Evolution and Human Behavior 46 (2025) 106715

Contents lists available at ScienceDirect

Evolution and Human Behavior

journal homepage: www.elsevier.com/locate/ens

Coalitional support regulates resource divisions in men

Elsa Ermer [a,b,*], Gary Charness [d], John Tooby [a,c], Leda Cosmides [a,b]

[a] Center for Evolutionary Psychology, University of California, Santa Barbara, CA 93106, United States of America
[b] Department of Psychological & Brain Sciences, University of California, Santa Barbara, CA 93106, United States of America
[c] Department of Anthropology, University of California, Santa Barbara, CA 93106, United States of America
[d] Department of Economics, University of California, Santa Barbara, CA 93106, United States of America

ARTICLE INFO

Keywords:
Coalitional psychology
Economic games
Resource division
Coalitional support
Decision making

ABSTRACT

The logic of animal conflict predicts that organisms should assess cues of formidability to mitigate the costs of escalated contests. Accordingly, individual fighting ability has been shown to regulate the outcome of contests: All else equal, more formidable individuals claim a larger share of disputed resources, and less formidable individuals defer to their claims. The human ability to cooperate in groups complicates these interactions because a coalition of individuals can take resources from an individual that none of them could dominate when acting alone. We propose that the prevalence of male coalitional aggression in humans selected for psychological mechanisms that track how much coalitional support is immediately available to men when they are contesting a resource and use this information to regulate decisions about how to divide it. Specifically, men with coalitional allies present should be motivated to press their self-interest more than men who are acting alone—even if the solitary man has allies elsewhere. Experiments using economic games in a university lab setting were employed to test this coalitional support hypothesis. Across six experiments employing three different economic games (total $n = 496$), coalitional support consistently regulated men's—but not women's—choices. These results suggest that coalitional support is an important factor regulating resource division in men. The fact that women pressed their self-interest, but did so whether allies were present versus absent, suggests that women's coalitional psychology was designed by different selection pressures than men's.

1. Introduction

The extent, magnitude, frequency, and complexity of human cooperation are unparalleled in the animal kingdom. Humans are one of the few species in which non-kin form coalitions in which three or more individuals cooperate to achieve a common goal and then share the resulting benefits. A zoologically unusual form of group cooperation among ancestral humans was male coalitional aggression, that is, groups of men—not always kin—cooperating with one another to compete against males in other groups (Gat, 1999; Wrangham, 2019; Wrangham & Peterson, 1996). We propose that group cooperation among non-kin in humans is enabled, in part, by a *coalitional psychology*: a set of species-typical neurocognitive mechanisms that regulate coordination and cooperation within groups and competition between groups.

Some components of human coalitional psychology should be present in both sexes. Cognitive systems for tracking patterns of cooperation and conflict to predict who is allied with whom are an example (Kurzban, Tooby, & Cosmides, 2001; Pietraszewski, Cosmides, & Tooby, 2014). Alliance tracking machinery is operational in men and women, with no sex differences found so far. The same is true of mechanisms that decide who counts as a free rider on a collective action (Delton, Cosmides, Guemo, Robertson, & Tooby, 2012). In defensive war scenarios, the more willing people are to participate in the war, the more punitive they feel toward free riders—a relationship that is strong in both sexes (Lopez, 2017; Price, Cosmides, & Tooby, 2002).

Despite these similarities, some components of coalitional psychology may differ in men and women. We investigate one potential difference here: the extent to which the presence of allies—coalitional support—regulates resource divisions.

1.1. Male coalitional psychology

Conflict over resources is a recurrent evolutionary selection pressure, yet fighting to the death is rare. Evolutionary biologists have solved this apparent puzzle by analyzing the selection pressures that shape decisions about when to contest or cede a resource (Maynard Smith, 1974).

* Corresponding author at: Center for Evolutionary Psychology, University of California, Santa Barbara, CA 93106, United States of America.
E-mail address: elsa.ermer@gmail.com (E. Ermer).

https://doi.org/10.1016/j.evolhumbehav.2025.106715
Received 17 May 2025; Accepted 11 June 2025
Available online 16 June 2025
1090-5138/

Fighting over a contested resource entails costs for the individuals involved; both eventual winners and eventual losers save time, energy, and avoid injury if the outcome of a contest could be determined without having to hold the contest. This creates selection pressures to assess and track the relative formidability of individuals with whom one comes into conflict (Hammerstein, 1981; Maynard Smith, 1982; Maynard Smith & Parker, 1976; Parker, 1974; Parker & Rubenstein, 1981). Adaptations for assessing relative formidability exist in many species, including humans: people accurately estimate men's physical strength from their face, body, or voice, and use this information to infer fighting ability (Sell et al., 2010, 2009).

Decisions about when to contest or cede a resource should also depend on the presence of allies; a coalition of cooperating individuals may be able to seize resources that no member could take when acting alone. According to the *coalitional support hypothesis*, the formidability of an individual man is augmented by his allies, and this support is used to regulate decisions about resource divisions. Humans and other species that manage coalitional behavior need a decision system that can integrate how allies change payoff structures—that compute coalition-derived formidability—and input this value to regulate welfare tradeoffs. This should be most evident in contests where one man is accompanied by his coalitional allies but his opponent is alone.

Coalitional alliances play an important role in the intergroup aggression observed among common chimpanzee and human males, as well as in the various political strivings of men. Among common chimpanzees, females do not form extensive coalitions with one another, but male chimpanzees do (Fox et al., 2023). Moreover, males use the size of a coalition as a cue of coalitional formidability. During border patrols, when adult male chimpanzees come across males of a neighboring group, their behavior depends on the number of males encountered. If there are more males present in the other group, the patrolling chimps retreat. However, if they outnumber their rivals sufficiently, they respond with loud calls (Wilson, Hauser, & Wrangham, 2001) and may attack a lone individual from the other group. Here, size of coalition (number of members present) is used as a cue to determine whether to attack or retreat in conflicts over territory boundaries (Manson & Wrangham, 1991). Attacks are most common when 4 to 6 males encounter a solitary individual from a neighboring community (Wilson, Kahlenberg, Wells, & Wrangham, 2012); lethal attacks usually involve a ratio of 8:1 (Massaro et al., 2022). By eliminating members of neighboring communities, male coalitions expand the feeding territory available to females with whom they associate (Mitani, Watts, & Amsler, 2010); this lowers their interbirth intervals thereby increasing reproductive success (Williams, Oehlert, Carlis, & Pusey, 2004).

Intergroup aggression practiced by males is common, if not universal, across hunter-gatherer groups (Gat, 1999) and shows similarities with the aggression patterns observed for chimpanzees (Wilson & Wrangham, 2003). Human groups form many more nested hierarchies of group membership than chimpanzees do (Boehm, 1992), although human groups typically recognize classes of outsiders whose interests need not be taken into account (Hill & Hurtado, 1996). The similarities in male intergroup aggression between chimpanzees and humans suggest common evolutionary origins, whether from a shared evolutionary history or convergent evolution of coalitional psychological mechanisms (Wilson & Wrangham, 2003). If the sex differences in the incidence and fitness payoffs of coalitional aggression that were typical of hunter-gatherer life also typified the conditions that obtained during human evolution, it is plausible that the specific coalitional psychological mechanisms that have evolved are sexually dimorphic (Tooby & Cosmides, 2025/1988). The psychology may be more elaborated in men, or easier to activate across a broader range of conditions. Sensitivity to the size or formidability of coalitions should be particularly evident in men when a contest is over valued resources.

A number of separable components should go into the computation of coalition-derived formidability, such as number of allies, their individual formidability, and social status, but here we focus on relatively basic considerations: whether an individual has allies and whether those allies are physically present for a given interaction. Presence of allies—coalitional support—is predicted to act as a cue that governs men's decision-making in disputes over resources. Specifically, when a man's allies are physically present and his opponent is alone, this cue should upregulate his motivation to claim more of a disputed resource. On the other hand, in resource disputes where he is alone and an opponent has allies present, the solitary individual should defer more to his opponent's interests. That is, he should make tradeoffs that put more weight on the welfare of an opponent who is flanked by his male allies.

1.2. *Female coalitional psychology*

The above analysis, based on our species' evolutionary history of male coalitional competition, suggests that men's resource division decisions will be regulated by their relative coalitional support, such that men will make decisions to claim more resources when they have coalitional support than when they do not. Would the same selection pressures have operated on women's coalitional psychology? There are several competing views on the extent to which the physical presence of coalitional support would have been selected to regulate women's resource division decisions.

