Individual differences in preferences for cues to intelligence in the face

MOORE, F. R.[a], LAW SMITH, M. J.[b] & PERRETT, D. I.[c]

[a] School of Psychology, University of Dundee, UK

[b]Department of Psychology, University of Limerick, Ireland.

[c]School of Psychology, University of St Andrews, UK.

[a]Author for correspondence: School of Psychology, Scrymgeour Building, Park Place, University of Dundee, Dundee, DD1 1HG, UK. f.moore@dundee.ac.uk. +44 1382 386 754

Abstract

We tested for individual differences in women's preferences for cues to intelligence in male faces in accordance with hormonal status (i.e. menstrual cycle phase and use of hormonal contraceptives), relationship status and context, and self-rated intelligence. There were no effects of hormonal or relationship status (Studies 1 and 2) on preferences. There was, however, a positive relationship between self-rated intelligence and preferences for cues to intelligence in the face in the context of a long-term relationship, suggesting context-specific assortment (Study 3). In Study 4, self-rated partner intelligence correlated with preferences for facial cues to intelligence. We discuss these results in the context of intelligence as a fitness indicator and suggest that future research must control for assortative mating for cognitive traits in order to better understand intelligence in mate choice.

Keywords: fitness-indicator; intelligence; face; attractiveness; individual-differences

Introduction

Intelligence is an important consideration in human mate choice decisions (e.g. Buss, 1989; Lee & Zeitch, 2011; Li et al., 2001; Moore et al., 2011; Prokosch et al., 2009; Zebrowitz et al., 2002). Miller (2000a,b) argues that the high heritability of general intelligence (g) (Plomin & Spinath, 2004) implicates evolution through sexual (rather than natural) selection, and points to close associations between scores on g-loaded tests and various proxies of fitness such as health and developmental stability (e.g. Arden et al., 2008, 2009; Banks et al., 2010; Furlow et al., 1997; Gottfredson & Deary, 2004; Miller & Penke, 2007; Prokosch et al. 2005). That intelligence is the product of variation across the genome (e.g. Plomin and Kovas, 2005), and is inversely related to mutation load (e.g. Yeo et al. 2011), lends strong support to a role of intelligence in signaling fitness to potential partners (Miller, 2003). Such 'fitness indicator' traits signal mutation load and maintain additive genetic variance in sexually selected traits via condition-dependent expression (Houle, 2000; Houle & Kondrashov, 2002; Rowe & Houle, 1996; Tomkins et al., 2004). Mate preferences that result in avoidance of mates with a high mutation load confers a selective advantage in terms of securing superior genetic material for offspring. Since there doesn't appear to be a sex difference in preferences for intelligent partners, it is possible that sexual selection has shaped human intelligence via mutual mate choice (Hooper and Miller, 2008).

Recently, researchers have attempted to identify context dependency in women's preferences for intelligence in a partner. Women's mate choice decisions are complex, involving context- and condition-dependent tradeoffs between, for example, cues to the willingness and ability to commit to a relationship versus cues to indirect heritable benefits (e.g. Debruine et al., 2010a). In particular, women express preferences for a committed partner in the context of long-term relationships, but switch to preferences for cues to alternative heritable qualities in the context of short-term relationships (Little et al., 2002; Little et al., 2007) or during times of high fertility (Little et al., 2002; Penton Voak et al., 1999; Penton Voak & Perrett, 2000; but see Peters et al., 2009). Identifying when preferences for intelligence are strongest, then, can inform as to the qualities it may bestow.

While there is evidence that women's preferences for cues to men's creativity - a trait related to intelligence - increase during the fertile phase of the menstrual cycle (Haselton & Miller, 2006) and that male creative output is positively related to mating success (Nettle & Clegg, 2006), previous studies have failed to find effects of menstrual cycle phase on preferences for cues to general intelligence (e.g. Gangestad et al., 2007; 2010). Recently, for example, Prokosch and colleagues (2009) analysed women's preferences for men's verbal intelligence and subjective ratings of the men's intelligence and creativity based on video footage in long- and short-term relationship contexts. Subjective creativity and intelligence, and verbal intelligence scores each explained independent - albeit small - proportions of the variance in men's appeal for both long- and short-term relationships. These effects were not moderated by menstrual cycle phase, and results suggest that intelligence is equally valued in women's mate choice decisions regardless of hormonal status and relationship context.

