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Facing the situation: Testing a biosocial contingency model of leadership in intergroup relations using masculine and feminine faces

Brian R. Spisak [a,*], Astrid C. Homan [a], Allen Grabo [a], Mark Van Vugt [a,b]

[a] Department of Social and Organizational Psychology, VU University Amsterdam, Van der Boechorststraat 1, 1081 BT, Amsterdam, The Netherlands
[b] Institute for Cognitive and Evolutionary Anthropology, University of Oxford, 64 Banbury Road, Oxford OX2 6PN, UK

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ABSTRACT

Using an evolutionary psychology framework we propose that leadership and followership are evolved traits to solve recurrent group coordination problems. We argue that adaptive problems such as those concerning intergroup conflict or cooperation activate different cognitive leadership prototypes, and the face conveys diagnostic information about the suitability and emergence of intergroup leadership. Consistent with hypotheses we find that followers expect masculine-faced leaders to behave competitively and feminine-faced leaders cooperatively in intergroup relations. Furthermore, individuals prefer leaders whose facial cues match the adaptive problem. For example, a masculine-looking leader is preferred in a competitive intergroup setting. Also, this match between face and situation is reinforced with a consistent leadership message such as a masculine-looking leader expressing the need for competition. An evolutionary perspective provides a deeper understanding of the biological aspects of leadership and generates many novel hypotheses about how markers such as the human face affect leadership emergence and effectiveness.

In recent years the science of leadership has made a number of advancements through the application of an evolutionary perspective (Van Vugt, 2006; Van Vugt, Hogan, & Kaiser, 2008). Using insights from a range of disciplines such as social psychology, evolutionary biology, behavioral economics, and neuroscience, an evolutionary perspective examines the possible evolved functions of leadership and followership (Van Vugt & Ahuja, 2010). As this new theoretical approach gains traction a logical next step is to investigate how it can provide novel hypotheses about leadership emergence and effectiveness (Spisak, Nicholson, & Van Vugt, 2011). In the present paper we examine how an evolved physical feature—the human face—affects opportunities to influence others across different adaptive domains.

Imagine two leadership candidates for a presidential election, one more masculine-looking and the other more feminine-looking. Suppose there would be an external threat to the country, such as a terrorist attack. Would this increase the chances of the masculine-looking candidate to win the election and decrease the chances of a feminine-looking candidate? We believe so. Furthermore, aspiring leaders are active agents in social networks and could manipulate the environment in such a way that they fit the leadership prototype. For example, with aggressive messages such as "winning the war on terror" a masculine looking leader could shift followership perception of the required prototype in their direction so that they are able to exercise more influence. Using an evolutionary framework, the present research investigates what the human face signals about leadership and social influence particularly during times of intergroup conflict (war) or cooperation (peace).

We argue that humans have evolved to be exceptionally sensitive to oscillations between conflict and cooperation within and between groups and that these shifts alter their perceptions of leadership (Van Vugt, 2006; Van Vugt & Spisak, 2008). Specifically, we hypothesize that individuals follow a more masculine-looking leader in times of war and a more feminine-looking leader in

* Corresponding author. Tel.: +31 20 598 9473; fax: +31 20 598 8702.
E-mail address: BR.Spisak@psy.vu.nl (B.R. Spisak).

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times of peace. We report two experiments showing that facial appearance in combination with a leader's message influences the degree to which leadership is attributed to people in competitive versus cooperative environments.

A biosocial contingency model of leadership is introduced to account for the interaction between these biological-based facial *traits* of leaders, their *message*, and the social *situation* in which the group finds itself. The model suggests that cooperative versus competitive intergroup situations elicit different leadership prototypes, and that individuals who closely match these prototypes—through their facial appearance—are more likely to emerge as a leader and exercise influence (cf. implicit leadership theory; see Schyns & Meindl, 2005).