1.2.1. *The male intergroup conflict hypothesis*

Intergroup conflict during human evolutionary history was disproportionately conflict between different groups of *male* alliances, and strong alliances increased the probability of prevailing in aggressive conflicts (Chagnon, 1988; Tiger, 1969; Tooby & Cosmides, 2025/1988; Wrangham & Peterson, 1996). Female alliances did not determine group boundaries, male alliances did. The fission-fusion societies of human hunter-gatherers imply flux in coalition divisions. This means coalitional power changed in ontogenetic time, requiring cognitive variables that track these changes. The ongoing and opportunistic nature of conflict meant numbers of men physically present at a particular time were important determinants of resource acquisition. Thus, men faced selection pressures to identify and track relative strength (indexed by coalition presence and relative numbers) in group conflict and use this information to determine when to lay claim to or cede resources. However, because women were not involved in these contests, they did not face the same selection pressures that men did. Women form alliances with one another (Hess, 2006, 2017), but these are not usually to project physical force in confrontations with other females. This view predicts, then, that women's resource division decisions will be unaffected by the presence or absence of coalitional support from other women.

1.2.2. *The male pre-emption hypothesis*

Men are larger and stronger than women; as such, men have a disproportionate ability to wield physical force as a means to defend their interests. Thus, on average, women's physical violence would have been ineffective against men. Plausibly, physical violence against other women would also have been ineffective, as such confrontations may trigger the intervention of males allied with the other woman—father, brother, husband, etc. On this view, women and men have similar coalitional psychologies, but they both evolved to deal with male coalitions. Women evolved to track male coalitions, and female alliances with male coalitions, and were selected to use *male* coalitional support to regulate resource divisions. This view predicts, then, that women's resource division decisions will be unaffected by female coalitional support, but would be regulated by male coalitional support.

1.2.3. *The female coalitional support hypothesis*

Female bonobos form coalitions that include non-kin to defend against male aggression, but female chimpanzees do not (Pusey & Schroepfer-Walker, 2013; Surbeck et al., 2025). The last common ancestor (LCA) of humans, chimpanzees, and bonobos lived 8 million years ago, before the split between chimpanzees and bonobos. Accordingly, a common view is that the LCA was more chimp-like (Pusey, 2022), with coalitional aggression in female bonobos arising later, enabled by ecological conditions south of the Congo River. This line of reasoning, along with ethnographic reports from small-scale societies, suggests that female coalitional aggression has not been a major target of selection in humans.

Nevertheless, female alliances do have a long evolutionary history in primates. They are extremely important for the rank, health, and reproductive success of many non-human primates (Perry, 2003; Silk, 1992). Women have many opportunities to benefit one another; membership in larger cooperative networks may have granted greater access to resources (such as information, mating opportunities, mobility). On this view, women, like men, were selected to use coalitional support to regulate resource divisions. If so, then relative number of allies present should act as a cue to contest or cede disputed resources. This view predicts, then, that women's resource division decisions will be regulated by the physical presence of female coalition members in the same way that men's decisions are.

1.3. Experimental economics

Experimental economics provides a paradigm for explicitly testing questions about the factors regulating resource division. Indeed, several factors related to formidability have been shown to regulate people's decisions in economic games, in ways that favor the more formidable party. For example, in terms of individual formidability, there is evidence that tall children keep more money in dictator games than shorter children do (Harbaugh, Krause, & Liday, 2003). Height is a correlate of relative formidability, especially among children. On average, men have greater formidability than women, and Holm (2000) found that men and women made choices in a coordination game that consistently favored the better outcomes for men. Results from resource allocation games have found evidence of decisions favoring men from both sexes (Solnick, 2001; Solnick & Schweitzer, 1999; Eckel & Grossman, 1998; Croson & Buchan, 1999; Murningham & Saxon, 1998; Harbaugh et al., 2003; but cf. Eckel & Grossman, 2001; Bolton & Katok, 1995). These effects occur in the absence of rational choice incentives to favor particular outcomes, at least in terms of game payoffs.

There is also evidence that suggests coalitional support regulates people's economic decisions. Coordination games, such as battle of the sexes, have been interpreted as revealing status relations. In this game (see Table 2), players receive money by coordinating their actions, but each has a different preferred (higher payoff) strategy. A status marker can determine which outcome individuals choose using the rule that the higher status individual gets the better payoff (Camerer & Fehr, 2004). Using this game, Charness, Rigotti, and Rustichini (2006) had two individuals play at a time, with one of them flanked by his or her group members (who watched the interaction). The audience had a vested interest in the outcome of the games: they received a fraction of the payoff to the individual who was a member of their group. Individuals played more aggressively (seeking more money for themselves and their group members by playing their preferred strategy) when their own group members were present than when their group members were not present. Individuals who were alone were more likely to accommodate these aggressive moves, ceding resources to the other side, by playing the (other) group's preferred strategy. These results were strongest when audience members were given feedback on the outcome of each round of the game, creating shared knowledge of individuals' decisions and group outcomes.

The results from Charness et al. (2006) are consistent with the idea that coalitional support regulates people's economic decisions in ways consistent with the coalitional support hypothesis. However, their study was not designed to test this hypothesis and, in their study, coalitional support was perfectly correlated with playing in either a home or away room, which could be interpreted as a territory cue; indeed, they referred to players as "hosts" and "guests". In addition, they used mixed-sex groups, which could activate mating motivations (e.g., intrasexual competition within the group; male displays to impress women). Indeed, a recent study using a threshold public goods game showed that both sexes contributed more when they were in mixed-sex compared to same-sex groups (Muñoz-Reyes et al., 2023). Here we test same-sex groups to examine potentially sexually dimorphic coalitional psychologies.

We designed a series of experiments to test the coalitional support hypothesis using three different experimental economics games. One virtue of using experimental economics methods is that they were developed to test the extent to which people's choices reflect "rational" self-interest with respect to the given payoff structure. This method allows evolutionary hypotheses (here, coalitional support) to be tested against alternatives that invoke domain-general reasoning in the service of maximizing monetary payoffs. In our experiments, the payoffs were designed such that the presence or absence of coalitions does not alter the payoff structure of the game. Thus, there is no rational incentive for people to pay attention to or regulate their choices based on coalitional support.

Typically, participants in experimental economics games interact anonymously, yet real-life interactions are rarely anonymous and social perceptions may regulate decisions about resource divisions in predictable ways. Humans evolved as a face-to-face species, and the motivational systems designed to regulate welfare tradeoffs should be activated in the physical presence of others. Thus, all of our experiments involved face-to-face interaction between opponents.

If coalitional support regulates resource allocation decisions, the effect should not depend on various particular features of a game, but should generalize across a range of scenarios.[1] To this end, we tested the effect of coalitional support in three very different economic games: a coordination game, the hawk-dove game, and the dictator game. Our experiments compared men's and women's choices with and without coalitional support (presence of same-sex team members). The experi-

Table 1
Variation in experimental game features in the Coordination, Hawk-Dove, and Dictator games.

Feature	A. Coordination Game	B. Hawk-Dove Game	C. Dictator Game
Game outcome	Determined jointly	Partially determined jointly and partially determined individually	Determined unilaterally
"Safe" option (guaranteed $)	No	Yes	Yes, for dictator No, for receiver
Team assignment	Transparently random	Transparently random	Hometown location
Common fate	Monetary: 33 % of teammates' payoffs	Monetary: 25 % of teammates' payoffs	Psychological: Team building exercise
Monetary Pot	Windfall from experimenter	Windfall from experimenter	Partially earned through quiz scores
Relative coalitional power	Reversals	Reversals	Fixed
Choice Options	Limited	Limited	Unconstrained
Feedback about outcome?	Yes	Yes	No

[1] If our decision-making is sensitive to coalitional support, this should be easier to detect using games in which the partner cannot retaliate. The games used here have that property (unlike trust games with punishment or ultimatum games).

mental design varied a number of game features (see Table 1). Thus, any observed consistent effects of coalitional support across all three games cannot be attributed to any of these factors. Table 1 summarizes similarities and differences in features of the three games used in the experiments reported herein.

2. Study 1: the coordination game

In the coordination game, players can only earn payoffs if they both choose the same option. Players have a conflict of interest, however, regarding which option each player would prefer to coordinate on. The payoff matrix for the coordination game (also known as Battle of the Sexes) is shown in Table 2.

