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Sex Differences in Cooperation: A Meta-Analytic Review of Social Dilemmas

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Although it is commonly believed that women are kinder and more cooperative than men, there is conflicting evidence for this assertion. Current theories of sex differences in social behavior suggest that it may be useful to examine in what situations men and women are likely to differ in cooperation. Here, we derive predictions from both sociocultural and evolutionary perspectives on context-specific sex differences in cooperation, and we conduct a unique meta-analytic study of 272 effect sizes—sampled across 50 years of research—on social dilemmas to examine several potential moderators. The overall average effect size is not statistically different from zero ($d = -0.05$), suggesting that men and women do not differ in their overall amounts of cooperation. However, the association between sex and cooperation is moderated by several key features of the social context: Male–male interactions are more cooperative than female–female interactions ($d = 0.16$), yet women cooperate more than men in mixed-sex interactions ($d = -0.22$). In repeated interactions, men are more cooperative than women. Women were more cooperative than men in larger groups and in more recent studies, but these differences disappeared after statistically controlling for several study characteristics. We discuss these results in the context of both sociocultural and evolutionary theories of sex differences, stress the need for an integrated biosocial approach, and outline directions for future research.

Keywords: gender, sex differences, cooperation, social dilemmas, meta-analysis

Are women or men more cooperative? There is some evidence that women, relative to men, are kinder (Conway, Pizzamiglio, & Mount, 1996; Eagly & Steffen, 1984), more agreeable (Feingold, 1994), more supportive of their friends (Oswald, Clark, & Kelly, 2004), and more cooperative in same-sex work groups (Chatman & O'Reilly, 2004). In contrast, men provide more help to strangers in need (Eagly & Crowley, 1986), have a stronger preference for coordinated social play as children (Benenson, Apostoleris, & Parnass, 1997), and tend to cooperate more in larger groups (Gabriel & Gardner, 1999).

In a seminal review of sex differences, Maccoby and Jacklin (1974) examined the degree to which men and women differ in a variety of social behaviors. Although they found some evidence for sex differences, in most behavioral domains—including cooperation—research findings were rather inconclusive. Recent behavioral economics research comparing men's and women's decisions in bargaining games (Eckel & Grossman, 2001; Solnick, 2001) and dictator games (Andreoni & Vesterlund, 2001; Bolton & Katok, 1995; Dufwenberg & Muren, 2006) also finds no systematic sex differences. Taken together, several decades of research suggest that overall women and men are equally cooperative.

Recent theorizing on sex differences suggests that rather than looking for main effects, it may be more productive to investigate the environment in which men and women make cooperative decisions (Hyde, 2005; Simpson & Van Vugt, 2009; Weber, Kopelman, & Messick, 2004). Depending on contextual factors, sometimes women may be more cooperative, and other times men. To investigate context-dependent sex differences in cooperation, we use a meta-analytic approach to analyze research on experimental social dilemmas, a decision environment that is highly controlled and allows us to test some potentially important moderators.

Although cooperation can be studied with a variety of methods, including ethnographies (e.g., Mauss, 1950/1990; Mead, 1961; Sahlins, 1972) and surveys (e.g., Major & Adams, 1983; Swap & Rubin, 1983), the social dilemma literature uses a standard experimental paradigm to investigate when and how individuals coop-

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erate (Pruitt & Kimmel, 1977). In social dilemmas, cooperative motives are pitted directly against selfish motives, and individuals must choose between these two motivations (Dawes, 1980).[1] In addition to offering an unambiguous and carefully controlled decision situation to study cooperation, two strengths of the social dilemma literature are its vastness—it spans over 50 years of research—and the fact that many important contextual variables, including the size and sex composition of the group, have been investigated. As we outline below, these contextual variables may be crucial in determining whether women or men are more cooperative.

The present research examines 50 years of empirical research on social dilemmas with three primary goals in mind. First, we provide a conclusive meta-analytic test to examine whether women or men are more cooperative. Second, we draw insights about potential sex differences in cooperation by utilizing two dominant frameworks on sex differences in social behavior: the evolutionary and the sociocultural perspective. Third, we examine several potential moderators of sex differences in cooperation (e.g., sex of the partner, one-shot vs. iterated interactions, group size, and year of publication).

Social Dilemmas

Social dilemmas are situations in which two or more individuals interact with each other. Each person must decide between a behavioral option that results in a good outcome for themselves versus one that results in a good collective outcome (Dawes, 1980; Kollock, 1998; Komorita & Parks, 1994). If each individual chooses selfishly, then everyone in the group ends up with a worse outcome than if each individual acts in the interest of the group. The most commonly studied social dilemma is the prisoner's dilemma. In its most simplified version, this dilemma involves two individuals and presents each person with two options (cooperate or defect). If both individuals cooperate (the C-choice), each person receives a modest monetary reward (say $10). However, if only one person cooperates, then the defecting partner (the D-choice) receives a large payoff (say $40), and the cooperator receives the lowest payoff ($0)—the so-called "sucker" payoff. If both individuals pursue their dominant strategy (to defect), then each receives a lower payoff (say $2) than if both cooperated ($10). It is a social dilemma because each individual gains more by defecting regardless of what the other person does, but they will both be better off if they both cooperate rather than defect.

Social dilemmas can involve two persons or more. Extensions of the prisoner's dilemma to larger groups include N-person prisoners dilemmas, public goods dilemmas (give-some games), and resource dilemmas (take-some games). In public goods dilemmas, the players can decide to cooperate with each other to provide the public good (e.g., public radio), but there is a temptation for each to not contribute. In resource dilemmas, the players can cooperate with each other to maintain a common resource (e.g., common fisheries), but there is a selfish temptation for each individual to consume as much as possible. There is much research both on public goods (Ledyard, 1995) and resource dilemmas (Kopelman, Weber, & Messick, 2002) that has reported the effect of sex on cooperation, which we include in our meta-analysis.

The social dilemma paradigm has both a high internal and external validity, which makes it very suitable for testing potential sex differences that can be generalized across a wide range of cooperative situations, from helping complete strangers to cooperating in romantic relationships and from dyadic social dilemmas to group dilemmas. Furthermore, the social dilemma paradigm measures actual behavior rather than hypothetical decisions or behavioral intentions. Finally, the social dilemma literature is vast—spanning over 50 years—and one of the most commonly reported variables in research on social dilemmas is the participant's sex, which makes it ideally suited for a thorough meta-analytic review.

Sex Differences in Cooperation

In one of the earliest research on sex differences in cooperation, Rapoport and Chammah (1965) compared male–male, female–female, and mixed-sex dyads behavior in an iterated (repeated) prisoner's dilemma lasting 300 trials. They found that, on average, the male–male pairings exhibited greater cooperation than the mixed-sex pairings, with the female–female pairings being least cooperative. Although this study failed to provide a convincing explanation for these results, it nevertheless sparked a great deal of interest in sex differences in cooperation in the late 1960s and early 1970s (e.g., Bedell & Sistrunk, 1973; Grant & Sermant, 1969). However, there was not a clear picture emerging from these studies (Maccoby & Jacklin, 1974).

Without a clear theory to work from, social psychologists' interest in sex differences in cooperation waned by the 1990s. Nowadays, it is primarily behavioral economists who study sex differences in social dilemmas (e.g., Brown-Kruse & Hummels, 1993; Cadsby & Maynes, 1998; Mason, Phillips, & Redington, 1991; Ortmann & Tichy, 1999). For instance, Croson and Gneezy (2009) recently provided a narrative review of the economics literature and concluded that the results on sex differences are inconclusive. Without doing a systematic meta-analysis, they observed a greater variation in women's cooperation across studies, suggesting that women are relatively more sensitive to the experimental context. However, they did not specify in which situations women and men respond differentially to social dilemmas. Thus, there is still no comprehensive picture of when sex differences in cooperation are likely to emerge in social dilemmas and, if so, why they are there.

A notable exception is Simpson and Van Vugt's (2009) recent theory arguing that men and women respond to different aspects of

[1] More specifically, social dilemmas involve a conflict between altruistic and cooperative (maximizing joint gain or equality) motives against individualistic, competitive, and aggressive motives (Van Lange, 1999). One prior meta-analysis examined sex differences in competition using social dilemmas (Walters et al., 1998). However, we believe that social dilemmas do not provide a strong test of sex differences in competitive motives because of at least two reasons. First, most individuals are driven by either cooperative or selfish motives during social dilemmas, with very few individuals adopting a competitive motivational orientation (Au & Kwong, 2004). Second, even when people are placed in matrix games that isolate competitive motives from self-interest, most everyone chooses to cooperate, presumably because cooperation is now aligned with self-interest (McClintock & McNeel, 1966). In fact, for the reasons outlined above, researchers label behavior either cooperative or non-cooperative in social dilemmas to avoid implying that non-cooperation was the result of being competitive (De Dreu, 2010; Pruitt & Kimmel, 1977). Therefore, in keeping with the literature on social dilemmas, we focus on sex differences in cooperation and not competition.

the social dilemma. Using an evolutionary approach, they argued that men defect primarily because they are motivated by personal greed, whereas women defect primarily because they are motivated by the fear of other's defection. Because prisoner's dilemmas, public goods dilemmas, and resource dilemmas involve both fear and greed components, there are no overall sex differences in cooperation showing up, but by manipulating fear and greed separately one can expect to find them (e.g., Simpson, 2003). Our research builds upon this idea by focusing on whether women and men respond differently to the social features of the social dilemma.

Theoretical Perspectives on Sex Differences in Cooperation

There have been various theoretical advances in social psychology in recent decades contributing to the scientific understanding of sex differences in social behavior (Deaux & LaFrance, 1998; Eckes & Trautner, 2000). Recent theoretical progress on understanding sex differences has been made primarily through both sociocultural and evolutionary psychology theories. Each of these major perspectives has guided research on sex differences in many areas, including helping behavior (Eagly, 2009; Eagly & Crowley, 1986), aggression (Archer, 2004, 2009; Eagly & Steffen, 1986), leadership styles (Eagly & Johnson, 1990), mate preferences (Kenrick & Keefe, 1992), and sexual strategies (Buss & Schmidt, 1993). Yet, surprisingly little research on sex differences in cooperation has been guided by either of these theoretical perspectives (for exceptions, see Geary, Byrd-Craven, Haord, Vigil, & Numtee, 2003; Sell & Kuipers, 2009; Simpson & Van Vugt, 2009), and, to our knowledge, no research has systematically compared these perspectives. As we describe below, each perspective provides unique insights into the origins and manifestation of sex differences in social dilemmas.

The Sociocultural Perspective

The sociocultural theory of sex differences considers different social experiences between men and women as the origin of sex differences in social behavior (Cross & Madson, 1997; Eagly & Wood, 1999; Wood & Eagly, 2010). According to this perspective, social structural aspects of society—a different distribution of men and women in specific social roles and a gender hierarchy—are the main contributors to sex typical social behaviors (Eagly & Wood, 1999). For instance, because men are, on average, physically stronger and faster and because women bear the costs of pregnancy and childcare, men and women have historically taken on different social roles. Because of these biological differences, men and women acquire culturally different sets of skills to fulfill the duties of their social roles, and this affects the expectations associated with their gender. Women are expected to assume a domestic role (or occupational role) that involves a great deal of interpersonal relationship skills. Accordingly, women are—or at least are perceived as—more communal in orientation, less selfish, more caring, friendly, and emotionally expressive (Eagly, 2009). On the other hand, men assume social roles of high status and power and so they are—or are perceived as—more independent, assertive, ambitious, and dominant. As a result of different socialization experiences, women thus develop more interpersonal skills, and men develop more agentic skills. Moreover, women and men may include their gender stereotype into their self-concept and self-regulate their behavior according to these standards (Witt & Wood, 2010). Indeed, previous research has found that stereotypes of men and women as agentic and communal, respectively, underlie many sex differences in social behavior, especially in contexts when these stereotypes are salient (Eagly & Wood, 2011).

What are the implications of sociocultural theory for understanding gender differences in social dilemmas? Cooperation in a social dilemma, by definition, conveys a concern for the welfare of others, which is what a communal orientation is all about (e.g., Conway et al., 1996; Deaux & Lewis, 1984; Eagly & Steffen, 1984). In contrast, an agentic orientation involves a concern for own outcomes over others outcomes (A. Campbell, Muncer, & Gorman, 1993; Pruitt, 1983), which should lead to greater defection in social dilemmas. Indeed, there is evidence that people with a communal orientation (Balliet, Parks, & Joireman, 2009; Probst, Carnevale, & Triandis, 1999) or who display communally oriented behaviors cooperate more in social dilemmas (Karremans & Van Lange, 2004; Rusbult, Verette, Whitney, Slovic, & Lipkus, 1991; Van Lange et al., 1997; Van Vugt & De Cremer, 1999). Women are expected to be more cooperative than men in social dilemmas (e.g., Orbell, Dawes, & Schwartz-Shea, 1994), which is consistent with gender stereotypes (e.g., Deaux & Lewis, 1984). Moreover, women are aware of these expectations in social dilemmas (e.g., Greig & Bohnet, 2009), so this may be considered a context when men and women may self-regulate their behavior according to these expectations.

Although Wood and Eagly (2010) have suggested that women should primarily display communal oriented behaviors toward close others, there is reason to believe that the communal orientation of women extends to strangers. Prior research on gender stereotypes suggests that women are more able to devote themselves to others more generally (e.g., Conway et al., 1996; Deaux & Lewis, 1984; Eagly & Steffen, 1984). Women also self-report greater importance of universalism values than men, which suggests they extend concern to others beyond close relationships (Schwartz & Rubel, 2005). Although the sociocultural view suggests a main effect of sex on cooperation, gender role stereotypes may be more or less activated in specific social contexts, and so sex differences may only appear within these contexts (Deaux & Major, 1987). Thus, we can examine the implications of this perspective for context-dependent sex differences in cooperation.

