributors with a different type of social dilemma. Initial stages of collective action, characterized by an accelerating production function, pose an Assurance Game. As the function becomes linear, the collective action problem is transformed into Prisoner's Dilemma. The final stage of mobilization, in which the production function is decelerating, confronts actors with a Chicken Game.

In the terminology of this article, the motivation for not contributing in the initial stages of collective action is based on fear. As collective action proceeds, the fear component is gradually replaced by greed. Thus, holding constant the reason for collective action, the theory and findings outlined earlier would lead us to expect similar contributions by males and females during the intermediate stages of the collective action. On the other hand, the above findings would lead us to expect higher contributions from females in the later stages of collective action. And while one of the hypotheses leads us to expect higher contributions from males in the initial stages, the findings did not support this prediction. Future research should assess these predictions using data on contributions to real-world collective actions.

These findings should also have import for a more commonplace phenomenon: everyday social and economic exchanges. For example, as discussed earlier, many types of exchanges entail high levels of greed. The theory and results reported earlier suggest we should expect more opportunistic acts from males in such exchanges. If so, this may provide *one* micro-mechanism through which sex-based resource inequalities persist.

Alternatively, perhaps future research will show that baseline sex differences like those reported above are attenuated (or perhaps magnified) by the characteristics of potential contributors to collective actions or parties to exchanges. For instance, the studies outlined earlier were based on the simplifying assumption that actors do not have information about alter's sex. While this simplification is a useful starting point, group characteristics, such as sex composition (Sell, Griffith & Wilson 1993) and the salience of group boundaries (Kramer & Brewer 1984) have been shown to produce sex differences in cooperation. The exact mechanisms through which group composition effects occur, however, remain unclear. For this reason, an important objective for future research is the development of theories that account for the more situational aspects of gender. Such a research program should offer important insights into the determinants of male-female differences in cooperation and competition as well methods for the elimination of those differences.

## Notes

1. For recent reviews, see Kollock (1998) and Yamagishi (1995). In this article, I follow the formal definition of social dilemmas offered by Liebrand (1986:113–14). Social dilemmas "are situations in which (a) [defection] yields the person the best payoff in at least one configuration of choices made by others; (b) [defection] has a negative impact on the interests of other persons involved; (c) the collective choice of [defection] results in a deficient outcome, that is, a result that is less preferred by all persons than the result which would have occurred if all had [cooperated] instead of [defected]."

2. Sociologists distinguish between *sex, sex category,* and *gender* (see Wiley 1995:362). This article reviews both gender- and sex-based explanations but takes no stance on the extent to which differences in cooperation stem from gender or from sex. Thus, while *sex category* is probably the more suitable term for this article, I opt to use the shorter term, *sex.*

3. Some of the contradictory findings probably result from procedural differences between studies. Yet even similar experimental designs have yielded inconsistent results (cf. Sell, Griffith & Wilson 1993 experiment 1 with Sell & Wilson 1991). Thus, while the majority of studies find no sex differences in cooperation in Prisoner's Dilemma (Eckel & Grossman 2000), the question remains: Why so many inconsistent findings? I can only speculate. The Prisoner's Dilemma literature is notoriously large and it is possible that the number of studies reporting sex differences is less than chance. A meta-analysis of results from previous research is difficult because researchers do not always report whether they investigated the possibility of sex differences in cooperation, which cannot be taken to mean an absence of a difference. For example, Stockard, van de Kragt & Dodge (1988) report significant sex differences in data from two previously published articles (Orbell, van de Kragt & Dawes 1988; van de Kragt, Orbell & Dawes 1986). But neither original study mentioned sex. Thus, studies of Prisoner's Dilemma originally motivated by some other theoretical question may become impromptu studies of sex and cooperation.

4. I define fear and greed more formally below. Note that the meanings of the terms fear and greed as used here differ from the way the terms are employed in everyday discourse. My use of these terms is based on previous work (Dawes et al. 1986; Van Lange et al. 1992; Yamagishi & Sato 1986).

5. Some previous studies of gender and cooperation (e.g., Sell 1997; Sell, Griffith & Wilson 1993) have employed an *N*-person public goods variant of Prisoner's Dilemma. The comments to follow also apply to these designs.

6. It is for this reason that some researchers object to the use of terms like sex or gender *roles.* West and Zimmerman (1987), for example, write, "Roles are *situated* identities — assumed and relinquished as the situation demands — rather than *master* identities. Unlike most roles ... gender has no specific site or organizational context" (128, emphasis original).

7. Hypothesis 1 is the null hypothesis. Thus large $p$ values are necessary to claim with any confidence that it is supported by the data. This is not an issue with the results reported below.

8. That is, Greed + Fear = $[(T - R) / (T - S)] + [(P - S)/(T - S)] = (T - R + P - S)/(T - S) = (T - S)/(T - S) - (R - P)/(T - S) = 1 - K$.

9. Study 2 was conducted immediately *before* a pilot test of a theory of social exchange so that participants' responses would not be affected by the social exchange procedure.

10. They were paid for their responses in a subsequent procedure. (See note 9.)

11. For the record, the author received no summer salary, had no secretary, and even abandoned the computer terminals after Study 1. Over the course of the two studies,

three research assistants (Farshid Azad, Antoinette Schoenthaler, and Mia Solvesson) were motivated with microscopic amounts of money to help with data collection and coding. I thank them for their assistance.

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