The Male Warrior Hypothesis:

Sex Differences in Intergroup Aggression

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FROM THE AUTHORS

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Abstract

A number of studies tested various predictions emanating from the Male Warrior Hypothesis (MWH) in the domains of inter-group and intra-group behaviour, tribal political attitudes, and inter-group cognition and affect. Consistent with predictions, experimental evidence revealed that men, relative to women, are more aggressive in inter-group games, infra-humanize out-group members more, and display stronger in-group loyalty in the presence of an inter-group threat. Survey data revealed that men report having more competitive inter-group interactions in their own lives, evaluate intergroup conflict more positively, and score higher on social dominance. The MWH has the ability to explain and integrate a diverse set of previously unconnected findings from across the behavioural science literature.

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"He could have lived a risk-free, moneyed life, but he preferred to whittle away his fortune on warfare" – Xenophon (430-355 BC), The Anabis

"The first thing they heard in the world when the lid was taken off their box had been the words 'Tin Soldiers!' These words were uttered by a little boy, who clapped his hands with delight" – Hans C. Andersen, The brave tin soldier (1838)

"War is hell, but peace, peace is f***ing boring" – Joaquin Phoenix in the movie Buffalo Soldiers (2001)

Humans are a tribal social species. They are capable of great benevolence towards members of in-groups, but at the same time can be extremely hostile towards members of out-groups. The social psychological literature substantiates this claim. Humans spontaneously make in- versus. out-group-categorizations, form deep emotional attachments to symbolic in-groups (such as nations and religions), and make costly sacrifices on behalf of these in-groups (Brewer & Brown, 1998; De Cremer & Van Vugt, 1999; Kurzban & Neuberg, 2005). At the same time, they are prejudiced against members of out-groups and sometimes openly hostile and aggressive (Fiske, 2002; Neuberg & Cottrell, 2002). Where do these tribal tendencies come from, and how does in-group/out-group psychology vary across different types of individuals such as men and women?

There are good reasons to suspect sex differences in intergroup behavior. Intergroup conflict, violence and warfare have been pervasive features throughout human history with men being far more likely than women to be both perpetrators and victims (Buss, 1999; Goldstein, 2003; Keeley, 1996; Wrangham & Peterson 1996). Based on evolutionary reasoning, we hypothesize that intergroup relations have shaped the minds of men and women differently. Specifically, we argue that men (more so than women) have evolved a specific *tribal psychology* which encompasses a range of psychological mechanisms that increase their propensity for inter-group aggression.

We are not saying that women do not respond to intergroup threats -- they do (Navarrete, Fessler, & Eng, 2007) -- but their intergroup behaviour has been shaped by different selection pressures which make inter-group aggression more costly, less beneficial, or more adaptively left to men (Campbell, 1999; Taylor et al., 2000). This does not mean that women have not gained from such behaviour in evolutionary history. Lawrence Keeley reports that among the Western Apaches of Arizona, women are often the ones that encourage men to go on raids when resources are running out (Keeley, 1996: p. 135). However, they are not expected to have undergone selection for cognitive adaptations for actual coalition formation and inter-group aggression to the same degree as men. Here we present data from several experiments and surveys that are generally supportive of the predicted sex differences in intergroup psychology, which has been dubbed the *male warrior hypothesis* (MWH; Van Vugt, De Cremer, & Janssen, 2007). In the discussion we speculate about the biological and cultural causes of the male warrior phenomenon, and its implications for society.

Evolution and the Social Psychology of Intergroup Relations

Many social psychologists recognize the importance of integrating social psychological data on intergroup relations with evolutionary theories in order to generate novel hypotheses and findings (Ackerman et al., 2006; Campbell, 1965; Cottrell & Neuberg, 2005; Kurzban & Neuberg, 2005; Schaller, Park, & Faulkner, 2003; Simpson & Kenrick, 1997). The evolutionary approach is based on the premise that the human mind—and its behavioral product—has been shaped by evolution through natural selection just as human physiology is shaped by evolution. Evolutionarily-minded psychologists propose that the human brain is socially oriented, comprising many functional psychological adaptations designed to solve recurrent problems associated with living in hunter-gatherer style groups in the Pleistocene environment of human evolutionary history (Buss, 2005; Cosmides & Tooby, 1992; Kenrick, Li, & Butner, 2003; Van Vugt & Schaller, 2008).

Compared to our evolutionary forebears, group size expanded significantly across human evolutionary history, posing complex social challenges for the brain to deal with, but also giving our ancestors considerable benefits in enabling them to acquire, distribute, and defend resources more effectively (Dunbar, 1996). The need to maintain group unity in large, socially complex groups might have led to the emergence of various (more or less) uniquely human social traits such as language, social cognition, culture, and high levels of cooperation. Individuals that were better equipped to take the opportunities of group life and avoid its dangers, extracted greater reproductive benefits and thus spread in the population at the expense of less "groupish" individuals.

Intergroup aggression is a common strategy among vertebrates, including other great apes (and presumably our common ancestor), to protect and acquire valuable resources such as food, water, mates, and territories (Wilson & Wrangham,

2003). Among humans, inter-group aggression and in-group unity may have become particularly salient because as human group sizes increased, only groups solid enough and large enough to defend themselves would survive against hostile out-groups (Campbell, 1965; Van Vugt et al., 2007). In ancestral environments, defending a valuable resource such as a waterhole or hunting ground against powerful rivals would have been impossible without the help of others. This could have produced a coalitional "arms race" where, in order to survive, bands of individuals teamed up with other bands, resulting in the emergence of first tribes then chiefdoms, and later, nation states (Alexander, 1987; Carneiro, 1971; Van Vugt et al., 2008). Supporting this theoretical chain of events, empirical work finds significant correlations between resource richness, group size, and levels of inter-group warfare among pre-industrial societies around the globe (Roes & Raymond, 2003). Recent formal models and empirical data also suggest that in-group cooperation probably evolved in tandem with inter-group aggression (Bowles 2006; Choi & Bowles 2007).

We assert that a prolonged history of intense inter-group conflict may have produced a uniquely human coalitional psychology that includes various "tribal" psychological mechanisms such as in-group favoritism, out-group derogation, inter-group aggression, and dehumanization of members of out-groups. As Kurzban and Leary (2001) note: "membership in a potentially cooperative group should activate a psychology of conflict and exploitation of out-group members—a feature that distinguishes adaptations for coalitional psychology from other cognitive systems" (p. 195).

The Male Warrior Hypothesis

An important implication of this evolutionary analysis is that inter-group selection pressures are likely to have affected the psychologies of men and women

differently. There is considerable evidence for sex differences in morphology, psychology, and behavior that are functionally related to different selection pressures operating on men and women throughout human, primate, and mammal evolution (Campbell, 1999; Eagly & Wood, 1999; Geary, 1998; Taylor et al., 2000; Short & Balaban 1994). Due to a combination of differences in parental investment and parental certainty men and women pursue somewhat different mating strategies yielding implications for social behavior (Buss & Schmitt, 1993; Trivers, 1972). In humans, as in most other mammals, mothers must invest more heavily and for a longer period in their off-spring and, as a consequence, engaging in openly aggressive acts to acquire resources, either individually or as part of a group, will be physiologically and genetically costlier for women (Archer, 2000; Campbell, 1995; Taylor et al., 2000). Conversely, given the right conditions, it can pay for males to join forces in attacking others to acquire valuable reproductive resources despite the substantial risks involved.

