

1 **Facial Cues in Humans Predict Winners and Losers in Mixed Martial Arts**
2 **Fights**

3

4 **Running head:**

5 Facial cues to fighting success

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Abstract

26 In antagonistic encounters the primary decision to be made is to fight or not and so it
27 is predicted that animals may possess adaptations to assess fighting ability in their
28 opponents. Previous studies suggest humans can assess strength and fighting ability
29 based on facial appearance. Here we extend these findings to specific contests by
30 examining the perception of male faces from paired winners and losers of individual
31 fights in mixed martial arts sporting competitions. Observers were presented with
32 image pairs and asked to choose which of the two men was most likely to win if they
33 fought while other observers chose between the faces based on other questions. We
34 found that individuals performed at rates above chance in correctly selecting the
35 winner as more likely to win the fight than the loser. We also found that winners were
36 seen to be more masculine, stronger, and aggressive than losers. Finally, women saw
37 the winners as more attractive than the losers. Together these findings demonstrate
38 that 1. humans can correctly predict the outcome of specific fighting contests, 2. that
39 perceived masculinity/strength/aggression are putative cues to fighting success
40 available from faces, and 3. that facial cues associated with successful male-male
41 competition are attractive to women.

42 **Key words: Face appearance; competition; intra-sexual; violence; fighting**

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Introduction

45 Adaptive behaviour relies on an animal's ability to make adaptive decisions given
46 certain situations. Adaptive, or fitness enhancing decisions, are those that maximize
47 the net benefits while minimising the net costs of particular actions (1). Across many
48 animal species, fighting as a form of intra-sexual selection, relating to competition
49 between members of the same sex, is common and has led to the evolution of animal
50 weapons, such as horns and antlers, particularly in males (2). In antagonistic
51 encounters with other individuals of the same species, the primary decision to be
52 made is to fight or not. The benefits to be gained, such as territory, must be weighed
53 against the costs, the potential for injury or even death.

54 While the benefits of fighting will vary across species and environment, the
55 same costs are applicable to many species and, critically, the costs vary greatly
56 depending on whether an animal is likely to be the winner or loser of the fight. We
57 can then expect that animal's that engage in intra-species fighting will possess
58 perceptual/cognitive adaptations to assess the risks involved in this behaviour by
59 assessing fighting ability in their opponents (3, 4) using cues that are potentially
60 related to fighting ability such as body size, strength, and weaponry (1). Indeed, there
61 is evidence that animals make decisions about fighting based on the assessment of the
62 relative fighting abilities of their opponents (5, 6) and that specific traits of some
63 species can be related to fighting success. For example, in terms of visual perception,
64 variable black facial patterns in paper wasps are related to both body size and social
65 dominance (7) and red chest colouration in gelada baboons is related to troop status,
66 with leader males having the reddest chests (8). Given appearance imparts
67 information about fighting ability, other individuals can base their decisions on such

68 information allowing them to compete when likely to win and to avoid costly
69 agonistic interactions when likely to lose.

70 In humans, there is cross-cultural evidence that male-male competition is
71 important, at least in some cultures. For example, as noted by Sell et al. (2009),
72 fighting ability is associated with access to resources in the Yanomamo of Venezuela
73 (9), the Achuar of Ecuador (10), and the Tsimane of Bolivia (11). In other cultures,
74 sports involving ritualized combat between men are common and take many forms,
75 such as Sumo in Japan and stick-fighting in the Suri of Ethiopia. These ritualized
76 forms of combat have a long recorded history, including fencing in the 16th century
77 Germany and gladiatorial combat in Ancient Rome. In line with this history of
78 violence, also noted by Sell et al., there are a range of anatomical and physiological
79 sex differences that appear to reflect adaptation to male-male competition in humans,
80 including sex differences in height and physical strength(12, 13).

