

Facial Attractiveness as a Function of Athletic Prowess

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Abstract

We investigate the relationship between facial attractiveness and athletic prowess. We study the connection between subjective facial attractiveness (measured on a 5-point scale of judged facial attractiveness) and athletes by gender and age of respondents. Five age classes were investigated in Studies 1–5: preadolescents (average age: 8.85 years; $n = 92$), adolescents (average age: 15.8 years; $n = 82$), young adults (average age: 21.6 years; $n = 181$), middle-aged adults (average age: 47.5 years; $n = 189$), and older adults (65 years old; $n = 183$). The findings show that world-class athletes are perceived as more facially attractive than amateur athletes, with women athletes perceived as more facially attractive than men, and these findings generally occur to a greater extent for female than male respondents. These findings hold for preadolescents, adolescents, young adults, and older adults. However, results were mixed for middle-aged adults where generally amateur athletes were evaluated more attractive than world-class and men athletes more attractive than women.

Keywords

facial attractiveness, athletic prowess, age and gender differences

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There must . . . be in our very nature a very radical and wide-spread tendency to observe beauty, and to value it. No account of the principles of the mind can be at all adequate that passes over so conspicuous a faculty.

Santayana (quoted in Etcoff, 1999, p. 2)

There is growing evidence that people possess the ability to infer traits of persons such as trust and competence merely by seeing “thin slices” of information such as cues of facial expressions (Sell et al., 2009; Todorov, Gobbini, Evans, & Haxby, 2007). Due to evolutionary pressures, the human brain has developed specialized modules (or neural networks) that immediately detect or direct attention to facial attractiveness (subjective beauty; Miller & Todd, 1998; Thornhill & Gangestad, 1999). Although a matter of debate, people in general, no matter their gender or age, tend to agree on whether one female or male person is more facially attractive than another (Langlois, Ritter, Roggman, & Vaughn, 2000; Rhodes, 2006; Thornhill & Gangestad, 1999; for exceptions, see, e.g., Nedelec & Beaver, 2011). Starting from studies by Gangestad and Buss (1993) and Schakelford and Larsen (1999), facial attractiveness is

useful because it signals in both males and females the trait of biological quality Buss (1989).

There are direct and indirect benefits for an individual to detect facial attractiveness in others. First, facial attractiveness indicates good health or strength which works to protect the appraiser; for example, it insulates the appraiser from diseases that the appraised person might carry or ensures that investments made in the appraised person are reciprocated, thus helping to check for trust (e.g., Little, Paukner, Woodward, &

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Suomi, 2012). These direct effects resonate with the claims made by economists who claim that facially attractive people have significant advantages in the work force and in society (e.g., Hamermesh, 2011). Second, indirectly the ability to detect facial attractiveness helps people; for example, in their long-term choices of mates, thus ensuring healthy offspring (Little et al., 2012; Miller & Todd, 1998). In this second supposition, facial attractiveness communicates “good” genes, and people implicitly in a rational sense prefer a facially attractive mate because the traits they convey are inheritable (Hönekopp, Bartholomé, & Jansen, 2004; Kanazawa, 2011; Little et al., 2012; Maestripieri, Klimczuk, Traficante, & Wilson, 2014). Note the distinction between direct benefits and indirect effects: The first indicates appraisals and possibly social attraction without sexual connotations, whereas the second indicates appraisals, preferences, and sexual attraction. In our study, both direct and indirect benefits play a role, albeit a limited one, as we asked participants only to appraise the facial attractiveness of other persons. We did not ask, for example, whether or not they would want an appraised person as a friend or mate.

A growing literature finds an inconsistent or weak link between facial attractiveness and biological quality (e.g., Hönekopp, Rudolph, Beier, Liebert, & Müller, 2007; Kalick, Zebrowitz, Langlois, & Johnson, 1998; Rhodes, 2006; Scott, Clark, Boothroyd, & Penton-Voak, 2013). Facial attractiveness is supposedly in “the eye of the beholder,” or rather, the hormones: An appraiser’s preferences for facial attractiveness and ability to detect cues are affected by levels of estrogen and testosterone. For instance, the 2D:4D digit ratio (index finger length divided by ring finger length) in females, indicating testosterone exposure in utero, matters when females appraise masculinity in male faces (Johnston, 2006). Around ovulation, females are more prone to focus on, and be attracted to, masculine faces (Penton-Voak et al., 1999).

Some researchers doubt whether facial attractiveness indicates biological quality and suggests instead that facial attractiveness functions like the Fisherian runaway model of sexual selection, provoking attraction (“good taste”) without true indirect benefit for the appraiser (“good genes”; e.g., Kalick et al., 1998). Others suggest that evolution has prepared people to appraise facial attractiveness (or beauty) and, in general, people prefer symmetry in both objects and faces, no matter the age of the appraiser (e.g., Langlois et al., 1991; Rhodes, 2006). Another stream of literature suggests that physical attractiveness is too narrowly defined and should be studied using different conceptual dimensions such as beautiful, sexy, feminine, or competent (e.g., Graham, Harvey, & Puri, 2016). Probably, the most important criticism of facial attractiveness as a signal for good genes is that biological quality is too broad a concept with a host of different meanings implied, including health, intelligence, fertility, immunocompetence, parental care, or good genes (e.g., Kanazawa, 2011; Miller & Todd, 1998). Better focused research strategies are therefore needed to study the relationship between facial attractiveness and biological quality (see, e.g., Fink, Neave & Seydal, 2007; Hönekopp et al., 2007, 2004; Kalick et al., 1998; Thornhill & Gangestad, 1999).

Various researchers note that the relationship between facial attractiveness and health should be studied in settings where biological quality matters. For instance, facial attractiveness and biological quality are more important in environments at high risk of parasitism (Thornhill & Gangestad, 1993) or intensely competitive sporting contexts (Rhodes, 2006, p. 213). Hence, it is no surprise that several studies have investigated facial attractiveness and biological quality in athletic settings. Biological quality in these studies is conceived as athletic strength, which is easily measured by rankings in the sport. For example, Postma (2014) used bike rider’s performance in one race in the Tour de France, as it indicates endurance “thought to have been the target of selection in early hominids,” to show that both males and females (the latter moderated by the menstrual hormone cycle and whether they were on the pill) found highly ranked riders more facially attractive. Females independent of age or ethnicity found the better quarterbacks in the American National Football League (NFL) more facially attractive (male subjects were not included in this study; Williams, Park, & Wieling, 2010). Note that in these studies the focus was not on mate choice or preference but merely on detecting facial attractiveness. Our article builds further on this line of research and focuses on the relationship between facial attractiveness and athletic prowess.

Different aspects of studies to date relating facial attractiveness to athletic prowess have been noted in the literature: First, most studies use one specific sport as the gold standard of general endurance (Tour de France by Postma, 2014, and American NFL by Williams, Park, and Wieling, 2010), but both sports are team sports where teammates facilitate the ranking of the players. Hence, the ranking of athletes might not be a good indicator of general endurance (e.g., Smoliga & Zararsky, 2015, 2016). Second, there has been no scrutiny of cross-gender appraisals; for example, men and women evaluating both male/female athletes (cf. Postma, 2014, where both genders appraised the facial attractiveness of males alone, or Williams et al., 2014, who only studied how females appraise American NFL male quarterbacks’ facial attractiveness). Third, no control for the appraisers’ age has been investigated. Some argue that young children can appraise facial attractiveness (Langlois et al., 1991), while others suggest that, from puberty on, differences might exist in reactions to specific facial cues (Johnson, 2006). Fourth, the selection of the athletes by Postma (2014) has shortcomings; for example, by excluding some top athletes and those who stopped the race (Smoliga & Zararsky, 2016). Fifth, focusing on a select group of athletes, without comparing with the population average or average sports level, does not provide information about how facial attractiveness relates to athletic prowess (Smoliga & Zararsky, 2015, 2016). Sixth, the rankings of athletes in past studies might be due to using better sports-specific training methods (Smoliga & Zararsky, 2016) and due to better coaching; for example, players high on facial attractiveness might attract better coaches which in turn affects performance (e.g., Bakkenbüll & Kiefer, 2015).

We seek to address these gaps in the literature on how athletic prowess affects appraisals of facial attractiveness. We create larger differences in athletic prowess by comparing professional players near the top of the world rankings (i.e., world-class athletes) to nonprofessional (amateur) players. In addition, we chose athletes from two sports to test the generalizability of our hypotheses. That is, we investigate athletes from a team sport, basketball, and athletes from an individual sport, tennis singles. In order to be successful in both sports, however, a great amount of endurance performance is required from the athletes yet also entails other skills like social skills.

We have four broad objectives. First, we investigate whether male and female respondents will subjectively appraise world-class athletes higher on facial attractiveness than amateur athletes of both genders. Postma (2014) showed that both females and males appraise top versus lower ranked athletes (professional bicycle riders) higher on facial attractiveness. Yet females are known to use social context as cues for deciding what makes a male facially attractive, such as learning from friends (Buss, 1989; Nordell & Valone, 1998). Similarly, as females and males engage in intrasex competition and often infer or guess what the opposite gender prefers, they likely appraise world-class athletes as higher on facial attractiveness than amateur athletes (Rhodes, 2006).

Second, we study whether age plays a role in detecting facial attractiveness, using five groups containing both genders (in roughly 50/50 proportions): Preadolescents (aged 6–11), adolescents (aged 14–18), young adults (aged 18–32) whose sensitivity to facial cues may be especially affected by hormonal changes (e.g., by the estrogen/testosterone ratio), middle-aged adults (aged 31–64), and older adults (aged 65).

People are believed to have well-developed neural networks for appraising facial attractiveness (e.g., Langlois et al., 1991; McKone, Crookes, Jeffery, & Dilks, 2012), so we expect them to be able to appraise world-class athletes as higher on facial attractiveness than amateur athletes because the former are likely to have better facial symmetry no matter the gender, compared to the latter (see also Saxton, Caryl, & Craig Roberts, 2006). In fact, Rhodes (2006) argues that the symmetrical aspect of facial attractiveness appraisal (e.g., degree of symmetry about a vertical axis of the face) indicates an evolutionary-based neural network that ranks people higher on facial attractiveness. We invited participants to merely appraise facial attractiveness (which by itself does not necessarily activate the reward system; Senior, 2003). Finally, we investigated whether middle-aged and older adults rate world-class athletes as having greater beauty than amateur athletes. Consistent with observed facial attractiveness appraisals across all age groups, we expect the ability to detect facial attractiveness in athletic competitors' remains intact later in life (Maestripieri et al., 2014; Langlois et al., 2000).

Our third objective is to explore whether women athletes are perceived to be more facially attractive than men (Kanazawa, 2007), an observation which was based on implications from the generalized Trivers–Willard hypothesis. Finally, our fourth

goal is to discover whether females detect facial attractiveness in athletes more than males (Cela-Conde et al., 2009).