Tooby and Cosmides' (1988) risk contract hypothesis specifies four conditions for the evolution of inter-group aggression in men. First, the average long-term gains in reproductive success (i.e., mating opportunities) must be sufficiently large to outweigh the average costs (i.e., injury or death). Second, members of warfare coalitions must believe that their group is likely to emerge victorious in battle. Third, the risk that each member takes and the importance of each member's contribution to victory must translate into a corresponding share of benefits (cf. the free-rider problem). Fourth, when individuals go into battle they must be cloaked in a "veil of ignorance" about who will live or die. Thus, if an inter-group victory produces, on average, a 20% increase in reproductive success then as long as the risk of death for any individual coalition member is less than 20% (say 1 in 10 men) such warrior traits

can be selected for potentially. This analysis presents not only a checklist for theoretical development, but also a set of specific hypotheses that can be tested with psychological and behavioral data.

Preliminary Evidence for Male Warrior Psychology

From Behavioral Sciences

Evidence for various aspects of this male warrior phenomenon can be found throughout the behavioral science literature, for instance, in anthropology, sociology, and primatology. Across all cultures, almost any act of inter-group aggression and violence, for instance, warfare, genocide, rebellion, street-gang and hooligan violence, is perpetrated by coalitions of men (Browne, 2007; Goldstein, 2003; Livingstone Smith, 2007).[2] Evidence of male-to-male inter-group violence goes back as far as 200,000 years ago (e.g., mass graves containing mostly male skeletons with evidence of force; Keeley, 1996). On average death rates due to warfare among hunter-gatherers are 13% (according to archaeological data) and 15% (according to ethnographic data; Bowles 2006), suggesting strong selection pressures operating on ancestral males. The figure is sometimes even higher. Among the Yanomamö in the Amazon Basin an estimated 20-30% of adult males die through tribal violence (Chagnon, 1988). This compares to less than 1% of the US and European populations in the 20th century. Furthermore, male warriors in traditional societies are held in higher esteem, and they have more sexual partners and children (Chagnon, 1988), suggesting a direct reproductive benefit -- Richard Dawkins labelled this the "Duke of Marlborough" effect (1976). This relationship might still be operative in modern society. A US-study revealed that male youth street gang members have more sexual partners than ordinary young males (Palmer & Tilley, 1995). Finally, the primate literature reveals that among chimpanzees adult males form coalitions to engage in

violence against members of neighbouring troops. This suggests that there is phylogenetic consistency between humans and one of our most closely related species (Wilson & Wrangham, 2003).

From Social Psychology

What about the social-psychological literature? Although social psychological research has been relatively mute about sex differences in intergroup prejudice and aggression, several lines of research are quite consistent with the MWH. First, intergroup biases such as racism and ethnocentrism appear to be more strongly held among men than women (Gerard & Hoyt, 1974; Sidanius, Cling, & Pratto, 1991; Watts, 1996). Several experiments yield a greater sensitivity of out-group stereotypes for in-group men, especially under conditions of inter-group competition. Mark Schaller and colleagues (Schaller, Park, & Mueller, 2003) have shown, for example, that men are more strongly affected by cues of ambient darkness when using danger-relevant stereotypes. The notorious out-group homogeneity effect disappears when in-group members are shown faces of angry out-group males rather than females (Ackerman et al., 2006). Recent experiments also reveal that inter-group conflict produces more in-group cooperation in men than women (Van Vugt et al., 2007).

Furthermore, a classic social psychological study, the Stanford prison experiment (Zimbardo, 1971), which highlighted some disturbing aspects of human inter-group psychology, was conducted with males only. Similarly, in economic game experiments involving teams (e.g., Goren, 2001) researchers frequently only use males groups (in a personal communication, Bornstein 2006, suggested that female groups were less competitive). When mixed samples are being studied, men are indeed more competitive than women in intergroup games (Wildschut et al., 2003).

Consistent with the MWH, male and female groups also tend to have different group dynamics. Whereas female groups are more egalitarian, groups of males form more hierarchical groups and these hierarchies tend to be more stable over time. The difference in group structure corresponds with sex differences in leadership style (Eagly & Johnson, 1990; Van Vugt, 2006). Hierarchy formation is an effective response in dealing with intergroup conflict requiring an urgent, coordinated response (Keegan, 1994). Finally, there are developmental sex differences in social behavior consistent with the MWH. Boys play in larger groups than girls and more often play complex competitive team games, which sometimes involve the use of weapons such as toy guns and swords (Geary, 1998). Boys also put greater social pressure on team members to conform to group norms during play activities (Sherif et al., 1961) and they have more transient friendships with a larger number of peers than girls (Geary, 1998). These sex differences are all consistent with the MWH, arguing for a more pronounced coalitional psychology among men.

Research and Predictions

The behavioral science literature reveals sex differences in various aspects of human inter-group behavior and psychology that can be interpreted as being supportive of the MWH. Unfortunately many of these studies were not designed to test predictions emanating from our hypothesis -- some studies only used male samples while others provided only indirect support. The MWH offers an integrative conceptual framework in which these diverse findings can be understood better. Furthermore it generates predictions in novel domains that can be tested with experimental and survey data. Here we investigate new evidence from the domains of intergroup and intra-group behavior, political attitudes, inter-group affect and

cognition, with a view to more explicit tests of predictions of the MWH (for an overview of predictions and studies, see Table 1).

A first generic prediction is that there will be sex differences in the propensity to engage in intergroup aggression (Prediction 1). Men should on average be more willing to engage in intergroup conflict. We test this hypothesis in a variety of ways. First, we look at how men and women behave in war games simulated in the laboratory (Prediction 1a). Second, we examine if men and women differ in their involvement in competitive inter-group encounters in their daily lives (Prediction 1b).

The second prediction concerns potential sex differences in reactions to out-groups. The MWH posits that it can be functional for in-group members to derogate out-group members during inter-group conflict, and one way to achieve is through infra-humanization of out-group members, a strategy to deny them unique human qualities such as culture and decency (cf. Leyens et al., 2001). The rationale is that by considering an out-group member as sub-human or animal-like, it will be psychologically easier to treat them badly. Thus, in salient inter-group contexts, we expect men to show a greater tendency towards infra-humanization than women (Prediction 2).

The third prediction concerns potential sex differences in intra-group cooperation as a function of inter-group competition. Being successful in inter-group competitions requires a strong intra-group cohesion and collaboration between in-group members (Brewer & Brown, 1998; Van Vugt et al., 2007). This logic implies that the underlying psychology for inter-group aggression must be quite different than for dyadic (one-on-one) inter-personal aggression, which requires no collaboration between individuals. In earlier research we found that men were more likely to contribute to their group when there was an inter-group threat (Van Vugt et al., 2007).