Here we conducted a series of studies designed to test for individual differences in preferences for cues to intelligence in the face on the basis of wider measures of hormonal status (i.e. menstrual cycle phase and use of hormonal contraceptives) in a more representative sample of women than the University students used in previous studies. Furthermore, since sexual selection for intelligence in humans is likely to have evolved via mutual mate choice, resulting in positive assortment (or 'fitness matching'; Miller, 2000; Hooper and Miller, 2008) we also controlled for the strong tendency for individuals to mate assortatively on the basis of intelligence (Watson et al., 2004). We used a set of facial stimuli parametrically controlled and manipulated to differ in cues to intelligence but that were matched for cues to sexual dimorphism, health and age. In Study 1 we tested the effects of menstrual cycle phase and relationship status on preferences for the facial stimuli in a sample of undergraduate female students. In Study 2 we tested for these effects, as well as effects of hormonal contraceptive use, in a sample of women from a broader age, education and socioeconomic profile. In Study 3 we tested the effects of relationship context on preferences for cues to intelligence in the face while controlling for positive assortative mating on the basis of intelligence. In Study 4 we assessed the validity of our measure of preference for cues to intelligence by comparing it with women's partner intelligence.

Study 1

The aim of Study 1 was to test the effects of menstrual cycle phase and relationship status on preferences for cues to intelligence in the face, using facial stimuli parametrically manipulated to differ in cues to perceived intelligence whilst controlling for sexual dimorphism, health and age.

Methods

Participants

Participants were a sub-sample (n = 34) of those described in Law Smith et al (2006) who completed a series of face preference tests. All were Caucasian female students recruited from the University of St Andrews (UK) who reported a heterosexual orientation, and were not pregnant or using hormonal contraceptives (age: 19.67 (1.35)). Ten participants were single during the period of testing. See table 1.

Table 1 about here.

Materials

a. Stimuli creation

Stimuli were a pair of male facial composites that differed in perceived intelligence but were matched for attractiveness, age and sexual dimorphism described in Moore et al. (2011). Briefly, 166 male faces were rated by 19 participants (male: n = 8) for intelligence, health, attractiveness and sexual dimorphism (i.e. “How intelligent/healthy/attractive/masculine is this face?”, with intelligence defined as “knowledgeable, analytic and rational, adaptable, independent in opinion and solves problems”). Residuals extracted from a multiple linear regression model (dependent variable: intelligence ratings; predictor variables: age, and ratings of attractiveness and sexual dimorphism) were used to identify the 5 faces that received higher ratings of intelligence than predicted by the model, and the 5 faces that received intelligence ratings lower than predicted by the model. These faces were blended together and symmetrized using Psychomorph software (Tiddeman et al., 2001) to provide a pair of faces that were matched for components of attractiveness (i.e. sexual dimorphism, health and age) but that differed in perceived intelligence (although it is important to note that the high perceived intelligence composite was rated as more attractive than the low perceived intelligence composite, despite these controls). See Fig 1. Perceived intelligence of the face has been shown to be associated with various measures of actual intelligence (see Zebrowitz et al. (2002) for a review of meta-analyses).

[Figure 1 about here]

b. Menstrual cycle phase & relationship status

Menstrual cycle phase was estimated from self-report data (number of days in a typical cycle and number of days since onset of last period of menses) using the countback method in which ovulation was estimated to occur 14 days after the onset of the most recent period of menses. All women reported regular menstrual cycles. The follicular phase (i.e. the period during which women's hormonal profile is consistent with high fertility) was estimated to occur during the week prior to ovulation, with the luteal (i.e. non-fertile) phase between ovulation (e.g. starting on day 15) and the onset of the next period of menses.

To assess effects of relationship context, we asked participants to report whether they were currently in a committed relationship (e.g. Penton Voak et al., 1999).

c. Face preference tests

Participants rated the composite faces, presented individually, for attractiveness on 1 – 7 scales ("How attractive is this face?"; 1 = not at all attractive, 7 = extremely attractive). Faces were presented in random order, distributed among the stimuli of an unrelated study.

Procedure

Participants attended between 4 and 6 weekly testing sessions, to ensure they rated the faces during late follicular and luteal cycle phases. At each session participants reported their menstrual cycle status and rated the facial stimuli for attractiveness.

Preference for the high perceived intelligence composite over the low perceived intelligence composite was calculated by subtracting ratings of the latter from those of the former (high-low). A positive score represented a preference for the high perceived intelligence face, and a negative score a preference for the low perceived intelligence face. A score of 0 equated to no preference in either direction.