This perspective is broadly consistent with contingency models of leadership (e.g., Fiedler, 1964; Hersey & Blanchard, 1969; Thompson & Vecchio, 2009) but extends these in various ways. First, the relevance of intergroup competition (war) versus cooperation (peace) in human evolutionary history will be addressed. It will be argued that war and peace constituted different selection pressures for the emergence of leadership in ancestral environments and that, as a result, humans have evolved cognitive mechanisms to recognize "fitness relevant" situations as requiring leadership as well as decision rules about who to follow—what we refer to as cognitive leadership prototypes (Lord, Foti, & De Vader, 1984; Van Vugt & Spisak, 2008). For example, "If being attacked (and want to be safe) then follow a physically strong individual." Such context-based heuristics are highly automatic and functional throughout human evolution (Cosmides & Tooby, 1992; Van Vugt et al., 2008). Second, we argue that the human face provided our ancestors (and still us today) with diagnostic information about who to follow in these situations. Finally, we propose that leaders espousing a message which accords with their non-verbal cues can significantly affect influence over followers.

1. Evolutionary leadership theory

Humans are among a number of animals that have evolved a group living strategy (Silk, 2007). The ability to live in large complex groups partly explains our success as a biological species (Dunbar, 1998; Pusey & Packer, 1997). Yet it also poses significant problems of coordination and cooperation, and consequently creates pressures on groups to organize collective action to pursue their reproductive goals (Sober & Wilson, 1998). As population sizes and densities increased over the course of human evolution the relations between groups became a significant issue. In dealing with other groups two commonly observed behaviors in past and present cultures are raiding or trading (Chagnon, 1988; Ridley, 1997; Van Vugt, 2009; Wrangham & Peterson, 1996).

Archeological evidence shows that warfare was constant and lethal for much of our evolutionary history (Chagnon, 1997; Knauft, 1987; Wrangham & Peterson, 1996), and certainly prevalent enough to alter the evolution of human social behavior (Bowles, 2009). We argue that warfare may also have affected leadership (King, Johnson, & Van Vugt, 2009). At the same time, there would also have been strong pressures to maintain peaceful relations with other groups, especially for trading purposes (Van Vugt, 2009). Thus, depending upon the situation, it would have been adaptive for our ancestors to engage in either hostile or peaceful intergroup actions. Factors such as the relative proximity, the relative size and strength of these groups, as well as the intensity of resource competition could affect whether intergroup relations were primarily peaceful or hostile (Wilson & Wrangham, 2003).

Coordinating intergroup activities paved the way for the emergence of leadership, yet the kind of leadership required likely differed for war or peace-making purposes. Given the different requirements of being a war or peace leader it is likely that two distinct leader prototypes emerged (Van Vugt, 2009; Van Vugt & Kurzban, 2007). For instance, expressing aggression and dominance may be valuable in times of war yet prove to be a major hindrance for brokering peace. Think of the bullish Winston Churchill who was an excellent war leader but was voted out of office the moment the Second World War had ended. It is also noteworthy that in traditional societies the roles of war or peace leader are often occupied by different people (Johnson & Earle, 2000). Based on this reasoning, two primary leadership roles for dealing with other groups have been identified:

1) A "prosocial" (peace) leader prototype which focuses on maintaining and creating positive intergroup relations based on empathy, altruism, and reciprocity for beneficial cooperation between-groups.
2) A "dominant" (war) leader prototype which focuses on maintaining and creating advantage over a competing group based on dominance, risk-taking, status seeking, and so on for the overall benefit of the in-group.

In our evolutionary model we assume that environments fluctuating between war and peace shaped the emergence of different leader prototypes. This is broadly consistent with leadership categorization theory (LCT) which argues that individuals who closely match the prototype are more likely to emerge as leaders (Lord et al., 1984). However, unlike LCT, we suggest that these prototypes are not exclusively formed through socialization and cultural learning, but rather that they are products of evolved human nature. Furthermore, these leader prototypes are likely to contain both physical (such as face and body) and psychological markers (such as an aggressive personality).