81 Given evidence for intra-sexual conflict in humans and following theoretical
82 predictions for adaptations to assess fighting ability (3, 4), previous researchers have
83 suggested that humans possess adaptations to infer fighting ability, specifically that
84 fighting ability might be inferred from facial, body, and vocal cues (14, 15). For
85 example, people make relatively accurate inferences about men's physical strength
86 from static facial images (14) and voice recordings (15), and measurements of
87 physical strength are associated with ratings of fighting ability (14). Focusing on
88 human facial cues, masculinity in male faces has been associated with perceived
89 dominance (16) and physical strength is positively related to ratings of facial
90 masculinity (17). Recent studies have also highlighted that face measurements are
91 associated with aggression in men. For example, facial width scaled for face height is
92 correlated with perceived aggression (18), related to self-reported dominance and,

93 relating to real behaviour, aggressive behaviour in sport (19). Further, one study
94 examining forensic data from skeletons has shown that men with narrow faces are
95 more likely to have died from contact violence than their wider faced peers (20).

96 While the accurate assessment of strength and its association with fighting
97 ability (14) and links between facial measurements and aggression (19) are in line
98 with the notion that humans can assess fighting ability from facial cues, they do not
99 provide direct evidence for this notion. One study has, however, examined fighting
100 success based on instances of real fights in mixed martial arts sporting contests.
101 Calculating fighting success as the ratio of wins to losses across a fighter's UFC
102 fighting career, it was found that the perceived aggressiveness of fighters' faces was
103 linked to their success in actual physical confrontations, although perceived fighting
104 ability and differences in facial shape were only associated with fighting success in
105 heavyweight fighters (21). This suggests that perceived aggression may be an
106 underlying cue to fighting success rather than the cognitively complex inferred
107 fighting success. However, calculating fighting success across fights may
108 underestimate human ability to accurately assess fighting outcomes from faces in
109 particular contests. In other words, only one face is relevant when assessing general
110 fighting ability, whereas, in specific contests, individuals can compare the traits of
111 two protagonists. This comparison may enable greater accuracy in judgement and is
112 more akin to decisions made in potential specific conflicts when information from
113 both parties would be available. For example, an individual can compare their own
114 perceived ability to a competitor's ability based on appearance. Additionally, the
115 ability to choose between alternatives in terms of who to ally with or who to
116 manipulate based on fighting ability may prove adaptive.

117 In the current study, we examined individual's abilities to directly assess the
118 outcome of particular fights. While previous results suggest that individuals can
119 assess the fighting ability of particular fighters from their faces based on their overall
120 success across a number of fights (21), here we focused on a more fine-grained
121 analysis in which face images of fighters were presented as pairs such that observers
122 were tasked to judge the difference in perceived traits of the winners and losers of
123 specific fights. We asked observers to judge between the winners and losers of fights
124 for a variety of traits to test ideas relating to intra-sexual and inter-sexual selection.
125 Firstly, we addressed accuracy in judgement by asking observers to choose who they
126 think would win in a fight. Accuracy at this level would indicate that observers are
127 able to assess the relative fighting ability of two fighters to correctly determine the
128 outcome. Secondly, we examined specific cues from faces that may underlie
129 accuracy: perceived masculinity, strength, and aggressiveness. Thirdly, we addressed
130 attractiveness to the opposite-sex because, while perception of fighting ability is often
131 considered the domain of intra-sexual selection, it may also be related to inter-sexual
132 selection. In terms of attractiveness to the opposite-sex, there are benefits that could
133 be associated with preferring better fighters: 1. indirect benefits, genetic benefits that
134 are passed to offspring such as genes associated with health, strength, or strong
135 immune systems, and 2. direct benefits, benefits that are directly passed to mates or
136 offspring such as resources or protection from other males. We then also asked a
137 sample of women who they thought was more attractive out of the pair.

138 **Methods**

139 **Participants acting as observers**

140 There were four different studies in which participants chose between pairs of faces
141 for different traits. There were 44 participants who selected the most likely to win in a

142 fight out of the pair (33 women, 11 men, mean age = 26.8, SD = 9.3), 35 participants
143 who selected the most masculine out of the pair (23 women, 12 men, mean age =
144 25.0, SD = 8.0), 25 participants who selected the strongest out of the pair (19 women,
145 6 men, mean age = 26.6, SD = 8.4), 20 participants who selected the most aggressive
146 out of the pair (11 women, 9 men, mean age = 27.5, SD = 8.9), and 27 women who
147 selected the most attractive out of the pair (mean age = 27.4, SD = 8.9). Participants
148 were selected for being older than 16 and less than 46 years of age. For attractiveness
149 judgements, only women reporting to be heterosexual were selected for analysis.
150 Participants were recruited for the study online via a research-based website and the
151 study was conducted online.