The coordination game experiments conducted by Charness et al. (2006) were not explicitly designed to test the coalitional support hypothesis. Study 1 was designed to replicate Charness et al.'s (possible) coalition effect while eliminating territory cues as a confounding variable. Single players did not go to the "home territory" of the other team for the interaction. All games were conducted in a neutral room. Feedback and common fate were present and held constant.

Coalitional support was operationalized by manipulating the number of group members present when two individuals from different teams played. Because mixed-sex groups may introduce other dynamics (e.g., mating), only same-sex groups were used. Study 1a was limited to all male subjects because the theoretical arguments for relative formidability and the physical presence of allies regulating coalitional psychology are stronger for men than for women. Men may have a more specialized coalitional psychology than women do, or their coalitional mechanisms may be triggered more easily or by different circumstances. Study 1b was identical, but limited to all female subjects. We expect that contested resources will be divided in ways that are more favorable to those with greater relative coalitional support. In the coordination game, this coalitional support hypothesis predicts that:

1. Coalition presence will serve as a coordination cue and will allow subjects to achieve a relatively high coordination rate (compared to experimental results reported in the literature where such cues are lacking).
2. Coalition presence will favor coordination on the outcome that is best for the coalition.

These considerations also lead to specific predictions about subjects' decisions in the game, namely:

3. Subjects will be more likely to choose the self-preferred option when they have a coalition present and the other player is alone.
4. Subjects will be more likely to choose the other-preferred option when they are alone and the other player has a coalition present.

In this game it is rational (i.e., produces higher payoffs) to select coordinated rather than uncoordinated choices, but there is nothing in the structure of the game to indicate which set of choices will increase the probability of coordination. If there is a psychology of group formidability, the presence of a larger coalition will allow mutual mind-reading, and the expectation that the higher payoff will go to the individual with greater coalitional-derived formidability.

Table 2
Coordination game decision and payoff matrix.

Team	Choice	Column Player	
		A	B
Row Player	A	3, 1	0, 0
	B	0, 0	1, 3

Note. Cells are payoff to row player, payoff to column player. For the Row Player, Choice A is their preferred outcome and Choice B is the other player's preferred outcome.

2.1. Method

2.1.1. Subjects

In all studies reported here, subjects were students recruited from flyers, the university center, and a web-based study sign-up system. Volunteers were paid cash for their participation, with a guaranteed payment of US$5, plus earnings from the games (if any). Details for all three studies are given in Table 3. There was no deception in these studies. This research was approved by the University of California Santa Barbara (UCSB) Human Subjects Committee. Data and materials are available as supplementary information.

2.1.2. Procedure

After arriving at the lab, subjects were assigned a subject number and a team (white or orange) by drawing a numbered, colored ping-pong ball from an opaque bag. Teams were of equal sizes: 4 each for 10 sessions and 3 each for 2 sessions.

After team assignment, the teams were immediately separated into two different, adjoining rooms. In each room, an experimenter explained the game and handed out a chart of the decision matrix (as in Table 2 above). The matrix was also written on a whiteboard in the main lab where the games were played. The experimenter then informed each team which subject would be playing the next game and whether the team would be present or not. An experimenter remained in the room with team members who were neither playing nor witnessing the game.

The player and team, if applicable, then entered the main lab. The players were seated at a table across from each other. Team members stood behind the player from their team. Players could not verbally consult with their team members (or each other) about game play at any time.

Each player had a set of cards, marked A and B, and made his choice by passing the card corresponding to his decision to a third experimenter who conducted the games. The experimenter then announced what the choices were, as well as what this meant in terms of payoffs. The players then went back to their respective rooms, and the experimenter accompanied the lone player back to his room and announced the outcome of the game to his team members, who had not witnessed the game. Which team was present to witness the game alternated back and forth between the two teams (white and orange). The team that first witnessed the game (white or orange) was counterbalanced across sessions, although team assignment was random and arbitrary and team color only served to distinguish the two groups.

Each subject played the game three times, each time against a different opponent from the other team, with at least one game with the subject's team present and at least one game with the opponent's team present. Games alternated back and forth between which team's

Table 3
Sample characteristics. Means (and standard deviations) where appropriate.

Study #	Game	Subjects	N	Age	Mean Earnings (US $)
1a	Coordination	Men	92	20.4 (2.50)	11.77 (3.08)
1b	Coordination	Women	92	19.7 (1.66)	11.26 (2.48)
2a	Hawk-Dove	Men	88	20.5 (2.63)	10.91 (2.42)
2b	Hawk-Dove	Women	88	19.5 (1.56)	11.38 (1.66)
3a	Dictator	Men	56	19.6 (1.64)	15.79 (3.74)
3b	Dictator	Women	80	19.8 (1.70)	14.25 (2.96)
All			496	19.9 (2.04)	12.31 (3.18)

members were present for the game. All subjects played once before any subject played twice, and all subjects played twice before any subjects played a third time. Subjects were not told the specific number of games that they would play.

After the last game (game 12 for teams of 4 and game 9 for teams of 3), all subjects were brought back into the main lab to complete a questionnaire. The questionnaire asked about perceptions of the other team, the subject's own team, the subject's first opponent, satisfaction with the outcomes, influence over the game, and demographic information.

Upon completing the questionnaire, subjects were taken individually into an adjoining room and paid cash for their participation, including a $5 show-up fee. Subjects earned money from the games in which they participated (1 point = US$1), as well as 33 % of what their teammates earned in their games (regardless of whether the team was physically present for a game).

The procedure was identical for women in Study 1b.

2.2. Results

Coordination was achieved in 57.2 % (79/138) of men's games and 52.2 % (72/138) of women's games. These rates were significantly higher than the predicted mixed strategy Nash equilibrium rate of 37.5 % (binomial tests: $p < .001$) and the typical experimentally observed rate of 41 % (Camerer, 2003; binomial tests, $p < .001$ for men, $p < .005$ for women). Coordination rates were not different for men and women ($p = .40$).

In games where subjects failed to coordinate, both players chose their preferred option most of the time (74 % (44/59 times) for men; 68 % (49/72 times) for women).

Fig. 1, panel A shows the main result for Studies 1a and 1b: how likely subjects were to choose the self-best outcome when their team was present versus absent.

2.2.1. Results for men (Study 1a)

Did team presence affect men's choices in the coordination game? Yes. Men were significantly more likely to choose their preferred outcome when their team was present (and their opponent was alone: 79.3 %, SD = 34.89) than they were when they were alone (and their opponent's team was present: 42.9 %, SD = 46.63; $t(91) = 5.84$, $p < 10^{-6}$, point-biserial $r = 0.52$; Fig. 1, Panel A). This pattern was present even for the initial round of each of the 12 sessions, before men had feedback about any outcomes (see Table 4, last row). For the team x self-best interaction, the effect size in this initial round ($\phi = 0.26$, $N = 12$) is about the same as for the significant interaction based on all 46 first round choices ($\phi = 0.20$).

Overall, 60 % of men chose the self-best outcome. Those who did were much more likely to have their team present. Men who chose the other-best outcome were much more likely to be alone. See Fig. 2, panel A.

When coordination was achieved, did it favor men with a team present? Yes, 81.0 % (64/79) of the games in which coordination was achieved favored the team that was present, $\chi^2(1, N = 79) = 30.39$, $p = 10^{-8}$, $\phi = 0.37$. Averaging rates across individual sessions, 76.9 % (SD = 28.71) of coordinated outcomes favored the team present, significantly greater than chance (one-sample $t(11) = 3.25$, $p = .008$, $r = 0.70$).

Did the pattern of choices change over the course of the experiment? Yes, men showed a stronger effect of team presence on outcome choices as the experiment progressed (see Table 4). Each subject played the game three times. Examining decisions for the first game for each subject, there was a sizeable effect of team presence on outcome choice, $\chi2$ (1, $N = 92$) = 3.56, $p = .059$, $\varphi = 0.20$. Nevertheless, this effect increased markedly during the second round of games (decisions from the second game played for all subjects), $\chi2$ (1, $N = 92$) = 20.84, $p < .001$, $\varphi = 0.48$, and remained high during the third (and last) round of games, $\chi2$ (1, N = 92) = 18.25, $p < .001$, $\varphi = 0.44$.

Questionnaires showed that men rated their own team more favorably than the other team, but these ratings did not predict the number of self-best outcomes.