1.1. Facial cues of evolved cognitive leadership prototypes

One important physical marker of leadership is the human face. As Zebrowitz and Montepare (2006) suggest, facial cues may indicate various ecologically relevant traits and these may elicit consistent behavioral responses from perceivers. The human face is a significant predictor of leadership emergence because it conveys particular behavioral affordances. Research on voting behavior has found that participants can accurately pick the winner of political elections within one second using only facial information of the candidates (Todorov, Mandisodza, Goren, & Hall, 2005). Moreover, children as young as 5 (void of any political knowledge or expertise) can make accurate predictions about election results (Antonakis & Dalgas, 2009). However neither of these studies examined the relevance of particular facial cues as a function of shifting political environments (i.e., the situation).

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Based on previous research we suggest that cues of facial masculinity or femininity of actual political candidates might affect leadership emergence in war versus peace. Using face morphs of the masculine-faced Bush and the feminine-faced Kerry—the two candidates in the 2004 US Presidential election—Little, Burriss, Jones, and Roberts (2007) showed that the masculine features of Bush were preferred as a leader during war and the feminine facial traits of Kerry were preferred during peace. However, it is possible their design was not complex enough to get a deeper understanding of this facial trait/situation connection. Our current research utilizes more in-depth intergroup information and considers how the leader can use a message to reinforce their prototypical image to match the situation. Consequently, we provide a design complex enough to better elaborate on this connection.

Also building upon previous research, we suggest that facial masculinity (or femininity) may be an accurate cue of dominant (or prosocial) leadership because facial masculinity (and femininity) is influenced by hormones such as testosterone. Research showed that high levels of testosterone are associated with risk-taking and dominance behaviors (Cashdan, 1995; Dabbs, Carr, Frady, & Riad, 1995) as well as facial cues of masculinity (broader jaw, thicker brow; Pound, Penton-Voak, & Surridge, 2009; Thornhill & Møller, 1997). Conversely, estrogen, which is linked to facial femininity (Law Smith et al., 2005) produces prosocial tending-and-befriending behaviors (Taylor et al., 2000). For this reason we hypothesize that facial perceptions of masculinity and femininity may signal leadership potential across different situations with masculine-looking individuals exercising more influence during intergroup competition and feminine-looking individuals being more influential in cooperative intergroup environments.

A final consideration is that potential leaders may create situations that best match their facial prototype as either a dominant or prosocial leader to increase their influence. As Shamir, House, and Arthur (1993) have discussed, for a leader to have charismatic effect their message must be congruent with the values and goals of potential followers. We advance upon this by suggesting that a leader's message, if consistent with their physical features, could strengthen the match between their appearance and the leadership prototype of followers. For instance, a masculine-looking leader emphasizing the threat of war would be expected to be most influential.

1.2. Hypotheses

In two experiments we test hypotheses derived from the biosocial contingency model of leadership. First, we predict that feminine-looking leaders are more likely to be endorsed when they convey a message of cooperation, and masculine-looking leaders when they convey a message of competition between groups (H1). Second, we propose that cooperative environments encourage peaceful actions and competitive environments hostile actions among followers (H2). Third, we predict that followers expect feminine-looking leaders to behave cooperatively and masculine-looking leaders to behave competitively (H3). Finally, leaders that will be most supported are either leaders with feminine facial traits sending cooperative messages in a cooperative situation or leaders with masculine facial traits, sending competitive messages in a competitive situation (H4).

2. Study 1

2.1. Participants and design

Forty-one students from the VU University Amsterdam (13 males, 28 females; $M_{age} = 20.46$, $SD = 2.05$) participated in the experiment and received either money or course credit. The participants were randomly assigned to a 2 (facial traits: masculinized faces versus feminized faces) between-subjects by 2 (message: congruent versus incongruent) within-subjects design.