The Evolutionary Perspective

Evolutionary psychology assumes that some sex differences in social behavior result from unique—but flexible—evolved male and female psychologies. The argument is that men and women faced many similar adaptive problems in their ancestral environments—such as selecting food and finding a safe shelter—but they also faced some unique adaptive problems that gave rise to sex-differentiated physical and psychological adaptations (Buss, 1995).[2] These sex-differentiated adaptations have been shaped both by the processes of natural and sexual selection.

[2] Although some researchers characterize evolved predispositions as rigid and inflexible, they are not. Social and ecological conditions are known to dampen or amplify the extent to which these evolved predispositions affect decision making (Flinn & Low, 1986; Geary, 2010).

Naturally selected traits or adaptations reflect strategies to increase one's survival by dealing with challenges of the natural environment, such as finding food and avoiding predators. Sexually selected traits or adaptations may not directly confer survival benefits but instead help individuals to attract sexual mates (Darwin, 1871). Sexual selection comes about through two separate processes. Whereas *intrasexual* selection involves members of the same sex competing among one another to gain access to members of the opposite sex, *intersexual* selection refers to external events or psychological processes that cause members of one sex to preferentially select characteristics in the opposite sex (Andersson, 1994). Both natural and sexual selection mechanisms have affected the psychologies of men and women, sometimes resulting in sex-typical adaptations (Geary, 2010; Geary et al., 2003).

For instance, the majority of modern day and ethnographically recent foragers maintain a sexual division of labor where men forage for large packaged resources through hunting, and women target low-variance resources through gathering (Wood & Eagly, 2002). It is hypothesized that our ancestors did the same, and this may have produced evolved sex differences in specific cognitive abilities associated with these roles that are due to natural (Silverman & Eals, 1992) or sexual selection (Hawkes & Bliege Bird, 2002). Hunting requires skills related to tracking and killing animals, whereas gathering requires skills related to locating and recalling food sources among an array of vegetation. Ancestral men and women who were successful in these domains provided more resources to themselves and their offspring and thus gained a reproductive advantage. Thus, an evolutionary perspective predicts that men and women possess different psychological adaptations to successfully accomplish these sex-differentiated tasks. Supporting this evolutionary hypothesis, across cultures women outperform men in the spatial recall of objects—an ability useful for foraging (Eals & Silverman, 1994; Silverman & Eals, 1992; Voyer, Postma, Brake, & Imperato-McGinley, 2007), whereas men outperform women on mental rotation tasks (Voyer, Voyer, & Bryden, 1995)—an ability relatively more useful for hunting.

When accounting for sex differences in cooperation, the evolutionary perspective assumes that women and men have evolved different context-specific decision rules that enable each sex to reap the benefits from interactions with other people in different environments. That is to say, the evolutionary perspective (like the sociocultural perspective) suggests that sex differences emerge in response to specific environmental inputs.

Sex Differences in Cooperation: A Matter of Context?

Research on sex differences in social behavior, guided by each of these perspectives, supports the general proposition that men and women may respond differently in social interactions depending on specific contextual factors (Hyde, 2005). Our research fits in with these more sophisticated models of sex differences in social behavior by arguing that men and women show different cooperation levels in different social decision-making environments. Although social dilemma studies are conceptually similar in that they are all concerned with situations involving a conflict between self-interest and the collective interest, there are several contextual features that vary systematically between these studies that may be correlated with sex differences. We identify several of these in our meta-analytic review of the social dilemma literature (e.g., sex of the interaction partner, one-shot vs. iterated dilemmas, group size, and year of publication) and apply both theories to advance predictions about how these moderators will impact sex differences in cooperation.

Same-Sex Versus Mixed-Sex Interactions

Do sex differences in cooperation depend on whether interactions occur among same- versus opposite-sex partner(s)? The two perspectives make different predictions.

According to a sociocultural perspective, boys and girls spend a significantly greater amount of time interacting with same-sex others during childhood (Maccoby & Jacklin, 1987), and this has resulted in distinct sex-typical modes of interactions between boys and girls that may affect sex differences in social behavior even during adolescence and adulthood (Maccoby, 1990). As Maccoby (1990) has suggested, girls' same-sex interactions tend to be more cooperative and prosocial, whereas boys' same-sex interactions tend to place greater emphasis on social dominance. Thus, gender differences in communal and agentic orientations may be partly socialized in this context of same-sex peer relationships during childhood (Maccoby, 1990). If so, we might expect women to develop a particular style of interacting with other women that makes their same-sex interactions more cooperative than among men.

Alternatively, an evolutionarily informed hypothesis predicts that, compared to women, men are more cooperative during same-sex interactions. Specifically, men may have evolved a disposition toward male-to-male cooperation and bonding because cooperation with other men has had important consequences for their survival and reproductive success (at least in ancestral times). Specifically, two selective pressures in our ancestral environment may have selected for male cooperation to overcome social dilemmas: hunting and warfare/inter-group conflict (Bowles, 2006, 2009; Foley & Lee, 1989; Geary et al., 2003; Manson & Wrangham, 1991; Wrangham, 1999). The argument is that throughout human evolutionary history, male coalitions have been an effective strategy for men to acquire reproductively relevant resources such as food, territory, and access to mates (Alexander, 1987; Gat, 2006; Guilaine & Zammit, 2004; Keeley, 1996; LeBlanc & Register, 2003; Thayer, 2004; Tooby & Cosmides, 1988; Wrangham & Peterson, 1996). Because evolutionary theorizing suggests that men have evolved a male coalitional psychology that facilitates male cooperation, an evolutionary hypothesis predicts that male same-sex interactions are more cooperative than female same-sex interactions.

What do these theories suggest about cooperation in mixed-sex interactions? A sociocultural perspective suggests sex differences may be more pronounced in contexts when gender stereotypes are activated (Deaux & Major, 1987). Prior research has found that gender stereotypes are more activated while interacting with an opposite-sex partner (Hogg & Turner, 1987; Skrypnek & Snyder, 1982). Men and women may conform to these gender stereotypes to avoid being negatively evaluated by others (Costrich, Feinstein, Kidder, Marecek, & Pascale, 1975). Because women are perceived to be more cooperative than men (e.g., Eagly & Steffen, 1984), this stereotype may especially influence women to be more cooperative than men while interacting with an opposite-sex partner, compared to a same-sex partner (Deaux & Major, 1987). Thus, women are expected to be even more cooperative than men in mixed-sex (vs. same-sex) groups.

From an evolutionary perspective, the prediction about mixed-sex interactions is not so clear. Sexual selection theory (Buss & Schmitt, 1993) hypothesizes that both sexes have evolved strategies to signal desirable traits to potential opposite sex partners. As in most mammalian species, women invest more resources in producing and caring for offspring and so they might signal to potential mates that they are kind and committed. Being the less investing sex, men compete more heavily with each other for mates, and they should therefore be more competitive in the presence of women. This leads to the prediction that when interacting with women, men may be motivated to signal their social dominance and therefore should cooperate less in mixed sex groups.

Yet, sexual selection theory also provides an argument for why men may be especially cooperative during mixed-sex interactions. In choosing a sexual partner, women selectively prefer men who possess resources yet are also committed to sharing these resources (Phillips, Barnard, Ferguson, & Reader, 2008). Thus, women also look for cues in men that they are generous and kind, and men might signal these prosocial qualities by making a cooperative choice in mixed-sex interactions (Barclay, 2010; Iredale, Van Vugt, & Dunbar, 2008). We test these different predictions by considering whether sex differences in cooperation are moderated by the partner's sex.

One-Shot Versus Iterated Dilemmas

Do men and women behave differently in response to their partner's cooperation or defection? Studies of social dilemmas allow participants to interact either once with each other (i.e., one-shot games) or repeatedly for several trials (i.e., iterated games). If there is a difference between men's and women's tendencies in the way they respond to their partner's decisions, then sex differences should be more pronounced across several trials of the dilemma. We can examine this in the meta-analysis by comparing one-shot social dilemmas with iterated social dilemmas.

The sociocultural perspective suggests that because women are relatively more communal than men, women would be expected to be more accommodating and forgiving of a partner's defection in a social dilemma. On the other hand, men, as a result of their agentic roles, may possess a proclivity to exploit and dominate and, thus, would be expected to be less forgiving and more inclined to retaliate. This suggests that over the course of an interaction with the same partners, women will become more cooperative, whereas men will become less cooperative (sometimes ending up in a cycle of mutual defection).

Alternatively, according to an evolutionary perspective, men's survival and reproductive success were affected by their ability to form stable cohesive groups, and this may have implications for sex differences in response to other people's behavior. Male groups are maintained through dominance hierarchies (Geary, 2010). Although men may compete to acquire status within group hierarchies, such hierarchies evolved to facilitate social cohesion (Buss, 2005; de Waal, 2000; Hemelrijk & Gygax, 2004). Thus, although men can fight with each other, they may be more tolerant of defections because of the benefits of prolonged male cooperation (Benenson, 2009; Geary et al., 2003). In fact, there is some evidence that boys (and men), compared to girls (and women), have greater tolerance for within-group interpersonal conflict (Benenson & Christakos, 2003; Benenson et al., 2009; Fehr, Bernhard, & Rockenbach, 2008; Whitesell & Harter, 1996). If men are less likely to respond to defection with subsequent defection, the level of cooperation over time among men should be higher than among women.

Group Size

Do men or women differ in cooperation as a function of group size? The sociocultural perspective suggests that women find close interpersonal relationships more important for defining their self concept compared to men (Cross & Madson, 1997), whereas men tend to value groups in defining their self concept (Baumeister & Sommer, 1997)—and this perspective predicts relatively greater male cooperation in larger groups (Gabriel & Gardner, 1999). An evolutionary perspective suggests that men should be more cooperative than women in larger groups, because men have more to gain (and less to lose) from interacting with many other individuals for the purpose of trading and warfare (Van Vugt, 2009). Thus, both perspectives predict that men will cooperate more than women in larger groups (e.g., N-person games). Indeed, relative to women, men describe themselves more in terms of their group memberships (McGuire & McGuire, 1982), have larger social networks (Belle, 1989), and are more inclined to help a group than a friend (Gabriel & Gardner, 1999). Our meta-analytic review is the first to examine the possibility that sex differences in cooperation are moderated by group size.

Year of Publication

Have sex differences in cooperation changed over time? Sociocultural theory suggests that sex differences in social behavior change over time as gender roles change culturally (Diekman & Eagly, 2008; Eagly & Wood, 2011; Wood & Eagly, 2010). Eagly and Wood (2011) have argued that relatively recent societal changes in Western culture—such as an increase in women's education, a declining birth rate, and less physical work—remove obstacles for women to occupy high-status positions in society. Such societal changes could have influenced different cooperation rates of men and women over time. For example, there is evidence to suggest that women have become more similar to men in terms of their agentic (but not communal) orientation over the last 50 years (Twenge, 1997, 2001). This may reduce potential sex differences in cooperation over time. Therefore, we examined whether sex differences in cooperation have changed over the course of 50 years of research on social dilemmas.

Overview of the Meta-Analysis

We conducted a meta-analytic review of sex differences in cooperation with 272 studies on social dilemmas, covering 50 years of research with over 30,000 participants. We first examine whether there is any overall sex difference in cooperation and then test for possible moderators. We examine the moderators identified above (e.g., sex of partner, iterations, group size, and year of publication), including a few additional moderators (e.g., type of social dilemma and country of participants). Lastly, we consider the possibility that sex of partner influences cooperation, that is, we test whether people are generally more cooperative with a male or female partner.

Method

Selection of Studies

We searched the PsycINFO database for English written articles that contained either of the following social dilemma-related terms: *social dilemmas*, *prisoner's dilemmas*, *public goods*, or *resource dilemmas*. Next, we examined abstracts to identify relevant articles. We subsequently searched directly within the text of relevant articles for *gender* or *sex*. We also searched more generally for studies using several databases in the social sciences (e.g., ABI/INFORM, Business Source Elite, PsycARTICLES, Social Sciences Citation Index, Google Scholar, Sociological Abstracts, Web of Science, Worldwide Political Science Abstracts, Dissertations Online, and Econlit). We searched the entire text of English written articles by using the terms: *gender*, *sex*, *sex differences*, with *cooperation*, *social dilemmas*, *prisoner's dilemmas*, *public goods*, or *resource dilemmas*. We also searched the references of all review articles (e.g., Croson & Gneezy, 2009; Komorita & Parks, 1994; Ledyard, 1995; Maccoby & Jacklin, 1974; Simpson & Van Vugt, 2009; Walters, Stuhlmacher, & Meyer, 1998; Weber et al., 2004). Additionally, we searched the text of all articles reported in prior meta-analyses on behavior in social dilemmas (Balliet, 2010; Balliet, Mulder, & Van Lange, 2011; Balliet et al., 2009; Balliet & Van Lange, 2011; Sally, 1995). Also, we contacted several authors who published articles on social dilemmas over the past 5 years. Lastly, we contacted over 150 experts on social dilemmas for unpublished data.

There were several criteria for selection. First, all studies had to have either adolescent or adult participants. Second, all studies had to report the biological sex of the participants. Third, only studies using pure social dilemma paradigms were included (i.e., prisoner's dilemma, public good, and resource dilemma). Studies on related economic games—such as ultimatum, dictator, negotiation, or trust—were excluded. We coded effect sizes for studies that either involved participants interacting with a confederate, a preprogrammed strategy, or another participant. Importantly, in all studies, participants believed they were interacting with other participants. For articles with multiple studies, we coded an effect size for each study in the article. This resulted in a total of 203 articles that contained 257 published and 15 unpublished effect sizes ($n = 31{,}462$).