As an extension, we predict that in inter-group competition men show greater in-group loyalty, a prerequisite and promoter of intra-group cohesion (Prediction 3).

Fourth, we expect men to find inter-group conflict stimuli more emotionally involving (Prediction 4). Relative to women, men will be more favourable towards inter-group stimuli such as war movies (Prediction 4a). In addition, men will report less negative affect towards warfare than women (Prediction 4b). These are old stereotypes, but our aim here is to put these stereotypes to scientific test.

Fifth, the MWH predicts sex differences in political attitudes towards inter-group conflict (Prediction 5). First, we expect men to have a stronger acceptance of inter-group dominance hierarchies, the inevitable outcome of competitions between groups. Thus, we expect men to score higher in social dominance orientation (Prediction 5a; Pratto et al., 1994). In addition, we expect men to show relatively stronger political support for intergroup aggression in the real world (Prediction 5b); we test this prediction using data from a random selection of recent national and international opinion polls (e.g., "Do you support Britain going to war in Iraq?").

A sixth and final prediction is that tribal associations will be activated more easily in men than women (Prediction 6). When giving explanations for why they prefer certain abstract stimuli like the choice of a favourite colour we expect men to make spontaneous tribal associations more frequently.

EXPERIMENTS

Experiment 1: Sex Differences in Warfare

The first prediction emanating from the MWH is that men and women differ in their propensity to engage in intergroup aggression. We test this prediction first by examining how men and women behave in war game simulations in the laboratory. Specifically we predict that men – as leaders of a fictitious country – will be more

likely to make unprovoked attacks on their opponents and will invest significantly more in strengthening their army rather than in other available goals, such as industrial output (Prediction 1a).

Method

Participants and Design. One-hundred-and eighty-six students at Harvard University (107 men and 79 women; $M = 21.0$, $SD = 5.5$) participated in the experiment for money. There were 20-40 people in the laboratory at any-one time.

Procedure and Materials. Following an existing war game methodology (McDermott & Cowden, 2001) the participants played a simulated war game in a networked computer laboratory. Each person was asked to role-play the leader of a fictitious country in conflict with another player (also a country leader) over newly discovered diamond resources along a disputed border. On top of the $20 fee for participating they could earn an additional $10 if they won the game (winning was defined as finishing with the greatest individual wealth or being the sole surviving state if they defeated their opponent in war). Players were given background on the scenario and were asked to resolve the crisis without being told how. Each player played the entire game via a computer connected to others in a computer network room.

All players were randomly and anonymously assigned to dyads. They were not aware of the sex of their opponent and they were not able to size up their opponents during play. Because of random assignment and because there were several dozens of players per session it was impossible for anyone to know who they were playing against. Neither did they know how long the game would last for. In actuality all games were played for a fixed six rounds, with players taking an average of 7 minutes per round.

The War Game. At the start of the game each players received $100 million which they could invest in military forces, industrial infrastructure, or they could reserve the money in cash. From the outset, players were made aware that the player with the most money in their industrial account at the end of the game would emerge victorious. They could gain additional resources by selling diamonds to their opponents or by achieving success in battle.

Each round of play they had to make a decision about what action to take. They could (1) do nothing, (2) negotiate, (3) make a threat (4) initiate or continue a war, or (5) surrender. If they choose to go to war, victory was dependent in part on how many battalions they committed to battle but there was also an element of chance (akin to rolling a dice). Players had the option of launching a war at any time. We were particularly interested in "unprovoked" attacks, because this revealed a cleaner measure of aggressive behaviour. Unprovoked attacks occurred whenever a player launched a war without any prior violence being carried out by their opponent. Thus, retaliation is deliberately excluded (since this behaviour is, at least partly, a reaction to the situation rather than an attribute of the individual). Because decisions were revealed simultaneously in each round, both could decide to attack within the same round, which would both be counted as unprovoked attacks.

After the sixth round the game finished and each participant was debriefed about the purpose of the experiment. They were then thanked, received their money (plus a bonus for the winner), and dismissed.

Results and Discussion

Across all six rounds, men chose to fight (rather than any other possible decision) significantly more often than women, χ^2 (1, N = 1116) = 5.72, p< .02; men 46 instances, women 18).[3] Sex differences in behavior may be obscured here by

whether players were making unprovoked attacks (i.e., attacks against a peaceful opponent). Consistent with Prediction 1a, men made significantly more unprovoked attacks than women, $\chi^2(1, N = 184) = 5.61$, $p<.02$ (Figure 1a). Men were also more likely to either make unprovoked attacks *or* retaliate, rather than never fight, compared to women, χ^2 $(1, N = 184) = 4.24$, $p<.05$ (Figure 1b). Finally, men (M = 4.69, SD = 9.86) purchased significantly more "battalions" (army units) than women (M = 1.95, SD = 2.88) in the initial round (Mann-Whitney U test: Z=-4.50, N=79,105, $p< .001$ -- again focusing on behavior in the initial round, uninfluenced by subsequent interactions and events.

It was also noticeable that, in the first round and before anyone had any experience of the game, several women instantly sold some of their starting battalions but hardly any men did so, while several men instantly bought enormous armies of dozens of battalions but hardly any women did so.. Finally, comparing how sexes played against each other, there was a trend for the number of war decisions to increase from female-female, to male-female, to male-male dyads (Figure 2), although this relationship was not statistically significant, $\chi^2(1, N = 1116) = 3.66$, $p=$ .16. Given that the identity or sex of the partner was not known, such a trend suggests that behavior typical of females may help defuse conflict, while behaviour typical of males may exacerbate it.

In sum, across a number of dimensions consistent with the MWH, men and women significantly differ in their propensity to behave aggressively in intergroup games that simulate real world crises (Prediction 1a).

Experiment 2: Sex Differences in Infra-humanization

A second prediction emanating from the MWH concerns potential sex differences in the reactions to out-groups. Out-group derogation might be a functional

response during intergroup conflict, and we therefore predicted that men would be more likely to display this bias under conditions of inter-group threat. We are particularly interested in out-group derogation through infra-humanization, a strategy aimed at denying unique human qualities to members of out-groups (Haslam, 2006; Leyens et al., 2001). We focused on religious differences as the particular inter-group context. We examined Christians' reactions toward fellow Christians (in-group) and Muslims (out-group) on various traits that are either prototypically human or prototypically non-human. We expected Christian men to infra-humanize Muslim targets more (Prediction 2).

Method

Participants and Design. Fifty-three participants took part in this study (23 men and 30 women). All the participants reported their religion as being Christianity. Participants' ages ranged from 16 to 48 years (M = 21.77, SD = 7.44).

Procedure and Materials. Participants were approached at various sitting places across the University of Kent (e.g. parks and computing rooms) and asked if they identified themselves as being of Christian faith. If they agreed they were asked to complete a short questionnaire. On the cover sheet of the questionnaire, participants were informed that they would be asked to attribute various words to different groups. Participants were then presented with two similar lists of 20 randomly ordered words. Of these words, ten were human-related (e.g. person, humanity, citizen, civilian), and ten were animal-related (e.g. feral, mongrel, creature, wild; see Viki et al., 2006 for a full description of the methodology and validation of the words). Participants were then asked to select words that best characterised Christians and Muslims respectively. We used the same list of words for attributing characteristics to the Christians and Muslims. Participants first attributed words to Christians and then

Muslims. The order of the attributed task was counterbalanced. At the end of the experiment participants were thanked and debriefed.