152 **Stimuli**

153 The study population consisted of 285 MMA fighters for which facial photographs
154 and details of their previous fight (opponent and win/loss), as well facial photographs
155 of their opponent, were available from the official Web site of MMA division
156 Ultimate Fighting Championship (UFC; www.ufc.com; database accessed in June
157 2012). Because this represented the total pool of fighters, excepting unselected
158 fighters for which data or photographs were unavailable, it was possible to match the
159 285 fighters with their opponent in their most recent fight. Out of the 285 fighters, 12
160 of the winners and 15 of the losers were represented twice because they fought two of
161 the other 284 fighters in their most recent fight. No fighter was repeated more than
162 twice. These data were included because each fight is a unique pair. The final set of
163 images used were 156 unique pairs representing 156 fights between two different
164 fighters. Using the available database, for each pair, one fighter was classified as the
165 winner and one as the loser.

166 For each pair of fighters, we obtained data on their weight class, which was
167 the same for each fighter. To reduce the number of classifications and increase the
168 sample size of final groupings, we averaged the seven available weight classes into
169 three groupings: lightweight (bantamweight, featherweight, lightweight, N = 68
170 pairs), middleweight (welterweight, middleweight, N = 52 pairs), and heavyweight
171 (lightheavyweight, heavyweight, N = 32 pairs).

172 The stimulus set comprised the official front-on photographs available from
173 www.ufc.com (photographs and fight information were downloaded in June 2012).
174 These photographs appear to have approximately similar lighting and background
175 with individuals posing with an approximately neutral expression. To equate size of
176 the face in the image, all images were aligned to standardize the position of the pupils
177 in the image.

178 **Figure 1 around here**

179 **Procedure**

180 Participants were administered a short questionnaire assessing age, sex, and sexual
181 orientation (only used for women rating attractiveness), followed by a forced-choice
182 face test. There were five different forced-choice face tests for which the stimuli and
183 procedure was identical except that participants in each test were given different
184 instructions on what type of discrimination they were asked to do. Different
185 participants took part in each of the tests.

186 In the forced-choice tests, the 156 pairs of winners and losers of MMA fights
187 as described above were shown with both order and side of presentation randomized.
188 Participants were asked to choose the face from the pair that they found most of a
189 particular trait. Clicking a button below the face selected moved participants on to the

190 next face trial. There was no time limit for responses and both faces remained on
191 screen until participants selected a face.

192 Specific questions for the five tests were:

193 “Which person is more likely to WIN in a physical fight?”

194 “Which person is more MASCULINE?”

195 “Which person is PHYSICALLY STRONGER?”

196 “Which person is more AGGRESSIVE?”

197 “Which person is more ATTRACTIVE?”

198 **Results**

199 **By-observer analysis**

200 For each observer, we calculated the proportion of winner’s faces chosen out
201 of the 156 pairs of faces to provide an overall score reflecting how likely the winner’s
202 faces were chosen for a particular question compared to the loser’s faces. We
203 additionally calculated the proportion of winner’s faces chosen over loser’s faces
204 separately for the three weight categories.

205 Mixed model ANOVAs were carried out with *relative proportion of winner’s*
206 *faces chosen* as the dependent variable, *weight class* (light vs. middle vs. heavy) as a
207 within-participant factor, and *sex of observer* (male vs. female) as a between-
208 participant factor. These were followed-up with one-sample t-tests against chance
209 (50%). Mean proportion of winner’s vs. loser’s faces chosen for each questions plit by
210 weight category can be seen in Figure 2.