2.2. Materials and manipulations

Faces of leader candidates (all males) were taken from a neutral expressions faces database maintained by the Center for Vital Longevity (Minear & Park, 2004). In a separate pilot involving 40 participants, 84 of these faces were used to determine which would be rated as most neutral in terms of masculinity/femininity.[1] The faces were posted in two batches of 42 each and presented individually with a 5-point scale. Scale ends were labeled 1 (very feminine), 3 (neutral), 5 (very masculine). The scores were submitted to a one-way ANOVA, and those faces that did not differ significantly from the neutral rating were used as the base-faces for morphing. These neutral faces were then morphed with facial prototypes so that their features were enhanced to look either 30% more masculine or feminine, then symmetrized, and cropped. This procedure was developed in a previous study (see Spisak et al., 2011; see Fig. 1 for the masculine and feminine prototypes).

2.3. Procedure

The participants in the study (separate from the pilot group) were led to individual cubicles where the experiment was conducted on a computer running Macromedia Authorware. Following a brief introductory screen, each participant was randomly assigned to either the masculinized faces or feminized faces condition. This was the only between-subjects manipulation. Participants in both conditions were then presented with the cover story, explaining that they would be viewing the faces of various leadership candidates for a student group at the VU University, who would be interacting with another group from another local university, the University of Amsterdam (UvA). The instructions explained that the student group would work to get media attention and funding for projects, and that the interactions between the two groups could "take various forms, and require different approaches for successful outcomes."

[1] Due to a programming error demographic questions were not captured.

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Fig. 1. Cropped and symmetrized feminine and masculine composite prototypes used for morphing in Study 1 and game play in Study 2.

Following these instructions, participants were shown 8 faces of potential group leaders (in random order), either masculine or feminine depending upon condition. Underneath each face was one of 8 possible messages. Half of the statements were explicitly cooperative (e.g., "We should work together with the group from the UvA, if we don't cooperate from the start both groups could suffer"). The other half were competitive (e.g., "It's us versus them…"). When a masculine face was paired with a competitive statement, or a feminine face was paired with a cooperation statement, the combination was labeled "congruent". When a masculine face was paired with a cooperation statement, or a feminine face was paired with a competitive statement, the combination was labeled "incongruent". Also, to control for potential idiosyncratic effects such as attractiveness or distinctiveness of an individual face, the face-statement pairings were randomized across all participants so that no one face was paired consistently with either a congruent or incongruent statement.

Participants were then asked to rate the leader-qualifications of each face individually, using 7-point scales. All items were arranged such that higher numbers indicated more positive evaluations. The seven items included questions such as "How likely would you be to follow this person?", and statements such as "This person is a potential leader." To test Hypothesis 1, we were interested in the effect of congruent and incongruent face-statement pairings on leader ratings. As explained above, each participant was shown four congruent and four incongruent face-message combinations. As such, we collapsed the leader ratings for each item into two combined scales—one for congruent pairings ($M = 4.15$, $SD = 0.84$, $\alpha = .95$) and one for incongruent pairings ($M = 3.73$, $SD = 0.63$, $\alpha = .91$). Participants were also asked to rate the perceived masculinity/femininity of each face as a manipulation check. Scale ends were labeled 1 (very masculine), 4 (neutral), 7 (very feminine). Finally, demographic information was collected and participants were thanked and debriefed.

2.4. Results and summary

In order to verify that our facial morphing of masculinity/femininity worked we conducted a manipulation check using participants' ratings of the morphed faces and found that the masculinized faces were rated as significantly more masculine ($M = 3.03$, $SD = 1.50$) than feminized faces ($M = 3.65$, $SD = 1.60$; $F[1, 40] = 13.21$, $p < .001$, $\eta^2 = .04$).

We then entered the leader qualification scales into a repeated measures general linear model. In line with Hypothesis 1, we found that participants who viewed faces paired with a congruent message (e.g., masculine with competitive statement) considered them more influential and leader-like ($M = 4.15$, $SD = 0.84$) than participants who viewed faces paired with incongruent statements ($M = 3.73$, $SD = 0.63$; $F[1, 40] = 10.65$, $p < .01$, $\eta^2 = .210$). This supports the hypothesis that followers are more likely to endorse masculine-looking leaders when conveying a competitive message and feminine-looking leaders with a cooperative message. However, we do find a significant gender effect, such that after controlling for gender our main effect does lose significance ($F[2,39] = 1.23$, $p = .28$, $\eta^2 = .03$). However, this gender effect is likely due to the substantial difference between male and female participants (i.e., 13 male and 28 female).