Method

Stimuli

For basketball and tennis, we selected 20 professional athletes (five males and five females in each sport) with worldwide rankings, hence the term, “world-class.” Professional male basketball players were chosen from their salary-based ranking, as found on the ESPN website (<http://espn.go.com/nba/salaries>). To reduce the possibility that respondents might recognize and be familiar with chosen athletes, we scrutinized names for those ranked, beginning with the person ranked at 101 or lower. For each person, we used Google Image to generate photographs. We continued the search until we had five usable photos. The chosen players earned approximately US\$5–6 million per year and were of course accomplished athletes. Familiarity effects, if any, should be very low too because stimuli were either photos of U.S. athletes/amateurs or lesser professional-ranked athletes, but respondents were Dutch residing in the Netherlands.

Five female basketball players were chosen from the gold medal winning team shown on the website (<http://goldmedal-greats.com/athlete-endorsement/hire-team-usa-women-basketball-stars/>) and from a presentation on the website of the U.S. Women's National Basketball association (<http://www.ranker.com/list/best-current-wnba-players/ranker-sports>). As recognition of women basketball players is unlikely given the much lesser popularity of women's basketball and commercial broadcasting of games compared to men's, we selected athletes more or less at random.

Professional male tennis players were chosen from those ranked on the website of the Association of Tennis Professionals (<http://m.atpworldtour.com/Rankings/Singles.aspx>). We again began with the player ranked 101st to lessen the chance of familiarity and used Google Image to generate photos until we arrived at five players.

Professional female tennis players were chosen from the players ranked on the website of the Women's Tennis Association (<http://www.wtatennis.com/singles-rankings>). Again, we began with the player ranked 101st and used Google Image to generate photos until we obtained five players.

To select five male and five female nonprofessional (i.e., amateur) athletes for basketball and for tennis (total $n = 20$), we used Google to search for photos. The goal was to obtain athletes from local or recreational teams in the United States. Search terms included such descriptors as “local basketball team,” “local tennis team,” and “recreation tennis.” Photos of all 40 stimuli are available on request.

Subjective Measurement of Facial Attractiveness

A 5-point scale was used to measure subjective ratings of facial attractiveness of the 40 photos, where 1 = *far below average on*

Table 1. Means and Standard Deviations of Ages of Respondents by Sex With Ranges.

Study	Males		Female		Total Sample		Age Range (Inclusive)
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	
Preadolescents ($n = 92$)	8.77	1.33	8.97	1.32	8.85	1.32	6–11
Adolescents ($n = 82$)	15.63	0.77	15.95	0.87	15.79	0.83	14–18
Young adults ($n = 181$)	21.84	2.53	21.44	2.70	21.60	2.63	18–32
Middle-aged adults ($n = 189$)	48.06	8.47	46.76	8.96	47.45	8.71	31–64
Older adults ($n = 92$)	65.00	0.00	65.00	0.00	65.00	0.00	65
Mirror image sample ($n = 87$)	21.46	1.34	21.56	2.31	21.52	1.97	18–31

beauty (*homely*), 2 = *below average (quite plain)*, 3 = *average*, 4 = *above average (good looking)*, and 5 = *far above average (strikingly, beautiful, or handsome)*. This scale was drawn from Hamermesh and Biddle (1993). Hard copies of questionnaires were used for each sample, except as noted below for the sample of older adults.

Data Analysis

A mixed design was employed where world-class/amateur and women/men athletes were the random effects factors, and gender of respondent was the between-groups variable in the analyses of variance (ANOVAs), and again each respondent rated each of the 40 athletes. In all our analyses, across the age groups, the three-way interactions were nonsignificant. Therefore, we focus on the two-way interactions between gender of respondent and either world-class/amateur or women/men athletes and their interpretation. Bonferroni corrections are used in each case. Full findings and the data are available on request from the authors.

Respondents

Permission to conduct the study was obtained from the Erasmus University Internal Review Board—Section Experiments (<http://www.irim.eur.nl/research-support/irim-internal-review-board-section-experiment/>). Respondents responded anonymously and could refuse to participate. They were thanked for their participation upon completion for participation, except for the sample of young adults where participation was part of class requirements.

The six samples can be described as follows (see Table 1): The sample of preadolescents was obtained from an elementary school and recruited face-to-face via questionnaire after receiving permission from school administrators. A total of 92 children (52% males, 48% female) evaluated 10 photos of men and 10 photos of women athletes each for basketball and tennis performers. The average age was $M = 8.85$, $SD = 1.31$, and the range in ages was from 6 to 11 inclusive.

The sample of adolescents ($n = 82$, 50% boys, 50% girls) was obtained from a high school, after receiving permission from the school administrators. The average age was $M = 15.8$, $SD = 0.83$, and the range in ages was from 14 to 18 inclusive.

Recruiters secured the permission of school administrators and handed questionnaires to respondents.

The sample of young adults consisted of 181 Dutch university students who were enrolled in either economics or business studies courses and in either undergraduate or master's programs. The sample can be characterized as follows: 59% were males, 41% female; the average age was 21.6 years ($SD = 2.63$), age range from 18 to 32 inclusive. The gender difference is reflective of actual enrolment percentage in such programs.

The sample of middle-aged adults ($n = 189$) consisted of 47% males and 53% females. The average age was 47.5 years ($SD = 8.71$), and the age range was from 31 to 64 inclusive. Recruiters approached respondents in public shopping or mass transit areas.

For the sample of older adults, we received permission to conduct our study on a panel of older people conducted by a marketing research firm. The questionnaire was administered via the Internet. In total, 183 older people aged 65 years participated, approximately 50% male and 50% female.

We investigated whether right-hand head tilt, if any, would bias attractiveness ratings in a new sample. Mirror images of all stimulus photos were taken to produce a left-hand tilt. Respondents were again either economics or business students. The average age was 21.5 years ($SD = 1.97$), and for the 87 respondents, 40.2% were females, 69.8% males.

Results

Study 1: Subjective Facial Attractiveness Evaluation by Preadolescents

Table 2 presents the means and standard deviations for each respondent age-group for each random effects condition (i.e., world-class/amateur and woman/man athlete) and by gender of respondent. Table 3 summarizes the ANOVA results.

For basketball performers, Figure 1a displays the interaction between world-class/amateur athletes and gender of respondents, which was significant: $F(1, 90) = 6.16$, $p = .015$, $\eta^2 = .04$. It can be seen that world-class athletes are perceived as more facially attractive than amateur athletes, and this difference is greater for female than male preadolescent respondents ($p < .001$).

Table 2. Means and Standard Deviations for Each Condition.

Sport/condition	Preadolescents (n = 92)		Adolescents (n = 82)		Young Adults (n = 181)		Middle-Aged Adults (n = 189)		Older Aged Adults (n = 92)	
Basketball										
World-class/amateur by gender of respondent										
	Wf	Wm	Wf	Wm	Wf	Wm	Wf	Wm	Wf	Wm
	M = 2.74	M = 2.48	M = 2.63	M = 2.86	M = 2.77	M = 2.77	M = 2.84	M = 2.73	M = 2.88	M = 2.91
	SD = 0.66	SD = 0.67	SD = 0.54	SD = 0.64	SD = 0.46	SD = 0.46	SD = 0.49	SD = 0.36	SD = 0.46	SD = 0.57
	Af	Am	Af	Am	Af	Am	Af	Am	Af	Am
	M = 2.21	M = 2.16	M = 2.44	M = 2.56	M = 2.64	M = 2.57	M = 2.84	M = 2.91	M = 2.80	M = 2.91
	SD = 0.57	SD = 0.63	SD = 0.57	SD = 0.52	SD = 0.47	SD = 0.48	SD = 0.41	SD = 0.34	SD = 0.43	SD = 0.41
	Ff	Fm	Ff	Fm	Ff	Fm	Ff	Fm	Ff	Fm
	M = 2.89	M = 2.46	M = 2.80	M = 2.79	M = 2.94	M = 2.76	M = 2.70	M = 2.71	M = 3.00	M = 3.13
	SD = 0.67	SD = 0.75	SD = 0.64	SD = 0.49	SD = 0.47	SD = 0.46	SD = 0.53	SD = 0.44	SD = 2.42	SD = 0.53
	Mf	Mm	Mf	Mm	Mf	Mm	Mf	Mm	Mf	Mm
	M = 2.06	M = 2.18	M = 2.27	M = 2.62	M = 2.46	M = 2.58	M = 2.98	M = 2.93	M = 2.69	M = 2.72
	SD = 0.54	SD = 0.66	SD = 0.52	SD = 0.73	SD = 0.47	SD = 0.54	SD = 0.39	SD = 0.33	SD = 0.50	SD = 0.50
	FW	FA	FW	FA	FW	FA	FW	FA	FW	FA
	M = 2.94	M = 2.40	M = 3.00	M = 2.60	M = 2.96	M = 2.71	M = 2.81	M = 2.59	M = 3.10	M = 3.02
	SD = 0.84	SD = 0.74	SD = 0.61	SD = 0.59	SD = 0.52	SD = 0.52	SD = 0.61	SD = 0.51	SD = 0.56	SD = 0.52
	MWV	MA	MWV	MA	MW	MA	MW	MA	MW	MA
	M = 2.27	M = 1.98	M = 2.50	M = 2.40	M = 2.58	M = 2.49	M = 2.76	M = 3.16	M = 2.70	M = 2.70
	SD = 0.71	SD = 0.63	SD = 0.74	SD = 0.64	SD = 0.57	SD = 0.55	SD = 0.44	SD = 0.43	SD = 0.62	SD = 0.54
Tennis										
World-class/amateur by gender of respondent										
	Wf	Wm	Wf	Wm	Wf	Wm	Wf	Wm	Wf	Wm
	M = 2.97	M = 2.76	M = 2.77	M = 2.94	M = 2.99	M = 3.12	M = 2.86	M = 2.78	M = 3.35	M = 3.14
	SD = 0.60	SD = 0.71	SD = 0.51	SD = 0.50	SD = 0.45	SD = 0.43	SD = 0.41	SD = 0.37	SD = 0.44	SD = 0.44
	Af	Am	Af	Am	Af	Am	Af	Am	Af	Am
	M = 2.60	M = 2.45	M = 2.47	M = 2.50	M = 2.70	M = 2.70	M = 3.03	M = 2.85	M = 2.92	M = 3.12
	SD = 0.68	SD = 0.67	SD = 0.48	SD = 0.46	SD = 0.42	SD = 0.41	SD = 0.39	SD = 0.35	SD = 0.46	SD = 0.53
	Ff	Fm	Ff	Fm	Ff	Fm	Ff	Fm	Ff	Fm
	M = 3.17	M = 2.74	M = 2.85	M = 2.94	M = 3.06	M = 3.11	M = 3.14	M = 3.05	M = 3.23	M = 3.63
	SD = 0.71	SD = 0.75	SD = 0.60	SD = 0.39	SD = 0.41	SD = 0.39	SD = 0.47	SD = 0.40	SD = 0.47	SD = 0.60
	Mf	Mm	Mf	Mm	Mf	Mm	Mf	Mm	Mf	Mm
	M = 2.39	M = 2.46	M = 2.34	M = 2.50	M = 2.63	M = 2.72	M = 2.74	M = 2.58	M = 3.04	M = 2.90
	SD = 0.65	SD = 0.78	SD = 0.45	SD = 0.64	SD = 0.48	SD = 0.51	SD = 0.41	SD = 0.37	SD = 0.46	SD = 0.58
	FW	FA	FW	FA	FW	FA	FW	FA	FW	FA
	M = 3.31	M = 2.58	M = 3.35	M = 2.44	M = 3.46	M = 2.72	M = 2.95	M = 3.25	M = 3.71	M = 3.15
	SD = 0.86	SD = 0.78	SD = 0.57	SD = 0.54	SD = 0.49	SD = 0.45	SD = 0.47	SD = 0.67	SD = 0.58	SD = 0.65
	MWV	MA	MWV	MA	MW	MA	MW	MA	MW	MA
	M = 2.41	M = 2.45	M = 2.36	M = 2.49	M = 2.68	M = 2.69	M = 2.69	M = 2.64	M = 3.05	M = 2.89
	SD = 0.72	SD = 0.79	SD = 0.61	SD = 0.56	SD = 0.57	SD = 0.53	SD = 0.44	SD = 0.43	SD = 0.57	SD = 0.59

Note. W = world-class; A = amateur; F = women target; M = male target; f = female respondent; m = male respondent.