211 **Figure 1 around here**

212 **Perceived likelihood to win**

213 A one-sample t-test, ignoring weight class and sex of observer, revealed that,
214 overall, winner's faces were more likely to be chosen as winners than loser's faces (M
215 = .535, SD = .034, $t(43) = 6.77$, $p < .001$).

216 A mixed model ANOVA revealed no significant interaction between *sex of*
217 *observer* and *weight class* ($F_{2,84} = 2.02$, $p = .139$, $\eta_p^2 = .046$), no significant main
218 effect of *sex of observer* ($F_{1,42} = 0.49$, $p = .488$, $\eta_p^2 = .012$), and a close to significant
219 main effect of *weight class* ($F_{2,84} = 2.54$, $p = .085$, $\eta_p^2 = .057$).

220 To examine the impact of weight class, one-sample t-tests, ignoring sex of
221 observer, revealed that winner's faces were more likely to be chosen as winners than
222 loser's faces for heavy (M = .536, SD = .092, $t(43) = 2.59$, $p = .013$), medium (M =
223 .569, SD = .078, $t(43) = 5.84$, $p < .001$), and light (M = .517, SD = .049, $t(43) = 2.33$,
224 $p = .025$) weight categories. The non-significant effect of *weight class* then appears to
225 reflect that observers were most accurate at choosing winners correctly in the middle
226 weight class versus other classes.

227 **Perceived masculinity**

228 A one-sample t-test, ignoring weight class and sex of observer, revealed that,
229 overall, winner's faces were more likely to be chosen as more masculine than loser's
230 faces (M = .532, SD = .039, $t(34) = 4.84$, $p < .001$).

231 A mixed model ANOVA revealed no significant interaction between *sex of*
232 *observer* and *weight class* ($F_{2,66} = 0.31$, $p = .738$, $\eta_p^2 = .009$), no significant main
233 effect of *sex of observer* ($F_{1,33} = 0.23$, $p = .632$, $\eta_p^2 = .007$), and no significant main
234 effect of *weight class* ($F_{2,66} = 1.32$, $p = .273$, $\eta_p^2 = .039$).

235 While not significant, for consistency, one-sample t-tests, ignoring sex of
236 observer, revealed that winner's faces were more likely to be chosen as more
237 masculine than loser's faces for heavy (M = .530, SD = .076, $t(34) = 2.32$, $p = .026$),

238 medium ($M = .556$, $SD = .063$, $t(34) = 5.24$, $p < .001$), and light ($M = .526$, $SD = .063$,
239 $t(34) = 2.40$, $p = .022$) weight classes.

240 **Perceived physical strength**

241 A mixed model ANOVA revealed no significant interaction between *sex of*
242 *observer* and *weight class* ($F_{2,46} = 0.09$, $p = .911$, $\eta_p^2 = .004$), no significant main
243 effect of *sex of observer* ($F_{1,23} = 0.21$, $p = .651$, $\eta_p^2 = .009$), and a significant main
244 effect of *weight class* ($F_{2,46} = 8.39$, $p = .001$, $\eta_p^2 = .267$).

245 To examine the impact of weight class, one-sample t-tests, ignoring sex of
246 observer, revealed that winner's faces were more likely to be chosen as stronger than
247 loser's faces for heavy ($M = .547$, $SD = .083$, $t(24) = 2.82$, $p = .009$), medium ($M =$
248 $.585$, $SD = .047$, $t(24) = 9.08$, $p < .001$), but not light ($M = .498$, $SD = .056$, $t(24) =$
249 0.18 , $p = .858$) weight classes. The significant effect of *weight class* then appears to
250 reflect that observers were most likely to choose winners as stronger in the middle
251 weight class and at chance for the light weight class. A one-sample t-test, ignoring
252 weight class and sex of observer, revealed that, overall, winner's faces were more
253 likely to be chosen as stronger than loser's faces ($M = .534$, $SD = .034$, $t(24) = 4.98$,
254 $p < .001$).

255 **Perceived aggression**

256 A one-sample t-test, ignoring weight class and sex of observer, revealed that,
257 overall, winner's faces were more likely to be chosen as more aggressive than loser's
258 faces ($M = .530$, $SD = .040$, $t(19) = 3.35$, $p = .003$).