3. Study 2

3.1. Participants and design

One-hundred and eight participants from the VU University Amsterdam participated in the experiment for either money or course credits. Participants (34 males, 74 females; $M_{age} = 21.21$, $SD = 2.42$) were randomly assigned to one of four experimental conditions, following a 2 (game prime: competition or cooperation) by 2 (leader tactic: congruent or incongruent) between-subjects design. Each participant was confronted with a masculinized and feminized male facial image, who both served as "teammates." These faces were treated as a within-subjects factor.

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3.2. Materials

The materials used for the experiment were a digital photo camera, five computers running Macromedia Authorware, with every computer placed in a cubicle that was physically separated from the others, and two composite male facial images, either masculinized or femininized (images developed using E-FITV by VisionMetric Ltd; see Gibson, Solomon, Maylin, & Clark, 2009; see Fig. 1).

3.3. Procedure

Participants played an online team game with other individuals in small groups (of three players each) whose avatars appeared on the computer screen (these were in fact bogus team members). To maintain the illusion of being part of a small group a passport style photo was taken of each participant with a neutral facial expression used to "prepare their avatar." Also to avoid suspicion, there was a delay in the start of the game so that the experiment could only begin when "everyone's avatar was prepared." The avatars of the other players were the composite images manipulated to control for their masculinity or femininity.

3.3.1. Game prime

Subsequently, the participants were informed about the rules of the game, which was an Intergroup Prisoner's Dilemma between two groups of three players with three rounds of iteration. In each round each player could indicate whether they wanted their group to cooperate or compete with the other group and we told them that the final strategy would be decided based on the majority rule. Participants were then primed using game instructions. For the situation prime, the objective of the game for half the participants was described as choosing between "competition" or "no competition" with the other group (competitive prime) and for the other half the game's objective was either "cooperation" or "no cooperation" with the other group (cooperative prime). The participants were shown the points they would receive for each behavioral strategy (i.e., a standard PD payoff matrix) and received a test to examine if they understood the instructions. All participants answered these questions correctly.

The facial images of two male team players (one masculinized, one feminized) appeared as avatars on the screen before the game started (i.e., the trait manipulation). From the answer to a control question it was clear that all participants correctly indicated that the two team members were males. The images were displayed side-by-side and counterbalanced throughout the experiment.

3.3.2. Leader tactic

Round 1 of the game started and participants were told they had to wait with making a decision to cooperate or compete until the other two players had indicated their preferred strategy. One of them always defected and the other always cooperated, and so the participant had to decide which avatar's tactic to follow (a measure of influence).

Furthermore, participants were assigned to one of two voting conditions: congruent or incongruent (the message manipulation). In the congruent condition, the masculine-looking avatar always chose to compete with the other group and the feminine-looking avatar to cooperate. This was reversed in the incongruent condition. After the participant had made a decision which team member to follow they were asked to rate each avatar on 7-point scales. After round 1 there were two additional rounds. Both rounds followed the same procedure as the first and the avatars made the same choice.

Finally, the participants were told that they would play an additional game later on and were asked to indicate which of the two avatars they would prefer as the leader in this subsequent task.

3.3.3. Manipulation checks

The manipulation of the game prime was checked with one question: "How likely are you to prefer a certain tactic in this game?" Participants could answer on a 7-point scale ranging from 1 = *very likely to prefer competition* to 7 = *very likely to prefer cooperation* ($M = 3.47$, $SD = 1.97$).

The manipulation of congruence of leader tactic was checked with three questions regarding the expectations that the participants had regarding the choice of the two avatars in the three rounds of the game (i.e., "My fellow group members chose the option that I'd expected them to in the first/second/third round"). The scale ranged from 1 = *completely disagree* to 7 = *completely agree*. The three items formed a reliable scale ($M = 4.22$, $SD = 1.61$, $\alpha = .77$).