Coding of Studies

We had two researchers code each article for several study characteristics, including partner-sex, number of iterations, group size, year of publication, type of dilemma, and country of participants. Each variable was reliably coded (Cohen's kappas between .80 [number of iterations] and 1.00 [year of publication]). When discrepancies within codings did exist, the researchers read over each article together and were able to later agree on the coding. This resulted in 100% agreement for each coded variable.

Same-sex or mixed-sex interactions. Social dilemmas research examines behavior either in same-sex or mixed-sex dyads or groups. Therefore, we coded whether the study examined cooperation in same-sex interactions ($k = 95$) or mixed-sex interactions ($k = 145$). In same-sex studies, participants were always led to believe they were interacting with same-sex partners. However, in mixed-sex studies, researchers did not control the sex composition of dyads or groups. These studies involve a mixture of both same-sex and other-sex interactions. Importantly, in the mixed-sex studies, participants would come to the laboratory in groups composed of both men and women, and participants did not know who was assigned to their dyad or group. Studies that involved hypothetical scenarios (e.g., Gabriel & Gardner, 1999), observed donations to a charity (e.g., Iredale et al., 2008), or reported extensive procedures to keep participants unaware of their partners identity (e.g., Hartman, 1974) were coded as "other" ($k = 32$).

One-shot or iterated dilemma. We coded whether participants either interacted in a one-shot dilemma ($n = 93$) or an iterated-trial dilemma ($k = 171$). In a few studies, the results comparing men and women were only reported for the first few trials ($k = 4$) or the later trials ($k = 1$) of an iterated interaction. We also coded the number of iterations as a continuous variable ranging from 2 to 400 (*Mode* = 18, *Mdn* = 24; $M = 47$).

Group size. We coded whether participants were either in a dyadic social dilemma ($k = 144$) or a dilemma involving three or more persons ($k = 118$). There were a few studies that asked participants to donate to a charity or to contribute to a public good when the number of participants in the dilemma was unknown to the participant ($k = 24$). These studies were excluded from the analysis of the effect of group size on the sex–cooperation relationship. Group size was also coded as a continuous variable. Groups ranged from two-person interactions to a 175-person group.

Year of publication. We coded year of publication. For unpublished data, we recorded either the date on the manuscript or the date when the data were collected (if reported). The range of the year of publication was 1961–2010, with the median date being 1993.

Type of dilemma. There are many types of social dilemmas, but the most common dilemmas in the current analysis include the prisoner's dilemma ($k = 122$), public goods or give-some dilemma ($k = 82$), and the resource or take-some dilemma ($k = 21$). Other dilemmas were mostly matrix games (e.g., chicken) and were coded as a separate "other" category ($k = 48$).

Country of participants. A total of 18 countries are represented in the sample. Most studies were conducted in the United States ($k = 177$), followed by the Netherlands ($k = 25$), Canada ($k = 12$), England ($k = 11$), and Japan ($k = 10$). Other countries represented in the sample include Belgium, Germany, India, Israel, Kenya, Russia, Singapore, Sweden, Switzerland, and Taiwan.

Age, anonymity, and communication. In the current analysis, most studies were conducted on students ($k = 247$), and of the studies that reported the average age of participants ($k = 31$), the average age was 24 years. Also, the majority of studies were conducted with strangers in the laboratory ($k = 256$), and only a few studies were done with friends, partners, or with a protocol that allowed individuals to choose their partner. Lastly, although most studies in the present sample did not allow any communication between participants ($k = 231$), there were a few studies that either allowed communication or manipulated communication in the experiment ($k = 34$).[3]

Overview of Analysis

We used the *d* value as the measure of effect size. The *d* value is the difference between two means divided by the pooled standard deviation and is corrected for sample size bias (Hedges & Olkin, 1985). The *d* value for each study was calculated by using the mean difference and standard deviations for men versus women, but when these descriptive statistics were unavailable we calculated *d* by using a *t* score, *F* score, χ^2 value, or rates of cooperation. When a study included a manipulated variable, we coded the overall main effect of gender across experimental conditions. Women were coded as 1, and men were coded as 2 so that a positive *d* value indicates greater cooperation by men, relative to women, whereas a negative *d* value is telling of greater cooperation by women compared to men. All results of resource or take-some dilemmas are reverse coded to indicate that less taking equals greater cooperation.

Several articles reported a null relationship between sex and cooperation, but failed to provide the statistics necessary to calculate the effect size. We estimated that these studies had an effect size of zero. This is a very conservative estimate, as several of these articles observed a mean difference between men and women, but lacked the statistical power to detect a small effect size (e.g., Gallo & Sheposh, 1971; Kershenbaum & Komorita, 1970; Mack, Auburn, & Knight, 1971; R. R. Miller, 1967; Voissem & Sistrunk, 1971). Therefore, for all analyses, we first report the results excluding the null findings coded as zero effect size, followed by an additional analysis including these estimated null findings. We report any discrepancies between the actual coded effect sizes and those analyses including the null estimated effect sizes.

Some studies allowed us to code several effect sizes. However, the effect sizes may be non-independent because they share several methodological features. Therefore, we applied Cooper's (1998) shifting-units-of-analysis approach to handling non-independent effect sizes when conducting moderator analyses. Using this approach, we averaged over all the effects abstracted from a single study that shared the same study characteristics. More specifically, this method creates a single effect size for a study with multiple effect sizes that share the same coding on a specific moderator. For example, Sell, Griffith, and Wilson (1993), in a single study, report two effects sizes based on mixed-sex interactions and one effect size based on same-sex interactions. When conducting the moderator analysis for same-sex versus mixed-sex interactions, we averaged the two mixed-sex effect sizes to create a single mixed-sex effect size for this study. We repeat this procedure for the other moderator analyses.

In our analysis, we first estimate the overall effect size using a random effects model, along with both the 95% confidence interval and the 90% prediction interval. We then consider the variation in the effect size distribution by using several indicators of heterogeneity of variance (T, T^2, I^2, and Q). Next, we examine the possibility that the effect size distribution contains a publication bias. In so doing, we formally examine the distribution of studies in a funnel plot (plotted according to their effect size and standard error) using Egger's regression intercept and Duval and Tweedie's (2000) Trim and Fill approach. Following these analyses, we then use a mixed-effects model to conduct several univariate moderator analyses of the effect size. We did not apply a fixed or random effects model to these analyses because (a) we did not assume that we had gathered all studies from the population of studies, and (b) we did assume that there would be both systematic and random variation in the effect size distribution. However, one limitation of random and mixed-effects models is that they increase the chance of Type II errors, relative to a fixed-effects model (Lipsey & Wilson, 2001). Thus, we reported any discrepancies between random or mixed-effects analyses and a fixed-effects analysis. Analyses were conducted using Hedges and Olkin's (1985) approach with the Comprehensive Meta-Analysis Software.

Results

Overall Analysis

Table 1 displays the distribution of effect sizes for sex differences in cooperation in a stem-and-leaf plot, whereas Table 2 presents the coding and effect size for each study included in the meta-analysis. As shown in the stem-and-leaf plot, there is a normal distribution of effect sizes. We found that the relationship between sex and cooperation in social dilemmas is not statistically different from zero ($d = -0.05$, 95% CI [−0.11, 0.001], 90% prediction interval [−0.52, 0.42]). There is also variation in the true effect size distribution ($T = .29$, $T^2 = .08$), and a substantial portion of this variation may be explained by between study differences ($I^2 = 72.54$). Moreover, the effect size distribution contains greater variation than would be expected by chance alone, $Q(175) = 637.21$, $p < .001$. Including the estimated null findings slightly reduced the estimated overall effect size ($d = -0.04$, 95% CI [−0.07, 0.000]).

It may be that the sample of studies contains a publication bias. To examine the possibility of a publication bias, we formally examined the funnel plot, where all studies were plotted according to their sample size and standard error, using Duval and Tweedie's (2000) Trim and Fill approach. This method examines the symmetry of the effect size in the funnel plot and removes the most extreme small studies from either side of the plot while recalculating the effect size at each iteration until symmetry is achieved. In taking this approach, there were no studies filled above the estimated effect size. However, two studies were filled below the estimated effect size. This resulted in an estimate of a small significant negative effect size ($d = -0.06$, 95% CI [−0.12, −0.001]). Moreover, Egger's regression analysis resulted in a non-significant intercept: *Intercept* = .09, $t(174) = 0.29$, $p = .77$,

[3] Although we include these codings primarily to describe our data set, we did analyze these variables as potential moderators of the effects size. We did not find age, stranger, or communication to significantly moderate the sex–cooperation relationship. However, there is restriction in range of the age variable. Additionally, for the studies that were coded as using communication, the effect sizes were coded by averaging over both non-communication and communication conditions, and therefore this may have diluted any possible sex differences. Therefore, these analyses are limited, and future research is still encouraged to examine how age, communication, and the type of relationship may moderate sex differences in cooperation.

Table 1
Stem-and-Leaf Diagram of the Overall Distribution of Effect Sizes for Sex Differences in Cooperation

d value	0.1 units of the *d* value
1.5	3
1.4	
1.3	0
1.2	
1.1	4 8
1.0	
0.9	8
0.8	0 6
0.7	0 0 0 3 5 5 7 8
0.6	0 5 7 9
0.5	0 2 3 3 4 5 7 7
0.4	0 0 7 7 7 9 9
0.3	0 1 3 5 5 6 6 8
0.2	0 0 0 2 3 5 5 6 6 6 6 7 8 9
0.1	0 0 1 1 2 3 4 5 6 6
0.0	0 0 0 0 2 2 3 3 4 5 5 5 6 6 7 7 7 7 8 8 8 8 8 9 9
−0.1	0 0 0 0 1 1 2 2 3 4 4 4 5 5 6 6 6 6 7 9 9
−0.2	0 0 0 1 1 1 1 1 3 3 3 4 6 7 8 8
−0.3	0 0 1 1 2 4 5 6 6 6 7 7
−0.4	0 3 3 3 5 6 6 6 7 7
−0.5	0 0 1 2 3 5 6 6 7 7
−0.6	0 0 1 2 3 5 8
−0.7	2 5 6 6
−0.8	5 7
−0.9	2 4 4 8
−1.0	4
−1.1	7
−1.2	
−1.3	
−1.4	
−1.5	3

Note. This plot omits three outliers: 1.65, −1.76, and −1.90. This plot only includes the 176 effect sizes that were coded and does not include the null effect studies that were estimated to have zero effect size.

which indicates an absence of bias in the data. Taken together, these analyses suggest that a publication bias is absent in our data.

We note, however, that the conclusions derived from the above random-effects estimate differ from the result of the fixed-effects analysis. Using a fixed-effects analysis, we found that women were significantly more cooperative than men ($d = -0.04$, 95% CI [−0.06, −0.02]). However, this is an exceptionally small effect size, and the analysis may have resulted in a Type I error. Additionally, we do not have all the studies in the population of studies, which violates an assumption of a fixed-effects analysis. Thus, we conclude that there is no meaningful overall sex difference in cooperation.

Moderators

In the following section, we first conduct a series of univariate moderator analyses. For each moderator, we first examine the effect with only the coded effect sizes and then an additional analysis including the null findings that were estimated to be zero. After reporting the univariate tests, we report the correlations among some of the moderating variables and conduct a multiple regression model predicting the effect size.

Same-sex versus mixed-sex interactions. The results of the categorical moderator analyses are presented in Table 3. There is a statistically significant difference between the effect size estimates in the mixed-sex studies compared to the same-sex studies, $Q(1) = 41.16$, $p < .001$. During mixed-sex interactions, women were more cooperative than men ($d = -0.22$, 95% CI [−0.29, −0.15]). However, during same-sex interactions, men were more cooperative than women ($d = 0.16$, 95% CI [0.06, 0.25]). For many of the studies coded as mixed-sex dilemmas, researchers did not control for the sex of participants. In these studies, several individuals (strangers) came to the laboratory to participate in a social dilemma. As such, it is likely that some of these data contain interactions that are based on same-sex groups. Based on this concern, we conducted a separate analysis only on dyadic interactions, where we can be more certain that studies labeled as mixed-sex are indeed heterogeneous on sex. For dyadic, mixed-sex interactions, women were more cooperative than men ($d = -0.30$, 95% CI [−0.39, −0.21]), whereas for dyadic same-sex interactions, men were more cooperative than women ($d = 0.22$, 95% CI [0.12, 0.33]), $Q(1) = 53.83$, $p < .001$. As displayed in Table 3, these conclusions do not change after introducing the null findings into the analysis.[4]

Single versus repeated interactions. We used the number of iterations as a continuous variable predicting the effect size in a meta-regression. In the overall sample, we found a statistically significant positive slope, $b = .003$, $Q(1) = 21.10$, $p < .001$, indicating that men, compared to women, tended to become more cooperative as iterations continued. To rule out the possibility that this was due to greater cooperation by women than men in one-shot interactions, we also examined this relationship excluding one-shot interactions. When we considered just the iterated interactions, there was still a significant positive effect of the number of iterations, $b = .002$, $Q(1) = 12.05$, $p < .001$. According to the overall analysis, the estimated effect size of the sex–cooperation relationship at 100, 200, and 300 iterations is $d = 0.13$, 0.38, and 0.63, respectively. Including the null findings in this analysis does not eliminate the effect of iterations on the sex–cooperation relationship. Therefore, these results suggest that as people interact during repeated social dilemmas, over time men become increasingly more cooperative than women.