Results

In ANOVA, with menstrual cycle phase as a within-subjects factor (2 levels: late follicular and luteal) and relationship status as a between subjects factor (2 levels: single and in a relationship), there were no significant effects of cycle phase or relationship status and no interaction between the two (all $p > 0.5$). Women preferred the high intelligence face in both phases of their cycle (late follicular: mean = 0.27; luteal: mean = 0.21)), and regardless of their relationship status (single: mean = 0.23; in a relationship: mean = 0.24). For full descriptive statistics, see Table 1.

Discussion

The women in Study 1 preferred facial cues to intelligence across relationship and fertility contexts. Cyclic shifts in women's preferences for cues to creativity in a potential short-term partner (Haselton & Miller, 2006), then, may be independent of preferences for intelligence (see Prokosch et al., 2009). Our findings using careful controlled facial stimuli are consistent with those showing that intelligence is treated as an "essential" rather than a "luxury" in mate choice decisions (Li et al., 2002), and that verbal- and perceived-intelligence predict desirability regardless of relationship context or menstrual cycle phase (Prokosch et al., 2009). Taken together, results suggest that, unlike traits such as masculinity, intelligence is not traded-off with other desirable characteristics in mate choice decisions. The work to date, however, has been largely limited to samples of undergraduate students who are unlikely to provide a representative intelligence profile, which may obscure any such tradeoffs. In Study 2, then, we tested relationship-context and menstrual cycle phase effects on preferences for facial cues to intelligence in a broader, larger, sample.

Study 2

To address the limitations of previous work, we tested for effects of relationship status and menstrual cycle phase in a larger sample with a broad age, education and socioeconomic profile. As use of hormonal contraception has been shown to influence face preferences (e.g. Jones et al., 2005), we also tested effects on preferences for perceived intelligence.

Methods

Participants

Five hundred and twenty eight heterosexual female participants who were not pregnant and were aged 16 - 45 (mean: 24.58 (7.37)) completed an online questionnaire and face preference test hosted on a face research website (www.perceptionlab.com). Thirty percent reported use of hormonal contraceptives, and 43% were in a relationship. Eighty seven percent were European residents. Eighty six percent reported being Caucasian, 2% being Afro-Caribbean, 1% being Asian, and the remainder reporting their ethnicity as “other”. Twenty one percent reported having postgraduate level of education, 62% having attended college or University, and the remainder having graduated from high school. See Table 1.

Materials

a. Facial Stimuli

The composite perceived intelligence faces described in Study 1 were used as the end points of a continuum along which 9 base faces (created as the average of 5 – 6 male faces selected at random from 3 different image sets) were transformed (25% towards the high perceived intelligence transform, and 25% towards the low perceived intelligence transform). This was achieved using Psychomorph software, which adds 25% of the shape, colour and texture difference between the base face and the composite high or low perceived intelligence face, to the base face (Tiddeman et al., 2001). This resulted in 9 pairs of faces, with the same identity within each pair transformed to look more or less intelligent. These were rated by a sample of 244 male and 210 female students via on online survey hosted at perceptionlab.com (mean age: 30.87 (11.59)) for perceived intelligence ("How intelligent does this face look?"; 1 = not at all intelligent, 7 = extremely intelligence). The high intelligence transforms were perceived as significantly more intelligent than the low intelligence transforms (high intelligence: 3.61 (0.75); low intelligence: 2.61 (0.91); $t(453) = 25.78$, $p < 0.001$). See Figure 2.

[Figure 2 about here.]

b. Questionnaires

Participants answered identical questions regarding their menstrual cycle as in Study 1, and also reported whether they are currently using – or stopped using in the preceding 3 months – hormonal contraception. They indicated their age, sexual orientation, country of residence, ethnicity, relationship status and maximum level of education.

Procedure

Participants completed the questionnaire followed by the face preference tests. Face pairs were displayed and rated on 1 to 7 likert scales ("Which face do you prefer?"; 1 = strongly prefer left, 2 = prefer left, 3 = slightly prefer left, 4 = no preference, 5 = slightly prefer right, 6 = prefer right, 7 = strongly prefer right). The side on which the high- and low-perceived intelligence composites were displayed and the order of pairs were fully randomized. Menstrual cycle phase was calculated as described for Study 1, with the exception that days falling between menstrual cycle day 0 and ovulation were treated as the fertile period (i.e. the entire follicular phase).