259 A mixed model ANOVA revealed no significant interaction between *sex of*
260 *observer* and *weight class* ($F_{2,36} = 1.26$, $p = .295$, $\eta_p^2 = .066$), no significant main
261 effect of *sex of observer* ($F_{1,18} = 0.47$, $p = .502$, $\eta_p^2 = .025$), and a significant main
262 effect of *weight class* ($F_{2,36} = 4.25$, $p = .025$, $\eta_p^2 = .191$).

263 To examine the impact of weight class, one-sample t-tests, ignoring sex of
264 observer, revealed that winner's faces were more likely to be chosen as more
265 aggressive than loser's faces for medium ($M = .572$, $SD = .069$, $t(19) = 4.62$, $p <$
266 $.001$), but not heavy ($M = .531$, $SD = .111$, $t(19) = 1.24$, $p = .230$) or light ($M = .501$,
267 $SD = .046$, $t(19) = 0.07$, $p = .946$) weight classes. The significant effect of *weight*
268 *class* then appears to reflect that observers were most likely to choose winners as
269 aggressive in the middle weight class and at chance for the heavy and light weight
270 class.

271 **Perceived attractiveness**

272 A one-sample t-test, ignoring weight class, revealed that, overall, winner's
273 faces were more likely to be chosen as more attractive than loser's faces ($M = .534$,
274 $SD = .031$, $t(26) = 5.59$, $p < .001$).

275 A repeated measures ANOVA revealed a significant main effect of *weight*
276 *class* ($F_{2,52} = 5.60$, $p = .006$, $\eta_p^2 = .177$).

277 To examine the impact of weight class, one-sample t-tests revealed that
278 winner's faces were more likely to be chosen as more attractive than loser's faces for
279 heavy ($M = .572$, $SD = .088$, $t(26) = 4.35$, $p < .001$), medium ($M = .528$, $SD = .050$,
280 $t(26) = 2.96$, $p = .007$), and light ($M = .518$, $SD = .045$, $t(26) = 2.12$, $p = .044$) weight
281 classes. The significant effect of *weight class* then appears to reflect that observers
282 were most likely to choose winners as more attractive in the heavy weight class and
283 lower for the middle and light weight classes.

284 **By-Face analysis**

285 As an alternative analysis, we also addressed judgements using the pairs of
286 fighter's faces as the unit of analysis. To do this, mean proportion of time the winner's
287 face was chosen over the loser's faces was calculated for each pair of images. This

288 score additionally allowed us to calculate inter-correlations between perceptions and
289 run a regression examining predictors related to the perception of winning vs. losing
290 fights. These effects were confirmatory of the significant effects seen in the by-
291 observer analysis and are presented as 1-tailed.

292 Firstly, to confirm effects seen in the by-observer analysis, we ran one-sample
293 t-tests against chance for each question. These revealed, ignoring weight-class, that
294 winners were seen as more likely to win the fight ($M = .535$, $SD = .193$, $t(155) = 2.26$,
295 $p = .013$), as more masculine ($M = .532$, $SD = .189$, $t(155) = 2.11$, $p = .019$), as
296 physically stronger ($M = .534$, $SD = .242$, $t(155) = 1.76$, $p = .040$), as more aggressive
297 ($M = .530$, $SD = .203$, $t(155) = 1.83$, $p = .035$), and as more attractive by women ($M =$
298 $.536$, $SD = .245$, $t(155) = 1.71$, $p = .045$).

299 Secondly, we ran Pearson product-moment correlations to examine
300 relationships between the different perceptions. Correlations can be seen in Table 1.

301 **Table 1 about here**

302 Finally, we conducted two regression analyses. To examine predictors of
303 perceived winners, we entered perceived masculinity, physical strength, and
304 aggression as predictors of the perception of winning fights in a linear regression.
305 This revealed a significant overall model ($F_{3,152} = 152.30$, $p < .001$, $R^2 = .750$) in
306 which masculinity ($\beta = .194$, $p = .006$), physical strength ($\beta = .513$, $p < .001$),
307 and aggressiveness ($\beta = .266$, $p < .001$) were all significantly positively associated
308 with the perception of winning fights.