Table 3. Summary of Mixed Design Results: Random Effects Are for World-Class/Amateur and Women/Men Athletes: Between-Subject Effects Are Gender of Responder.

Sport/condition	Preadolescents (n = 92)	Adolescents (n = 82)	Young Adults (n = 181)	Middle-Aged Adults (n = 189)	Older Aged Adults (n = 92)
Basketball					
World-class/amateur by gender of respondent	$F(1, 90) = 6.16, p < .001, \eta^2 = .055$ Test of conditional effects: $p < .001$	$F(1, 80) = 2.57, p < .11, \eta^2 = .03$ Main effects: both genders rate world-class higher than amateur: $p < .001$	$F(1, 179) = 1.707.89, p < .193, \eta^2 = .01$ Test of conditional effects: $p < .001$	$F(1, 185) = 10.86, p < .001, \eta^2 = .055$ Test of conditional effects: $p < .001$	$F(1, 181) = 1.42, p < .235, \eta^2 = .008$ Test of conditional effects: $p < .001$
Women/men by gender of respondent	$F(1, 90) = 18.21, p < .001, \eta^2 = .17$ Test of conditional effects: $p < .001$	$F(1, 80) = 9.99, p < .002, \eta^2 = .11$ Test of conditional effects: $p < .001$	$F(1, 179) = 19.89, p < .001, \eta^2 = .10$ Test of conditional effects: $p < .001$	$F(1, 185) = 0.83, p < .364, \eta^2 = .004$ Test of conditional effects: $p < .001$	$F(1, 181) = 2.48, p < .117, \eta^2 = .014$ Test of conditional effects: $p < .001$
Women/men by world-class amateur	$F(1, 90) = 11.31, p < .001, \eta^2 = .11$ Main effects: both genders rate world-class higher than amateur: $p < .001$	$F(1, 80) = 25.65, p < .001, \eta^2 = .25$ Test of conditional effects: $p < .001$	$F(1, 180) = 9.33, p < .003, \eta^2 = .049$ Test of conditional effects: $p < .004$	$F(1, 186) = 153.03, p < .001, \eta^2 = .45$ Test of conditional effects: $p < .001$	$F(1, 182) = 2.93, p < .088, \eta^2 = .016$ Test of conditional effects: $p < .001$
Tennis					
World-class/amateur by gender of respondent	$F(1, 90) = 0.53, p < .47, \eta^2 = .01$ Main effects: both genders rate world-class higher than amateur: $p < .001$	$F(1, 80) = 2.01, p < .16, \eta^2 = .024$ Main effects: both genders rate world-class higher than amateur: $p < .001$	$F(1, 179) = 6.41, p < .012, \eta^2 = .035$ Test of conditional effects: $p < .001$	$F(1, 185) = 6.16, p < .02, \eta^2 = .029$ Test of conditional effects: $p < .001$	$F(1, 181) = 6.37, p < .012, \eta^2 = .034$ Test of conditional effects: $p < .001$
Women/men by gender of respondent	$F(1, 90) = 11.19, p < .001, \eta^2 = .11$ Test of conditional effects: $p < .001$	$F(1, 80) = 0.19, p < .663, \eta^2 = .002$ Test of conditional effects: $p < .001$	$F(1, 179) = 0.51, p < .474, \eta^2 = .003$ Test of conditional effects: $p < .001$	$F(1, 185) = 1.93, p < .17, \eta^2 = .010$ Test of conditional effects: $p < .001$	$F(1, 181) = 66.90, p < .001, \eta^2 = .27$ Test of conditional effects: $p < .001$
Women/men by world-class amateur	$F(1, 91) = 132.7, p < .001, \eta^2 = .59$ Test of conditional effects: $p < .001$	$F(1, 80) = 230.4, p < .001, \eta^2 = .742$ Test of conditional effects: $p < .001$	$F(1, 1809) = 246.815, p < .001, \eta^2 = .578$ Test of conditional effects: $p < .001$	$F(1, 185) = 56.93, p < .001, \eta^2 = .35$ Test of conditional effects: $p < .001$	$F(1, 182) = 67.15, p < .001, \eta^2 = .27$ Test of conditional effects: $p < .001$

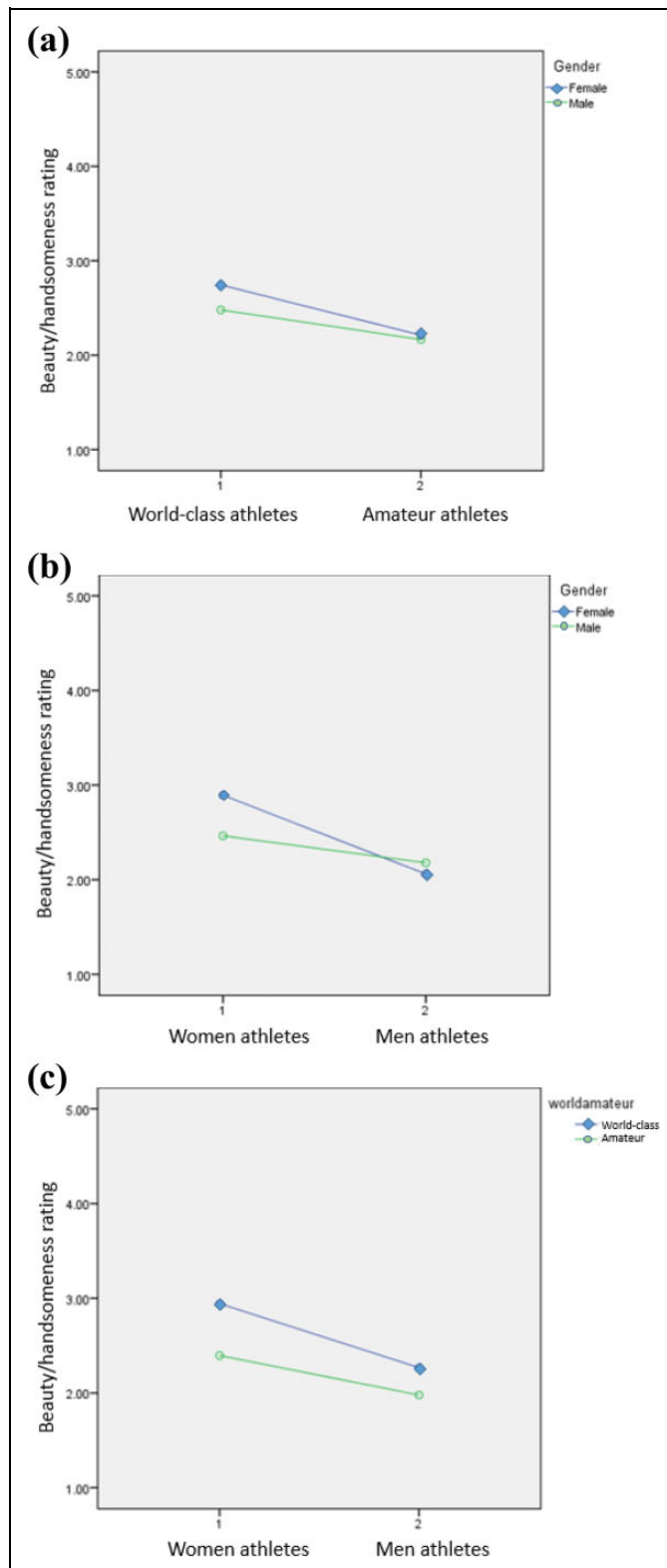


Figure 1. Study 1: Interaction plots for basketball (preadolescents). (a) World-class/amateur by gender of respondents, (b) women/men athletes by gender of respondents, and (c) world-class/amateur athletes by women/men athletes.

Figure 1b shows the interaction between women/men basketball athletes and gender, which was significant: $F(1, 90) = 18.21, p < .001, \eta^2 = .168$. It can be seen that women basketball athletes are perceived as more facially attractive than men athletes, and again this difference is greater for female than male respondents ($p < .001$).

Figure 1c presents the interaction between women/men athletes and world-class/amateur basketball athletes, which was significant: $F(1, 90) = 11.31, p < .001, \eta^2 = .112$. It can be seen that women basketball athletes are perceived as more facially attractive than men athletes, and this difference is greater for world-class versus amateur athletes ($p = .05$).

For tennis performers, Figure 2a displays the interaction between world-class/amateur athletes and gender, which was not significant: $F(1, 90) = 0.53, p = .467, \eta^2 = .006$. Both female and male respondents rate world-class athletes higher than amateur athletes, based on main effects ($p < .001$).

Figure 2b shows the interactions between women/men athletes and gender, which was significant: $F(1, 90) = 11.19, p < .001, \eta^2 = .111$. It can be seen that women athletes are perceived as more facially attractive than male athletes, and this difference is greater for female than male respondents ($p < .001$).

Figure 2c shows the interaction between women/men tennis athletes and world-class/amateur athletes, which was significant: $F(1, 90) = 131.04, p < .001, \eta^2 = .593$. It can be seen that women athletes are perceived as more facially attractive than men athletes, and this difference is greater for world-class than amateur athletes ($p < .001$).

Study 2: Subjective Facial Attractiveness Evaluation by Adolescents

For basketball players, Figure 3a displays the interaction between world-class/amateur athletes and gender of respondents, which was not significant: $F(1, 80) = 2.57, p = .113, \eta^2 = .031$. Both female and male respondents evaluate world-class athletes as more facially attractive than amateur athletes, based on main effects ($p < .001$).

Figure 3b shows the interaction between women/men athletes and gender, which was significant: $F(1, 80) = 9.99, p = .002, \eta^2 = .111$. It can be seen that women basketball athletes are perceived as more facially attractive than men athletes, and this difference is greater for female than male respondents ($p < .001$).