Group size. We coded group size as a continuous variable and used meta-regression with group size predicting the effect size distribution. Group size had a negative relationship with the sex–cooperation effect size, $b = -.02$, $Q(1) = 4.00$, $p = .045$. This conclusion remains the same when including the null effect studies in the analysis.

Year of publication. We coded year of publication as a continuous variable and used meta-regression to examine its effect on the sex–cooperation relationship. The analysis indicated a

[4] We also examined whether partner gender moderated the sex–cooperation effect size in each of the separate social dilemma categories. We found a similar pattern across both the prisoner's dilemma and the "other' category": Men were more cooperative in same-sex interactions, but women were more cooperative in mixed-sex interactions. However, for public goods dilemmas, the nine same-sex studies ($d = -0.07$) did not differ from the 33 mixed-sex studies ($d = -0.06$). Unfortunately, the resource dilemmas only included mixed-sex studies.

Table 2
Studies Included in the Meta-Analysis

Study	*N*	CO	DV	SAME/MIXED	GS	OS/IT	*d*	*LL*, *UL*
Ahmed (2008)	180	SE	PD	MIXED	2	OS	−0.21	−0.50, 0.09
Alcock & Mansell (1977)	60	CA	PD	MIXED	10	IT(30)	−0.11	−0.70, 0.46
Andersen et al. (2008)	80	IN	PGD	MIXED	N/A	OS	−0.20	−0.64, 0.24
Study 2	51	IN	PGD	MIXED	N/A	OS	−0.61	−1.68, −0.01
Study 3	61	IN	PGD	MIXED	N/A	OS	−0.21	−0.71, 0.70
Andreoni & Petrie (2008)	80	US	PGD	MIXED	5	IT(40)	0.29	−0.15, 0.73
Ando (1999)*	36	JP	PGD	MIXED	9	IT(3)	0.00*	−0.68, 0.68
Anthony & Horne (2003)	298	US	O	MIXED	6	N/A	−0.43	−0.66, −0.20
Aranoff & Tedeschi (1968)*	216	US	PD	SAME	2	IT(200)	0.00*	−0.27, 0.27
Baker & Rachlin (2001)*	48	US	PD	N/A	N/A	IT(100)	0.00*	−0.58, 0.58
Study 2	48	US	PD	N/A	N/A	IT(100)	0.00*	−0.58, 0.58
Study 3	48	US	PD	MIXED	2	IT(100)	0.00*	−0.58, 0.58
Balliet (2009)	55	SG	PGD	MIXED	4	OS	−0.09	−0.63, 0.46
Batson et al. (1995)*	120	US	PGD	MIXED	4	IT(2)	0.00*	−0.36, 0.36
Study 2*	45	US	PGD	SAME	4	IT(2)	0.00*	−0.61, 0.61
W. M. Becker & Miles (1978)	297	US	O	MIXED	2	OS	−0.87	−1.12, −0.62
Bedell & Sistrunk (1973)	60	US	PD	SAME	2	IT(100)	0.70	0.18, 1.22
Belianin & Novarese (2005)	24	RU	PGD	MIXED	6	IT(12)	−1.90	−2.87, −0.93
Belot et al. (2006)	138	NL	PD	MIXED	2	OS	−0.43	−0.80, −0.05
Belot et al. (2010)	138	NL	PD	MIXED	2	OS	−0.33	−0.67, −0.001
Bixenstine et al. (1964)	64	US	O	SAME	2	IT(160)	0.28	−0.26, 0.83
Bixenstine & Garebelein (1971)*	100	US	PD	SAME	2	IT(150)	0.00*	−0.40, 0.40
Bixenstine & O'Reilly (1966)	80	US	PD	SAME	2	IT(60)	0.54	0.09, 0.98
Bixenstine et al. (1963)	48	US	PD	SAME	2	IT(30/90)	0.05	−0.52, 0.61
Bixenstine & Wilson (1963)*	80	US	PD	SAME	2	IT(190)	0.00*	−0.45, 0.45
Black & Higbee (1973)*	72	US	O	SAME	2	IT(150)	0.00*	−0.47, 0.47
Bonacich (1972)	120	US	PGD	MIXED	5	IT(5)	−0.30	−0.79, 0.20
Boone et al. (1999)*	40	NL	PD	MIXED	2	IT(5)	0.00*	−0.64, 0.64
Boone et al. (2010)	112	BE	PD	MIXED	2	OS	−0.13	−0.50, 0.23
Brickman et al. (1979)	42	US	PD	SAME	2	IT(18)	−0.08	−0.69, 0.53
Sample b	42	US	PD	SAME	2	IT(18)	0.65	0.03, 1.27
Sample c	42	US	PD	SAME	2	IT(18)	1.53	0.85, 2.22
Sample d	42	US	PD	SAME	2	IT(18)	−0.94	−1.57, −0.30
Sample e	42	US	PD	SAME	2	IT(18)	−1.53	−2.22, −0.84
Sample f	42	US	PD	SAME	2	IT(18)	1.14	0.49, 1.79
A. Brown (2006)	61	US	TS	MIXED	4	OS	−0.20	−0.74, 0.33
A. Brown & Stasser (2004)	41	US	TS	MIXED	4	OS	−0.72	−1.37, −0.07
K. M. Brown & Taylor (2000)	242	US	PGD	N/A	N/A	OS	0.26	0.00, 0.51
Study 2	242	US	PGD	N/A	N/A	OS	0.33	0.07, 0.58
Brown-Kruse & Hummels (1993)	64	US	PGD	SAME	4	IT(6)	.50	0.00, 1.00
Buchan et al. (2009)	1,029	N/A	PGD	MIXED	12	IT	−0.04	−0.16, 0.08
Cadsby et al. (2007)	160	CA/JP	PGD	SAME	10	IT(25)	−0.14	−0.45, 0.17
Cadsby & Maynes (1998)	220	CA	PGD	SAME	10	IT(1/25)	−0.23	−0.49, 0.04
Caldwell (1976)*	130	US	PD	SAME	5	IT(80)	0.00*	−0.35, 0.35
W. K. Campbell et al. (2005)	232	US	TS	MIXED	4	IT(25)	−0.36	−0.63, −0.09
Study 2	166	US	TS	MIXED	4	IT(25)	−0.32	−0.64, −0.001
Carment (1974)	66	CA	O	SAME	2	IT(100)	0.31	−0.24, 0.87
Charness & Rustichini (2010)	160	US	PD	SAME	2	OS	−0.01	−0.26, 0.24
Study 2	74	US	PD	MIXED	2	OS	−0.23	−0.61, 0.12
M. L. Clark (1983)	40	US	PD	MIXED	2	IT(30)	−0.96	−0.29, −2.83
Sample 2	40	US	PD	MIXED	2	IT(30)	0.70	1.33, 2.14
K. Clark & Sefton (2001)*	120	UK	PD	MIXED	2	OS	0.00*	−0.36, 0.36
Cohen et al. (2010)	172	US	PD	SAME	2	OS	−0.02	−0.32, 0.28
Study 2	130	US	PD	SAME	2	OS	0.00	−0.36, 0.36
Conrath (1972)	84	US	O	SAME	4–6	IT(32)	−0.10	−0.19, −0.02
Corfman & Lehmann (1994)	227	US	PD	N/A	2	OS	−0.47	−0.74, −0.20
Croson et al. (2008)*	150	US	PGD	MIXED	5	IT(25	0.00*	−0.32, 0.32
Crowne (1966)	34	US	PD	SAME	2	IT(20)	0.80	0.12, 1.50
Dawes et al. (1977)	284	US	O	MIXED	8	OS	−0.17	−0.42, 0.08
Study 2	160	US	O	MIXED	8	OS	−0.30	−0.62, 0.01
Declerck et al. (2010)	131	BE	PD	MIXED	2	OS	−0.10	−0.45, 0.24
Study 2	128	BE	PD	MIXED	2	OS	−0.15	−0.51, 0.19

(table continues)

Table 2 (*continued*)

Study	*N*	CO	DV	SAME/MIXED	GS	OS/IT	*d*	*LL*, *UL*
De Cremer & Van Dijk (2009)*	148	NL	PGD	MIXED	4	OS	0.00*	−0.33, 0.33
Study 2*	114	NL	PGD	MIXED	4	OS	0.00*	−0.37, 0.37
Study 3*	110	NL	PGD	MIXED	4	OS	0.00*	−0.38, 0.38
Dolbear et al. (1969)*	46	US	PD	MIXED	2	N/A	0.00*	−0.60, 0.60
Drouvelis et al. (2010)	54	UK	PGD	MIXED	3	OS	−0.55	−0.47, 0.16
Eek & Biel (2003)*	68	SE	PGD	MIXED	4	IT(33)	0.00*	−0.49, 0.49
Enzle et al. (1992)*	134	CA	PD	MIXED	2	IT(40)	0.00*	−0.34, 0.34
Evans & Crumbaugh (1966)	20	US	PD	SAME	2	IT(100)	0.20	−0.81, 1.20
Farrelly et al. (2007)*	231	UK	PD	MIXED	2	OS	0.00*	−0.26, 0.26
Ferguson & Schmitt (1988)	40	US	PD	SAME	2	IT(30)	−0.12	−0.84, 0.60
Ferrin et al. (2008)	68	US	PD	SAME	2	IT(3)	0.10	−0.38, 0.57
Study 2	68	US	PD	SAME	3	IT(3)	0.40	−0.08, 0.88
Fisher & Smith (1969)	120	US	PD	SAME	2	IT(100)	−0.46	−0.98, 0.05
Fleishman (1988)*	170	US	PGD	SAME	5	IT(5)	0.00*	−0.30, 0.30
Fox & Guyer (1978)	80	CA	PD	SAME	4	IT(30)	−0.05	−0.67, 0.57
Frank et al. (1993)	207	US	PD	MIXED	2	OS	−0.52	−0.81, −0.25
Fundenberg et al. (2010)	274	US	PD	MIXED	2	IT(8)	−0.40	−0.64, −0.16
Gabriel & Gardner (1999)	137	US	PGD	N/A	N/A	OS	0.25	−0.08, 0.59
Study 2	137	US	O	N/A	2	OS	−0.35	−0.69, −0.01
Gallo et al. (1969)	20	US	PD	SAME	2	IT(50)	0.15	−0.98, 1.28
Gallo & Sheposh (1971)*	120	US	PD	SAME	2	IT(20)	0.00*	−0.36, 0.36
Garza & Borchert (1990)	84	US	PGD	MIXED	6	IT(20)	−0.46	−0.89, −0.03
Gillis & Woods (1971)	98	CA	PD	N/A	2	IT(20)	−0.46	−0.86, −0.06
Goehring & Kahan (1976)	60	US	PD	SAME	3	IT(150)	0.03	−0.48, 0.53
Granberg & Stevens (1975)	96	US	O	SAME	2	IT(60)	0.30	−0.10, 0.70
Grant & Sermat (1969)	48	CA	O	MIXED	2	IT(60)	0.00	−0.57, 0.57
Greig & Bohnet (2009)	270	KE	PGD	MIXED	4	OS	0.22	−0.08, 0.51
Hamburger et al. (1975)*	160	US	PD	SAME	5	IT(150)	0.00*	−0.31, 0.31
Hardy & van Vugt (2006)	62	UK	PGD	MIXED	3	IT(25)	0.49	−0.02, 0.99
Hartman (1974)	128	US	PD	N/A	2	IT(50/100)	0.09	−0.30, 0.47
Hartman (1980)*	128	US	PD	SAME	2	IT(25)	0.00*	−0.35, 0.35
Hemesath & Pomponio (1998)	30	US	PD	MIXED	2	OS	−0.59	−1.33, 0.13
Holm (2000)	87	SE	O	SAME	2	IT(2)	0.35	−0.15, 0.84
Sample b	58	SE	O	MIXED	2	IT(2)	−0.76	−1.42, −0.10
Study 2	85	SE	O	SAME	2	IT(2)	0.00	−0.47, 0.47
Sample b	86	SE	O	MIXED	2	IT(2)	−0.98	−1.50, −0.46
Study 3	40	US	O	SAME	2	IT(2)	0.07	−0.43, 0.50
Sample b	86	US	O	MIXED	2	IT(2)	−0.76	−1.33, −0.22
Hopthrow et al. (2007)*	158	UK	PD	MIXED	4	IT(4)	0.00*	−0.32, 0.32
Horai & Tedeschi (1969)*	90	US	PD	SAME	2	IT(150)	0.00*	−0.42, 0.42
Horai & Tedeschi (1975)*	60	US	PD	MIXED	2	IT(60)	0.00*	−0.52, 0.52
Hottes & Kahn (1974)	60	US	PD	SAME	2	IT(180)	0.86	0.33, 1.38
Hu & Liu (2003)	255	TW	PD	MIXED	2	OS	−0.47	−0.73, −0.22
Huntoon (2006)	333	US	PGD	MIXED	5	OS	0.02	−0.20, 0.24
Insko et al. (1987)*	260	US	O	MIXED	N/A	IT(10)	0.00*	−0.25, 0.25
Insko et al. (1993)*	77	US	O	SAME	N/A	OS	0.00*	−0.46, 0.46
Insko et al. (2005)*	292	US	O	SAME	N/A	OS	0.00*	−0.23, 0.23
Study 2*	258	US	O	SAME	N/A	OS	0.00*	−0.26, 0.26
Iredale et al. (2008)	30	UK	PGD	N/A	N/A	OS	−0.26	−1.00, 0.49
Jackson (2001)*	200	US	PGD	MIXED	7	OS	0.00*	−0.28, 0.28
Jackson (2008)*	66	US	PGD	MIXED	6	OS	0.00*	−0.49, 0.49
James et al. (2001)	33	CA	PD	MIXED	3	OS	−1.17	−1.95, −0.39
Jaster & Arrow (2010)	324	US	PGD	MIXED	N/A	IT(6)	−0.20	−0.42, 0.03
Kahn et al. (1971)*	40	US	PD	SAME	2	IT(75)	0.00*	−0.64, 0.64
Study 2*	80	US	PD	SAME	2	IT(75)	0.00*	−0.45, 0.45
Kamas et al. (2008)	162	US	PGD	MIXED	N/A	OS	−0.62	−0.94, −0.31
Kanouse & Wiest (1967)	187	US	PD	MIXED	2	OS	−0.13	−0.43, 0.15
Kennelly & Fantino (2007)	238	US	O	N/A	2	IT(20)	0.38	0.05, 0.70
Study 2	156	US	O	N/A	2	IT(20)	0.36	0.04, 0.68
Kershenbaum & Komorita (1970)*	96	US	PD	SAME	2	IT(40)	0.00*	−0.41, 0.41
Kiesler et al. (1996)*	86	US	PD	N/A	2	IT(6)	0.00*	−0.43, 0.43
Knight (1980)*	96	US	PD	MIXED	2	IT(100)	0.00*	−0.41, 0.41
Komorita (1965)	74	US	PD	SAME	2	IT(80)	0.73	−1.10, −0.02
Study 2	54	US	PD	SAME	2	IT(80)	−0.56	−1.10, −0.02
Komorita & Mechling (1967)*	64	US	PD	SAME	2	IT(4/10)	0.00*	−0.50, 0.50
Kortenkamp & Moore (2006)	112	US	TS	MIXED	N/A	OS	−0.65	−1.07, −0.23