2.2.2. Results for women (Study 1b)

Did team presence affect women's choices in the coordination game? No. Women's rates of choice of their preferred outcome did not differ significantly when their team was present (and their opponent was alone: 65.2 %, SD = 41.10) compared to when they were alone (and their opponent's team was present: 58.7 %, SD = 43.61; $t(91) = 1.09$, $p = .28$, $r = 0.11$; Fig. 1, Panel A).

When coordination was achieved, did it favor women with a team present? No. Only 56.9 % (41/72) of the games in which coordination was achieved favored the team that was present, $\chi^2(1, N = 72) = 1.39$, $p = .24$. Averaging rates across individual sessions, 51.7 % (SD = 28.80) of coordination outcomes favored the team present, which is not significantly greater from chance (one-sample $t(11) = 0.20$, $p = .84$, $r = 0.06$).

Did the pattern of choices change over the course of the experiment? We examined the pattern of choices women made over the three rounds of the coordination game. (Table 5) In the first round of games, women did choose their preferred option more frequently when their team was present and their opponents preferred option more when they were alone. In fact, the size of this interaction effect was exactly equal to the effect in the first round of games for men ($\varphi = 0.20$, $p = .06$). However, whereas the effect of team presence on men's choices increased substantially in the later rounds ($\varphi = 0.48$ and $\varphi = 0.44$, respectively), the effect on women's choices disappeared completely in later rounds ($\varphi = 0.05$ and $\varphi = 0.02$, respectively). Whereas men coordinated more on the team-presence cue as the games progressed, women abandoned this cue entirely by the second round of choices.

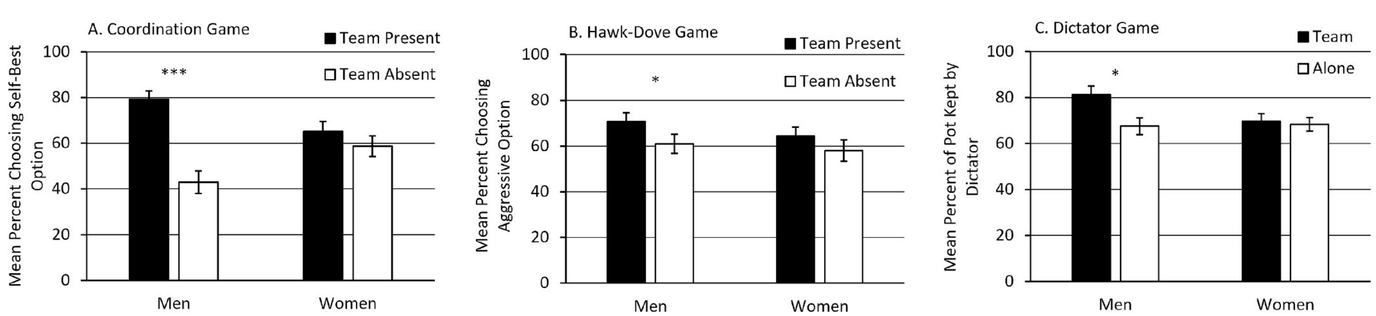

Fig. 1. Men's and women's choices across economic games as a function of coalitional support status. (A) *Coordination Game*: Men were significantly more likely to choose the self-best outcome when they were in the presence of their team members than when they were alone. (B) *Hawk-Dove Game*: Men were significantly more likely to choose the aggressive option when they were in the presence of their team members than when they were alone. (C) *Dictator Game*: Male dictators kept a significantly larger percentage of the pot when they were in the presence of their team members than when they were alone. Women's choices were not affected by the presence or absence of their team members in any of the games (all $p > .23$). Error bars are +/− 1 standard error of the mean (SEM). *$p < .05$. ****$p < .0001$.

Table 4
Percent of men choosing each outcome (self-best or other-best) for various samples of the data.

	# games (decisions)	Overall Self-best	Team Present		Alone		Effect size (φ)*
			Self-best	Other-best	Self-best	Other-best	
Overall	138 (276)	60.1	78.3	21.7	42.0	58.0	0.37
First games	46 (92)	55.4	65.2	34.8	45.7	54.3	0.20
Second games	46 (92)	64.1	87.0	13.0	41.3	58.7	0.48
Third games	46 (92)	60.9	82.6	17.4	39.1	60.9	0.44
First game in session	12(24)	37.5	50.0	50.0	25.0	75.0	0.26

Note. *Effect size (φ) is for the interaction between team or alone and outcome chosen.

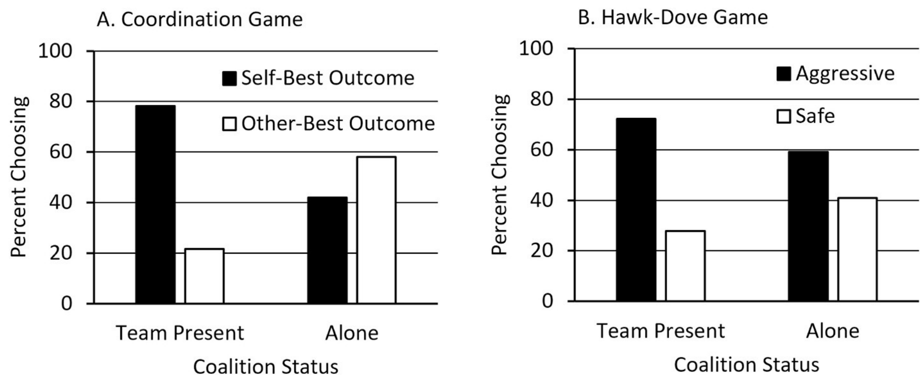

Fig. 2. Percent of men choosing the option with the highest payoff to self (white bars) as a function of coalition status. This way of presenting the data controls for their tendency to choose self-best more often than chance. (A) Coordination game. (B) Hawk-Dove game.

Table 5
Percent of women choosing each outcome (self-best or other-best) for various samples of the data

	# games (decisions)	Overall Self-best	Team Present		Alone		Effect size (φ)*
			Self-best	Other-best	Self-best	Other-best	
Overall	138 (276)	62.3	65.2	34.8	59.4	40.6	0.06
First games	46 (92)	55.4	65.2	34.8	45.7	54.3	0.20
Second games	46 (92)	69.6	71.7	28.3	67.4	32.6	0.05
Third games	46 (92)	62.0	60.9	39.1	63.0	37.0	0.02
First game in session	12(24)	58.3	66.7	33.3	50.0	50.0	0.17

Note. *Effect size (φ) is for the interaction between team or alone and outcome chosen.

Compared to women, men were significantly more likely to choose their preferred option when their team was present ($t(182) = 2.51$, $p = .01$, $r = 0.18$) and significantly less likely to choose their preferred option when their team was absent ($t(182) = -2.37$, $p = .02$, $r = 0.17$). Men's coordination favored the team significantly more often than women's coordination did ($z = 3.21$, $p = .001$, $\phi = 0.26$).

2.3. Discussion for Study 1

Results from the coordination game demonstrate that coalitional support regulates men's resource decisions, but not women's. Furthermore, these results cannot be explained by rational choice incentives. Although rational choice could support coordinating on any available cue, there is no a priori reason on this theory for coordination to favor team presence. Moreover, only men significantly coordinated on team presence; women did not consistently use this cue, despite its availability and the absence of other cues.

The presence of feedback in the coordination game suggests one alternative explanation, namely that men simply learned to coordinate their choices over the course of the game using the only cue that was available—coalition size. Evolutionary game analyses suggest that any arbitrary cue, in theory, can be used to decide the outcome. Several considerations speak against this idea as a cogent explanation. One, this view cannot explain why games were consistently coordinated in favor of the larger coalition, rather than the single individual. As an arbitrary cue, it is just as logical to coordinate choices that favor the lone individual as favor the team.

Indeed, Charness et al. commented that politeness norms could have led to the "host" team favoring the "guest", but that did not happen in their experiments. We eliminated home territories here, but there was nothing stopping larger groups from deferring to single individuals. Concerns with impression management could have created that equilibrium, but did not (e.g. larger groups might want to avoid looking like bullies, or be following a noblesse oblige norm).

If the coordination cue is arbitrary, one would expect no strong pattern of favoring the team present; rather, roughly half the games should converge on one cue-outcome pairing (favoring the team) as the other possible cue-outcome pairing (favoring the individual). This pattern was not observed with men; their decisions consistently favored the team present.