Figure 3c shows the interaction between women/men athletes and world-class/amateur athletes, which was significant: $F(1, 80) = 26.40, p < .001, \eta^2 = .248$. It can be seen that women basketball athletes are perceived as more facially attractive than men athletes, and this difference is greater for world-class than amateur athletes ($p < .001$).

For tennis performers, Figure 4a displays the interaction between world-class/amateur athletes and gender, which was

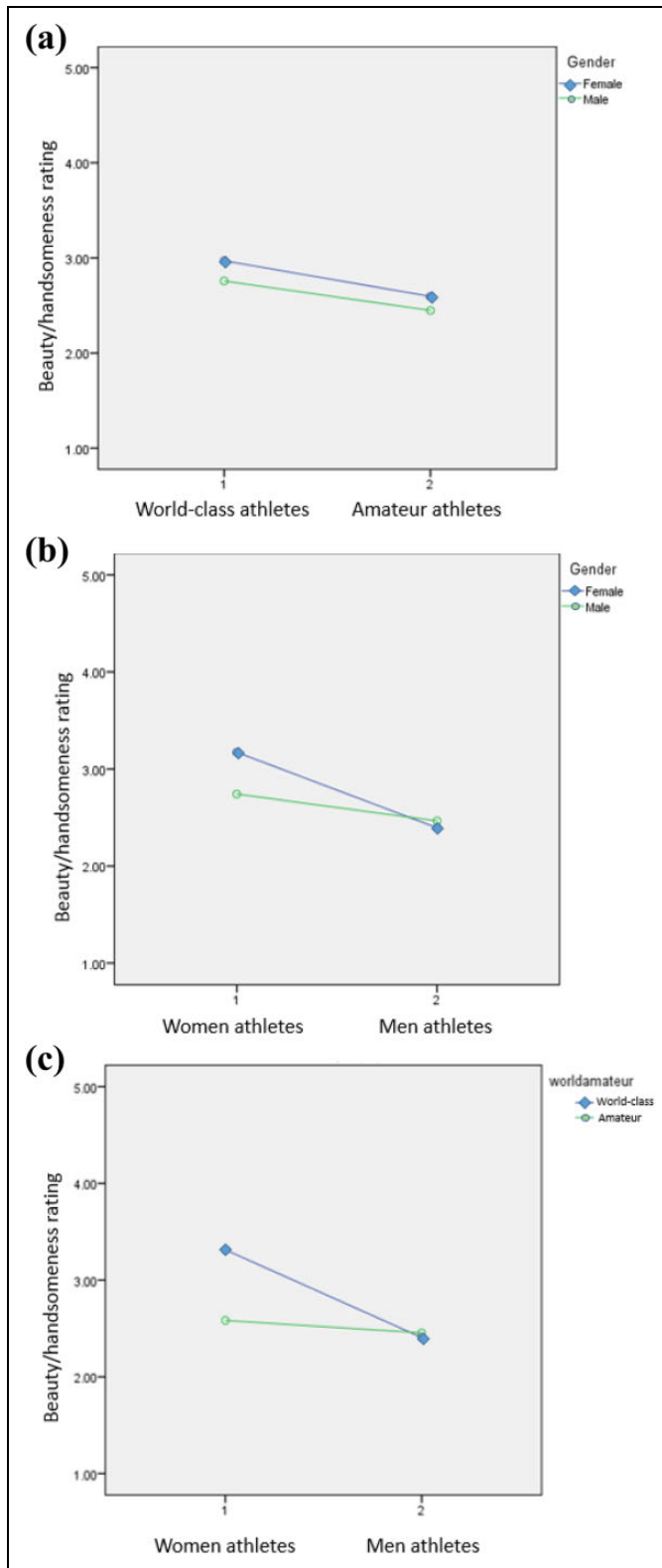


Figure 2. Study 1: Interaction plots for tennis (preadolescents). (a) World-class/amateur by gender of respondents, (b) women/men athletes by gender of respondents, and (c) world-class/amateur athletes by women/men athletes.

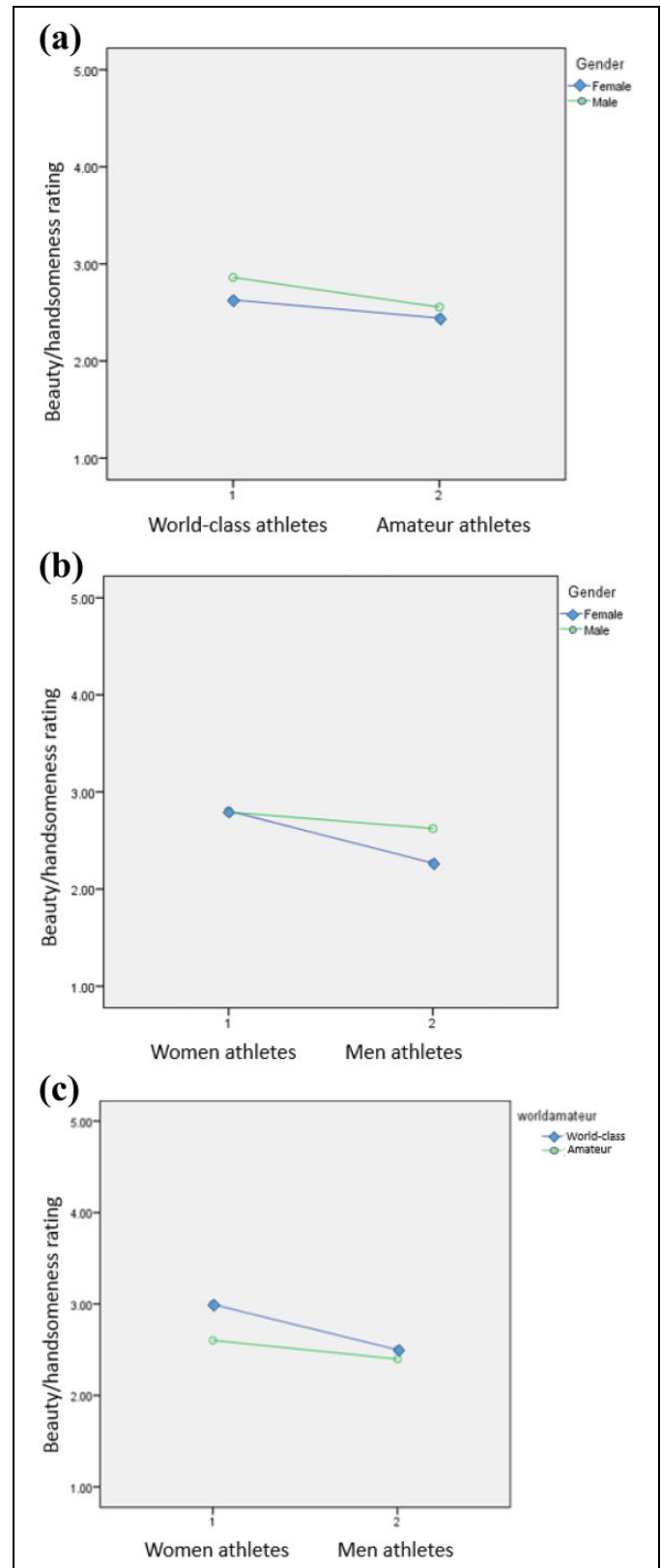


Figure 3. Study 2: Interaction plots for basketball (preadolescents). (a) World-class/amateur by gender of respondents, (b) women/men athletes by gender of respondents, and (c) world-class/amateur athletes by women/men athletes.

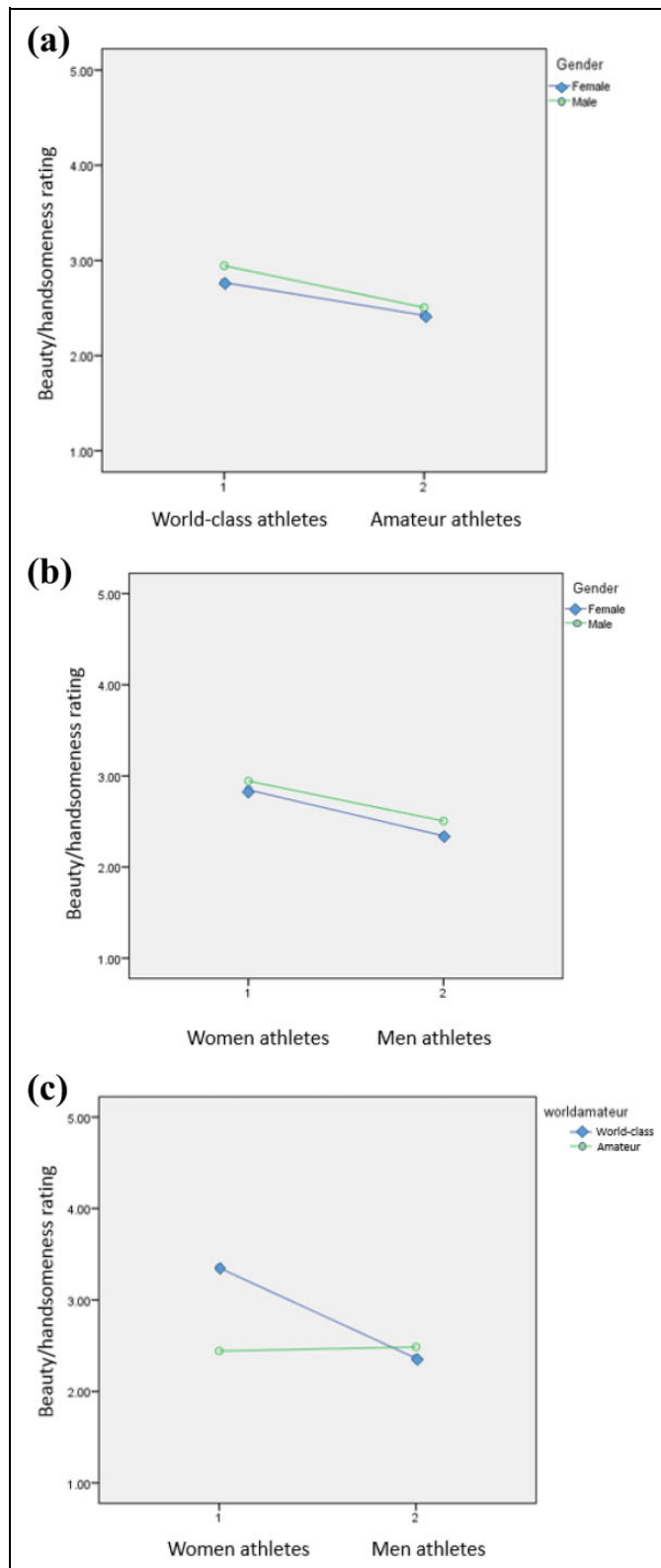


Figure 4. Study 2: Interaction plots for tennis (preadolescents). (a) World-class/amateur by gender of respondents, (b) women/men athletes by gender of respondents, and (c) world-class/amateur athletes by women/men athletes.

nonsignificant: $F(1, 80) = 2.01, p = .160, \eta^2 = .024$. Both female and male respondents evaluate world-class athletes as more facially attractive than amateur athletes, based on main effects ($p < .001$).