Mean preferences for perceived intelligence were computed (i.e. a score > 4 represents a preference for high perceived intelligence, a score < 4 represents a preference for low perceived intelligence, and a score of 4 represents no preference in either direction).

Effects of menstrual cycle phase, use of hormonal contraceptives and relationship status were assessed using ANOVA (Model 1: between subjects factors were cycle phase (follicular or luteal), and relationship status (single or in a relationship); Model 2: between subjects factors were use of hormonal contraceptives (yes or no), and relationship status (single or in a relationship)). Participants who reported use of hormonal contraceptives were excluded from Model 1.

Results

The results of Models 1 and 2 revealed no significant effects of cycle phase, use of hormonal contraceptives, or relationship status, and no significant interactions (all $p > 0.2$).

Discussion

Consistent with Study 1, and with Prokosch et al. (2009), we did not find effects of menstrual cycle phase or relationship context on preferences for facial cues to intelligence, despite our attempts to reach a more representative sample of women than has been achieved by previous research. While this suggests that failure to detect such effects is not simply an artifact of testing University students, our sample was still limited to women with access to the internet, with sufficient interest in psychology to participate, and to a relatively highly educated profile. Future work which accesses a truly representative sample both in terms of the participants who contribute to the facial stimuli, and those who rate them, may yield different results. To date, however, there is a consistent lack of support for context-dependent intelligence preferences.

A limitation of previous research, including Studies 1 and 2, is failure to control for the strong tendency for individuals to mate assortatively on the basis of traits including intelligence (Jensen, 1998; Watson et al., 2004). Any effect of relationship context or cycle phase may be secondary to positive assortment effects. In Study 3, then, we asked participants to rate their own intelligence and controlled for this in analyses. A further limitation of Studies 1 and 2 was our reliance on participant's relationship status as a method of assessing effects of relationship context on preferences. In Study 3 we sought to test preferences for our perceived intelligence stimuli under long-term and short-term contexts.

Study 3

Here we tested preferences for cues to intelligence under long- and short-term relationship contexts and controlled for self-rated intelligence.

Methods

Participants

Seventy eight heterosexual female participants aged 16 to 45 (age: 26.97 (8.06)) were recruited to an online experiment hosted on a face research website (www.perceptionlab.com). Eighty four percent were in a relationship at the time of testing. Data regarding country of origin and ethnicity was not collected.

Materials

a. Facial stimuli

Stimuli were those described in Study 2.

b. Questionnaire

Participants reported their age, sexual orientation and relationship status and rated themselves for intelligence ("How intelligent do you consider yourself to be?"; 1 = not at all intelligent, 7 = extremely intelligent).

Procedure

Participants completed the short questionnaire followed by the face preference test. Face pairs were displayed in random order in a forced choice paradigm, in which participants had to choose which face they found more attractive from each of the 9 pairs and to express the strength of their preference from a scale presented below the faces (“Which face do you prefer?”; 1 = strongly prefer left, 2 = prefer left, 3 = slightly prefer left, 4 = no preference, 5 = slightly prefer right, 6 = prefer right, 7 = strongly prefer right). Faces were rated for desirability for both a short-term and a long-term relationship (“Which face would you prefer for a short/long-term relationship?). Order of presentation of pairs, relationship context and the side on which each face was displayed were fully randomized. Responses were coded as for Study 2, and mean preferences across all 9 pairs for each relationship context were computed.

Results

In ANOVA with 1 within-subjects factor (relationship context: short-term and long-term) and self-rated intelligence (mean: 5.73 (1)) as a covariate, there were no main effects of relationship context ($F_{(1, 76)} = 3.58$, $p = 0.062$) or self-rated intelligence ($F_{(1,76)} = 5.19$, $p = 0.063$) and no interaction between relationship context and self-rated intelligence ($F_{(1,76)}= 3.29$, $p = 0.074$). As, however, results approached significance, bivariate correlations were explored and demonstrated significant relationships between self-rated intelligence and preferences for cues to intelligence in the face for long-term ($rs(78) = 0.29$, $p = 0.01$), but not short-term relationships ($rs(78) = 0.18$, $p = 0.116$).