While it may seem "obvious" that game outcomes should favor the larger group, this intuition follows from the coalitional support hypothesis. Furthermore, the data from women show that this pattern is not inevitable: women did not consistently favor the team present in their decisions in the coordination game. If coordinating on what is best for the larger group is "obvious" or "rational", this should have been true for women as well as for men. But it was not. Women may have used coalition presence as an arbitrary coordination cue in the first round, but they did not treat it has having inherent signal value. By the second round, women chose the self-best option just as frequently when their team was present as when they played alone. The fact that women abandoned use of team presence as a coordination cue suggests that they do not reliably interpret coalition presence as a cue for entitlement (when backed by a coalition) or deference (when facing an opposing coalition).

In the coordination game, there is no way to guarantee a positive payoff for oneself; receiving any money at all depends jointly on what choice the other player makes. But what happens if subjects can choose an option that guarantees them income? If men still use team presence as a cue to pursue higher payoffs when a reliable but lower option is available, this would rule out accounts that invoke risk aversion to explain the coordination game results and constitute stronger evidence for the coalitional support hypothesis. The second set of experiments examined this question.

3. Study 2. Hawk-dove game

In the hawk-dove game, individuals choose between a "safe" option, with a guaranteed positive payoff, and an "aggressive" option, which can yield the highest payoff, but only if one's opponent chooses their safe option. The payoff matrix for this game is shown in Table 6.

3.1. Method

3.1.1. Participants

Recruitment was as described for Study 1. See Table 3 for the sample sizes and subject profiles.

3.1.2. Procedure

In this game, players have a "safe" option that will always earn them some money (the "dove" strategy, choice B in Table 5). Players also have an "aggressive" option (the "hawk" strategy, choice A in Table 6) that can earn them a much higher payoff, but only if their opponent plays it safe. If both players choose the aggressive option, neither player earns money. The experimental procedure used in the Hawk-Dove games was the same as that used in the Coordination games, described above.

Subjects were assigned to teams by the same procedure as described in Study 1. Each subject played the game four times, each time against a different opponent from the other team. In two games, the subject's team was present and in two games the opponent's team was present. Games alternated back and forth between which team members were present for the game. Subjects earned money from the games in which they participated (1 point = US$0.50), as well as 25 % of what their teammates earned in their games (regardless of whether the team was physically present for a game).

Team importance was strengthened by common fate: each subject received a portion of the earnings (if any) from their teammates' games. The team that was present for the game alternated throughout the experiment; thus, there were frequent reversals of relative coalitional power, and everyone received feedback about the game outcomes. The frequencies of choosing the potentially higher-payoff option when the subject's team was present and when the subject's team was absent were compared.

Table 6
Hawk-dove game decision and payoff matrix.

Team	Choice	Column player	
		A	B
Row Player	A	0, 0	5, 1
	B	1, 5	2, 2

Note. Cells are payoff to row player, payoff to column player. For the Row Player, Choice A is the aggressive option and Choice B is the safe option.

3.2. Results for Study 2

Subjects chose the aggressive option (A) more often than chance: 65.6 % for men, 60.5 % for women. The main results are presented in Fig. 1, panel b.

Men failed to coordinate (both choosing aggressive and landing at 0,0 payoff) in 41.5 % of games, and women in 35.1 % of games.

3.2.1. Results for men (Study 2a)

Did team presence affect men's choices in the hawk-dove game? Yes. Men were significantly more likely to choose the aggressive option when their team was present (and their opponent was alone: 70.8 %, SD = 35.40) than they were when they were alone (and their opponent's team was present: 61.0 %, SD = 39.06; $t(87) = 2.20$, $p = .03$, $r = 0.34$; Fig. 2, Panel B). As Table 7 shows, the percent of men who chose aggressive when their team was present increased over rounds.

3.2.2. Results for women (Study 2b)

Did team presence affect women's choices in the hawk-dove game? No. Women's rates of choice of the aggressive option did not differ significantly when their team was present (and their opponent was alone: 64.4 %, SD = 36.54) compared to when they were alone (and their opponent's team was present: 58.0 %, SD = 43.61; $t(87) = 0.29$, p = .77, $r = 0.03$; Fig. 1, Panel B). As Table 8 shows, this pattern did not change substantively over rounds.

Men and women did not differ significantly in their rates of choosing the aggressive option when they were alone (t(174) = 0.51, $p = .61$, $r = 0.04$) or when their team was present (t(174) = 1.19, p = .24, $r = 0.09$).

3.3. Discussion for Study 2

Consistent with the coordination game experiments, results from the hawk-dove game show that coalitional support regulates men's, but not women's, resource decisions. Men were more likely to choose the aggressive strategy, with the highest potential payoff, when their team was present. These results show that one feature of the experimental design in the coordination game, lack of a "safe" option with a guaranteed positive payoff, is not crucial for demonstrating an effect of coalitional support in men.

However, the implementation of the coordination and hawk-dove game experiments shared a number of other features (Table 1): random assignment to teams, with common fate induced by linked monetary payoffs; a monetary pot that was a complete windfall from the experimenter; reversals of relative coalitional power throughout the games (i.e., within-subjects design); limited choice options about resource divisions; and feedback about the outcome of each game. If there is a robust effect of coalitional status on men's decisions, then it should not depend on these various particular features of the games, but should generalize across a range of scenarios.

To investigate the robustness of the coalitional effect, we conducted a third set of experiments using the dictator game, which has a different set of features.

Table 7
Percent of men choosing the aggressive option (highest payoff to self) over rounds in the hawk-dove game.

Round	# Decisions	% Choosing Aggressive		*p*-value	Effect size (φ)*
		Team	Alone		
Overall	352	72.2	59.1	0.01	0.14
Round 1	88	59.1	59.1	1	0
Round 2	88	70.5	61.4	0.37	0.10
Round 3	88	77.3	52.3	0.01	0.26
Round 4	88	81.8	63.6	0.06	0.20

Note. *Effect size (φ) is for the interaction between team or alone and outcome chosen.

Table 8
Percent of women choosing the aggressive option (highest payoff to self) over rounds in the hawk-dove game.

Round	# Decisions	% Choosing Aggressive		p-value	Effect size (φ)*
		Team	Alone		
Overall	352	64.2	56.8	0.16	0.08
Round 1	88	52.3	45.5	0.52	0.07
Round 2	88	70.5	59.1	0.26	0.12
Round 3	88	75.0	59.1	0.11	0.17
Round 4	88	59.1	63.6	0.66	0.05

Note. *Effect size (φ) is for the interaction between team or alone and outcome chosen.

4. Study 3. Dictator game

The dictator game (DG) experiments varied many features from the previous experiments, to test the robustness of the coalitional support effect in men.

The coordination and hawk-dove games are strategic: your payoff depends on what the other player does. The dictator game (DG) is not strategic: One player (the dictator) unilaterally decides how to divide a pot of money between himself and another player (the receiver). The dictator can obtain a favorable result without making inferences or assumptions about the receiver.

Charness et al. (2006) found that people with their team present behaved more "aggressively" when there was common fate and feedback about outcomes, so we removed these features from Study 3. There was no common fate: Team members earned nothing from payoffs to a dictator from their team. And there was no feedback about any outcome; subjects were paid privately after the study was complete.

Study 3 was unlike Studies 1 and 2 in other respects as well. In the coordination and hawk-dove games, teams could have learned to cooperate with one another over rounds, by reciprocating deference based on a team cue (whether absence or presence). Indeed, the effect of team presence on men's choices in Studies 1 and 2 was stronger as the experiment progressed (however, this was not accompanied by a corresponding decrease in self-best or aggressive choices over rounds when men were alone, which speaks against a reciprocation strategy). To block the development of a reciprocation by team cue strategy, there were no reversals of relative coalitional power in Study 3: Some individuals always played with their team present, others always played as individuals. This, combined with no feedback, eliminates the possibility of two teams hitting on a cooperative strategy in which they reciprocate favorable payoffs by choosing B (the other-best outcome) when their partner is flanked by his or her team.

In contrast to the previous studies, in which subjects saw that they were randomly assigned to minimal groups, teams in Study 3 were based on hometown, and they completed activities that can elicit ingroup favoritism. Moreover, the money at stake was partially earned, not a windfall—in the DG, earned stakes are shared less than windfalls (Arkes et al., 1994; Kameda, Takezawa, Tindale, & Smith, 2002; List, 2007).

4.1. Methods

4.1.1. Subjects

See Table 3 for sample characteristics.