Table 2 (*continued*)

Study	*N*	CO	DV	SAME/MIXED	GS	OS/IT	*d*	*LL*, *UL*
Kramer & Brewer (1984)*	58	US	TS	MIXED	6	IT(12)	0.00*	−0.53, 0.53
Study 2*	48	US	TS	MIXED	6	IT(24)	0.00*	−0.58, 0.58
Study 3*	66	US	TS	MIXED	6	IT(24)	0.00*	−0.49, 0.49
Kube & Traxler (2009)*	96	DE	PGD	MIXED	4	IT(11)	0.00*	−0.41, 0.41
Kuhlman & Marshello (1975)*	167	US	PD	SAME	2	IT(30)	0.00*	−0.31, 0.31
Kümmerli et al. (2007)	30	CH	PD	MIXED	2	IT(12)	−1.04	−1.84, −0.24
Kurzban (2001)	57	US	PGD	SAME	6	IT(10)	−0.10	−0.33, 0.13
Kurzban & Houser (2001)	72	US	PGD	MIXED	4	IT(15)	0.47	0.96, 1.91
Kuwabara (2005)	122	US	PD	MIXED	2	OS	0.11	−0.29, 0.51
Lacy (1978)	236	US	PD	SAME	2	IT(1/20)	−0.11	−0.42, 0.20
Liebrand (1984)	261	NL	TS	MIXED	7	IT(5)	−0.36	−0.70, −0.01
Study 2	132	NL	TS	MIXED	20	IT(5)	−0.62	−1.03, −.22
Liebrand & Van Run (1985)	270	US/NL	TS	MIXED	6–7	IT(5)	−0.31	−0.55, −0.06
Lindskold et al. (1986)*	128	US	PD	SAME	2	IT(40)	0.00*	−0.35, 0.35
Study 2*	57	US	PD	SAME	2	IT(40)	0.00*	−0.53, 0.53
Lindskold et al. (1977)	54	US	PD	SAME	2	IT(50)	−0.31	−0.59, −0.03
Sample b*	135	US	PD	SAME	2	IT(50)	0.00*	−0.34, 0.34
Study 2*	168	US	PD	SAME	2	IT(50)	0.00*	−0.31, 0.31
List (2006)	134	US	PD	MIXED	2	OS	−0.24	−0.53, 0.04
Lutzker (1961)	40	US	O	MIXED	2	IT(30)	0.00	−0.12, 0.13
Mack et al. (1971)	48	US	PD	SAME	2	IT(100)	0.78	0.19, 1.36
Mack et al. (1979)	20	UK	PD	N/A	2	IT(100)	−1.75	−2.79, −0.72
Majolo et al. (2006)*	20	UK	PD	SAME	2	IT(15)	0.00*	−0.95, 0.95
Marwell et al. (1971)	32	US	O	SAME	2	IT(12)	0.75	−0.07, 1.57
Study 2	22	US	O	SAME	2	IT(12)	1.65	0.68, 2.62
Mason et al. (1991)	82	US	O	MIXED	2	IT(25)	−0.23	−0.69, 0.23
McCallum et al. (1985)*	180	US	PD	SAME	2	IT(10)	0.00*	−0.30, 0.30
Study 2*	124	US	O	SAME	4	IT(10)	0.00*	−0.36, 0.36
McClintock et al. (1965)*	36	US	O	SAME	2	IT(30)	0.00*	−0.68, 0.68
McClintock & Liebrand (1988)*	129	US	PD	MIXED	2	IT(30)	0.00*	−0.35, 0.35
McKeown et al. (1967)*	60	US	O	MIXED	2	IT(100)	0.00*	−0.52, 0.52
McNeel et al. (1972)	96	BE	O	SAME	2	IT(100)	−0.21	−0.61, 0.19
Meeker (1984)	18	US	PD	SAME	2	IT(400)	1.30	0.26, 2.34
Meier (2005)	532	CH	PGD	N/A	N/A	OS	0.27	0.10, 0.44
Meux (1973)*	170	US	O	MIXED	12	IT(50)	0.00*	−0.30, 0.30
Miermin (1976)	90	US	O	SAME	3	IT(30)	0.16	0.10, 0.23
R. R. Miller (1967)*	120	US	O	SAME	2	IT(25)	0.00*	−0.36, 0.36
G. H. Miller & Pyke (1973)	82	CA	O	MIXED	2	IT	−0.60	−1.05, −0.16
Millet & Dewitte (2007)*	173	BE	PGD	MIXED	4	IT(3)	0.00*	−0.30, 0.30
Mitani & Flores (2007)	45	JP	PGD	MIXED	5	IT(10)	−0.50	−1.10, 0.09
L. B. Mulder (2008)	114	NL	PGD	N/A	4	OS	0.08	−0.41, 0.88
L. B. Mulder (2010)	50	NL	TS	N/A	4	OS	−0.11	−0.68, 0.46
L. B. Mulder & Nelissen (2010)	133	NL	TS	MIXED	N/A	OS	−0.16	−0.51, 0.18
Study 2	119	NL	TS	MIXED	N/A	OS	−0.28	−0.66, 0.10
L. B. Mulder et al. (2006a)	50	NL	PGD	N/A	4	OS	−0.13	−0.79, 0.51
Study 2	113	NL	PGD	N/A	4	OS	0.53	0.16, 0.91
Study 3	100	NL	PGD	N/A	4	OS	0.16	−0.25, 0.56
L. B. Mulder et al. (2006b)	52	NL	PGD	N/A	4	OS	0.41	−0.14, 0.95
Study 2	78	NL	PGD	N/A	4	OS	0.20	−0.25, 0.64
L. B. Mulder et al. (2009)	36	NL	PGD	N/A	4	OS	0.35	−0.31, 1.01
Murnighan & Roth (1983)*	252	US	PD	MIXED	2	N/A	0.00*	−0.25, 0.25
Nowell & Tinkler (1994)	44	US	PGD	SAME	4	IT(13)	−0.75	−1.98, 0.45
Oberholzer-Gee et al. (2010)	188	NL	O	MIXED	3	OS	−0.15	−0.47, 0.16
Oda (1997)	70	JP	PD	MIXED	2	OS	−0.16	−0.64, 0.32
Orbell et al. (1994)	108	US	PD	MIXED	2	OS	−0.19	−0.59, 0.22
Study 2	68	US	PD	MIXED	2	OS†	−0.10	−0.57, 0.36
Ortmann & Tichy (1999)	96	US	PD	MIXED	2	OS	−0.27	−0.44, −0.09
Orwant & Orwant (1970)	165	US	PD	MIXED	2	OS	−0.28	−0.60, 0.04
Oskamp & Kleinke (1970)	100	US	PD	SAME	2	IT(50)	0.57	0.18, 0.58
Oskamp & Perlaman (1965)	32	US	PD	SAME	2	IT(30)	1.18	0.43, 1.93
Patterson & Boles (1974)*	72	US	PD	MIXED	2	IT(16)	0.00*	−0.47, 0.47
Perugini et al. (2005)	108	DE	PGD	MIXED	3	IT(10)	−0.43	−0.82, −0.05
Pilisuk et al. (1968)	176	US	PD	MIXED	2	IT(25)	0.08	−0.24, 0.39
Poppe (2005)*	91	US	PGD	MIXED	175	IT(9)	0.00*	−0.42, 0.42
Poppe & Utens (1986)*	90	NL	TS	MIXED	6	IT(16)	0.00*	−0.42, 0.42
Pruitt (1967)	100	US	O	SAME	2	IT(1/20)	0.69	0.23, 1.15
Putterman et al. (2010)*	80	US	PGD	MIXED	5	IT(24)	0.00*	−0.45, 0.45

(table continues)

Table 2 (*continued*)

Study	*N*	CO	DV	SAME/MIXED	GS	OS/IT	*d*	*LL*, *UL*
Rapoport (1988)	69	CA	PD	MIXED	2	OS	0.03	0.03, −0.45
Rapoport & Chammah (1965)	140	US	PD	SAME	2	IT(300)	0.57	0.19, 0.94
Reich & Purbhoo (1975)*	57	CA	PD	MIXED	2	IT(50)	0.00*	−0.53, 0.53
Rooney et al. (2005)	1,409	US	PGD	N/A	N/A	N/A	−0.20	−0.31, −0.10
Ruffle & Sosis (2007)	212	IL	TS	N/A	2	OS	0.23	−0.04, 0.50
Sanna et al. (2003)*	110	US	TS	MIXED	2	IT(5)	0.00*	−0.38, 0.38
Study 2*	83	US	TS	MIXED	2	IT(5)	0.00*	−0.44, 0.44
Study 3*	75	US	PD	MIXED	2	IT(10)	0.00*	−.46, 0.46
Study 4*	94	US	TS	MIXED	2	IT(5)	0.00*	−0.41, .041
Seguino et al. (1996)	139	US	PGD	MIXED	5–52	OS	−0.51	−0.87, −0.17
Sell (1997)	82	US	PGD	N/A	4	IT(18)	0.25	−0.18, .067
Study 1b	83	US	PGD	SAME	4	IT(18)	−0.45	−.88, −.10
Study 1c	79	US	PGD	MIXED	4	IT(18)	0.47	0.02, 0.92
Sell et al. (1993)	22	US	PGD	N/A	4	IT(18)	−0.09	−0.92, 0.75
Study 1b	26	US	PGD	SAME	4	IT(18)	0.55	−0.23, 1.33
Study 1c	25	US	PGD	MIXED	4	IT(18)	0.52	−0.28, 1.32
Study 1d	26	US	PGD	MIXED	4	IT(18)	−0.15	−0.92, 0.63
Study 2	25	US	PGD	N/A	4	IT(18)	0.53	−0.27, 1.33
Study 2b	26	US	PGD	SAME	4	IT(18)	0.70	−0.10, 1.49
Study 2c	25	US	PGD	MIXED	4	IT(18)	0.98	0.15, 1.82
Study 2d	30	US	PGD	MIXED	4	IT(18)	0.63	−0.08, 1.42
Sell & Wilson (2001)	96	US	PGD	MIXED	4	IT(10)	0.49	0.06, 0.93
Sermat (1967)	32	US	O	SAME	2	IT(200)	0.26	0.20, 0.31
Setzman (1974)	40	US	PD	SAME	2	IT(50)	−0.11	−0.83, 0.61
Sheldon (1999)*	90	US	PD	MIXED	2	IT(15)	0.00*	−0.42, 0.42
Sheldon & McGregor (2000)*	80	US	TS	N/A	4	OS	0.00*	−0.45, 0.45
Study 2*	152	US	TS	MIXED	4	IT(N/A)	0.00*	−0.32, 0.32
Shinada & Yamagishi (2007)*	157	JP	PD	MIXED	3	OS	0.00*	−0.32, 0.32
Study 2*	144	JP	PD	MIXED	3	OS	0.00*	−0.33, 0.33
Shomer et al. (1966)	64	US	O	SAME	2	IT(15)	0.60	0.10, 1.10
Sibley et al. (1968)	24	US	PD	SAME	2	IT(100)	−0.84	−1.68, −0.01
Simpson (2003)	82	US	PD	MIXED	2	OS	0.00	−0.49, 0.49
Study 2	70	US	PD	MIXED	2	OS	0.14	−0.39, 0.67
Simpson & Macy (2004)*	114	US	O	MIXED	4	IT(15)	0.00*	−0.37, 0.37
Skotko et al. (1974)	134	US	PD	SAME	2	IT(50)	0.36	0.02, 0.70
Small & Loewenstein (2005)*	140	US	PGD	MIXED	10	OS	0.00*	−0.34, 0.34
E. R. Smith et al. (2003)	143	US	PGD	MIXED	7	OS	0.13	−0.20, 0.46
Study 2	209	US	PGD	MIXED	7	OS	0.10	−0.17, 0.37
Study 3	155	US	PGD	MIXED	7	OS	0.06	−0.26, 0.39
N. S. Smith et al. (1975)	96	US	PD	MIXED	2	IT(60)	−0.50	−1.08, 0.07
Solow & Krikwood (2002)	125	US	PGD	MIXED	5	IT(10)	0.47	0.11, 0.82
Speer (1972)	60	US	PD	MIXED	2	IT(75)	0.11	0.04, 0.17
Steele & Tedeschi (1967)	84	US	O	SAME	2	IT(300)	0.75	0.28, 1.21
Study 2*	84	US	O	SAME	2	IT(300)	0.00*	−0.44, 0.44
Stockard et al. (1988)	594	US/CA	PGD	MIXED	9	OS	−0.08	−0.54, 0.39
Study 2	100	US/CA	PGD	MIXED	7	OS	−0.23	−0.67, 0.21
Surbey & McNally (1997)	150	CA	PD	MIXED	2	OS	−0.36	−0.69, −0.04
Swingle (1970)*	60	US	O	SAME	2	IT(150)	0.00*	−0.52, 0.52
Swope et al. (2008)	48	US	PD	N/A	2	OS	−0.07	−0.75, 0.62
Takahashi et al. (2006)	99	JP	PD	MIXED	2	OS	−0.07	−0.46, 0.33
Tedeschi et al. (1970)	30	US	PD	MIXED	2	IT(150)	−0.92	−1.67, −0.17
Tedeschi et al. (1968)	64	US	PD	MIXED	2	IT(10)	−0.50	−1.00, −0.01
Tedeschi et al. (1969)	50	US	PD	MIXED	2	IT(20)	−0.68	−1.25, −0.11
Van Egeren (1979)	16	US	PD	SAME	2	IT(45)	0.12	0.00, 0.23
Study 2	16	US	PD	SAME	2	IT(45)	0.05	−0.07, 0.12
Van Lange (1999)*	196	NL	PD	MIXED	2	OS	0.00*	−0.28, 0.28
Van Vugt et al. (2007)	93	UK	PGD	MIXED	6	OS	−0.37	−0.79, 0.05
Study 2	120	UK	PGD	MIXED	6	OS	0.26	−0.10, 0.63
Study 3	90	UK	PGD	MIXED	6	IT(6)	−0.57	−1.00, −0.13
Vinacke et al. (1974)	144	US	PD	SAME	3	IT(10)	−0.74	−1.08, −0.40
Voissem & Sistrunk (1971)*	96	US	PD	SAME	2	IT(101)	0.00*	−0.41, 0.41
Wiley (1973)	64	US	PD	SAME	2	IT(20)	−0.04	−0.17, 0.07
Willer (2009)*	72	US	PGD	MIXED	6	IT(5)	0.00*	−0.47, 0.47
Study 2*	41	US	PGD	MIXED	6	OS	0.00*	−0.64, 0.64
Study 3*	97	US	PGD	MIXED	6	IT(10)	0.00*	−0.40, 0.40
Study 4*	86	US	PGD	MIXED	6	IT(5)	0.00*	−0.43, 0.43