309 To examine predictors of women's preferences, we entered perceived
310 masculinity, strength, and aggression as predictors of women's attraction in a linear
311 regression. This revealed a significant overall model ($F_{3,152} = 6.97$, $p < .001$, $R^2 = .121$)
312 in which masculinity was significantly positively ($\beta = .438$, $p = .001$),

313 aggressiveness was significantly negatively (beta = $-.403$, $p < .001$), and physical
314 strength was not significantly (beta = $.080$, $p = .477$) associated with women's
315 attraction.

316 **Discussion**

317 Our data demonstrated that both men and women perceive winners of fights
318 differently from losers. Specifically, using observer as the unit of analysis, winner's
319 faces were more likely to be seen as able to win the fight, be physically stronger, be
320 more aggressive, be more masculine, and be more attractive to women than loser's
321 faces. There was also a tendency for these effects to be different according to weight
322 category. Generally, effects were strongest for the middle weight category and
323 weakest for the light weight category. For attractiveness, however, the effect was
324 strongest for the heavy weight category. In all instances, effects were significant
325 across all weight categories except that winners in the light weight category were not
326 seen as physically stronger than losers and winners in the heavy and light weight
327 categories were not seen as more aggressive than losers.

328 In a by-face analysis, the same directional effects were observed, although the
329 effects were somewhat weaker. Weaker effects here are likely the result of greater
330 variance between faces than between observers in terms of choices. Such a pattern
331 highlights that accuracy in assessing the winners of fights is by no means perfect and
332 that individual cues, such as physical strength or aggression are unlikely to be perfect
333 predictors of fighting success. There are also two aspects of our study that may limit
334 accuracy. Firstly, our stimuli were drawn from sporting competitions in which fighters
335 are selected to fight within weight categories specifically designed to create more
336 even odds. In real fighting situations, where weight, as a proxy for muscle mass or
337 strength, is uneven, we might predict greater success in predicting the outcomes of

338 fights between humans. Secondly, our interest was in static facial cues, which under-
339 represents the actual information available when two individuals fight or are deciding
340 to fight. In real life fights, body size and dynamic cues are available which may
341 increase accuracy. Given the basic nature of static faces, it is all the more interesting
342 that humans can assess the outcome of fighting contests based on faces alone at all.

343 Given the potential importance of male intra-sexual selection in human
344 evolution(9-12), our data are in line with the notion that humans possess
345 perceptual/cognitive adaptations to assess the risks involved fighting by assessing
346 fighting ability in other humans, as expected in a species that engages in such
347 behaviour(3, 4). While previous researchers have suggested that humans possess
348 adaptations to detect fighting ability(14, 15) based on perceptions of strength, here we
349 show direct evidence that humans can predict the actual outcome of specific fights
350 based on facial information, in line with a previous demonstration that the perceived
351 aggressiveness of fighters' faces was linked to their career fighting success (21).
352 While humans do not necessarily have specific evolved weaponry or ornaments that
353 advertise their fighting abilities, as in other animals (1), humans may display cues to
354 their fighting abilities and possess adaptations to help guide their choice to fight
355 specific individuals (3, 4).

356 In terms of specific cues to fighting success, winner's faces were generally
357 seen as more masculine, stronger, and more aggressive than loser's faces. One
358 potential cue to fighting ability is facial masculinity as facial masculinity is positively
359 related to perceived dominance (16) and real physical strength(17). Facial masculinity
360 is also related to testosterone levels, although the relationship may be somewhat more
361 complex than a simple linear relationship (22). Judgements of perceived physical
362 strength from faces have been previously highlighted as a proxy for judgements of

363 fighting ability (14)with perceived strength relating to actual measured strength (14).
364 There are also links between facial measurements and aggression (19) and one
365 previous study has shown that fighter with more aggressive appearing faces are more
366 likely to have higher success in their fights over the careers (21). Given these traits are
367 potentially interlinked, they could all relate to fighting success via the same
368 mechanism. For example, underlying levels of testosterone could underpin facial cues
369 to masculinity, strength and aggression. However, at the perceptual level at least, each
370 factor was an independent and significant predictor of perceived fighting success,
371 suggesting that these traits may be associated with fighting success for different
372 reasons. For example, strength may be seen as a good predictor of who wins fights
373 because it is linked directly to the outcome of competition, but in more evenly
374 matched fights, cues to behavioural aggression may also be used to predict winners
375 independent of strength (see also 21).