Results and Discussion

Four composite scores for the number of human-related and animal-related words attributed to Christians and Muslims were computed for each participant by combining the selected words. We then ran a 2 (sex: men vs. women) X 2 (word type: animal word vs. human words) x 2 (group: ingroup vs. outgroup) mixed model ANOVA. This analysis revealed main effects for group, $F(1,51) = 5.11$, $p<.03$, $\eta^2 = .09$; and humanity, $F(1,51) = 165.12$, $p<.001$, $\eta^2 = .76$. No significant main effects of sex were obtained, $F(1,51) = 1.09$, *ns.* These main effects were qualified by a significant two-way interaction effect between Group and Word Type, $F(1, 51) = 17.28$, $p<.01$, $\eta^2 = .25$. No other interactions effects reached significance (all p's$>.13$). In line with the MWH, all the above effects were qualified by a significant three-way interaction involving Sex, Group and Word Type, $F(1,51) = 6.89$, $p<.02$, $\eta^2 = .12$, supporting Prediction 2.

Simple effects analyses revealed an interesting pattern of results. Among female Christian participants no significant group differences in the attribution of human and animal words were observed (all p's $>.22$). Among men, the infra-humanization effect emerged. Male Christian participants attributed more human words to their in-group, fellow Christians ($M = 7.61$, $SD = 0.19$) than out-group, Muslims ($M = 5.57$, $SD = 0.28$; $F(1,51) = 24.15$, $p<.001$, $\eta^2 = .32$). Conversely, they attributed fewer animal words to fellow Christians ($M = 1.26$, $SD = 0.14$) than to Muslims ($M = 2.22$, $SD = 0.19$), $F(1,51) = 6.45$, $p<.02$, $\eta^2 = .11$. These results suggest that in a religious context infra-humanization as a form of out-group prejudice is more manifest among men than women, which supports the MWH.

Experiment 3: Sex Differences in Group Loyalty

In this third experiment we were interested to see if under conditions of inter-group threat men would show a stronger in-group loyalty. This experiment extends previous research on the MWH which demonstrated that inter-group competition elicited male in-group cooperation (Van Vugt et al., 2007). In the present study participants were members of small mixed-sex groups playing a public goods game (cf. De Cremer & Van Vugt, 1999). Before the start of the game we induced group identification, and during the task we provided groups with false feedback implying that the group had not been very successful in obtaining the public good. This was believed to activate people's thoughts about their group membership. Subsequently, we measured in-group loyalty by offering each individual the choice to earn money by continuing working in the group or leaving the group and working alone for the remainder of the experiment. Based on the MWH we predicted that men would display stronger group loyalty in the inter-group condition when confronted with a (financially) attractive exit option (Prediction 3). We had no particular expectation about women other than that their in-group loyalty would be less affected by inter-group threat.

Method

Participants and Design. Fifty psychology undergraduate students at the University of Kent (19 men and 30 women) participated in the experiment for a combination of money and course credits (18 to 23 years; $M = 20.5$, $SD = 5.5$). Upon arrival in the lab, they were randomly assigned to one of two experimental conditions, following a 2 (Sex: men vs. women) by 2 (Comparison: inter-group vs. inter-personal) factorial design. There were 10 experimental sessions in total.

Procedure and Materials. We invited six participants at the same time. Upon arrival they were placed in an individual cubicle with chair, table, and computer. All instructions were computer-mediated. They would be playing a step-level pubic good game (De Cremer & Van Vugt, 1999), described as a group investment game, in groups of six players each. The task contained 4-8 trials but the exact number was not specified to avoid endgame effects (Komorita & Parks, 1994).

At the start of the game, each member received a personal endowment of £2 ($4) that they could keep or invest in the group fund (the endowment was depicted on the computer screen in single pound coins). If the total sum invested was £8 or more each member would receive a £4 bonus. Yet if it was less than £8 nobody would receive anything (and the contributors would lose their investment. Further, we explained that the money they had earned would be converted into lottery tickets and entered in a raffle with various attractive prizes (i.e., 5 £25 CD-vouchers).

Manipulation of inter-group threat. Participants were told that the study was conducted jointly by various psychology departments in the Southern England (for a similar procedure, see Van Vugt et al., 2007). Half of the participants were told that the study's aim was to investigate how well *groups* of students at *different* universities would perform in these tasks (inter-group condition). The other half were told that the study's aim was to examine how well *different* students would perform *individually* in these group investment tasks (inter-personal condition).[4] Then the public good game started. Each participant received the same bogus feedback that the group had achieved the good in trial 2, but had failed in trials 1, 3 and 4. After the fourth trial, a message appeared on the screen. It was stated that "perhaps some people might want to leave the group and work on their own for the remainder of the task to earn some more money." They then answered the critical group loyalty question: "I want to

leave this group" (1 = not at all agree, 9 = completely agree) after which the game was interrupted. They then received a thorough debriefing about the purpose of the experiment, were thanked for their efforts, and received their course credits and their names were entered in the prize draw (with CD-vouchers) that was held after the data-collection was completed.

Results and Discussion

According to the MWH men should be relatively more affected by an inter-group threat in their decision to stay loyal to their group (Prediction 3). To test this prediction we conducted a 2 (Sex: men vs. women) by 2 (Comparison: inter-group vs. inter-personal) ANOVA on the loyalty measure.

There was a (non-significant) tendency for people to prefer staying in their group (M = 4.51, SD = 2.74), $t(49) = -1.25$, $p < .22$. Further analysis revealed however that there were reliable main effects for Sex, $F(1, 45) = 5.11$, $p < .03$, $\eta^2 = .10$, and for Comparison, $F(1, 45) = 13.20$, $p < .001$, $\eta^2 = .23$. As predicted, these were qualified by the predicted Sex x Comparison interaction, $F(1, 45) = 4.97$, $p < .04$. $\eta^2 = .10$. Simple main effect tests showed that, as predicted, men only showed in-group loyalty in the inter-group (M = 3.38, SD = 2.45) but not in the inter-personal condition (M = 7.36; SD = 1.69), $F(1, 17) = 17.79$, $p < .001$, $\eta^2 = .51$. In contrast, among women there was no such difference and they were loyal to their group regardless of conditions (Mintergroup = 4.31, SD = 3.07; Minterpersonal = 3.35, SD = 1.84), $F(1, 29) = 1.13$, $p < .30$, $\eta^2 = .04$.

To summarize, under conditions of inter-group threat men responded with increased in-group loyalty, supporting Prediction 3. No such effect was found among women who displayed a stronger in-group loyalty, regardless of the group threat. Thus, there are sex differences in the nature of an individual's group commitment

with men increasing their group loyalty during intergroup competition only, which is consistent with the MWH.