Discussion

Results demonstrate an effect of relationship context on preferences for cues to intelligence in the face when self-rated intelligence is controlled for, with women expressing stronger preferences for cues to intelligence in the context of a short-term relationship. Post-hoc analyses revealed assortment to be present only in the context of long-term relationships. This suggests that women take their own intelligence into account when judging desirability of males for long-term relationships, perhaps reflecting considerations such as compatibility, but that these considerations may not be made in the context of short-term relationships. Failure to control for positive assortment in the context of long-term relationships may explain why previous studies have not detected an effect of relationship context on preferences for intelligence (but see Regan and Joshi, 2003). It should also be noted that women tend to underestimate their own intelligence (Furnham et al. 2002) and while self-ratings may correlate with other-rated intelligence they are not always an accurate reflection of actual intelligence (Borkenau and Liebler, 1993). Actual intelligence scores, then, would be a useful addition although we argue that self-perceived intelligence is likely to be at least as important to the mating decisions of individuals as actual intelligence scores.

Study 4

The aim of Study 4 was to test the validity of preferences for facial cues to intelligence by comparison with self-reported partner characteristics.

Methods

Participants

One hundred and fifty-three female participants (age: 25.1 (7.24)) were recruited to an online experiment via the Abertay University psychological research site. All participants were heterosexual and aged 16 or over. Thirty four percent of participants reported using hormonal contraceptives, and 57% reported being in a relationship. Eighty-one percent were European residents, 96% were Caucasian and 73% had a University education. See Table 1.

Materials

a. Facial stimuli

Facial stimuli were a subset of the 9 face pairs described in Study 3 (n = 3 pairs) transformed to differ in cues to intelligence. A subset (the first 3 face pairs displayed in Figure 2), rather than the full set of 9 face pairs, was used in order to reduce the duration of the test.

b. Questionnaires

Participants reported their age and sexual orientation, and rated intelligence of current or most recent partner ("How intelligent is your current or most recent partner?"; 1 – 7; 1 = not at all intelligent, 7 = extremely intelligent).

Procedure

Participants completed the questionnaire followed by the face preference tests (with faces displayed individually and in random order) on remote computers.

Average preferences for cues to high over low intelligence were computed by first calculating the mean preference for the 3 high-perceived intelligence faces (high IQ pref) and for the 3 low-perceived intelligence faces (low IQ pref). Preference for cues to high over low perceived intelligence was then calculated by subtracting low IQ pref from high IQ pref (high IQ pref – low IQ pref), such that a positive score represented a preference for cues to high intelligence, and a negative score preferences for cues to lower intelligence.

Results

In a bivariate linear regression model (Adj $R^2 = 0.03$, $F_{(1, 148)} = 5.13$, $p = 0.025$), partner intelligence was a significant predictor of preference for facial cues to intelligence ($\beta = 0.18$, $p = 0.025$).

General Discussion

There were no effects of menstrual cycle phase on preferences for facial cues to intelligence in 3 samples of women, spanning undergraduate students and women from a broader range of backgrounds. Neither were there effects of the use of hormonal contraceptives, suggesting that women's preferences for intelligence are not hormonally mediated. Women considering faces in the context of a short-term relationship, however, expressed stronger preferences for cues to intelligence than in the context of a long-term relationship. Importantly, this was only the case when self-rated intelligence was controlled for in analyses, suggesting that assortative mating on the basis of intelligence may account for the failure of previous studies to detect these effects. Post hoc tests revealed positive assortment only in a long-term relationship context, suggesting that an effect of relationship context on preferences may stem from the mediation of preferences in the long-term context, rather than greater value placed on intelligence in a short-term context. In addition, we found that preferences for perceived intelligence in the face were positively associated with self-rated partner intelligence.

Women's preferences for cues to intelligence have now been shown to be independent of hormonal status across 5 studies (Studies 1 – 3; Gangestad et al., 2007; Prokosh et al., 2009). Our results contribute to a growing body of results consistent with intelligence as a fitness indicator rather than a trait that is traded off against other valuable aspects of fitness (Arden et al., 2008, 2009; Banks et al., 2010; Furlow et al., 1997; Gottfredson & Deary, 2004; Miller & Penke, 2007; Prokosch et al. 2005). In other words, there may be multiple benefits associated with an intelligent partner that render it an essential consideration in mate choice decisions. One potential explanation is that fitness for the highly educated, high socioeconomic status women in our samples and those of the other studies reported here, is more closely linked to intelligence than to health. We may find different results under more diverse social and environmental conditions, suggesting great value to cross cultural work to answer these questions. Alternatively, intelligence may be associated with direct fitness benefits such as status and resource provision, meaning that it provides cues to traits essential to mate choice decisions regardless of context (but see Lee et al. 2012).