The masculinity and femininity of the avatars was checked with the item "The physical appearance of this group member is…." The participants could answer on a 7-point scale ranging from 1 = *more masculine* to 7 = *more feminine*.

3.3.3.1. Leader preference. After the third round of the game, participants were asked to indicate their preference for either the masculine looking avatar or feminine looking avatar as their leader in the next game.

3.3.3.2. Tactic preference. In all three rounds of the game we asked the participants to choose whether they wanted to cooperate or compete with the other group.

3.4. Results and summary

In order to account for potential gender effects, we controlled for participants' gender in all analyses.

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3.4.1. Manipulation check of facial traits

To check whether the masculine avatar was rated as more masculine than the feminine avatars we performed a repeated measures general linear model with the situational prime and congruence as between-subjects factors and the ratings of the two avatars as the repeated measure factor. As expected, the masculine looking avatar ($M = 2.16$, $SD = 0.12$) was rated significantly more masculine than the feminine looking avatar ($M = 5.24$, $SD = 0.11$; $F[4, 103] = 14.00$, $p < .001$, $\eta^2 = .12$). We found no main effects of participants' gender ($F[4, 103] = 0.92$, $p = .34$, $\eta^2 = .01$), the game prime ($F[4, 103] = 0.62$, $p = .43$, $\eta^2 = .01$) or the leader tactic manipulation ($F[4, 103] = 0.42$, $p = .52$, $\eta^2 = .004$). Additionally, we found no effects for any of the interactions (game prime by the different avatars, $F[4, 103] = 2.95$, $p = .09$, $\eta^2 = .03$; leader tactic by different avatars, $F[4, 103] = 0.91$, $p = .34$, $\eta^2 = .01$; three-way interaction, $F[4, 103] = 0.08$, $p = .97$, $\eta^2 < .001$).

3.4.2. Manipulation check of game prime

As expected, when examining the effects of our game prime on tactic preference we found a main effect of situation ($F[4, 103] = 3.90$, $p = .05$, $\eta^2 = .04$). Participants primed with competition ($M = 3.09$, $SD = 0.27$) were more likely to compete than participants primed with cooperation ($M = 3.85$, $SD = 0.27$). This supports Hypothesis 2, in which we expected that a competitive situation would cause participants to prefer more hostile behavior relative to those in a cooperative situation. We find no effect of participants' gender ($F[4, 103] = 0.60$, $p = .44$, $\eta^2 = .01$), congruence ($F[4, 103] = 0.88$, $p = .35$, $\eta^2 = .01$) nor an interaction ($F[4, 103] = 0.001$, $p = .97$, $\eta^2 < .001$).

3.4.3. Manipulation check of congruence of intended tactic

Also as predicted, results for the check on the leader tactic manipulation indeed showed an effect of our leader tactic manipulation ($F[4, 103] = 13.22$, $p < .001$, $\eta^2 = .11$). Participants in the congruent condition ($M = 4.73$, $SD = 0.21$) expected the choice of avatars (i.e., masculine avatar competing and feminine avatar cooperating) more than participants in the incongruent condition ($M = 3.67$, $SD = 0.20$) where avatar and tactic were mismatched. This is in line with Hypothesis 3, in which we predicted that participants would expect masculine-looking leaders to behave more competitively and feminine looking leaders to behave more cooperatively.

We also find an interaction between leader tactic and situation on this manipulation check ($F[4, 103] = 4.96$, $p = .03$, $\eta^2 = .05$), indicating that the difference between congruence and incongruence is stronger in the competition prime (congruence $M = 4.96$, $SD = 0.28$ versus incongruence $M = 3.25$, $SD = 0.30$) than in the cooperation prime condition (congruence $M = 4.50$, $SD = 0.31$ versus incongruence $M = 4.10$, $SD = 0.28$)—indicating that participants were more sensitive to changes in anticipated tactics in the competitive situation. This is perhaps due to the underlying logic of a Prisoner's Dilemma which dictates that the rational choice is competition. Individuals may attend more to deviations from expected leadership tactics when the logic of the game (defection) amplifies the situation prime (competition).