SURVEYS

Survey 1: Sex Differences in Intergroup Attitudes and Behavior

The goal of the first survey was to explore several aspects of the MWH, examining potential sex differences in the experience and evaluation of real-life intergroup competitions and conflicts such as warfare. We first predicted that men would be more frequently involved in competitive between-group interactions (Prediction 1b). In addition, we predicted that men would have less negative affect toward real-world intergroup conflict (Prediction 4). Specifically, men should have a greater aesthetic preference for intergroup stimuli, such as war movies (Prediction 4a) and show less negative affect towards warfare (Prediction 4b). Finally, we predicted that men would have a relatively stronger preference for between-group hierarchies, the inevitable result of inter-group competitions in societies (Prediction 5a). Here we attempted to replicate an earlier finding that men score higher on social dominance orientation (SDO; Pratto et al., 1994).

Method

Participants. Participants took part in an on-line survey that focused on inter-group attitudes (titled "Are you a hawk or dove?"). Internet studies offer an efficient way to collect data from large samples, and data from well-designed studies have been shown to be fairly comparable to those from more traditional paper-and-pencil studies (Gosling, Vazire, Srivasta, & John, 2004). Publicity for this study was generated through links on web sites dedicated to psychological research as well as positing on on-line forums. Of the 990 participants who started the questionnaire, 564 completed it (56.9%). Of these, 205 were men and 359 women, with an average age

of 26.33 (*SD* = 11.06). In the sample, 22.4% held a university degree, 41.4% a college level degree, and 36.5% a high school degree. There were respondents from over 60 countries in the sample, with the largest representations from the US (21.2%) and UK (13.2%), followed by France (1.8%) and Germany (1.4%) (i.e., many non-Western countries were also represented in the sample, including Colombia, the Philippines, Vietnam, and Zimbabwe).

Procedure and Materials. The survey contained seven parts. The first part contained a brief introduction to the survey and a consent form. The second part contained some biographical questions (e.g., sex, age, education). The third part contained the following question:

"Please tell us how many intergroup interactions you think you had in the last month: An intergroup interaction would consist of you, as a member of a group, in some way interacting with a separate group or groups."

We then asked them to pick two interactions and asked them to rate for each how (1) cooperative or competitive (7) they were.

The fourth part asked participants to rank-order their favorite movie genres, from the following list of 10: action/adventure, comedy, drama, romance, thriller/mystery, horror, musical, war, western, sci/fi/fantasy. We also asked them to reveal their all-time favourite movie (although we do not report these data here).

The fifth section contained a nine–item war affect scale (α = .85). Participants were asked to reflect upon warfare, and rate their feelings on nine bi-polar Likert scales (1 = negative affect; 7 = positive affect): e.g., "War is useless-useful;…foolish –wise;…unpleasant-pleasant; stupid-intelligent;…exciting-boring; ugly-glamorous.

The sixth section contained various pre-validated personality scales (all measured on 7-point Likert scales) including an abridged 10-item version of the

Social Dominance Orientation scale (Sidanius & Pratto, 1999); e.g., "Some groups of people are simply inferior than others;" "We should do what we can to equalise conditions for different groups;" "To get ahead in life, it is sometimes necessary to step on other groups" (α = .83). The 5-item Dominance subscale of the NAQ (Heckert et al., 1999; e.g., I would enjoy being in charge of a project"; α = .81). The Right-wing Authoritarianism scale (Altemeyer, 1988; α = .79); e.g., "Our country desperately needs a mighty leader who will do what has to be done to destroy the radical new ways and sinfulness that is ruining us". The abridged Subtle Prejudice scale (Pettigrew & Meertens, 1995): e.g., "It is just a matter of some people not trying hard enough. If immigrants would only try harder they could be as well off as native people" (α = .81). The Nationality questionnaire (adapted from the patriotism scale; Kosterman & Feshbach, 1989); e.g., "I am proud of my country" (α = .75). Finally, we included an abridged 16-item version of the Personal Attributes Questionnaire (Spence, Helmreich & Stapp, 1974) to measure an individual's masculinity vs. femininity, e.g., "Would you describe yourself as: not at all aggressive…very aggressive; not at all emotional…very emotional (α = .81).

The seventh and final section contained a debriefing for participants about the purpose of the study, and information about the prize draw (three prizes of $20 were randomly assigned to respondents who provided an email address).

Results and Discussion

The first prediction was that men and women would differ in their involvement in competitive intergroup relations in the real-world. Overall, men (M =18.47, SD = 73.48) reported having relatively more intergroup interactions in the past month than women (M = 12.77, SD = 59.68); Mann-Withney U, Z = -2.76, p <.01 (mean rank for males: 326.25; mean rank females: 285.62). Relevant to Prediction 1b,

men rated both their first intergroup encounter (*M*male vs. female = 3.17 vs. 2.31, *SD*'s = 2.50 and 2.22) and second intergroup encounter as relatively less cooperative (*M*male vs. female = 2.44 vs. 1.97, *SD*'s = 2.47 and 2.24), respective *F*'s(1, 563) = 17.58, $p<.001$, $\eta^2=.03$, and 5.31, $p<.03$, $\eta^2=01$. This is consistent with the MWH.

The second prediction concerned aesthetic preferences for movies with intergroup themes (Prediction 4a). We were particularly interested in whether men and women would rank the war and western movies differently. Consistent with this prediction, men ranked the war movie genre fourth out of ten (*M* = 4.19, *SD* = 1.78) and women seventh of ten (*M* = 6.96, *SD* = 1.31), F(1, 563) = 448.72, $p<.001$, $\eta^2=.44$. Similarly, men rated the western genre in sixth position (*M* = 6.02, *SD* = 1.32) and women in eight (*M* = 7.81, *SD* = 1.39), *F*(1, 563) = 222.41, $p<.001$, $\eta^2=.28$.

Another prediction concerned potential sex differences in affective experience of warfare (Prediction 4b). As predicted, men showed less negative feelings towards warfare (*M* = 2.82, *SD* = 0.95) than women (*M* = 2.38, *SD* = 0.94), *F*(1,563) = 28.38, $p<.001$, $\eta^2=.05$. Individual item analyses suggest that these sex differences were particularly pronounced on two affective dimensions: exciting vs. boring ($\eta^2=.05$) and glamorous vs. ugly ($\eta^2=.08$). This suggests that warfare elicits less negative and more positive affect among men than women.

We further predicted that men, relative to women, would score higher on social dominance orientation, which measures an individual's preference for between-group hierarchies. Men's SDO was indeed slightly higher (*M* = 2.56, *SD* = 1.13) than that of women (*M* = 2.28, *SD* = 1.0), *F*(1, 563) = 9.25, $p<.01$, $\eta^2=.02$. Individual item analyses suggest that men agreed more with the following items: "Sometimes war is necessary to put other countries in place" ($\eta^2=.05$). "It is OK if some groups have more of a chance in life than others" ($\eta^2=.02$) and "To get ahead in life it is sometimes

necessary to step on other groups" (η^2=.02). Finally, there were no differences between men and women on the NAQ-dominance scale, the right-wing authoritarianism scale, the prejudice scale, or nationalism scale, all F's <1. [5]

To summarize, consistent with the MWH, the survey findings show that men's real-world intergroup interactions are more competitive (Prediction 1b), men have a stronger aesthetic preference for stimuli depicting intergroup conflict (war and western movies; Prediction 4a); men show significantly lower negative affect toward warfare (Prediction 4b); and they score higher on a personality trait involving preference for between-group hierarchies (Prediction 5a) – there were no sex differences on other traits such as personal dominance, prejudice, nationalism, or right-wing authoritarianism.