Table 2 (*continued*)

Study	*N*	CO	DV	SAME/MIXED	GS	OS/IT	*d*	*LL*, *UL*
Wit & Kerr (2002)*	60	US	O	N/A	6	OS	0.00*	−0.52, 0.52
Study 2*	120	US	O	N/A	6	OS	0.00*	−0.36, 0.36
Study 3*	100	US	O	N/A	6	OS	0.00*	−0.40, 0.40
Wit & Wilke (1992)*	570	NL	PGD	MIXED	100	OS	0.00*	−0.17, 0.17
Wit & Wilke (1998)*	104	NL	PGD	N/A	100	OS	0.00*	−0.39, 0.39
Yamagishi (1986)*	192	JP	PGD	SAME	4	IT(12)	0.00*	−0.29, 0.29
Yamagishi et al. (2005)*	106	JP/AU	PD	N/A	2	OS	0.00*	−0.39, 0.39
Yamagishi & Mifune (2009)	131	JP	PD	SAME	2	OS	−0.21	−0.56, 0.12
Yamagishi et al. (2007)	105	JP	PD	N/A	2	OS	0.77	0.20, 1.34

Note. *N* = number of participants in study. An asterisk indicates that a study reported a null finding and that the effect size is estimated as zero. CO = country; DV = dependent variable; SAME = same-sex pairs or groups; MIXED = mixed-sex pairs or groups; GS = group size in social dilemma; OS = one-shot dilemma; IT(##) = iterated dilemma (number of iterations); *LL* = lower limit; *UL* = upper limit; SE = Sweden; CA = Canada; IN = India; US = United States; JP = Japan; SG = Singapore; RU = Russia; NL = the Netherlands; BE = Belgium; KE = Kenya; UK = United Kingdom; TW = Taiwan; DE = Germany; CH = Switzerland; IL = Israel; AU = Australia; PD = prisoner's dilemma; PGD = give-some game or public goods dilemma; O = Other; TS = take-some game or resource dilemma; N/A = not applicable.

statistically significant negative relationship between year of publication and the effect size, $b = -.005$, $Q(1) = 6.30$, $p = .01$. This continued to be significant after including the null findings. This result indicates that sex differences in cooperation significantly diminished over time. Specifically, the tendency for men to be more cooperative than women during the 1960s has significantly diminished, if not reversed. To illustrate, in studies conducted between 1960 and 1975, men were slightly more cooperative than women ($d = 0.11$), but between 1976 and 1999 and between 2000 to 2010, women were more cooperative than men ($d = -0.12$, and $d = -0.09$, respectively).

Type of dilemma. We found a statistical difference between the three types of dilemmas, $Q(2) = 11.96$, $p = .003$. First, there was no sex difference in the public goods dilemma ($d = 0.01$, 95% CI [−0.08, 0.10]). Second, women were marginally more cooperative than men in the prisoner's dilemma ($d = -0.08$, 95% CI [−0.16, 0.007]). However, women displayed a statistically greater amount of cooperation than men in the resource dilemma ($d = -0.30$, 95% CI [−0.45, −0.14]). As displayed in Table 3, including the null effects did not change the qualitative conclusions of this analysis.

Country of participants. We examined whether there were any differences between countries that were represented by at least seven studies in the sample. There were no statistically significant difference between countries, $Q(4) = 8.61$, $p = .07$. As displayed in Table 3, men and women displayed equal levels of cooperation in the United States, Netherlands, Japan, and England. However, women were more cooperative than men in Canada ($d = -0.26$, 95% CI [−0.45, −0.06]). The comparison between Canada and the United States is significant, $Q(1) = 5.51$, $p = .02$. These findings were the same after including the null results in the analysis.

Multiple regression model. It could be that gender composition and iterations predict the sex–cooperation effect size because these variables are confounded with other methodological features. In fact, as displayed in Table 4, gender composition has a significant correlation with the number of iterations, year of publication, and the type of dilemma. Number of iterations is also correlated with the year of publication. To examine whether gen-

Table 3
Results of the Univariate Categorical Moderator Analyses

Variable and class	*k* (*k* with null estimates)	*d* (*d* with null estimates)	*T* (*T* with null estimates)
Sex of partner(s)			
Same	58 (89)	0.16* (0.09)*	.27 (.19)
Mixed	90 (144)	−0.22* (−0.14)*	.25 (.19)
Sex of partner (dyads only)			
Same	44 (66)	0.22* (0.13)*	.25 (.19)
Mixed	42 (62)	−0.30* (−0.20)*	.22 (.19)
Type of dilemma			
Public goods dilemma	58 (81)	0.01 (0.01)	.26 (.20)
Prisoner's dilemma	74 (115)	−0.08 (−0.05)	.29 (.21)
Take-some dilemma	12 (21)	−0.30* (−0.18)*	.19 (.15)
Country of participants			
United States	108 (172)	0.02 (0.003)	.32 (.23)
Canada	10 (12)	−0.26* (−0.21)*	.20 (.19)
Japan	6 (10)	−0.10 (−0.05)	.24 (.11)
United Kingdom	7 (11)	−0.18 (−0.15)	.25 (.30)
Netherlands	15 (25)	−0.11 (−0.05)	.25 (.14)

* $p < .05$.

der composition and number of iterations are no longer significantly related to the sex–cooperation relationship after controlling for the variance explained by these other methodological features, we conducted a random-effects multiple regression analysis in SPSS using the syntax provided by Lipsey and Wilson (2001). The model predicting the effect size included the variables, mixed (coded as 1) versus same-sex interactions (coded as 2), number of iterations, group size, year of publication, and type of dilemma (public goods and prisoner's dilemmas were coded as 1, and resource dilemmas were coded as 2). To conduct a relatively conservative analysis, we included the null findings that were coded as zero effect. The overall model explained a significant amount of variation in the effect size distribution, $R^2 = .10$, $Q(5, 173) = 41.75$, $p < .001$. Supporting the prior analyses, gender composition was significantly positively related to the sex–cooperation relationship ($\beta = .18$, $p = .003$). The positive relationship between the number of iterations and the effect size also remained significant ($\beta = .18$, $p = .004$). As before, this analysis suggests that men were more cooperative than women in same-sex groups and over several iterations, whereas women were more cooperative than men in mixed-sex groups. However, when we controlled for the variance explained by these two variables, then group size, year of publication, and type of dilemma were no longer significantly related to the effect size. This is likely due to some confounding between the study characteristics.[5]

Sex of Partner and Cooperation: Ruling Out an Alternative Explanation

Lastly, we note that the greater cooperation between male–male dyads versus female–female dyads as well as greater female than male cooperation in mixed dyads might be due to people being generally more cooperative with men than women. To tease apart whether partner sex could be underlying such sex differences, we examined whether both men and women are more generally inclined to cooperate with either male or female partners. Of the studies that reported sex differences in cooperation, only 10 studies reported the main effect of sex of partner on cooperation. The effect sizes of these studies are reported in Table 5. The overall effect indicates that individuals were more cooperative while interacting with women compared to men ($d = -0.38$, 95% CI [−0.002, −0.75]). Although there is heterogeneity in the effect size distribution ($T = .57$, $T^2 = .32$), which can potentially be explained by between study differences ($I^2 = 91.23$), we refrain from exploring moderators of this relationship due to the low sample size.

Table 4
Correlations Between Study Characteristics

Study characteristic	1	2	3	4	5
1. Gender composition	—				
2. No. of iterations	.42*	—			
3. Group size	−.13	−.09	—		
4. Year of publication	−.51*	−.55*	.08	—	
5. Type of dilemma	−.20*	−.09	−.02	.10	—

Note. Gender composition: mixed-sex studies = 1, same-sex studies = 2; type of dilemma: prisoner's dilemma and public goods dilemmas = 1, resource dilemmas = 2.
* $p < .05$.

Table 5
Studies Reporting the Relationship Between Partner Sex and Cooperation in Social Dilemmas

Study	*n*	*d*	*LL, UL*
Carment (1974)	66	−0.71	−1.23, −0.19
M. L. Clark (1983)	120	0.35	−0.01, 0.71
Ferguson & Schmitt (1988)	40	−2.65	−3.25, −2.05
Grant & Sermat (1969)	48	−0.76	−1.35, −0.18
Orbell et al. (1994)	94	−0.18	−0.56, 0.20
Study 2	68	−0.04	−0.42, 0.34
Pilisuk et al. (1968)	176	−0.13	−0.44, 0.19
N. S. Smith et al. (1975)	96	0.07	−0.07, 0.21
Takahashi et al. (2006)	99	−0.58	−0.99, −0.18
Wiley (1968)	96	0.41	0.01, 0.81

Note. *LL* = lower limit; *UL* = upper limit.

This effect, however, may be due to a publication bias. In fact, several statistics raise our concerns about a possible publication bias. First, Egger's regression intercept is marginally significant, $t(8) = 1.95$, $p = .08$. Second, applying Duval and Tweedie's (2000) Trim and Fill approach, two studies were trimmed below the mean and this resulted in a lager estimated effect size ($d = -0.59$, 95% CI [−1.02, −0.16]). There were no studies trimmed above the mean. Lastly, calculating Orwin's fail-safe *N* suggests only 33 studies with a value of $d = -0.05$ would reduce the effect size to non-significance. According to Hedges and Olkin (1985), to ensure confidence in the results, Orwin's fail-safe *N* should be 5 times the number of studies (here, $5 \times 10 = 50$) plus 10 ($50 + 10 = 60$). Because this small sample of effect sizes may contain a publication bias, the current results are relatively inconclusive regarding the main effect of partner sex on cooperation. Nevertheless, they reduce our concern that our earlier analyses can be explained by people being more cooperative with men than women.

Discussion

This meta-analytic review examined sex differences in cooperation using the extant literature on social dilemmas—situations

[5] We also examined the interactions between partner sex with either the number of iterations, group size, or year of publication. We found statistically significant two-way interactions between partner sex and both group size and year of publication predicting the effect size. Follow-up analyses suggested that among same-sex interactions, both group size and year of publication were negatively related to the effect size ($\beta = -.19$, $p = .005$; $\beta = -.19$, $p = .002$, respectively). However, for mixed-sex interactions, both group size and year of publication were unrelated to the effect size ($\beta = .06$, $p = .33$; $\beta = .02$, $p = .71$, respectively). Among all the same-sex studies, however, the moderators are still correlated. Therefore, we conducted a multiple regression model using only the studies coded as same-sex to see whether both year of publication and group size remain significant predictors of the effect size after controlling for the number of iterations. After controlling for the number of iterations, both year of publication and group size were non-significant predictors of the same-sex study effect sizes, whereas the number of iterations continued to predict the effect size ($\beta = .28$, $p = .002$).

involving a conflict between maximizing personal versus collective interests ("mixed motive" games). Previous reviews examined sex differences in prosocial behaviors such as helping (Eagly, 2009; Eagly & Crowley, 1986) and heroism (S. W. Becker & Eagly, 2004), whereas other reviews have considered sex differences in competitive behaviors such as aggression (Archer, 2004, 2009; Bettencourt & Miller, 1996; Eagly & Steffen, 1986) and negotiations (Stuhlmacher & Walters, 1999; Walters et al., 1998). Yet, these results do not necessarily generalize to mixed-motive settings such as social dilemmas, which are psychologically unique because there is a tension between personal and collective interests in deciding whether people want to cooperate. Furthermore, the social dilemma paradigm has a high internal validity and is applicable to many real-world problems, which adds to the credibility of the results.