Figure 4b shows the interaction between women/men athletes and gender, which was not significant: $F(1, 80) = 0.19, p = .663, \eta^2 = .002$. Nevertheless, it can be seen that women world-class tennis athletes are perceived as more facially attractive than men athletes by both female and male respondents, based on main effects ($p < .001$).

Figure 4c presents the interaction between women/men tennis athletes and world-class/amateur athletes, which was significant: $F(1, 80) = 234.66, p < .001, \eta^2 = .746$. It can be seen that women tennis players are perceived as more facially attractive than men, and this difference is greater for world-class than amateur athletes ($p < .001$).

Study 3: Subjective Facial Attractiveness Evaluation by Young Adults

For basketball performers, Figure 5a displays the interaction between world-class/amateur athletes and gender of respondents, which was not significant: $F(1, 179) = 1.707, p = .193, \eta^2 = .01$. Nevertheless, world-class athletes are judged more facially attractive than amateur athletes, based on main effects ($p < .001$).

Figure 5b shows the interaction between women/men basketball athletes and gender, which was significant: $F(1, 179) = 19.89, p < .001, \eta^2 = .10$. It can be seen that women athletes are perceived as more facially attractive than men athletes, and this difference is greater for female than male respondents ($p < .001$).

Figure 5c presents the interaction between women/men basketball athletes and world-class/amateur athletes, which was significant: $F(1, 179) = 8.37, p = .004, \eta^2 = .045$. It can be seen that women basketball athletes are perceived as more facially attractive than men athletes, and this difference is greater for world-class than amateur athletes ($p = .004$).

For tennis performers, Figure 6a displays the interaction between world-class/amateur athletes and gender, which was significant: $F(1, 179) = 6.41, p = .012, \eta^2 = .035$. It can be seen that world-class athletes are perceived as more facially attractive than amateur athletes, and this difference is greater for male than female respondents ($p = .012$).

Figure 6b shows the interaction between women/men tennis players and gender, which was not significant: $F(1, 179) = 0.51, p = .474, \eta^2 = .003$. Nevertheless, women athletes are judged as more facially attractive than men athletes for both male and female respondents, based on main effects ($p < .001$).

Figure 6c shows the interaction between women/men tennis players and world-class/amateur players, which was

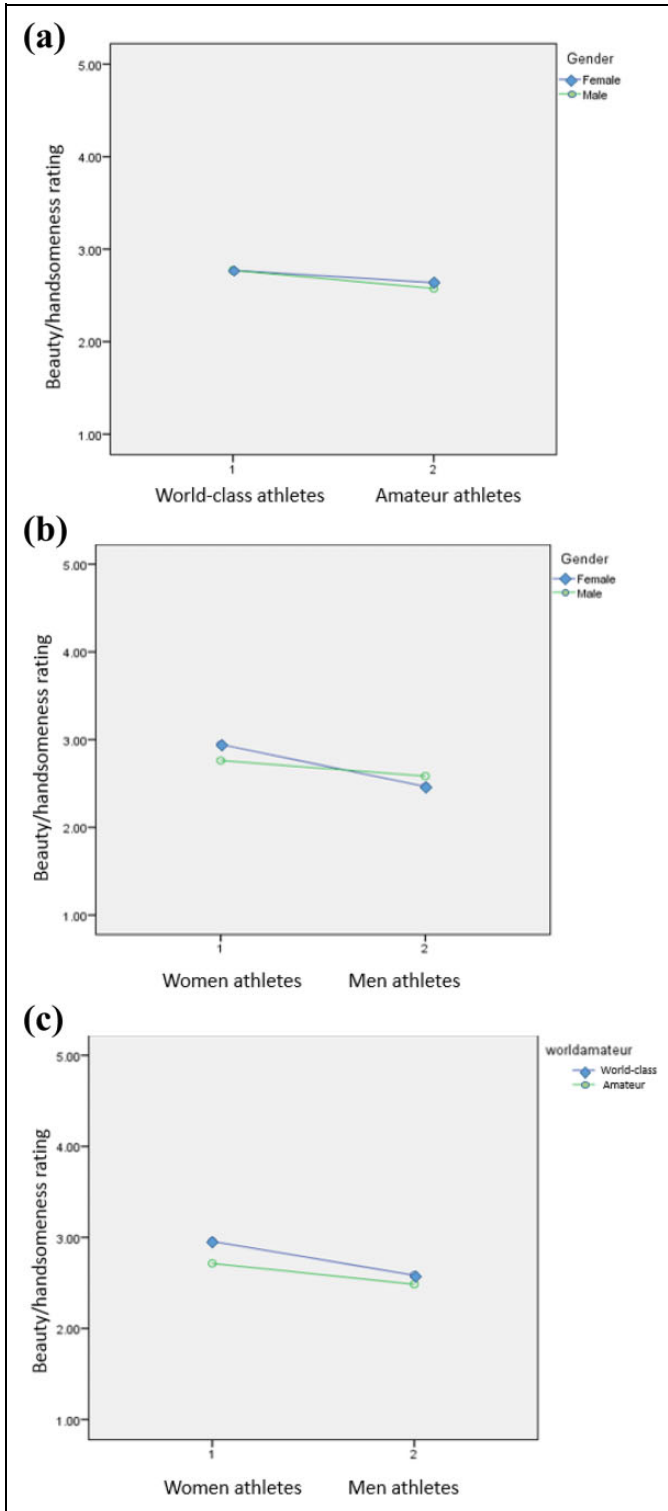


Figure 5. Study 3: Interaction plots for basketball (young adults). (a) World-class/amateur by gender of respondents, (b) women/men athletes by gender of respondents, and (c) world-class/amateur athletes by women/men athletes.

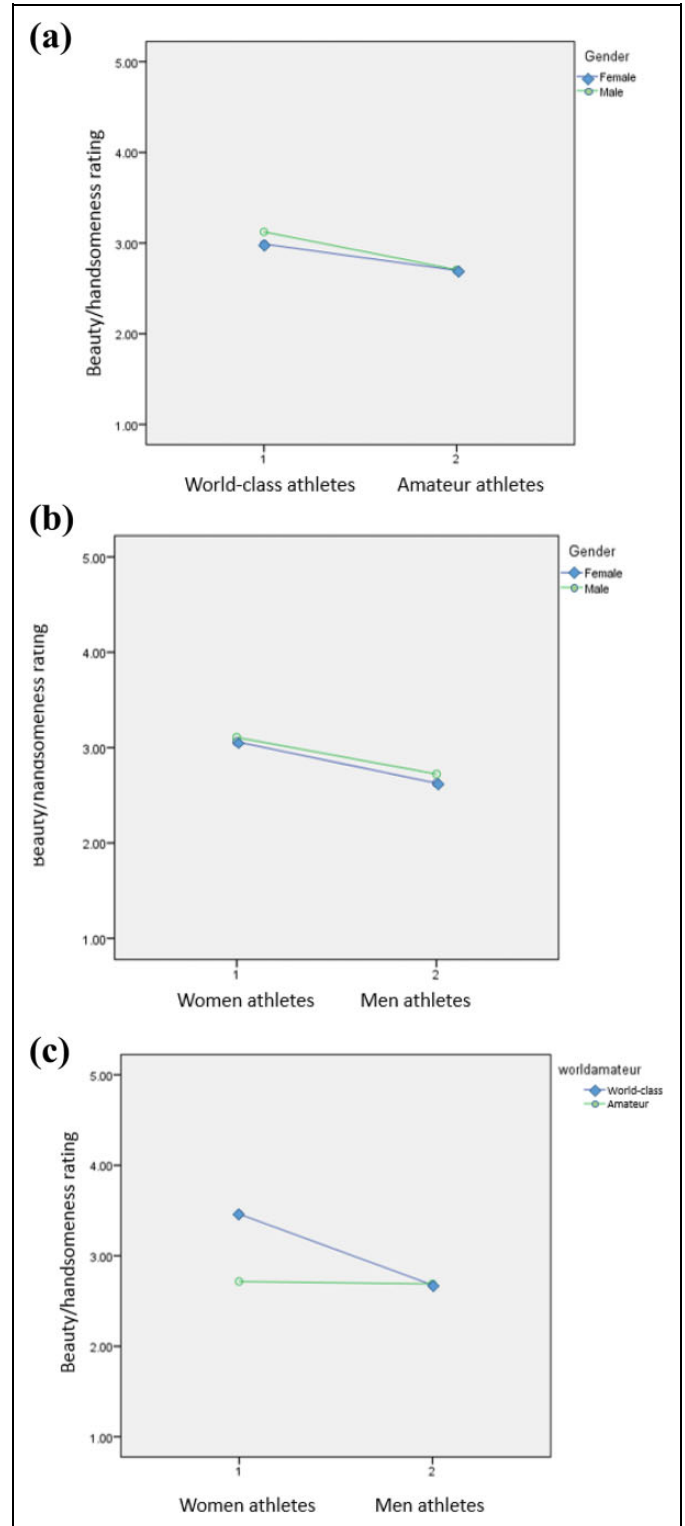


Figure 6. Study 3: Interaction plots for tennis (young adults). (a) World-class/amateur by gender of respondents, (b) women/men athletes by gender of respondents, and (c) world-class/amateur athletes by women/men athletes.

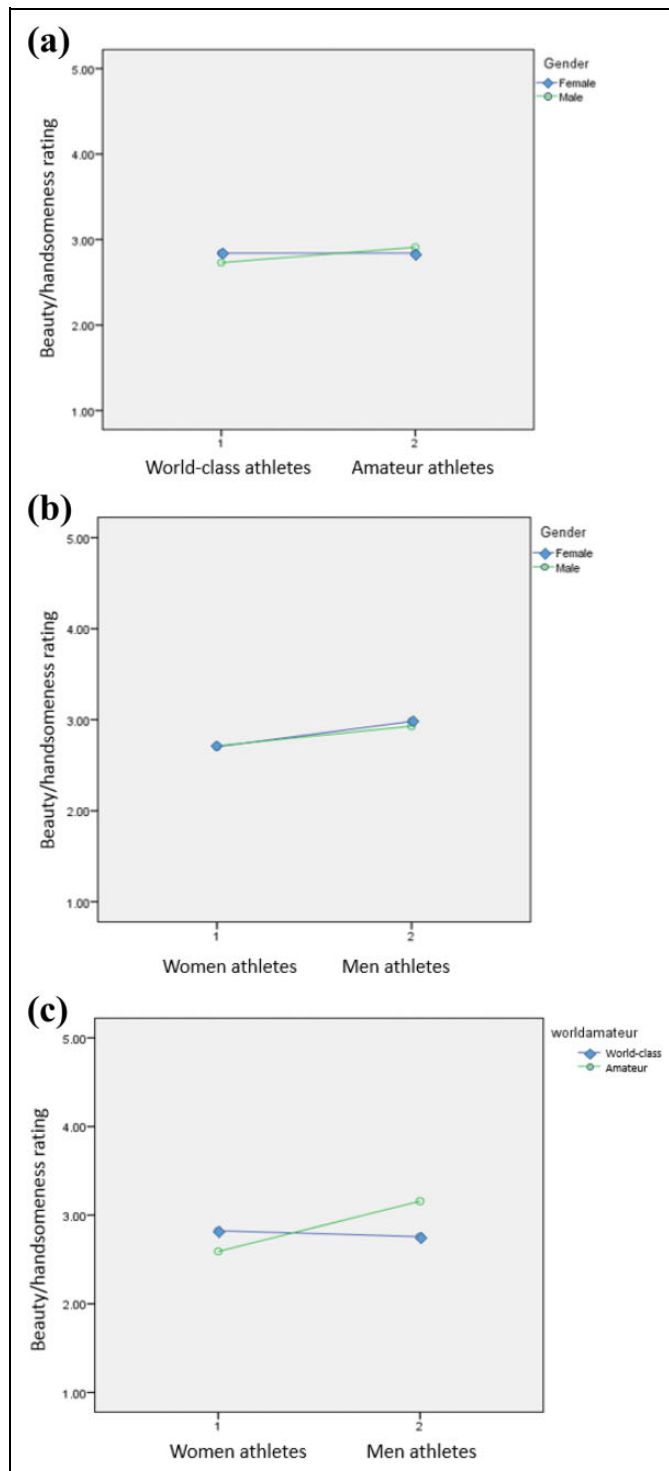


Figure 7. Study 4: Interaction plots for basketball (middle-aged adults). (a) World-class/amateur by gender of respondents, (b) women/men athletes by gender of respondents, and (c) world-class/amateur athletes by women/men athletes.