Survey 2: Political support for war

In terms of political attitudes, the MWH would predict sex differences in the support for real-world intergroup conflict. One way to test this prediction is to look at national and international opinion polls measuring people's support for war. We predicted that men would, on average, be more supportive of warfare, and used polling data from different surveys, available on the internet to look at this (Prediction 5b).

Method

We selected the opinion polls by keying in the terms "opinion poll" "war" "gender" in a Google search. This generated over 200,000 hits and we looked at the first 10 opinion polls that were generated that included data for both sexes. Within each poll we examined the responses to the main question divided by sex.

Results and Discussion

Table 2 contains the relevant data from the 10 opinion polls, including the name of the poll and polling organization, the sample size, the relevant question, and the percentages of agreement/disagreement split between the two sexes, and the associated margin of error. As predicted, each of these polls shows a significant sex difference in opinion with men being more strongly in support of war (with a range of 5 to 20 percentile points difference). These data support Prediction 5b and are further consistent with the MWH.

Survey 3: Tribal colours

The goal of the third and final survey was to examine if there were any sex differences in the spontaneous activation of tribal associations (Prediction 6). To test this prediction we asked people to choose their favourite colour (or colours) and explain why. The MWH would predict that more men would mention a tribal association for their favourite colour.

Method and Materials

A convenience sample of 100 participants (50 men and 50 women) took part in the survey. Their ages ranged from 19 to 69 years (M = 29.96, SD = 12.42). Participants were approached by an experimental assistant at various public locations on the University of Kent campus and the city centre, and asked to complete a short questionnaire. Among other questions, participants were asked to write down their favourite colour (or colours) and to briefly explain why. They were then thanked for their participation and dismissed.

Results and Discussion

In total there were 98 completed responses (49 men and 49 women). Two observers categorized the explanations independently into tribal versus non-tribal colour associations (i.e., a tribal association was defined as a colour associated with a

particular organization or group of people). There was a high inter-observer agreement (Cohen's *kappa* = .98). Examples of non-tribal associations included "I chose yellow, because it is a bright and happy colour" or "…green, because it is natural, versatile and restful." Tribal associations included "I chose red, because it is my favourite rugby team" "…white and blue, because they are the colours of the Hugenote cross" "…blue, because my football team plays in it " or "…indigo blue, in some countries indigo blue represents honour, loyalty and discipline"

In total, 14 responses were coded as tribal, and all of these were from men (29%) but none from women (0%). A statistical analysis on the explanations (tribal vs. non-tribal) revealed a statistically significant association between sex and tribal colour association, $\chi^2(1, N = 98) = 18.00$, $p<.001$. This experiment shows that in response to an abstract stimulus men are more likely to mention a spontaneous tribal association.

General Discussion

The MWH postulates that men, relative to women, have a more pronounced intergroup psychology, which includes various psychological mechanisms that make it more likely for them to promote, participate, and succeed in intergroup aggression. We conducted a number of experiments and surveys to examine different manifestations of the male warrior psychology in the domains of inter-group and intra-group behaviour, tribal political attitudes, and inter-group cognition and affect.

Consistent with predictions, the experimental evidence revealed that men, relative to women, are more likely to be aggressive in coalitional war games (Prediction 1a), infra-humanize out-group members more (i.e., Christians vs. Muslims; Prediction 2), and display in-group loyalty when there is an intergroup threat (Prediction 3). Corroborating and extending this evidence, survey data revealed

that men report more competitive inter-group interactions in their daily lives (Prediction 1b), evaluate inter-group stimuli (like war movies) more positively (Prediction 4), score higher on political social dominance (Prediction 5a), are more supportive of wars in national opinion surveys (Prediction 5b), and finally more often make spontaneous tribal attributions to explain preferences for abstract stimuli such as colour preference (Prediction 6).

The MWH has the ability to integrate a diversity of unconnected findings from the behavioural science literature. For instance, it can explain why inter-group conflict in human society, for example, wars between nations, civil rebellions, and gang violence are almost exclusively male activities (Goldstein, 2003; Livingstone Smith, 2007). It explains why men, despite being most at risk from intergroup aggression, are more likely to support their country going to war. It also explains why men are more likely risk-takers, engaging in acts of physical bravery to sacrifice themselves for their group (Farthing, 2005). It can account for developmental differences in social play, where boys engage more often in team games with complex social rules, and in friendship formation, with boys having more inclusive friendships with more peers (Eder & Hallinan, 1978; Geary, 1998; Lever, 1976). It could explain why men self-esteem is more strongly derived from the larger groups with which they associate, whereas women's self-esteem is more interpersonally orientated (Baumeister & Sommer, 1997). Finally, it might account for the popularity of "warrior" names for sons (but not daughters) in many cultures – for instance, Alexander, Duncan, Guy, Jari, Max, and Walter all refer to warriors.

It would be extremely interesting to look at the social and personality psychological literature on sex differences through the lens of the MWH. Our findings suggest that there may be sex differences hidden in a range of other intergroup

psychological phenomena. However, researchers on intergroup relations have not been terribly interested in sex differences, and many studies that contain mixed sex samples do not even report tests for sex. If nothing else, the MWH suggests that many existing social psychological studies may suffer from reduced power or noise in detecting the phenomenon of interest, purely because of systematic sex differences causing Type II errors in mixed samples. Other predictions that await investigation include whether men and women differ in their evaluations of personality traits of potential coalition partners. We suspect that men value "warrior" traits such as physical bravery and fighting prowess more than women do in coalition members. In addition, MWH predicts sex differences in leadership emergence in groups as a function of the specific group threat. For instance, voters might have a preference for a male or masculine-looking leader when their country is at war but this preference might shift towards a female leader during peace-time.

MWH is derived from evolutionary reasoning about sex-specific mating strategies, which argues that men and women have evolved different adaptations to enhance their reproductive potential as a result of different reproductive interests (Buss & Schmitt, 2001). Under certain conditions, it could pay for men to form coalitions with other men in order to acquire or defend reproductively relevant resources (food, mates). Furthermore, once this coalitional strategy emerged in evolutionary history, it presumably paved the way for a coalitional arms-race with substantial benefits in forming ever larger, stronger, and more aggressive coalitions to fight off rivals (Alexander, 1987).