4.1.2. Procedure

After arriving at the lab and reading an information sheet, subjects were assigned a subject number. They then filled out a demographics questionnaire and marked their hometown location on a map of the state of California. Subjects from places outside of California wrote their hometown location and subject number in the extra space around the map. An experimenter then gave subjects an overview of the experimental procedures.

To create a sense of entitlement to the monetary pot, subjects completed a multiple-choice vocabulary test. Tests were scored on the basis of the number of correct answers in the allotted time (3 min). For each DG, the scores of the divider (the "dictator") and the recipient were multiplied to determine the amount of money at stake for that round.

Subjects were assigned to play the game as team members or as individuals, based on their hometown location. We used this manipulation to try to instill a sense of group membership among subjects assigned to the team. The four team members were, in fact, a team in name only (i.e., team membership had no effect on the payoff structure of the game). Subjects knew that these assignments (play with team present or play as an individual) would continue for the duration of the experiment.

The most common grouping for the team was either Northern or Southern California.

To reinforce a sense of team membership, team members completed a short team building exercise together; the other players completed the same task individually. Subjects listed things they liked about their hometown area and people from that area and things they disliked about their opponent's area and people. The group of four and the individual who was selected to play first did this in the same room with their opponents. The remaining individuals completed this exercise in the adjoining room, with their dislikes in reference to the team, but without that team being present.

At this point the DGs began. For each round of the game, one team player was chosen to play against one individual player. The team members were physically present and stood behind their teammate during the game; the individual player was brought into that room and sat across from the team player. The experimenter announced the amount at stake, and the divider privately wrote down how he wanted to divide the money between himself and the receiver. These notes were put in a box so no one (including teammates) could see the amount. Dividers' choices were not constrained in any way. The experimenter collected the decisions; neither the receiver nor the other team members learned the outcome of the game.

Each subject played the game twice, once as divider and once as receiver; each game was against a different opponent. After the first individual played in both roles, he left to complete a questionnaire about perceptions of the team. The second individual player was then brought into the room, and this procedure continued until each of four individual players completed two DGs.

Subjects were paid individually and privately. They only earned money from the games in which they participated (as either dictator or receiver).

The percents of the pot kept by team dictators and by individual dictators were compared.

4.2. Results

On average, men gave 24.2 % of the pot to others, and women gave 31.0 %. The entire pot was kept by 35 % of men and 22 % of women.

The main results for the effect of team presence are shown in Fig. 1, panel c.

4.2.1. Results for men (Study 3a)

Did team presence affect men's choices in the dictator game? Yes. Men flanked by their team kept a significantly greater fraction of the pot (81.3 %, SD = 19.60) than individual men did (67.6 %, SD = 19.15, $t(54) = 2.65$, $p = .01$, $r = 0.34$; Fig. 1, Panel C). Furthermore, men with their teams were more likely than individual players to keep all of the money (32.1 % vs. 14.3 %; $z = 1.58$, $p = .057$, one-tailed, $\phi = 0.21$).[2]

4.2.2. 4.2.1 Results for women (Study 3b)

Did team presence affect women's choices in the dictator game? No. Women with team members present did not keep more of the pot (M = 69.7 %, SD = 21.66) than individual women did (68.4 %, SD = 18.23; $t(78) = 0.29$, $p = .77$, $r = 0.03$; Fig. 1, Panel C). There was no difference between women with and without teams in how likely they were to keep all of the money (22.5 % vs. 20.0 %; $z = 0.27$, $p = .78$, $\phi = 0.03$).

Men who were playing on the team kept significantly more of the pot than women who were playing on the team did ($t(66) = 2.26$, $p = .03$, $r = 0.27$). Men and women who were playing as individuals did not differ in how much of the pot they kept ($t(66) = 0.18$, $p = .86$, $r = 0.02$).

4.3. Discussion

Consistent with the coordination and hawk-dove game experiments, results from the dictator game showed again that coalitional support regulates men's, but not women's, resource decisions. These results demonstrate that the effect of coalitional support on men's resource divisions is robust to a variety of specific implementation features in these experimental economics games.

5. General discussion

Across three experiments, each using a different economic game, participants made resource decisions in which there was a conflict of interest between two same-sex individuals. In each experiment, one individual was surrounded by members of his or her team, and the other was not. The solitary individual was outnumbered, 3 to 1 or 4 to 1. There were no mixed sex teams; men were on all-male teams and women were on all-female teams.

Men with coalitional support—the physical presence of their team members—were more likely to make decisions that favored their own welfare over the welfare of their opponents than men whose coalition mates were absent during the decision. This was not true for women. Women's decisions did not change as a function of the presence or absence of their team members. Fig. 1 shows results from all three studies: men always responded to this cue and women never did.

5.1. Men

In a coordination game, a hawk-dove game, and a dictator game, men made more self-serving resource decisions when flanked by members of their coalition and their opponent was alone than when the tables were turned. This held despite the fact that a number of game features varied across the experiments, including the presence of feedback, monetary common fate among team members, and whether coalitional status—which team had the numerical advantage—was fixed or changed over rounds. Team presence versus absence regulated men's choices even though all three experiments lacked rational choice incentives to favor the coalition that had more members physically present when decisions were made.

In warfare and other violent conflicts, a man's success does not depend on how many allies he has in general; it depends on whether his coalitional allies are physically present to support him during a confrontation. During a direct confrontation, a man who is alone is vulnerable to exploitation by a coalition of men. This adaptive problem has such deep evolutionary roots that male chimpanzees take advantage of these situational asymmetries: coalitions of 4–6 males are most likely to attack males from other troops when they are found alone (Wilson et al., 2012). Our results suggest that the physical presence versus absence of coalitions remains a potent cue regulating men's resource decisions, even in the pacified environs of a university lab.

Results from the coordination and hawk-dove games, where there were frequent reversals in team presence, demonstrate that men's minds respond dynamically to this feature of a situation. The two teams did not differ in actual size; both teams always had the same number of members. Furthermore, this fact was obvious to all subjects. We only manipulated the physical presence of team members in the (neutral) room where the game was played. When men were alone, they knew that their teammates were simply waiting in an adjoining room; all members of the other team knew this as well. Yet men whose teams were waiting nearby were less likely to choose the self-best outcome, and more likely to defer to a player flanked by his teammates. Deference by men who knew their teammates were close by, in the adjoining room, suggests coalitional decision-making systems with a degree of cognitive impenetrability: men's decisions responded to the ancestral signal value of team absence, not to their beliefs about how readily their teammates could be summoned. After all, their teammates were in fact summoned and present in every other round.

Does the team present versus absent cue regulate choices only in situations where nothing can be gained unless one individual defers? In the coordination game, individuals' choices are limited to two options, and the only way to actually realize the resource (i.e., receive a positive payout) is to accept an unequal split favoring one party. In the hawk-dove game, choices are again constrained to two options, but an individual can always realize a positive payoff by choosing the safe option. In both games, men's decisions supported the coalitional support hypothesis: even though all men were on a team, players whose team members were standing behind them made claims to more resources than men whose team members were in another room.

Being constrained to two options cannot account for this result, however. Choice in the dictator game is relatively unconstrained: dictators can divide the money in any way they want, and there can be no reprisal on the part of the receiver. An unequal split is not contingent on the acquiescence of the lower status party. Yet men's choices in the dictator game also supported the coalitional support hypothesis. Dividers who were members of a team kept more of the pot when playing against solitary individuals than lone dividers who faced a team, whose fellow lone dividers were awaiting their turn in the other room.

Were men on a team keeping more of the pot to create a fair division, so that all team members and the individual opponent would benefit equally? No. There was no common fate in the dictator game. Members of a team did not receive *any* payoffs based on decisions made by a dictator from their team. Nor was there feedback whereby men could learn that they can get away with taking more when they are in the presence of a team.

Traditional rational choice explanations cannot explain men's choices. This inference is reinforced by the fact that women's resource divisions were not regulated by the presence versus absence of their team members. Moreover, any explanation positing that team presence was an arbitrary cue, used to coordinate reciprocation between teams across rounds, would apply equally to women and men. But women did not coordinate on team presence (or absence) in either game where this strategy might be possible (coordination and hawk-dove). Instead, the results for men follow straightforwardly from the hypothesis that an ancestrally reliable cue of formidability—the presence of your coalitional allies—regulates men's motivations to assert their self-interest in conflicts.