significant: $F(1, 179) = 232.55, p < .001, \eta^2 = .565$. It can be seen that women athletes are perceived as more facially attractive than men athletes, and this difference is greater for world-class versus amateur athletes ($p < .001$).

Study 4: Subjective Facial Attractiveness Evaluation by Middle-Aged Adults

For basketball performers, Figure 7a presents the interaction between world-class/amateur athletes and gender of respondents, which was significant: $F(1, 185) = 10.86, p < .001, \eta^2 = .055$. It can be seen that amateur athletes are perceived as more facially attractive than world-class athletes, and this difference is greater for male than female respondents.

For basketball performers, Figure 7b shows the interaction between women/men basketball athletes and gender of respondents, which was not significant: $F(1, 185) = 0.83, p = .364, \eta^2 = .004$. However, men basketball athletes are perceived to be more facially attractive than women, based on main effects ($p < .001$).

Figure 7c displays the interaction between women/men basketball athletes and world-class/amateur athletes, which was significant: $F(1, 185) = 152.20, p = .001, \eta^2 = .45$. Men athletes are judged as more facially attractive than women, and this difference is greater for amateur than world-class athletes ($p < .001$).

For tennis performers, Figure 8a shows the interaction between world-class/amateur athletes and gender of respondents, which was significant: $F(1, 184) = 5.50, p = .02, \eta^2 = .029$. It can be seen that amateur athletes are perceived as more facially attractive than world-class athletes for female respondents, and this difference is greater for female than male respondents ($p < .001$).

Figure 8b shows the interaction between women/men tennis athletes and gender of respondents, which was not significant: $F(1, 184) = 1.93, p = .17, \eta^2 = .010$. Nevertheless, women athletes were evaluated as more facially attractive than men, based on main effects ($p < .001$).

Figure 8c presents the interaction between women/men tennis athletes and world-class/amateur athletes, which was significant: $F(1, 184) = 62.88, p < .001, \eta^2 = .255$. It can be seen that women players are judged as more facially attractive than men players, and this difference is greater for amateur than world-class athletes ($p < .001$).

Study 5: Subjective Facial Attractiveness Evaluation by Older Adults

For basketball performers, Figure 9a displays the interaction between world-class/amateur athletes and gender, which was not significant: $F(1, 181) = 1.42, p = .235, \eta^2 = .008$. No difference in facial attractiveness was found between world-class and amateur athletes ($p = .174$).

Figure 9b shows the interaction between women/men basketball athletes and gender, which was not significant: $F(1, 181) = 2.48, p = .117, \eta^2 = .014$. However, women athletes were perceived to be more facially attractive than men athletes, based on main effects ($p < .001$).

Figure 9c presents the interaction between women/men basketball athletes and world-class/amateur athletes, which was not significant: $F(1, 181) = 2.92, p < .089, \eta^2 = .16$.

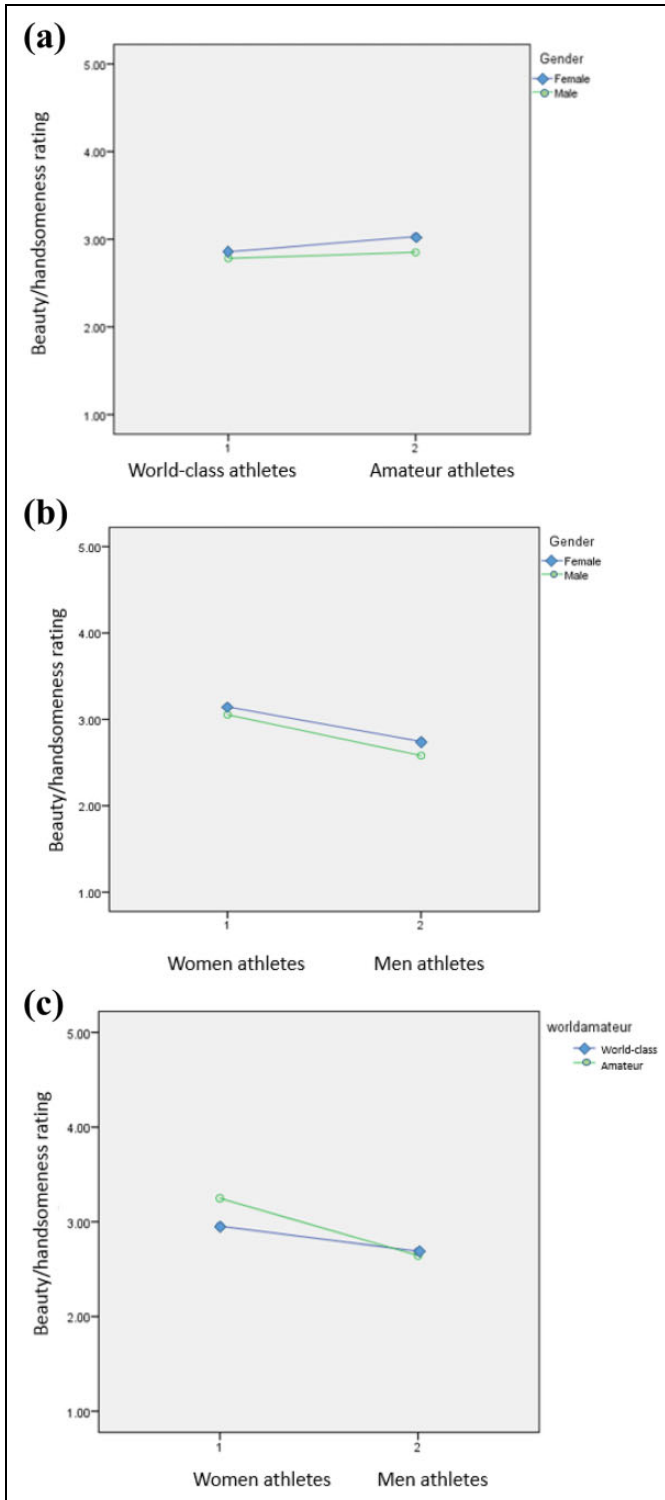


Figure 8. Study 4: Interaction plots for tennis (middle-aged adults). (a) World-class/amateur by gender of respondents, (b) women/men athletes by gender of respondents, and (c) world-class/amateur athletes by women/men athletes.

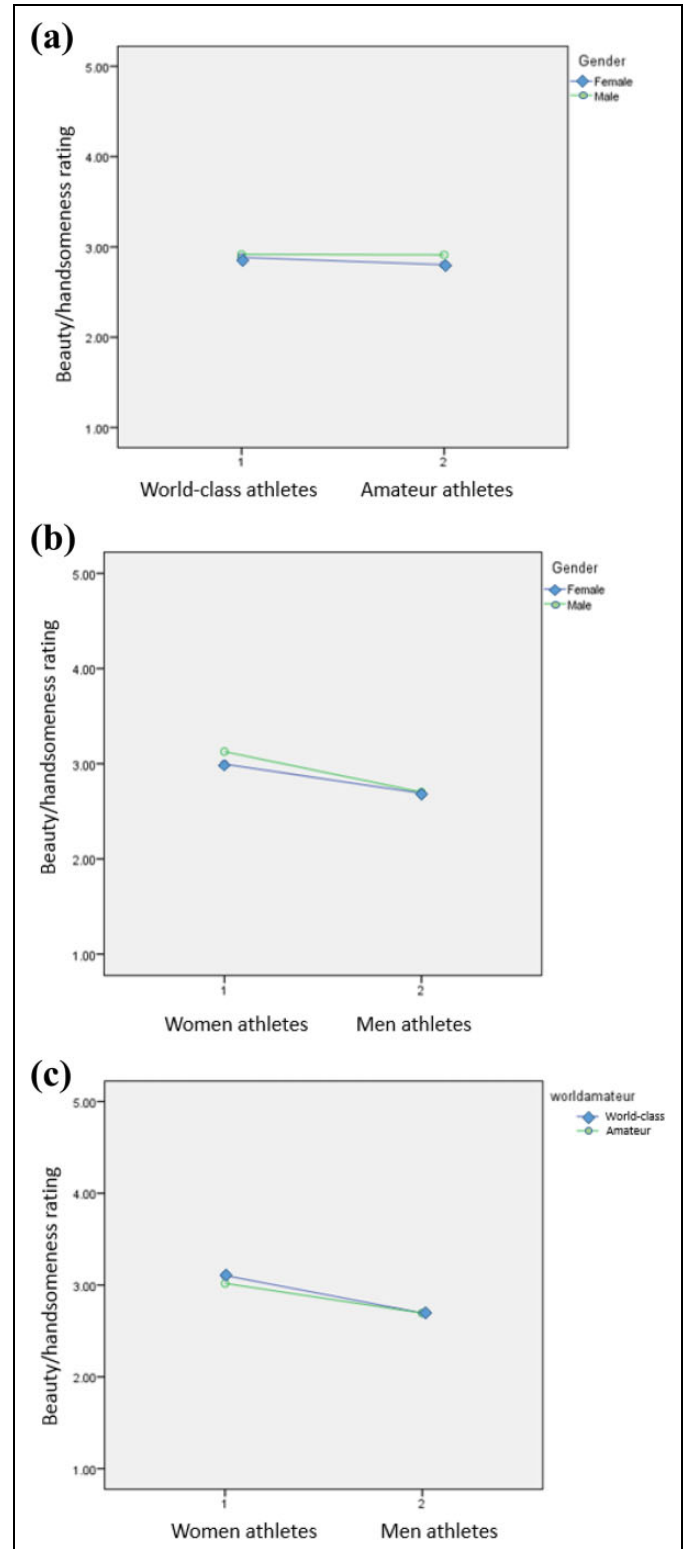


Figure 9. Study 5: Interaction plots for basketball (old age adults). (a) World-class/amateur by gender of respondents, (b) women/men athletes by gender of respondents, and (c) world-class/amateur athletes by women/men athletes.