Our meta-analytic review of 50 years of experimental research on social dilemmas including 272 effect sizes and 31,462 participants revealed a number of interesting results. First, we found no overall difference between the sexes in cooperation in social dilemmas ($d = -0.05$). This result confirms previous narrative reviews of the literature (e.g., Croson & Gneezy, 2009; Ledyard, 1995; Maccoby & Jacklin, 1974; Walters et al., 1998; Weber et al., 2004), and we can now conclude that this is a robust finding. This result is aligned with Hyde's (2005) perspective that men and women are equal on most psychological phenomena. Importantly, however, Hyde acknowledged that gender differences can vary according to features of the situation. Examining context-specific sex differences in cooperation, we find that men are more cooperative in same-sex interactions ($d = 0.16$), whereas women are more cooperative in mixed-sex interactions ($d = -0.22$). Also, as the game continues for several rounds, men become increasingly more cooperative than women. Finally, sex differences in cooperation are largely unaffected by group size, year of publication, or the type of dilemma. Below, we discuss these findings in the context of both sociocultural and evolutionary perspectives on sex differences in social behavior.

Are Women or Men More Cooperative?

The sociocultural perspective suggests that women are socialized more into communal roles and men into agentic roles. This produces sex differences in communal and agentic oriented behaviors (Wood & Eagly, 2010), which can be explained by the proximate mechanisms of gender stereotypes that reflect these orientations (Eagly & Steffen, 1984) as well as men and women regulating their behaviors according to standards consistent with these orientations (Wit & Wood, 2010). As we argued earlier, a relatively greater communal orientation and less agentic orientation of women would predict that women are more cooperative (and therefore less selfish) than men in social dilemmas. It is equally important to note, however, that these predicted sex differences in cooperation emerge in particular when these gender stereotypes or standards are salient (Deaux & Major, 1987).

Similarly, an evolutionary perspective does not make a strong claim about a main effect of sex on cooperation. Humans are thought to have evolved context-dependent decision rules for determining whether or not they should cooperate. For instance, whereas it is adaptive for men and women to defect in one-shot interactions both men and women should be more cooperative in repeated games with the same partners. Thus, it is unlikely that sex-differentiated adaptations would have emerged in our evolutionary history that incline either women or men to be *generally* more cooperative—that is, indiscriminately across a wide range of situations.

As it turns out, there were no meaningful overall sex differences in cooperation in our meta-analytic review. Future research may look at when gender-based communal and agentic stereotypes and/or standards are activated in specific social dilemma situations and whether such gender stereotypes are evolved or learnt through socialization.

Cooperation in Same-Sex Interactions

The sociocultural perspective suggested that female same-sex interactions would be more cooperative than male same-sex interactions. This is because boys and girls learn at a very young age distinct forms of social interactions with same-sex others, and these forms of interactions share features characteristic of agentic and communal orientations, respectively (Maccoby, 1990; Maccoby & Jacklin, 1987). Although this hypothesis finds support in a single study (Moskowitz, Suh, & Desaulniers, 1994), our meta-analytic findings indicate just the opposite: Men are actually more cooperative than women during same-sex interactions.

This finding is more in tune with an evolutionary perspective. According to an evolutionary perspective, two selective pressures in our ancestral environments may have selected for male cooperation to overcome social dilemmas: hunting large packaged prey and warfare/inter-group conflict (e.g., Bowles, 2009; Foley & Lee, 1989; Geary et al., 2003; Manson & Wrangham, 1991; Wrangham, 1999). The argument is that throughout human evolutionary history, male coalitions have been an effective strategy for men to acquire reproductively relevant resources (e.g., Gat, 2006; Guilaine & Zammit, 2004; Keeley, 1996; LeBlanc & Register, 2003; Thayer, 2004; Wrangham & Peterson, 1996). Both hunting and warfare are social dilemmas in that they firmly pit individual and group interests against each other. For instance, each individual is better off enjoying the spoils of hunting or war without actually having to do the work or take any risks. Yet, if everyone acts upon their immediate self-interest, then no food will be provided, and wars will be lost. To overcome such social dilemmas requires strategies to cooperate with each other, and the evidence suggests that this has produced a suite of male coalitional adaptations, including male bonding and male-to-male cooperation. For example, men display increased levels of cooperation during inter-group competition (Van Vugt, De Cremer, & Janssen, 2007; Yuki & Yakota, 2009), show greater amounts of ingroup favoritism in same-sex groups (Yamagishi & Mifune, 2009), have greater levels of cooperation in same-sex dyads (Rapoport & Chammah, 1965), and tend to be more accommodating during interpersonal conflict (Benenson et al., 2009; Eckel & Grossman, 1996). In contrast, there were no specific pressures on ancestral women to provide these highly salient public goods and the physical risks involved in contributing to hunting and warfare selected against women's participation in such tasks. Consistent with this view, the anthropological evidence suggests that both hunting large packaged resources and warfare are all-male activities in modern day and ethnographically recent foraging societies—which is the best available model of the way our ancestors lived—as they still are today (Dunbar, 1996; Kruger & Nesse, 2004; Potts & Hayden, 2008; Sidanius & Pratto, 1999; Wrangham & Peterson, 1996).

As a side issue, several researchers have proposed that the evolution of male cooperation has likely been facilitated by a history of male kin co-residency, whereby ingroups consist of genetically related men, such as brothers and cousins, with unrelated women (Dunbar, 1996; Geary et al., 2003; Lovejoy, 2009; Van Vugt & Ahuja, 2010; Wrangham & Peterson, 1996).[6] Because there was a high degree of genetic relatedness among the men in these ancestral groups, there were clear genetic benefits associated with male cooperation (Hamilton, 1964; Pasternak, Ember, & Ember, 1997). Such an ancestral environment would have made it easier for men to evolve a male coalitional psychology.

Conversely, because women usually migrated between groups, they would have been interacting mostly with non-kin women. These women tended not to be relatives, and many were co-wives. Indeed, ancestral hunter–gatherer societies were mildly polgynous, as they are today, which means that social dynamics among women would have been rife with sexual competition (Dupanloup et al., 2003; Flinn & Low, 1986; Hammer, Mendez, Cox, Woerner, & Wall, 2008; Josephson, 2002; M. B. Mulder, 1992; Sellen, 1999; Strassman, 1997). Thus, in an ancestral group environment that was mildly polygynous with men controlling access to resources and providing offspring care, women may have evolved dispositions to be less cooperative with other women (Benenson, Markovits, Thompson, & Wrangham, 2011; Geary, 2009). Hence, one would expect less cooperation among women, and this is what our meta-analytic findings show.

Cooperation in Mixed-Sex Interactions

The sociocultural perspective suggests that as a result of social roles, women are actually more kind and cooperative and that female stereotypes reflect these behavioral dispositions—a stereotype relevant to social dilemmas. In fact, women are expected to cooperate more than men in a social dilemma (e.g., Orbell et al., 1994), and this belief especially exists among women (Aguiar, Branas-Garza, Cobo-Reyes, Jimenez, & Miller, 2009; Greig & Bohnet, 2009; Lacy, 1978). Because women (and men) are evaluated negatively when they engage in counter-stereotypical behaviors (Costrich et al., 1975), they may be motivated to conform to their stereotypes. Furthermore, such gender stereotypical beliefs are likely to be stronger in interactions with the opposite sex because such situations activate the gender roles (Deaux & Major, 1987). Accordingly, if men and women possess agentic and communal self-concepts, then this should be especially salient in mixed-sex interactions (Hogg & Turner, 1987; Skrypnek & Snyder, 1982). Thus, a salient stereotype in mixed-sex social dilemmas may lead to communally oriented women to be more cooperative, and agentic oriented men to become less cooperative. This is indeed what we find: Women are more cooperative than men in mixed-sex interactions.

An evolutionary perspective offers an alternative explanation for these findings. Although the social dilemma context is not a mating context per se, one could argue that in mixed-sex interactions, mating motives are nevertheless sometimes salient (Li, Halterman, Cason, Knight, & Maner, 2008). Sexual selection theory asserts (Buss & Schmidt, 1993) that men and women have evolved to pay attention to different qualities in potential mates. Whereas men tend to prefer a mate who is prosocial and kind, women tend to prefer a high-status mate who is socially dominant because it conveys the man's success in resource competitions with other men (Buss, 1989; Gangestad, Simpson, Cousins, Garver-Apgar, & Christensen, 2004; Kelly & Dunbar, 2001; Li, Bailey, Kenrick, & Linsenmeier, 2002; Sadalla, Kenrick, & Vershure, 1987). Thus, if such mate preferences are salient when men and women interact, women would be motivated to cooperate more and men less.

Subsequent experimental research could pit the sociocultural and evolutionary predictions against each other by further examining situational cues eliciting sex differences in cooperation in mixed-sex interactions. An evolutionary hypothesis predicts that when men and women are being primed with mating motives—for example, imagining going on a date with an attractive opposite sex partner (Griskevicius et al., 2007)—this should exacerbate sex differences in cooperation. The sociocultural perspective predicts no such effect. In contrast, gender role primes—for example, imagining working in a traditional gender role job—would enhance sex differences in cooperation (and this effect might be larger among people strongly endorsing gender stereotypes).

Cooperation During Repeated Interactions

The sociocultural perspective suggests that because women are expected to be generally kinder and more concerned about others, they are more likely to accommodate a partner's defection. Men, however, as a result of their agentic roles may be more dominant and be inclined to retaliate in response to a partner's defection. This suggests that over the course of an interaction with the same partners, women will become more cooperative, whereas men will become less cooperative (sometimes ending up in a cycle of mutual defection). The meta-analysis results show the opposite: Over time, men became more cooperative than women during repeated social dilemmas.

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[6] Three lines of evidence suggest men tended to reside throughout life among close consanguineal kin, whereas women transferred residence away from kin at sexual maturity or marriage. First, human's closest living ancestors, chimpanzees, bonobos, and gorillas, all practice male philopatry with moderate female dispersal (e.g., Boesch & Boesch-Achermann, 2000; Bradley, Doran-Sheehy, Lukas, Boesch, & Vigiliant, 2004; Chapais, 2008; Goodall, 1986; Nishida et al., 2003; Watts, 1996), and phylogenetic analyses suggest that primate co-residential patterns are conservative over time (Chapais, 2008; Thierry, Iwaniuk, & Pellis, 2000). Second, behavioral studies on modern forager populations suggest they disproportionately practice sex-biased affiliation among male kin, with a tendency for brothers to co-reside (Hill et al., 2011). Moreover, cross-cultural research, finds that the majority of current human societies are normatively patrilocal (Murdock & Wilson, 1980). Lastly, some human population genetic studies show evidence of an evolutionary history of female-biased dispersal patterns (Balaresque, Manni, Dugoujon, Crousau-Roy, & Heyer, 2006; Seielstad, Minch, & Cavalli-Sforza, 1998; Wilson et al., 2001). Recently, the traditional position in anthropology that foragers practiced male philopatry (e.g., Ember, 1975; Foley, 1995) has been challenged in both the ethnographic literature (e.g., Marlowe, 2004) and in human population genetics (e.g., Wilder, Kingan, Mobasher, Pilkington, & Hammer, 2004). However, an adaptation for relatively stronger male same-sex cooperation may still exist regardless of sex-biased co-residency and dispersal patterns. For example, male inter-group competition may have been an enduring social challenge that could alone place enough selective pressure for the emergence of an adaptation for male intragroup cooperation.

This finding, however, supports an evolutionary line of reasoning. In male groups, cooperation is maintained primarily through dominance hierarchies (Geary, 2010). Although such hierarchies tend to involve some degree of interpersonal conflict, they evolved specifically to facilitate social cohesion (Buss, 2005; de Waal, 2000; Hemelrijk & Gygax, 2004). Thus, although men can fight with each other, they may be more tolerant of defections because of the benefits of prolonged male cooperation (Benenson, 2009; Geary et al., 2003). Indeed, developmental research finds that boys and adult men are more tolerant of interpersonal conflicts than girls and adult women (Benenson et al., 2009; Eckel & Grossman, 1996; Vigil, 2007).

There is other evidence too that women adhere to a strict tit-for-tat strategy in social dilemmas and are less tolerant of defection, especially when interacting with the same partner over time. Ben-Ner, Putterman, Kong, and Magan (2004) found that for women, more so than men, the amount given to another person in a dictator game hinged on how much the other person gave them on a previous trial. Behavioral economics findings suggest that women are more inclined to reciprocate the other person's trust or distrust (Buchan, Croson, & Solnick, 2008; Chaudhuri & Gangadharan, 2003; Croson & Buchan, 1999; Schwieren & Sutter, 2008; Snijders & Keren, 2001) and are more punitive of unfair behavior. A strict tit-for-tat strategy can result in prolonged periods of mutual defection (Kelley & Stahelski, 1970; Kuhlman & Marshello, 1975). Thus, if women are inclined to mirror others' actions, they may, compared to men, show less cooperation over time with the same partners.