5.2. Women

Identical experiments with women produced contrasting results. In the coordination game, women's choices were not consistently

[2] We also did a smaller study ($N = 22$), in which two equal-sized male teams were present during the resource division. Each team kept about ~70 % of the pot. This reinforces the interpretation that the differences found in the main experiment are due to the difference in coalition size (team vs. alone) rather than an arbitrary aspect of the design.

regulated by team presence and, when coordination did occur, the outcome was not more likely to favor the player flanked by her team than the player whose team was not present. Women's choices were not affected by team presence in the hawk-dove game either. One could posit that women's choices were made recognizing that the other player did not lack a coalition—she had an equal size coalition, which was waiting next door during game play. Results from the dictator game speak against this interpretation, which yielded the same null effect of team presence. This was true even though the coalitional imbalance was fixed for the entire duration of the experiment: women were either on a team or individual players. The results were consistent across games: women's decisions were not influenced by whether they were flanked by members of their own team or deciding alone.

During hominin evolution, attention to who has more coalition members physically present *in the moment* would have been especially valuable in contests that could be decided by coalitional aggression. If so, the fact that women's decisions did not respond to the team presence cue is not surprising: The ethnographic record provides ample evidence that men form coalitions to seize resources by force, but little evidence that women do the same (Gat, 1999; Rodseth et al., 1991). This pattern is similar in chimpanzees, but different from bonobos, where female coalitional aggression is common. Although humans, chimpanzees, and bonobos all descended from a common ancestor, bonobos evolved after the human-chimpanzee split, in a foraging ecology that made female coalitions a viable competitive strategy (Wrangham, 2019).

Women may benefit, now and ancestrally, from having female allies, especially when facing within-group competition. Hess (Hess, 2006, 2017; Hess & Hagen, 2023) argues that female coalitions are especially important when a woman's reputation is threatened by gossip: allies can wage informational warfare on your behalf. To do this, they need to know about the slander, but they do not need to be physically present when it occurred; this contrasts with the situation men face in direct aggression. Women did assert their self-interest with other women in our experiments, but they did this whether their female allies were physically present or absent. This speaks against the hypothesis that ancestral women benefited by the presence of female allies for the same reasons or in the same ways as ancestral men. The coalitional support hypothesis, which derives from the use of coalitional aggression to gain resources, was strongly supported for men but not for women.

The male intergroup conflict hypothesis argues that coalitional psychology was shaped by the selection pressures resulting from conflict between groups, but that this was primarily the domain of men during human evolutionary history. If so, then women would not have been selected to use transient differences in female coalitional support as a regulatory cue in their decision-making about resource allocations. The results for women are consistent with this hypothesis.

The results are also consistent with the male pre-emption hypothesis (see also the bodyguard hypothesis: Mesnick, 1997; Wilson & Mesnick, 1997). According to this view, women did not fight in all-female coalitions because men pre-empted the use of physical force ancestrally. This would imply that women and men both respond to transient differences in coalitional support, but these cues will regulate women's resource divisions only when men are present. Female-only coalitions would not activate attention to differences in immediate coalition support in either women or men.

Because women in our experiments were assigned to all-female coalitions, the present experiments cannot distinguish between the male intergroup conflict hypothesis and the male pre-emption hypothesis. If the male pre-emption hypothesis were true, women might respond more strongly to team presence versus absence when they are on a mixed-sex team; the presence of male coalitional allies would be a cue that women can more profitably assert their own interests against individuals who are alone. There are no strong tests of this hypothesis yet, but the coordination game by Charness et al. (2006) is suggestive. When they tested mixed-sex coalitions, they did not find sex differences as a function of team presence versus absence (Charness, personal communication). A stronger test of the male pre-emption hypothesis would use the design herein (which does not confound team presence with home territory) to directly compare women's response to the team-present cue when women are in mixed-sex coalitions versus all-female coalitions. Whereas the male pre-emption hypothesis predicts that women will respond to team presence when they are on mixed-sex teams, the male intergroup conflict hypothesis predicts that women will never respond to the team-present cue, even when they are in mixed sex coalitions.

None of this implies that women are indifferent to coalitional competition. Muñoz-Reyes et al. (2023) found that women (and men) contributed more to a threshold public goods game when they were in zero-sum competition with an equal size coalition than when competition was absent. This was true whether women were on same-sex or mixed sex teams. Women on mixed sex teams contributed more compared to same-sex teams only in the absence of team competition.

6. Conclusion

The present results paint a clear picture. In conflicts over resources, men flanked by their team members were more likely to make decisions that favor their own welfare over the welfare of their opponents, compared to men whose teammates were absent. Team presence versus team absence regulated men's decisions dynamically: the same men changed their decisions within minutes, based on whether their teammates were standing behind them at the time versus in an adjoining room. When it comes to male coalitional aggression, numbers are power. Attention to shifts in the balance of power are an expected feature of a male psychology designed to assert self-interest through coalitional aggression.

Aggression between coalitions of males is common in chimpanzees and humans, but aggression between all-female coalitions is not. Women in our experiments made self-interested decisions, but their willingness to do so did not depend on whether they were flanked by their teammates or not. The fact that men responded to cues of coalitional support but women did not suggests that selection acted differently on the coalitional instincts of men compared to women.

Overall, these results support the idea that the power differential when an individual faces a coalition regulates men's resource allocation decisions in the direction predicted by the coalitional support hypothesis, in the absence of rational choice incentives for attention to coalitional support. Men's economic decisions were consistent with making more favorable welfare tradeoffs for individuals with greater coalitional support and less favorable ones for individuals lacking such support. Individual formidability and kinship have been repeatedly shown to regulate these tradeoffs, but welfare tradeoffs should be influenced by other relevant factors as well, such as relationship history, shared goals, relative status, and social alliances. The present studies provide evidence that the presence of coalitional support is another important cue regulating welfare tradeoffs in decision-making.

CRediT authorship contribution statement

Elsa Ermer: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. **Gary Charness:** Conceptualization, Methodology. **John Tooby:** Conceptualization, Supervision, Methodology. **Leda Cosmides:** Conceptualization, Funding acquisition, Methodology, Supervision, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

We thank June Betancourt, Howard Waldow, and our research assistants, Alex Alereza, Christine Farson, Sally Gogol, Matin Hemmat, Johnson Li, Caitlin Meuel, Luke Remy, Lindsey Walker, Riley Wathen, and, especially, Christina Larson. Funding for this research was provided by University of California Santa Barbara (UCSB) Academic Senate Grant (LC), UCSB Graduate Division Humanities/Social Sciences Grant (EE), and National Institutes of Health Director's Pioneer Award (LC). The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Arkes, H. R., Joyner, C. A., Pezzo, M. V., Nash, J. G., Siegel-Jacobs, K., & Stone, E. (1994). The psychology of windfall gains. *Organizational Behavior and Human Decision Processes, 59*, 331–347.

Boehm, C. (1992). Segmentary 'warfare' and the management of conflict: Comparison of east African chimpanzees and patrilineal-patrilocal humans. In A. H. Harcourt, & F. M. B. de Waal (Eds.), *Coalitions and alliances in humans and other animals* (pp. 137–173). Oxford: Oxford University Press.

Bolton, G. E., & Katok, E. (1995). An experimental test for gender differences in beneficent behavior. *Economic Letters, 48*, 287–292.

Camerer, C. F. (2003). *Behavioral Game Theory*. New York/Princeton, NJ: Russell Sage Foundation/Princeton University Press.

Camerer, C. F., & Fehr, E. (2004). Measuring social norms and preferences using experimental games: A guide for social scientists. In J. Henrich, R. Boyd, S. Bowles, C. Camerer, E. Fehr, & H. Gintis (Eds.), *Foundations of human sociality* (pp. 55–95). New York: Oxford University Press.

Chagnon, N. A. (1988). Life histories, blood revenge, and warfare in a tribal population. *Science, 239*, 985–992.

Charness, G., Rigotti, L., & Rustichini, A. (2006). *Individual behavior and group membership*. To appear in American Economic Review.

Croson, R., & Buchan, N. (1999). Gender and culture: International experimental evidence from trust games. *The American Economic Review, 89*, 386–391.

Delton, A. W., Cosmides, L., Guemo, M., Robertson, T. E., & Tooby, J. (2012). The psychosemantics of free riding: Dissecting the architecture of a moral concept. *Journal of Personality and Social Psychology, 102*(6), 1252.

Eckel, C. C., & Grossman, P. J. (1998). Are women less selfish than men? Evidence from dictator experiments. *The Economic Journal, 108*, 726–735.