376 From the by-face analysis, we were also able to examine associations between
377 traits that led specific faces to be seen as likely to win fights or be more attractive to
378 women. As noted above, in predicting faces chosen as winners in fights, masculinity,
379 strength, and aggressiveness were all positively and independently related to faces
380 being selected as likely to win. While each may have a significant contribution to
381 perceived fighting success, it is also worth noting this does not preclude a shared
382 underlying component as outlined above. In fact there may be shared and unshared
383 factors relating to fighting success for each of these three factors.

384 In predicting women's preferences, masculinity was positively related,
385 aggressiveness negatively related, while strength was unrelated to faces being selected
386 as attractive to women. This is suggestive that while women found the winners faces
387 as more attractive than losers, this was directly accountable to perceived strength and

388 may reflect attraction to masculinity instead. This further highlights that these traits,
389 while having similar effects on perceived intra-sexual competition abilities (winning
390 fights), have quite different effects in term of inter-sexual selection (their
391 attractiveness to women). Indeed, the benefits of avoiding aggressive male partners
392 are clear despite the fact that such males may be successful in intra-sexual
393 competition. Previous studies have shown that women moderate their preferences for
394 masculine facial cues according to their recent experience of visual environmental
395 cues of direct male-male competition and violence. In these studies, women preferred
396 more masculine male faces after exposure to cues of direct male-male competition
397 and violence (23) which is consistent with idea that women here preferred the faces of
398 men who were most likely to be successful in male-male competition. Perhaps such
399 preferences reflect that ideal men should be able to compete successfully but not
400 actively seek out conflict (potentially indicated by high perceived aggression). In this
401 way women may select men who can defend themselves, their partner, and their
402 offspring from other men but who do not continually seek conflict. In such
403 preferences it is difficult to tease apart the role of indirect from direct benefits. This is
404 because preferences for successful competition can relate to both. For example,
405 preferring men who are likely to win in fights can lead to the direct benefits in terms
406 of resources as such men may most successfully defend or acquire resources.
407 However, the preference can lead to potential indirect benefits by passing genes for
408 such successful on to male offspring, if these factors are heritable. This reasoning also
409 suggests that if women prefer traits in men that are associated with the ability to
410 provide direct benefits then the ability to provide direct benefits and associated
411 attractive traits may be passed to her offspring providing indirect benefits (24). It is

412 then likely that both direct and indirect benefits from men play a role in generating in
413 preferences for the faces of men likely to win fights.

414 In summary, we found that individuals performed at rates above chance in
415 correctly selecting the winner as more likely to win the fight than the loser. We also
416 found that winners were seen to be more masculine and stronger than losers. Finally,
417 women saw the winners as more attractive than the losers. The effect sizes for each of
418 these relationships were generally small but could have potentially important
419 evolutionary consequences. Together these findings demonstrate that 1. humans can
420 correctly predict the outcome of specific fighting contests, 2. that perceived
421 masculinity/strength/aggressiveness are all putative cues to fighting ability available
422 from faces, and 3. that facial cues associated with successful male-male competition
423 are attractive to women.