Group Size and Cooperation

The sociocultural perspective suggests that sex differences in social roles may result in sex differences in the importance of close relationships and group memberships in defining women's and men's self-concepts, respectively (Baumeister & Sommer, 1997; Cross & Madson, 1997). An implication of this perspective is that women may be more cooperative in social dilemmas involving close interpersonal dyadic interactions, and men may be more cooperative than women in larger group social dilemmas. From an evolutionary perspective, it has also been suggested that men may possess social cognitive adaptations that support relatively greater amounts of male cooperation in larger groups (Markovits & Benenson, 2010; Van Vugt, 2009). Although one study has found that men are more cooperative than women in larger groups (Gabriel & Gardner, 1999), this study asked participants about their intentions to cooperate. Our review, which is based on actual behavior, does not support this hypothesis: After controlling for several study characteristics, group size did not affect sex differences in cooperation.

Year of Publication

According to the sociocultural perspective, if women assume more agentic roles or gain greater status, then this should subsequently change gender roles (Diekman & Eagly, 2008; Eagly & Wood, 2011; Wood & Eagly, 2010). In fact, there is evidence that women have become more agentic over time but still remain more communally oriented than men (Twenge, 1997, 2001). Although our initial analysis of year of publication suggested that women became relatively more cooperative than men in more recent years, after controlling for several study characteristics that were correlated with the year of publication, the effect of year of publication disappeared. These findings suggest that societal changes and their corresponding effects on social roles and gender stereotypes do not seem to have impacted sex differences in cooperation—at least in the laboratory studies examined in this meta-analysis. An evolutionary perspective, on the other hand, forwards the position that some sex differences in social behavior are the result of sex-specific adaptations that should be persistent over time in the population. However, adaptations tend to be sensitive to changes in social environments including, for example, reduced gender inequality or changes in sex ratios. Although research has suggested that sex-specific cooperative propensities are modulated by unique socio-ecologies (Macfarlan & Quinlan, 2008), there have been no theoretical developments about how specific features of a culture (e.g., marriage or residential rules) systematically affect sex-typical adaptations for cooperation. Also, we do not know how such sex-typical adaptations may interact with changes in recent culture over the past 50 years. In this regard, an integrative approach that seeks to understand how adaptations and culture mutually constrain and influence each other may be useful (Kenrick, Li, & Butner, 2003).

Summary of Findings

Although we found that women and men were similarly cooperative in general, the evolutionary and sociocultural perspectives put forward separate hypotheses about and explanations for context-specific sex differences in cooperation. Consistent with a sociocultural perspective, women were more cooperative in mixed-sex social dilemmas. Stereotypes of men and women are more likely to be activated in mixed-sex interactions. To match these stereotypes, women may become more cooperative and men less cooperative. Alternatively, an evolutionary perspective suggests that men may desire to signal social dominance to potential mates, leading to less cooperation by men than women. Also consistent with an evolutionary approach, which assumes that men have evolved specialized mechanisms for same-sex cooperation and greater tolerance for another's defection, men were more cooperative in same-sex groups, including dyads, and men became more cooperative over several iterations of the dilemma. These findings were contrary to a sociocultural perspective that predicted greater female same-sex cooperation and women being relatively more cooperative in response to another's defection. Additionally, the meta-analysis showed no support for either a sociocultural or evolutionary perspective that suggests men would be more cooperative in larger groups. Finally, although sex differences in social behavior were hypothesized from a sociocultural perspective to have changed over the last 50 years, our analysis did not indicate any significant change in sex differences in cooperation during this time.

Taken together, our meta-analytic review finds some support for both the evolutionary and sociocultural accounts of sex differences in cooperation. Indeed, we believe future research on sex differences in cooperation would be best served by the development of an integrated evolutionary and sociocultural perspective.

Theoretical Implications: Integrating Evolutionary and Cultural Perspectives

Sex differences in cooperation are perhaps better understood as a function of both evolutionary and cultural processes. Although a full theoretical integration of these perspectives is beyond the scope of this article (for previous attempts, see Archer, 1996, 2009; Kenrick et al., 2003), we briefly address two features of this integration and their importance for future research on sex differences.

First, evolved psychological sex differences may constrain the influence of the current social environment. For example, sex-typical adaptations may affect both the socialization process of boys and girls (Low, 1989) and the emergence of sex differentiated cooperative institutions (Kenrick & Luce, 2000; Kenrick, Trost, & Sundie, 2004). In this regard, an evolved male coalitional psychology explains why across all cultures there is an overrepresentation of men in business, politics, and warfare (Van Vugt, 2009; Wood & Eagly, 2002; Whyte, 1978) and why men are more cooperative especially under conditions of intergroup threat (Bugental & Beaulieu, 2009; Van Vugt et al., 2007; Yuki & Yokota, 2009) and in repeated interactions with the same partners (Benenson et al., 2011; Geary et al., 2003). In the absence of such ancestrally relevant cues, sex differences in cooperation are less likely to appear. Future research may extend this analysis by examining how cultural influences can exacerbate or diminish the influence of sex-typical adaptations for cooperation.

Second, values and behavior are influenced by cultural factors. Through cultural transmission processes, humans learn what is socially appropriate (D'Andrade, 1989), including stereotypical beliefs associated with sex roles. Two important cultural variables that may affect sex differences in cooperation are the family context (Belsky, Steinberg, & Draper, 1991; Flinn & Ward, 2005) and institutional structures (e.g., marriage and residence rules; Low, 1989). These cultural factors systematically affect socialization processes that may in turn reinforce or diminish the manifestation of sex differences in cooperation. Low's (1989) cross-cultural research shows that parents in patrilocal societies (a marriage rule specifying men and their brides reside among kinsmen after marriage, as such power is shared among male kin) teach boys to cooperate with each other and to obey authority figures, which facilitates the emergence of male cooperative groups headed by older men. In cultures in which male–male coalitions have less functional importance and male–female coalitions are more important (feminine cultures; Hofstede, 2001), socialization processes are likely to be less sex differentiated.

In general, the cultural environment likely provides important informational inputs for the evolution and the processing of adaptive decision rules, which operate at the individual level (Cosmides, Tooby, & Barkow, 1992; N. Henrich & Henrich, 2007; Kenrick et al., 2003). In turn, individuals interacting with one another, each with their evolved decision rules for adaptively processing information, dynamically comprise culture. Thus, cultural and evolutionary processes are likely intertwined, and an integrative approach, which seeks to understand how adaptations and culture mutually constrain and influence each other, may be most useful in understanding complex social phenomena such as sex differences in cooperation.

Social Dilemmas as a Paradigm to Examine Sex Differences in Cooperation

Social dilemma studies provide an exceptional context to study sex differences in cooperation, because these experiments are highly controlled situations that directly pit self against collective interests. Because these conflicts of interests are pervasive in our day-to-day social lives (Van Lange & Joireman, 2008), our findings generalize to a myriad of contexts involving dyads and groups. Furthermore, the diversity of studies in our sample enabled us to zoom in on key situational features affecting sex differences in cooperation. For instance, each study either allowed same-sex or mixed-sex interactions, had a predetermined number of group members, and had a predetermined number of iterations. However, the studies were limited in that they did not compare interactions between ingroup versus outgroup members, friends versus strangers, and kin versus non-kin. Future research on sex differences in cooperation will benefit by constructing experimental social dilemma contexts that manipulate these and other features of the situation that are hypothesized—based on an integrated evolutionary and cultural theory—to affect sex differences in cooperation (Van Vugt et al., 2007).

Do social dilemmas enable us to test for sex differences in competition and aggression? Theoretically, the social dilemma is not a test of cooperation versus competition (aggression) but of cooperation versus defection (i.e., *not* cooperating). There are many reasons why people may defect in social dilemmas, and only one of them is having a competitive motivation—normally only about 5% of participants have a competitive orientation (Au & Kwong, 2004; Komorita & Parks, 1994). Moreover, prior research suggests that people defect in social dilemmas—at least in the laboratory contexts we include in our meta-analysis—because of a concern for self-interest, not competition (Komorita & Parks, 1994). Hypotheses about sex differences in competition (or aggression) should be tested in competitive economic games, such as zero-sum or maximizing difference games.

Our meta-analytic findings extend previous work on social dilemmas in important ways. Walters et al. (1998) conducted a quantitative review of sex differences in two-person social dilemmas and also failed to find an overall main effect of sex. Our analysis goes further in several ways. First, whereas Walters et al. only examined behavior in prisoner's dilemma games, we examined behavior in all types of social dilemmas. In doing so, we found that men's and women's behavior in dilemmas are affected not only by the sex of the interaction partners but also the number of iterations of the dilemma. Second, whereas Walters et al. only considered dyadic interactions, we examined behavior in both dyads and larger groups. Third, their sample included many null findings that were estimated as zero effect sizes relative to actual coded effect sizes. This is problematic because several of these estimated null findings likely observed a mean difference between men and women but lacked the statistical power to detect a small effect size. In summary, our research overcomes some of the limitations of previous research by examining sex differences in cooperation in a much wider range of dilemmas with a much larger sample of studies ($k = 51$ vs. $k = 272$).

Practical Implications

Our meta-analytic findings are relevant to several disciplines in psychology. For example, research in developmental psychology may benefit from at least two aspects of the current research. First, past research on children's cooperation has often used paradigms that align self-interest with cooperation (for review, see Knight & Chao, 1989). However, the present findings suggest that by pitting self-interest *against* cooperative motives, developmental researchers can more directly examine when children value the welfare of others over personal welfare. Second, developmental researchers may benefit from a careful consideration of how age interacts with sex to predict cooperation in social dilemmas. Along these lines, one study found that boys' same-sex interactions become *more* cooperative between 7 and 11 years of age, whereas 7–11-year-old girls' same-sex interactions become *less* cooperative (Sampson & Kardush, 1965). Fehr et al. (2008) found that boys (3–8 years of age) are more tolerant than girls of receiving a lower share of outcomes than a fellow ingroup member, compared to when they were interacting with an outgroup member. Such findings suggest that a male bias toward cooperating with male ingroup members develops relatively early. However, the results of the present analysis suggest that these studies may benefit from manipulating the gender composition of dyads/groups and examining cultural influences that may exacerbate or inhibit sex differences such as different socialization practices and different societal threats (warfare).

Cross-cultural psychology may benefit from a consideration of how social roles correspond to structural aspects of the society, including family structure and the workplace. Such roles may moderate both male and female dispositions toward cooperation. Andersen, Bulte, Gneezy, and List (2008) recently found that men in a matrilineal society are more cooperative during mixed-sex interactions than men in a patriarchal society. Future research could expand on this work by controlling for additional cross-cultural differences (e.g., cultural values) while measuring potential mediating mechanisms (e.g., social roles and male vs. female stereotypes) of the effect of cultural differences on sex differences in cooperation. More generally, there is a need to methodologically isolate cultural variables to determine which aspects of culture are affecting the sex–cooperation association and to study the psychological processes that mediate the culture–cooperation relationship.

Strengths, Limitations, and Future Directions

The conclusions of our meta-analysis are limited to the types of social dilemmas included in our sample. Specifically, the studies included in our analysis were social dilemmas in which the interests and outcomes of the players were symmetrical and there was full information on others' outcomes. Thus, the results of our meta-analysis may not necessarily generalize to situations where cooperation occurs in the context of asymmetrical dependency (e.g., one partner has relatively more power) or information uncertainty (e.g., not knowing a partner's outcomes). Kelley et al. (2003) noted that changes in the structure of a situation (e.g., greater asymmetrical dependence) will affect the expression of particular traits and motives such as social dominance, which in turn may influence the manifestation of sex differences in cooperation.

A common misperception about social dilemmas research is that it lacks external validity. Yet, behavior in social dilemma experiments predicts cooperation outside the laboratory very well. For instance, the number of cooperative choices in dilemma games predicts how much people donate to charitable causes (Van Lange, Bekkers, Schuyt, & Van Vugt, 2007), and students quite accurately predict how their roommate would behave in such paradigms (Bem & Lord, 1979).

Another potential limitation of our work is that the effect sizes in our studies are relatively small. However, small effect sizes are common in meta-analytic reviews of sex differences and social psychological research in general (Eagly & Wood, 1991; Hyde, 2005) and can still be considered important due to an accumulative impact over time (Abelson, 1985; Martell, Lane, & Emrich, 1996). Thus, we believe that the small effect sizes do not undermine the importance of our findings. Finally, although our sample included studies conducted in 18 countries, our search was limited to English written articles, and most studies were conducted in the United States. This is a concern because most studies in our sample come from Western, Educated, Industrialized, Rich, and Democratic (WEIRD) countries, and studies conducted in WEIRD countries can generate different results than those conducted elsewhere (J. Henrich, Heine, & Norenzayan, 2010). Our understanding of the evolutionary and cultural basis of sex differences in cooperation will benefit from including participants from non-Western cultures.

Concluding Remarks

Since Maccoby and Jacklin's (1974) review concluded that sex differences in social behavior were small and negligible, a research tradition developed to review sex differences in specific domains such as aggression, helping, and leadership, applying meta-analytic techniques. Our quantitative review extends this literature by examining sex differences in social dilemmas. We started by asking the question: Are women or men more cooperative? Our answer: It depends. Women are not more cooperative than men, in general. However, several factors moderate the sex–cooperation relationship, including the sex of partner and the duration of the interaction. Several findings support an evolutionary perspective on sex differences in cooperation, but there is also some support for a sociocultural perspective. Future research will benefit from an integration of evolutionary and sociocultural approaches to develop a more sophisticated theory of sex differences in social behavior. Doing so will refine our questions and direct future research efforts, resulting in a more comprehensive understanding of the effect of sex on cooperation.

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