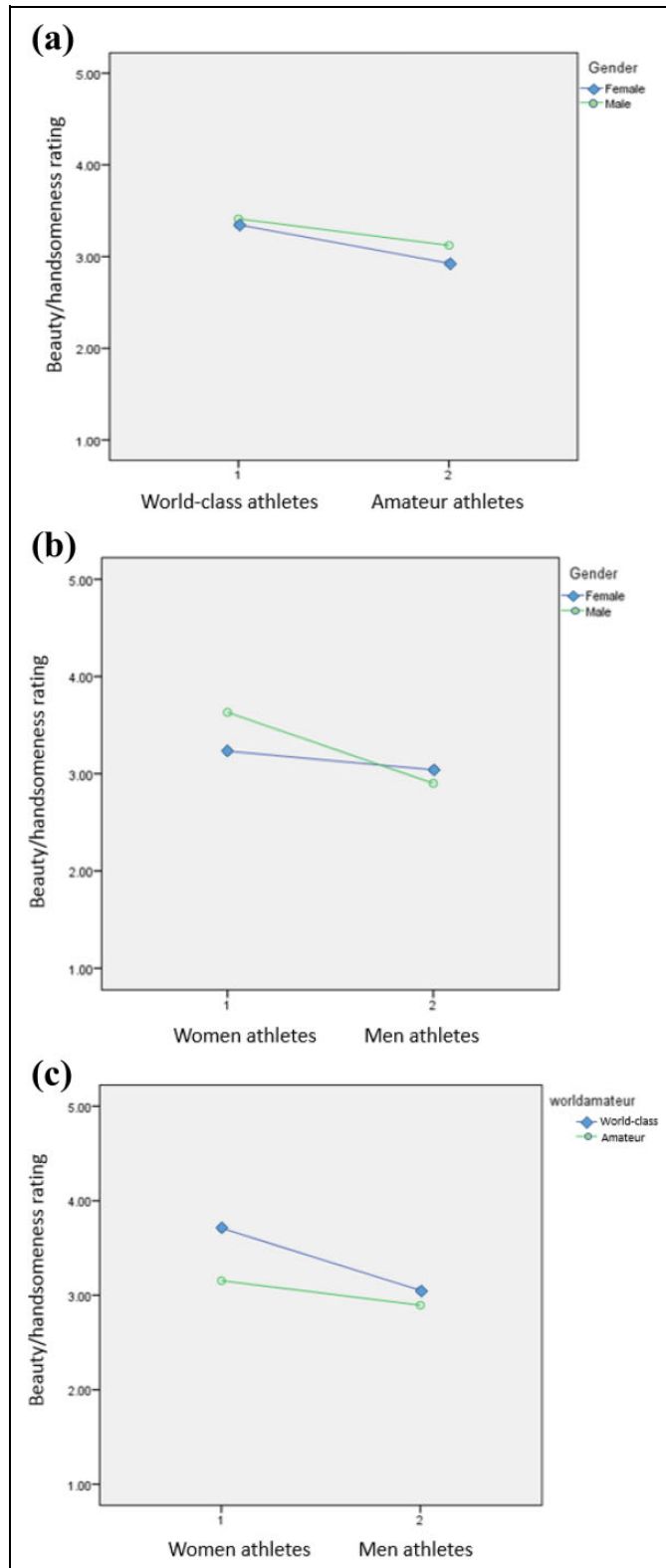


Figure 10. Study 5: Interaction plots for basketball (old age adults). (a) World-class/amateur by gender of respondents, (b) world-class/amateur athletes by women/men athletes, and (c) world-class/amateur athletes by women/men athletes.

Nevertheless, women athletes are perceived as more facially attractive than men athletes for both world-class and amateur athletes ($p = .05$), based on main effects.

For tennis performers, Figure 10a displays the interaction between world-class/amateur athletes and gender, which was significant: $F(1, 181) = 6.37, p = .012, \eta^2 = .034$. World-class athletes are perceived as more facially attractive than amateur athletes, and the difference is greater for female than male respondents ($p = .012$).

Figure 10b shows the interaction between women/men tennis players and gender, which was significant: $F(1, 181) = 37.05, p < .001, \eta^2 = .170$. It can be seen that women athletes are perceived as more facially attractive than men athletes, where this difference is greater for male than female respondents ($p < .001$).

Figure 10c presents the interaction between women/men tennis players and world-class/amateur tennis players, which was significant: $F(1, 181) = 66.90, p < .001, \eta^2 = .27$. It can be seen that women athletes are perceived to be more facially attractive than men athletes, and the difference is greater for world-class than amateur athletes ($p < .001$).

Study 6: Subjective Facial Attractiveness Evaluation by Young Adults (Mirror Image of Pictures of Athletes)

Because it is possible that people process faces differently in the sense of beginning with and/or emphasizing the left versus right side of a photo, and faces are not perfectly symmetric, we did an additional investigation by examining young adults and using as stimuli the mirror image of faces originally tested.

For basketball performers, Figure 11a displays the interaction between world-class/amateur athletes and gender, which was not significant: $F(1, 181) = 1.78, p = .185, \eta^2 = .021$. Nevertheless, world-class athletes are evaluated as more facially attractive than amateur athletes, based on main effects ($p < .001$). These findings are very similar to those found for young adults in Study 2 (cf. Figures 5a and 11a).

Figure 11b shows the interaction between world-class/amateur athletes and gender of respondents, which was significant: $F(1, 185) = 11.52, p < .001, \eta^2 = .119$. It can be seen that women athletes are perceived as more facially attractive than men athletes, and this difference is greater for male than female respondents ($p < .001$). These results are similar to those formed for young adults in Study 3 except that the difference for gender of respondents switched between the two studies (compare Figures 5b and 11b).

Figure 11c displays the interactions between women/men basketball athletes and world-class/amateur athletes, which was significant: $F(1, 185) = 19.43, p < .001, \eta^2 = .186$. It can be seen that women basketball athletes are perceived as more facially attractive than men athletes, and this difference is greater for world-class than amateur athletes ($p < .001$). These findings are very similar to those found for young adults (compare Figure 5c and 11c).

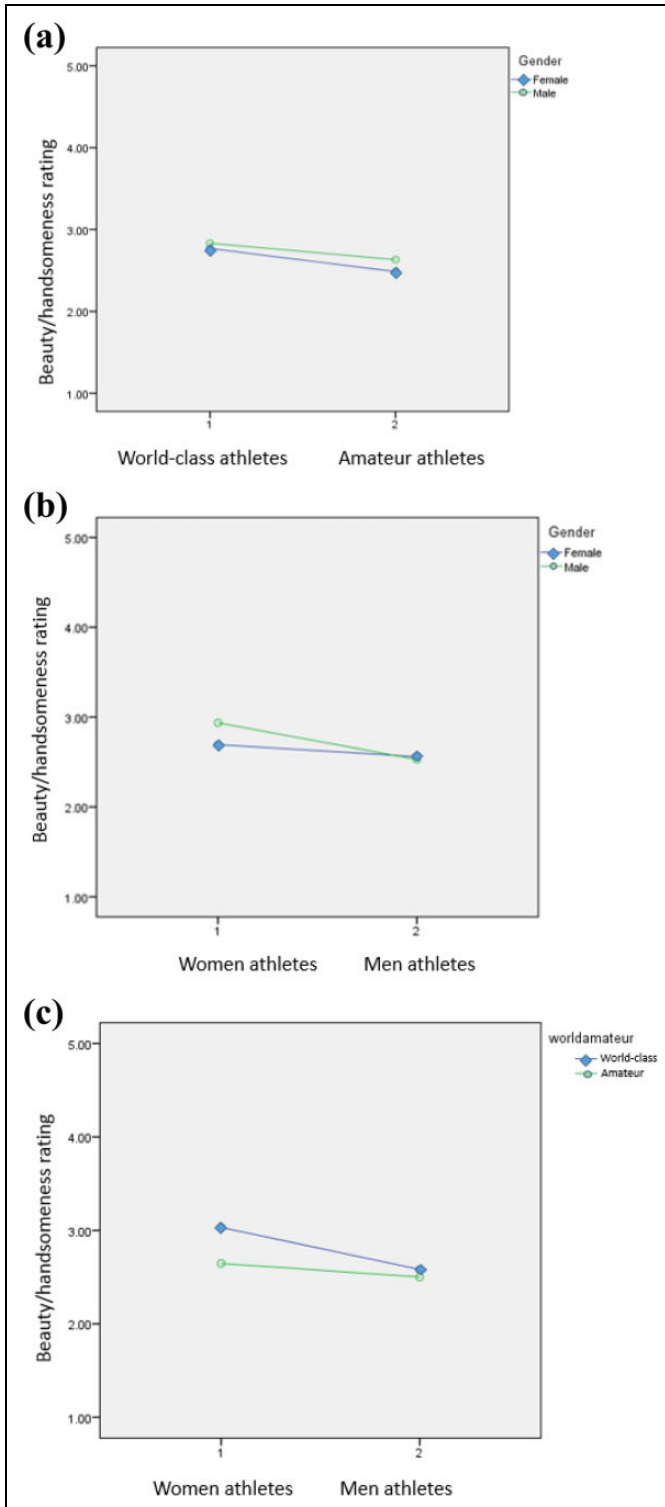


Figure 11. Study 6: Interaction plots for basketball (young adults). (a) World-class/amateur by gender of respondents, (b) world-class/amateur athletes by women/men athletes, and (c) world-class/amateur athletes by women/men athletes.