The male warrior phenomenon presumably has a very ancient phylogenetic history that might even predate humans. Among chimpanzees, one of our closest genetic relatives, males go on border patrols to defend the boundaries of their territory

and attack – and sometimes even kill – members of neighbouring communities. It has been suggested that this is a strategy to reduce the strength of the rival group so that out-group females will migrate to the stronger community and future group conflicts will end in their favour (balance-of-power hypothesis; Wilson & Wrangham, 2003). We know little yet about intergroup relations in the apparently more peaceful bonobo – our other close genetic relative – but anecdotal evidence suggest that when different troops meet, the females act as peace-brokers whereas the males stand aside (De Waal, 2006).

Regardless of the exact evolutionary history of the male warrior trait, its manifestation is likely to be influenced by cultural factors. For instance, in most societies boys are socialized as "warriors" through interactions with parents and other authority figures as well as peers (Maccoby, 1990). Parents often use socialization practices to reinforce strategies that are believed to be ultimately reproductively successful for each sex (Geary, 1998). However, certain socialization practices can no doubt inhibit the spontaneous activation of a sex-specific warrior psychology. For instance, in Israel, a country under threat from most of its neighbours, girls are being socialized more as boys in order to maximize the country's fighting power, and there is army conscription for both young men and women – although women's military service is shorter and exempts them from combat roles (Browne, 2007). It is probably no surprise that Israeli women score higher on psychological measures of competition and aggression relative to women elsewhere (Kopelman & Rosette, 2008). Equally, societies can "choose" to inhibit warrior tendencies in men, for instance, through offering mixed sex education to children or devaluing the army. Traditional peaceful societies such as the !Kung in Southern Africa have various mechanisms in place to curtail aggression in especially young males (Bonta, 1997).

Before closing, we should note some limitations of our research. The first limitation is that in some of the reported studies the sexes were not equally balanced nor randomly assigned to conditions. This applies to Experiments 2 and 3 where there were relatively small numbers of male subjects in some conditions. Nevertheless, the sex effects across all our studies were fairly consistent. Furthermore, although each individual study can be criticized for any number of reasons, the overall pattern of results makes a lot of sense within the framework of evolutionary psychology and the MWH, and the fact that we employed a diversity of research methodologies should give confidence in our findings. Another limitation perhaps is that we asked people about their biological sex instead of their gender identity. We do not know if the same conclusions apply to both masculine and feminine males, for instance (which would add noise to our data). There is some evidence from Survey 1 to suggest that, whereas biological sex was predictive of feelings toward war, gender identity was not.

A third limitation is that we were primarily concerned in men's social psychology. There is a growing body of research on women's unique social psychology, emphasizing the role of women in maintaining supportive social networks and in keeping the peace in ancestral groups (tend-and-befriend hypothesis; Taylor et al., 2000). Some recent evidence shows that women, rather than fight, use indirect coalitional aggression tactics like gossip to exclude females from their intimate social circle (Hess & Hagen, 2006). Another interesting extension would be to examine if women are more concerned with (and better able) to foster peaceful relations between groups – as diplomats – but as far as we are aware this has not been empirically investigated.

A final limitation is that our data were gathered among primarily Western samples (with the exception of Survey 2), and it would be good to try and replicate

these results with samples from other cultures. There is some recent evidence that the MWH is not a western phenomenon. Research from Japan shows that when primed with out-group threats males exhibit more in-group favouritism than females (Yuki, 2008).

Conclusions and Implications

In conclusion, the male warrior hypothesis asserts that men have a more pronounced inter-group psychology that includes various psychological mechanisms increasing the likelihood of prompting, engaging, and succeeding in interg-group aggression. This research examined various such psychological mechanisms such as infra-humanization, in-group loyalty, tribal political attitudes, and positive affect towards inter-group conflict. We believe that the male warrior hypothesis has the potential to integrate many previously unconnected findings in the social science literature and deserves serous attention from researchers interested in understanding the roots of human aggression and warfare. One important implication of our research is that efforts to minimize violent intergroup relations in society should concentrate on the role of men. Several recent studies suggest that, whatever other factors may be at work, it is largely young men that are at risk of becoming involved in violent coalitions such as hooligans, street gangs, and terrorist groups (Sosis & Alcorta, 2008). This is no surprise when viewed through the lens of the male warrior hypothesis.

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Footnotes

[1] There is also considerable support for gender similarities in domains in which men and women have faced identical selection pressures (Hyde, 2005).

[2] There are some documented cases of female warriors throughout recorded history, although the famous Greek Amazons are mythical creatures (Goldstein, 2003). Women have participated in warfare at various times in history -- most recently as soldiers in Iraq -- but, although we do not want to belittle their role, warfare is still largely a male activity, as it was in the past (Browne, 2007).

[3] The low incidence of decisions for war—64 out of a total of 1116 decisions—suggests we cannot attribute our results to a game "primed" for aggression. Sex differences in an environment in which peace was evidently perceived as advantageous by the majority of players, may therefore be all the more significant.

[4] This manipulation worked. In the inter-group condition, people identified more strongly with their group ($M = 5.33$, $SD = 1.71$) than in the inter-personal condition ($M = 4.04$, $SD = 1.81$), $F(1, 48) = 5.75$, $p<.001$, $\eta^2 = .11$ ("How much do you identify with this group?" 1 = not at all, 7 = very much).

[5] The masculinity-femininity scale did not correlate substantially with either the frequency of intergroup interactions ($r = .04$), the war affect scale ($r = .02$) or social dominance scale ($r = .10$).

Tables

Table 1. Domains of evidence, hypotheses and predictions from Male Warrior Hypothesis.

Domain of Evidence	Hypothesized Mechanism	Prediction	#	Test
1. Inter-group aggression	Propensity to engage in inter-group aggression	Men are more likely to make unprovoked attacks in war games	1a	Experiment 1
		Men have more competitive inter-group experiences	1b	Survey 1
2. Inter-group prejudice	Infra/de-humanization of antagonistic out-groups	Men are more likely to infra-humanize members of out-groups	2	Experiment 2
3. Intra-group Behavior	Displaying in-group loyalty during inter-group conflict	Men are more likely to show in-group loyalty during inter-group conflict	3	Experiment 3
4. Inter-group affect	Positive affect towards inter-group conflict.	Men rate inter-group stimuli such as war movies more positively	4a	Survey 1
		Men have less negative affect towards warfare	4b	Survey 1
5. Tribal political attitudes	Political support for inter-group aggression	Men score higher in social dominance orientation	5a	Survey 1
		Men show relatively stronger political support for intergroup aggression	5b	Survey 2
6. Tribal cognitions	Spontaneous activation of inter-group association	Men are more likely to make spontaneous tribal association to abstract stimuli such as favorite color	6	Survey 3

Table 2. Opinion poll data showing that men are more supportive of war (Survey 2).