Finally, we found no main effect of participant's gender ($F[4, 103] = 0.10$, $p = .75$, $\eta^2 = .001$) and the game prime on the leader tactic manipulation check ($F[4, 103] = 0.43$, $p = .51$, $\eta^2 = .004$).

3.4.4. Leader preference and emergence

In order to analyze the effects of our manipulations on the preference for one of the avatars as leader, we used the logistic regression procedure with our game prime and leader tactic manipulation as predictors and the forced leader-choice item as dependent variable. We find an interaction between game prime and leader tactic, $B = 1.77$, $SE = 0.83$, Wald $= 4.52$, $p = .03$, in such a way that people seem to marginally prefer the feminine looking avatar in the incongruent behavior condition of competition (44%) than in the congruent behavior condition of cooperation (32%), $\chi^2(1, N = 108) = 2.85$, $p = .09$. This likely indicates that for a prisoner's dilemma people do initially tend to follow a person showing a competitive tactic given that this is the rational choice.

However, of greater importance, we find that the masculine looking avatar was preferred *most* as a leader when he chose to compete in a competitive game prime (76%) and the feminine avatar was preferred *least* as a leader when cooperating in the same competitive game prime (24%), $\chi^2(1, N = 108) = 5.74$, $p = .02$. This lends support to our fourth hypothesis predicting that masculine individuals are endorsed most often as leaders in a competitive game prime if they convey a competitive message and feminine individuals are least likely to influence followers in the same situation when sending a cooperative message.

Finally, we found no main effect of situation, $B = -0.84$, $SE = 0.57$, Wald $= 2.17$. $p = .14$ nor participants' gender on leader preference, $B = 0.74$, $SE = 0.47$, Wald $= 2.49$. $p = .12$.[2]

3.4.5. Tactic preference

Finally, we were interested to see whether the participants would also be affected in their game play choices based on our manipulations. To explore the effect on leadership effectiveness we analyzed game play for the three rounds combined. We find that the game prime manipulation had a main effect on the preferred tactic ($F[4, 103] = 5.18$, $p = .03$, $\eta^2 = .05$), indicating that the preference for cooperation was lower in the competitive prime condition ($M = 0.79$, $SD = 0.20$) than in the cooperative prime condition ($M = 1.43$, $SD = 0.20$). There was no effect of participants' gender ($F[4, 103] = 0.07$, $p = .79$, $\eta^2 = .001$), our leader tactic manipulation ($F[4, 103] = 0.42$, $p = .20$, $\eta^2 = .002$), nor an interaction between game prime and leader tactic ($F[4, 103] < 0.001$, $p = .99$, $\eta^2 < .001$). Again, this main effect of situation on participant behavior can perhaps be attributed to the underlying logic of a Prisoner's Dilemma which dictates competition.

[2] Effects sizes for the logistic regression procedures were not reported as the dichotomous nature of the dependent variable only provides limited information—particularly for relatively small sample sizes (Jodoin & Gierl, 2001).

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4. General discussion

The results of these two experiments support our biosocial contingency model of leadership. Masculine- and feminine-looking leaders were most preferred conveying messages of intergroup competition versus cooperation respectively (H1). Second, cooperative environments encouraged peaceful actions and competitive environments hostile actions among followers (H2). Third, followers expected masculine-looking leaders to behave competitively and feminine-looking leaders to behave cooperatively towards other groups (H3). Finally, a masculine leader behaving competitively in a competitive environment was endorsed most strongly (whereas a feminine leader behaving cooperatively in the same competitive situation was endorsed least) (H4).