We acknowledge that our results are limited to preferences for cues to intelligence in the face, and further to one set of facial stimuli, so are prone to issues of pseudo-replication. Furthermore, our stimuli were created on the basis of perceived – rather than actual – intelligence, perhaps limiting the ecological validity of our findings. While we advocate replication of methods using stimuli based on actual intelligence scores and which address multiple modalities, we suggest that perceived intelligence

– particularly when controlling for an attractiveness halo effect as we sought to achieve with our stimuli – is both a good proxy to actual intelligence (Zebrowitz et al., 2002) and valid in terms of assessing preferences. Future work, however, should attempt to identify the specific qualities that are signaled in our facial stimuli and which contribute to perceived intelligence (e.g. social dominance, mental altertness, self esteem).

In conclusion, our results demonstrate that women prefer facial cues to intelligence regardless of their hormonal status or the relationship context. Effects of relationship context on preferences when own intelligence or attractiveness are controlled for appears to be due to positive assortment for intelligence in the long-term relationship context. We propose that our results are consistent with intelligence as a fitness indicator, but that cross cultural research is required to identify whether all traits associated with intelligence are consistently preferred across environments with different social and physical demands.

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Figure 1. Composite low (left) and high (right) perceived intelligence facial stimuli. Faces constructed from groups of five faces that differed in perceived intelligence, but were matched for attractiveness, age and sexual dimorphism (Moore et al. 2011).

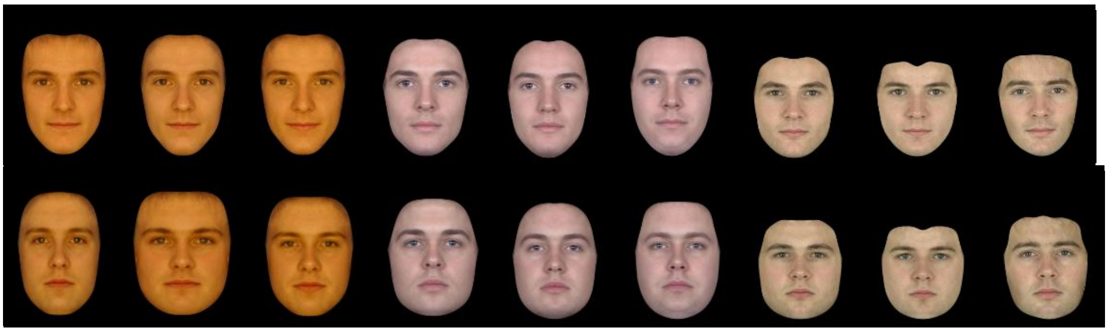

Figure 2. Face pairs transformed to look high (upper level) and low (lower level) in perceived intelligence.

Study	Participant age	n	Selection criteria	Stimuli	Preference ratings	Follicular	Luteal
1	19.67 (1.35)	34	Heterosexual, not pregnant or using hormonal contraceptives	Pair of composite male faces (Fig 1)	Positive score = pref for high perceived intelligence; Negative score = pref for low perceived intelligence; 0 = no pref.	0.27 (0.23) *n = 34*	0.21 (0.29) *n = 34*
2	24.58 (7.37)	528	Heterosexual, not pregnant, age >= 16 & <= 45	9 pairs of transformed faces (Fig 2)	Score > 4 = pref for high perceived intelligence; score < 4 = pref for low perceived intelligence; score of 4 = no pref.	5.24 (1.12) *n = 165*	5.06 (1.2) *n = 126*
3	26.97 (8.06)	78	Heterosexual, age >= 16 & <= 45	9 pairs of transformed faces (Fig 2)	Score > 4 = pref for high perceived intelligence; score < 4 = pref for low perceived intelligence; score of 4 = no pref.	NA	NA
4	25.1 (7.24)	153	Heterosexual, age >= 16 & <=45	3 pairs of transformed faces (Fig 2)	Score > 4 = pref for high perceived intelligence; score < 4 = pref for low perceived intelligence; score of 4 = no pref.	NA	NA

Table 1 showing participant profile (age, sample size and selection criteria), stimuli, ratings structure, and descriptive statistics (mean (1 SD)) for Studies 1 – 4.