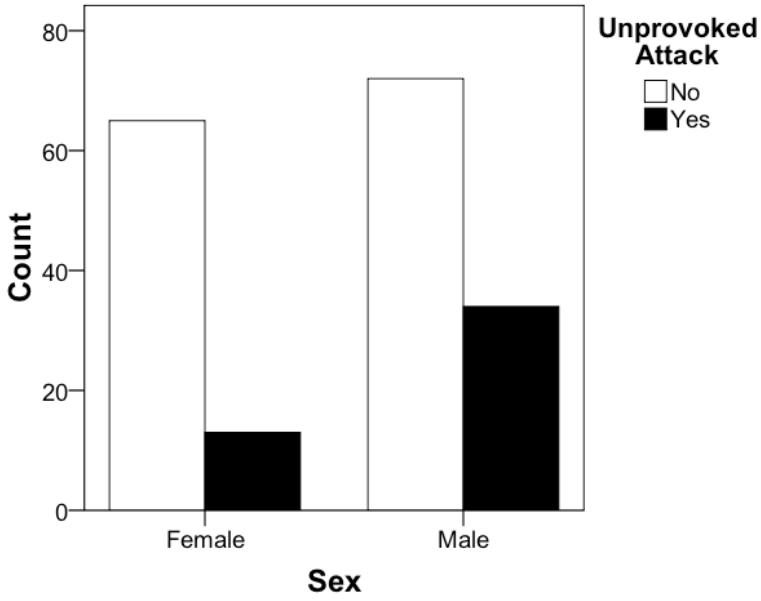
Opinion Poll	Poll Question/Statement	Country of Origin	Sample Size	% Male	% Female	Margin of Error
Washington Post-ABC News – April 2003	Do you support the US having gone to war in Iraq?	USA	1,030	82% agree	72% agree	+/- 3.0
NPR Poll – May 2003	The Iraq war was a success and was worth the cost in lives and dollars.	USA	723	57% agree	40% agree	+/- 3.64
L.A. Times – December 2002	Support the war and still support it if there were military troop casualties.	USA	1,305	53% agree	33% agree	+/- 3.0
Angus Reid Strategies – September 2007	The mission should be extended past its end date.	Canada	1,171	27% agree	13% agree	+/- 2.9
Gallup News Service – Jan.-May 2007	The Iraq war was a mistake.	USA	7,074	46% disagree	37% disagree	+/- 2.0
Princeton Survey Research Associates International – July 2005	The U.S. should keep troops in Iraq until the situation there has stabilized.	USA	1,502	57% agree	48% agree	+/- 3.0
Public Policy Polling – January 2007	Do you support President Bush's plan to send 22,000 additional troops to Iraq?	North Carolina, USA	501	46% agree	36% agree	+/- 4.3
Angus Reid Global Monitor – July - August 2007	Your country has contributed troops to the North Atlantic Treaty Organization (NATO) mission in Afghanistan. So far, do you think the war against militant groups in Afghanistan has been mostly a success or mostly a failure?	Britain	1,000	21% success	12% success	+/- 3.1
		France	1,000	14% success	9% success	+/- 3.1
		Italy	1,000	24% success	12% success	+/- 3.1
		Germany	1,000	20% success	11% success	+/- 3.1
		Canada	1,075	29% success	14% success	+/- 3.1
Guardian opinion poll - 2001	Do you approve or disapprove of military action by the United States and Britain against Afhanistan	Britain	1004	76% approve	56% approve	+/- 4.0

Figure Captions

Figure 1. Males were significantly more likely to (a) make unprovoked attacks, and (b) either attack or retaliate against attack (Exp 1)

Figure 2. The more males were present in the dyad, the more likely were unprovoked attacks (Exp 1).

Figures 1a and 1b



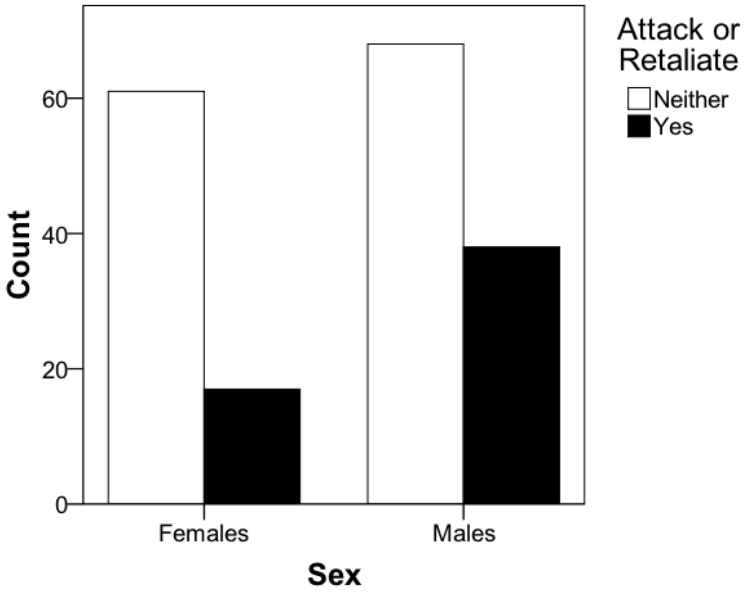
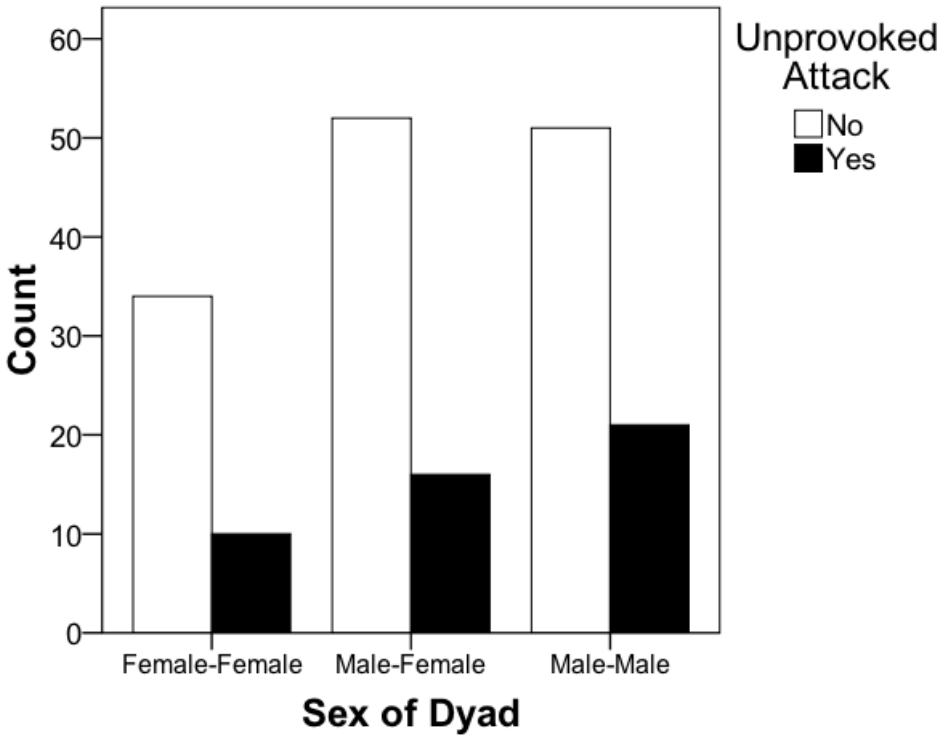


Figure 2


Unprovoked Attack
No
Yes
Count
60
50
40
30
20
10
0
Female-Female
Male-Female
Male-Male
Sex of Dyad