For tennis players, Figure 12a presents the interaction between world-class/amateur athletes and gender, which was significant: $F(1, 185) = 3.95, p = .050, \eta^2 = .044$. It can be

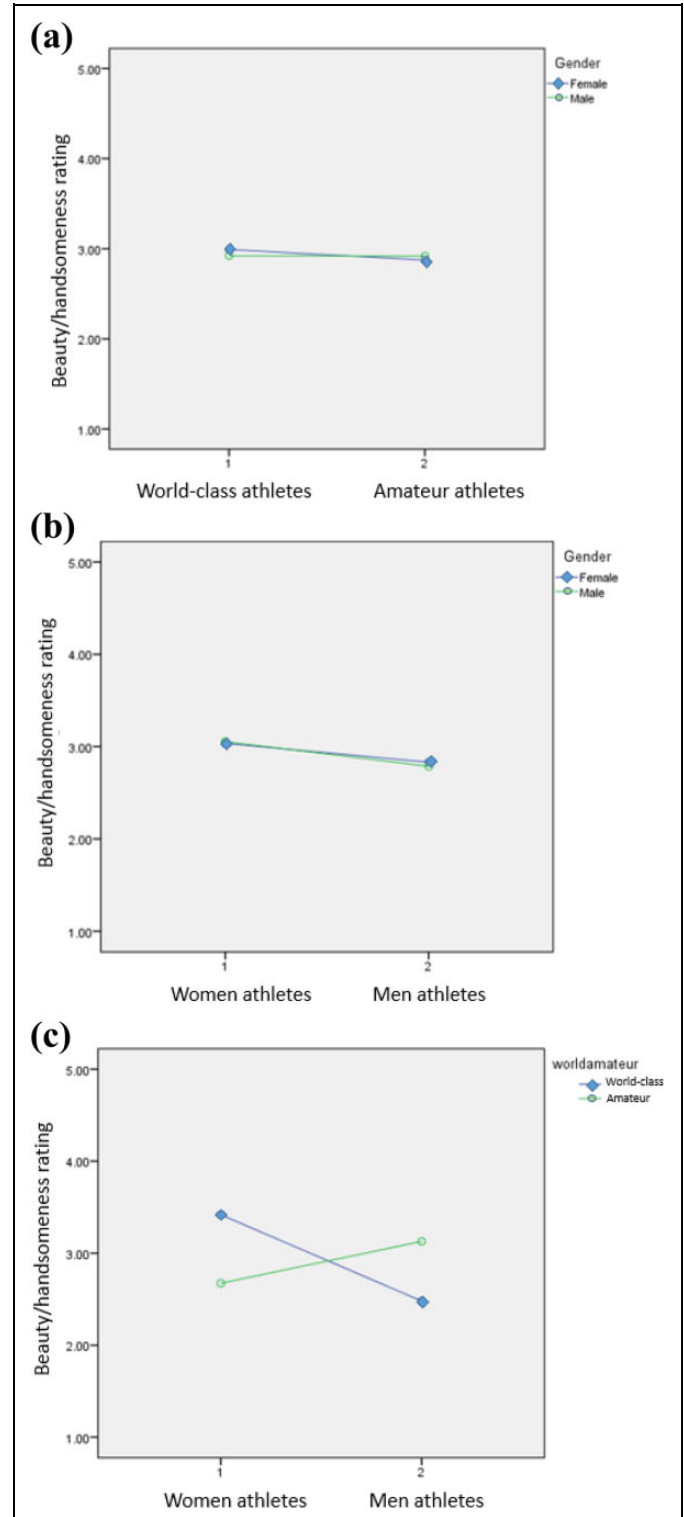


Figure 12. Study 6: Interaction plots for tennis (young adults). (a) World-class/amateur by gender of respondents, (b) world-class/amateur athletes by women/men athletes, and (c) world-class/amateur athletes by women/men athletes.

seen that world-class athletes are perceived as more facially attractive than amateur athletes, and this difference is greater for female than male respondents ($p = .050$). These findings

are similar to those found in Study 3 except that the difference for gender of respondent's switches between the two studies (see Figures 6a and 12a).

Figure 12b displays the interaction between women/men tennis players and gender, which was not significant: $F(1, 185) = 0.57, p = .453, \eta^2 = .007$. Nevertheless, women athletes are perceived as more facially attractive than men, based on main effects ($p < .001$). These results are very similar to those found in Study 3 (cf. Figures 6b and 12b).

Figure 12c shows the interaction between women/men tennis players and world-class/amateur players, which was significant: $F(1, 185) = 434.79, p < .001, \eta^2 = .836$. It can be seen that women tennis players are perceived as more facially attractive than men, and this difference is greater for world-class than amateur athletes ($p < .001$). These findings are very similar to those found for young adults in Study 3 (cf. Figures 6c and 12c).

Discussion

Evolutionary psychology builds on the notion that due to evolutionary pressures the human brain has developed specialized brain modules (or neural networks) to immediately detect, or orient to, facial attractiveness, and this facial attractiveness indicates biological quality (Miller & Todd, 1998; Thornhill & Gangestad, 1999). Detection of facial attractiveness is assumed to have direct advantages for the appraiser as it insulates one from health risks or allows one to obtain reciprocity for investments made in the relationship or group (Little et al., 2012). Detection of facial attractiveness also has indirect effects as it indicates good genes, which might ensure better offspring in mate selection (Little et al., 2012).

Some studies cast doubts on these conjectures. For example, it has been argued that biological quality is too broad a concept or the relationship between biological quality and facial attractiveness has not been substantiated. Thus, various researchers note that the relationship between facial attractiveness and health should be studied in settings where biological quality matters. For instance, facial attractiveness and biological quality are more important in environments at high risk of parasitism (Thornhill & Gangestad, 1993) or intensely competitive sporting contexts (Rhodes, 2006, p. 213). Hence, it is no surprise that several studies have investigated facial attractiveness and biological quality in athletic settings. Biological quality is conceived as athletic strength, which is easily measured by rankings in the sport. Therefore, our study addressed biological quality by focusing on the relationship between facial attractiveness as an indication of biological quality, especially athletic strength, and using photos of people who actually operated in intensely athletic competitive environments (e.g., Postma, 2014).

We showed that the predicted effects occurred across a wide spectrum of ages: preadolescent children, adolescents, young adults, and older adults. Both males and females generally rated the facial attractiveness of all world-class athletes (men and women) higher than all amateur athletes (men and women).

This is consistent with previous findings showing that there is strong consensus among humans in their appraisal of facial attractiveness (Postma, 2014). In addition, women athletes generally scored higher on beauty than men athletes which substantiates Kanazawa's (2007) findings. The above findings tended to be stronger for female than male appraisers as well, which is consistent with Nedelec and Beaver (2011). See Also Buss (1989). Note that we also controlled in Study 6 for mirror images and found similar results overall except one case out of six.

The findings for middle-aged adults showed a reversal compared to the six other age -groups in the sense of amateur athletes scoring higher than world-class and men athletes scoring higher than women in facial attractiveness. We do not have a good explanation for this reversal and can only speculate at this time. The ancient Brothers Grimm fairy tale, "Little Snow White," provides possible insights (e.g., Strayer, 1996). In the fairy tale, the queen constantly asks her mirror interlocutor, "who is the fairest of them all," as she ages. After a period of time, when she is constantly told she is the most beautiful, she learns that the beauty of Snow White surpasses her own. The threat to her self-image resembles what is classically referred to as the midlife crisis, which has been defined as an emotional conflict centered around diminution in physical attractiveness and prowess, thoughts about mortality, and uncertainty and doubt about the future (e.g., Whitbourne & Willis, 2014). The queen in the fairy tale coped with her acute perceived loss of beauty by trying to kill and eliminate Snow White. We speculate that the middle-aged adults in our sample coped with unfavorable comparisons of beauty between the athletes and themselves by downgrading the attractiveness of the most attractive in relation to the least attractive, so as to psychologically deny the threat and protect their identities and self-images. Younger people have less need to do this than middle-aged persons, whereas by the time, the latter reach old age they have come to terms with their decline in beauty. This is the first study to observe the reversal in assessments of facial attractiveness by middle-aged respondents to our knowledge, and our conjecture that the heightened threat of personal decline in middle-aged accounts for this represents a possible line of inquiry for future research. Our findings on the relationship between facial attractiveness and athletic prowess resonate with what evolutionary psychologists propose by arguing that facial attractiveness signals good health (see Gangestad & Buss, 1993; Little et al., 2012; Schakelford & Larsen, 1999). We need to explore further whether facial attractiveness merely communicates biological quality or health (direct benefits for the appraiser) and/or good genes (indirect benefits for the appraiser). We might subscribe to the notion that people high on facial attractiveness have several social advantages. For example, attractive people are chosen more frequently as mates and for alliances and stay alone less after divorce (or termination of friendships; Berscheid & Walster, 1974). Attractive people are treated more fairly by others (Hosoda, Stone-Romero, & Coats, 2003), judged more favorably (Dion, Berscheid, & Walser, 1972), believed to possess more desirable

personality traits (halo effect; e.g., Eagly, Ashmore, Makhijani, & Longo, 1991), attain upward social mobility better (e.g., Elder, 1969), and achieve higher compensation at work (Halford & Hsu, 2014; Hamermesh, 2011). Note that all these social benefits might in turn positively affect people's health; for example, being treated fairly comes with lower levels of stress or being surrounded by a good social network affects immune functioning positively (e.g., Luo, Hawkley, Waite, & Cacioppo, 2012). These factors make a causal inference between facial attractiveness and biological quality more difficult.

Limitations

A number of shortcomings in our study should be mentioned. First, the stimulus slides are not entirely uniform. For example, 6 of the 40 athletes failed to show even a hint of a smile. Such variation may be less of a problem in our study because of the mixed design where the subjects responded to all photos and only gender of subjects was a between-effects condition, but it would have been better to have complete uniformity in the stimuli. Second, the quality of the photos varied somewhat across athletes. Third, some research shows some effects of female hormonal cycle on appraisals of masculinity in male faces (Johnston, 2006; Penton-Voak et al., 1999), but we did not control for this. Future research should control for such effects. However, we measured observers' judged attractiveness of athletes, not judged masculinity. Fourth, our findings would have been strengthened had we had a different control group, other than comparing world-class to amateur athletes. Therefore, our results cannot be easily generalized beyond the samples of athletes. Fifth, it may be desirable to control for adiposity, differences in body fat, in future research. Differences in body fat may not be great in our study, at least as reflected in the face, and our athletes were relatively young and in excellent physical condition. Sixth, facial attractiveness is context sensitive (Cash, Cash, & Butters, 1983), but we did not check for different contrast effects (e.g., encouraging comparisons by placing two tennis players on one line or placing a male and a female on one line). Seventh, by choosing world-class athletes below 100 ranking and amateur athletes all active in the United States, we assumed that respondents living in the Netherlands did not know or recognize the athletes. Still, despite the low chance of occurrence, some people might have recognized one or more players. The above limitations would, however, tend to make it more difficult to find the effects we found, as they would increase measurement error and the denominator of F tests.

Recommendations for Further Research

First, our study is based on theory inspired by evolutionary psychology, but these arguments may not be always convincing. For example, the phenotype of facial attractiveness indicating biological quality may be too broad a concept and might stand for a plethora of other attributions or psychological processes. As our insights into biological processes advance,

biology-based research may help to explain the facial attractiveness to biological quality relationship more fully. Most important, if facial attractiveness signals biological quality, then molecular genetics might be employed in hypothesis testing to help us explore the relationship between genes and facial attractiveness more accurately. For example, different gene polymorphisms might affect the wanting and liking systems in the brain differently to influence subjective judgments of beauty.

Second, given that some evolutionary psychologists speak of specialized brain modules to detect facial attractiveness, researchers could use functional magnetic resonance imaging-based research and other neuroscientific methods to identify the key neural networks involved and how they function. For instance, would the same networks be activated to different degrees or different networks be activated when raters appraise world-class athletes versus amateur athletes, or would different networks be activated when, for example, a female (or male) appraises men versus women world-class athletes (e.g., Senior, 2003)? These and other opportunities deserve study.

Declaration of Conflicting Interests

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