These results are promising for theory development on cognitive leadership prototypes (Lord et al., 1984) because they demonstrate that different leader prototypes emerge when the context differs between intergroup competition and cooperation, and that if there is a match between the situation and prototype then leadership is granted. Extending previous research in the domain of leader categorization, we demonstrate that biological markers such as the human face also contain important prototype information. Given the importance of leadership in our ancestral environment we speculate that humans may have built-in mechanisms to quickly recognize leadership suitability in different adaptive situations and the face serves as a highly diagnostic tool. In addition to the face, other relevant cues may be someone's height, their voice pitch, and their physical strength—all of these traits have been shown to be influenced by hormonal differences in testosterone levels (Sell et al., 2009). Further, we suspect these mechanisms are activated at various levels of leadership (from small groups to a national level) provided an underlying evolved group dynamic is present.

Our research provides a biological basis for contingency-based models of leadership such as Fiedler's contingency model (1964) and Hersey and Blanchard (1969). We show first that problems that would have been important in ancestral environments, such as peacekeeping and warfare, elicit quite different leadership prototypes. To find full support for an evolutionary explanation we must examine whether these same preferences for masculine- versus feminine-looking leaders during times of war versus peace are found across different cultures, and whether young children also have these same biases (Antonakis & Dalgas, 2009). It would also be an important objective to provide a taxonomy of situations based on an evolutionary analysis, to see which prototypes emerge and which leader styles are preferred. For instance, teaching knowledge and rituals would have been another important group problem to solve in our ancestral environment, and this would activate a different cognitive prototype, perhaps an older-looking leader.

A practical implication of our findings is that it can influence intergroup dynamics. From a military perspective, understanding how individuals perceive situations as either requiring warfare or peacekeeping can help explain their choice of leaders and, in consequence, whether groups choose to wage war or make peace. Thus, to encourage peace it is crucial to stress cooperative messages and choose leaders with a constellation of more feminine prosocial traits, both physical and psychological. Our findings are also relevant for change management in business organizations in which leaders are regularly replaced to best fit the situation (Spisak et al., 2011). Another application is for the study of politics and voting behavior. Our findings suggest that candidates may fare best if their facial features match the situation and they convey a congruent message (e.g., a female or feminine-looking politician advocating the need for peace). Aligning one's message to one's physical qualities increases the fit with the prevailing leadership prototype and thus increases the likelihood of being voted into office.

One of the limitations of our research concerns the overrepresentation of female participants. Although we did find sex differences in Study 1, we did not find sex effects in Study 2. As we feel that the findings in Study 1 might be due to the very low number of males, we do not suspect that sex is actually driving the results or can act as an alternative explanation. Another limitation is related to the economic game experiment (Study 2). Because the dominant behavior in the game is competition, perhaps the cooperative environmental prime was less influential. Further work on the game parameters is needed in order to show the behavioral implications of having masculine- or feminine-looking leaders. Also, we propose that people should gather real world data from leaders to see if masculine versus feminine looking leaders (CEOs and nation states) have a different impact on the fate of organizations. Finally, we feel that it is important to use advanced 3-D face morphing technology, including manipulating facial expressions, to provide a more realistic experimental context for testing hypotheses.

5. Conclusion

This work has taken a first step in understanding the biology of leadership by looking at how facial cues influence an individual's leadership potential across different environments. Evolutionary thinking suggests that humans may have different, possibly innate, decision rules about who to follow and grant leadership in various adaptive situations. Here we focused on intergroup competition versus cooperation because such situations carried significant reproductive challenges for our ancestors.

Our research offers a novel evolutionary framework for understanding the biological basis of leadership by suggesting that cognitive leadership prototypes may have an innate basis and that biological markers (such as the human face) may influence leadership emergence. Using adaptive reasoning we hypothesized and found that people endorse a more masculine looking leader for intergroup competition (war) and a feminine looking leader for intergroup cooperation (peace). In ancestral times, such physical cues could have provided valuable information about the suitability of being a dominant (war) or prosocial (peace) leader. Theoretically, our framework provides a biological foundation for both contingency models and implicit leadership theories by assuming that humans possess different evolved cognitive leadership prototypes for solving different adaptive problems in our environment. The further identification of such inherent factors will help to construct a more unifying understanding of leadership in a manner that is consistent with human evolution.

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