Eckel, C. C., & Grossman, P. J. (2001). Chivalry and solidarity in ultimatum games. *Economic Inquiry, 39*, 171–188.

Fox, S. A., Muller, M. N., González, N. T., Enigk, D. K., Machanda, Z. P., Otali, E., … Thompson, M. E. (2023). Weak, but not strong, ties support coalition formation among wild female chimpanzees. *Philosophical Transactions of the Royal Society B, 378*(1868), 20210427.

Gat, A. (1999). The pattern of fighting in simple, small-scale, prestate societies. *Journal of Anthropological Research, 55*, 563–583.

Hammerstein, P. (1981). The role of asymmetry in animal conflicts. *Animal Behaviour, 29*, 193–205.

Harbaugh, W. T., Krause, K., & Liday, S. J. (2003). Bargaining by children. In *University of Oregon economics working paper, (2002-4)*.

Hess, N. (2006). *Informational warfare: Female friendship and the coalitional manipulation of reputation*. Doctoral dissertation,. Santa Barbara: Department of Anthropology, University of California.

Hess, N. (2017). Informational warfare: Coalitional gossip as a strategy for within-group aggression. In M. Fisher (Ed.), *Oxford handbook of women and competition* (pp. 223–246). Oxford University Press.

Hess, N. H., & Hagen, E. H. (2023). The impact of gossip, reputation, and context on resource transfers among Aka hunter-gatherers, Ngandu horticulturalists, and MTurkers. *Evolution and Human Behavior, 44*(5), 442–453.

Hill, K., & Hurtado, M. A. (1996). *Ache life history: The ecology and demography of a foraging people*. New York: Aldine de Gruyter.

Holm, H. J. (2000). Gender based focal points. *Games and Economic Behavior, 32*, 292–314.

Kameda, T., Takezawa, R., Tindale, R. S., & Smith, C. M. (2002). Social sharing and risk reduction: Exploring a computational algorithm for the psychology of windfall gains. *Evolution and Human Behavior, 23*, 11–33.

Kurzban, R., Tooby, J., & Cosmides, L. (2001). Can race be erased?: Coalitional computation and social categorization. *Proceedings of the National Academy of Sciences, 98*(26), 15387–15392.

List, J. A. (2007). On the interpretation of giving in dictator games. *Journal of Political Economy, 115*(3), 482–493.

Lopez, A. C. (2017). The evolutionary psychology of war: Offense and defense in the adapted mind. *Evolutionary Psychology, 15*(4), Article 1474704917742720.

Manson, J., & Wrangham, R. (1991). Intergroup aggression in chimpanzees and humans. *Current Anthropology, 32*, 369–390.

Massaro, A. P., Gilby, I. C., Desai, N., Weiss, A., Feldblum, J. T., Pusey, A. E., & Wilson, M. L. (2022). Correlates of individual participation in boundary patrols by male chimpanzees. *Philosophical Transactions of the Royal Society B, 377*, 20210151.

Maynard Smith, J. (1974). The theory of games and the evolution of animal conflicts. *Journal of Theoretical Biology, 47*, 209–221.

Maynard Smith, J. (1982). *Evolution and the theory of games*. Cambridge: Cambridge University Press.

Maynard Smith, J., & Parker, G. A. (1976). The logic of asymmetric contests. *Animal Behaviour, 24*, 159–175.

Mesnick, S. (1997). Sexual alliances: Evidence and evolutionary implications. In P. A. Gowaty (Ed.), *Feminism and evolutionary biology* (pp. 207–260). Boston: Springer.

Mitani, J. C., Watts, D. P., & Amsler, S. J. (2010). Lethal intergroup aggression leads to territorial expansion in wild chimpanzees. *Current Biology, 20*(12), R507–R508.

Muñoz-Reyes, J. A., Torrico-Bazoberry, D., Polo, P., Figueroa, O., Guzmán-Lavín, E., Fajardo, G., … Pita, M. (2023). Evidence of the active participation of women in the intergroup conflict based on the use of aggression and cooperation. *Scientific Reports, 13*(1), 17742.

Murningham, J. K., & Saxon, M. S. (1998). *Ultimatum bargaining by children and adults*.

Parker, G. A. (1974). Assessment strategy and the evolution of fighting behaviour. *Journal of Theoretical Biology, 47*, 223–243.

Parker, G. A., & Rubenstein, D. I. (1981). Role assessment, reverse strategy, and acquisition of information in asymmetric animal conflicts. *Animal Behaviour, 29*, 221–240.

Perry, S. (2003). Coalitionary aggression in white-faced capuchins, *Cebus capucinus*. In F. B. M. de Waal, & P. L. Tyack (Eds.), *Animal social complexity: Intelligence, culture, and individualized societies* (pp. 111–114). Cambridge, MA: Harvard University Press.

Pietraszewski, D., Cosmides, L., & Tooby, J. (2014). The content of our cooperation, not the color of our skin: An alliance detection system regulates categorization by coalition and race, but not sex. *PLoS One, 9*(2), Article e88534.

Price, M. E., Cosmides, L., & Tooby, J. (2002). Punitive sentiment as an anti-free rider psychological device. *Evolution and Human Behavior, 23*(3), 203–231.

Pusey, A. E. (2022). Warlike chimpanzees and peacemaking bonobos. *Proceedings of the National Academy of Sciences, 119*(31), Article e2208865119.

Pusey, A. E., & Schroepfer-Walker, K. (2013). Female competition in chimpanzees. *Philosophical Transactions of the Royal Society B: Biological Sciences, 368*(1631), 20130077.

Rodseth, et al. (1991). The human community as a primate society. *Current Anthropology, 32*, 221–254.

Sell, A., Bryant, G. A., Cosmides, L., Tooby, J., Sznycer, D., Von Rueden, C., … Gurven, M. (2010). Adaptations in humans for assessing physical strength from the voice. *Proceedings of the Royal Society B: Biological Sciences, 277*(1699), 3509–3518.

Sell, A., Cosmides, L., Tooby, J., Sznycer, D., Von Rueden, C., & Gurven, M. (2009). Human adaptations for the visual assessment of strength and fighting ability from the body and face. *Proceedings of the Royal Society B: Biological Sciences, 276*(1656), 575–584.

Silk, J. B. (1992). The patterning of intervention among male bonnet macaques: Reciprocity, revenge, and loyalty. *Current Anthropology, 33*, 318–324.

Solnick, S. J. (2001). Gender differences in the ultimatum game. *Economic Inquiry, 39*, 189–200.

Solnick, S. J., & Schweitzer, M. E. (1999). The influence of physical attractiveness and gender on ultimatum game decisions. *Organizational Behavior and Human Decision Processes, 79*, 199–215.

Surbeck, M., Cheng, L., Kreyer, M., Gort, G., Mundry, R., Hohmann, G., & Fruth, B. (2025). Drivers of female power in bonobos. *Communications Biology, 8*(1), 550.

Tiger, L. (1969). *Men in groups*. New York: Random House.

Tooby, J., & Cosmides, L. (2025/1988). The evolution of war and its cognitive foundations. *Evolution and Human Behavior, 46*(3), Article 106687.

Williams, J. M., Oehlert, G. W., Carlis, J. V., & Pusey, A. E. (2004). Why do male chimpanzees defend a group range? *Animal Behaviour, 68*(3), 523–532.

Wilson, M., & Mesnick, S. L. (1997). An empirical test of the bodyguard hypothesis. In P. A. Gowaty (Ed.), *Feminism and evolutionary biology* (pp. 505–511). Boston: Springer.

Wilson, M. L., Hauser, M. D., & Wrangham, R. W. (2001). Does participation in intergroup conflict depend on numerical assessment, range location, or rank for wild chimpanzees? *Animal Behaviour, 61*, 1203–1216.

Wilson, M. L., Kahlenberg, S. M., Wells, M., & Wrangham, R. W. (2012). Ecological and social factors affect the occurrence and outcomes of intergroup encounters in chimpanzees. *Animal Behaviour, 83*(1), 277–291.

Wilson, M. L., & Wrangham, R. W. (2003). Intergroup relations in chimpanzees. *Annual Review of Anthropology, 32*, 363–392.

Wrangham, R. (2019). *The goodness paradox: The strange relationship between virtue and violence in human evolution*. Vintage.

Wrangham, R. W., & Peterson, D. (1996). *Demonic males: Apes and the origins of human violence*. NY: Houghton Mifflin.