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425

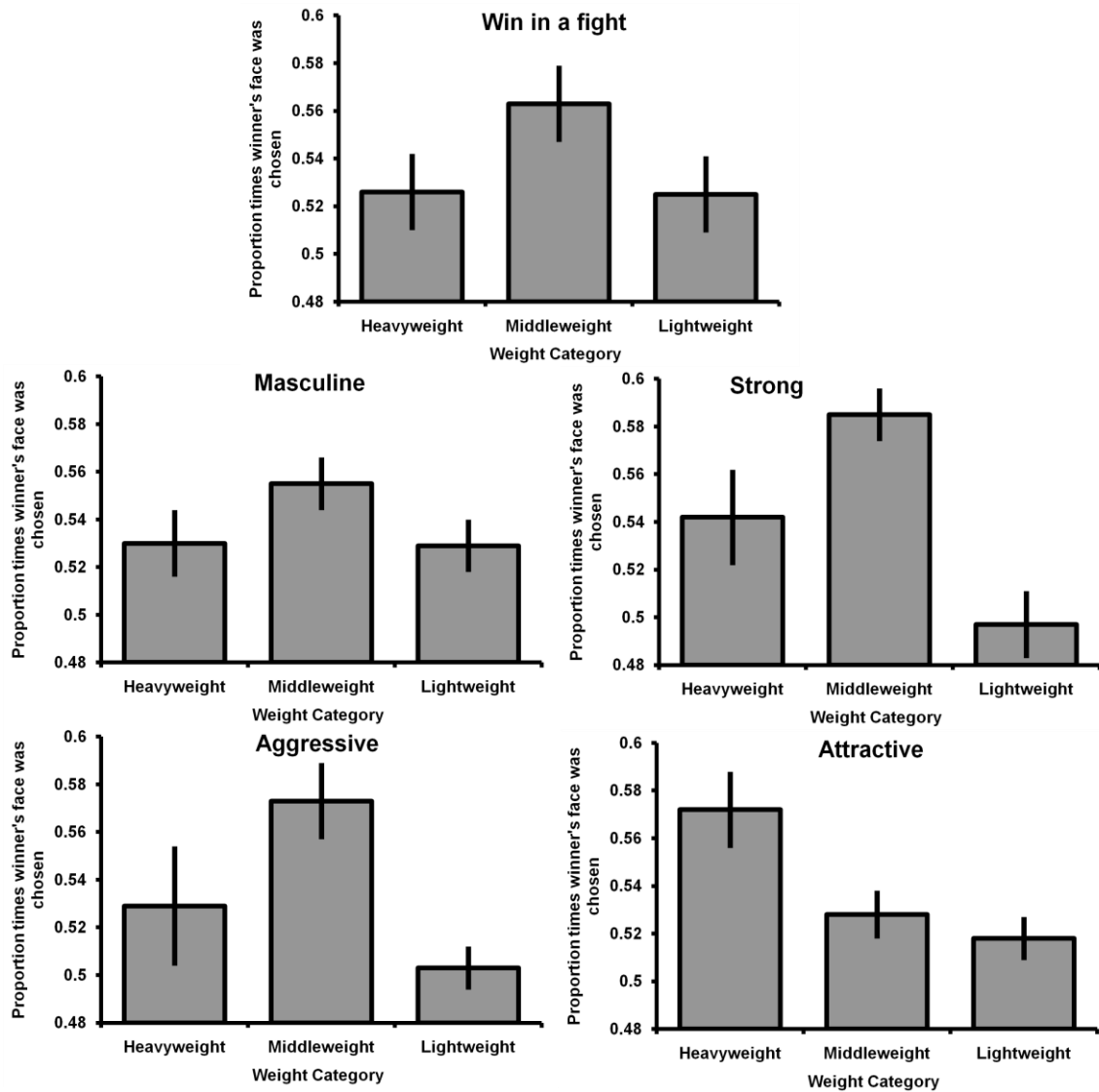
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486 **Figure 1: Proportion of winner's faces chosen over loser's faces (+/- 1SE of**
 487 **mean) split by weight category for each question: More likely to win in a fight,**
 488 **more masculine, stronger, more aggressive, and more attractive.**
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493 **Table 1: Inter-correlations among perceived traits based on the choice of a face**
 494 **out of a pair for each question.**

	Masculine	Strong	Aggressive	Attractive
Win fight	.760**	.810**	.705**	.166*
Masculine		.732**	.717**	.208**
Strong			.584**	.166*
Aggressive				-.042

495 **significant at $p < 0.01$, *significant at $p < 0.05$.

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