Evolution and Human Behavior 35 (2014) 193–203

Contents lists available at ScienceDirect

Evolution and Human Behavior

journal homepage: www.ehbonline.org

Original Article

A multivariate approach to human mate preferences

Anthony J. Lee [a,*], Shelli L. Dubbs [a], William Von Hippel [a], Robert C. Brooks [b], Brendan P. Zietsch [a,c,*]

[a] School of Psychology, The University of Queensland, St. Lucia 4072, Brisbane, Queensland, Australia
[b] Evolutionary and Ecology Research Centre, University of New South Wales, 2052 Sydney, New South Wales, Australia
[c] Genetic Epidemiology Laboratory, Queensland Institute of Medical Research, Herston 4006, Brisbane, Queensland, Australia

ARTICLE INFO

Article history:
Initial receipt 28 May 2013
Final revision received 13 January 2014

Keywords:
Facial attractiveness
Sexual dimorphism
Multiple cues
Sexual selection

ABSTRACT

Human mate choice is complicated, with various individual differences and contextual factors influencing preferences for numerous traits. However, focused studies on human mate choice often do not capture this multivariate complexity. Here, we consider multiple factors simultaneously to demonstrate the advantages of a multivariate approach to human mate preferences. Participants ($N = 689$) rated the attractiveness of opposite-sex online dating profiles that were independently manipulated on facial attractiveness, perceived facial masculinity/femininity, and intelligence. Participants were also randomly instructed to either consider short- or long-term relationships. Using fitness surfaces analyses, we assess the linear and nonlinear effects and interactions of the profiles' facial attractiveness, perceived facial masculinity/femininity, and perceived intelligence on participants' attractiveness ratings. Using hierarchical linear modeling, we were also able to consider the independent contribution of participants' individual differences on their revealed preferences for the manipulated traits. These individual differences included participants' age, socioeconomic status, education, disgust (moral, sexual, and pathogen), sociosexual orientation, personality variables, masculinity, and mate value. Together, our results illuminate various previously undetectable phenomena, including nonlinear preference functions and interactions with individual differences. More broadly, the study illustrates the value of considering both individual variation and population-level measures when addressing questions of sexual selection, and demonstrates the utility of multivariate approaches to complement focused studies.

1. Introduction

Mate choice is complicated. In even the simplest of animal mating systems, the outcome of mate choice can depend on a suite of variables (Moller & Pomiankowski, 1993; Brooks & Endler, 2001b). Mate choice among humans is more complex than in almost any other species, with studies showing mate preferences for a large range of traits. This includes effects on attractiveness of wealth (Henrich, Boyd, & Richerson, 2012), status (Li, Bailey, Kenrick, & Linsenmeier, 2002), intelligence (Miller, 2000), strength (Puts, 2010), smell (Wedekind, Seebeck, Bettens, & Paepke, 1995), facial masculinity or femininity (Perrett et al., 1998; Little, Jones, Penton-Voak, Burt, & Perrett, 2002), voice pitch (Puts, 2005), stature (Kurzban & Weeden, 2005), body shape (Singh, 1993), kindness (Li et al., 2002), and personality (Botwin, Buss, & Shackelford, 2006). This list of features considered cues for mate choice is not exhaustive and is still growing rapidly.

In addition, variation among individuals has also been shown to be important when choosing a mate. This includes whether an individual is considering a short- or long-term partner (Buss, 1989), their physical attractiveness—both self-rated (Little, Burt, Penton-Voak, & Perrett, 2001) and other-rated (Montoya, 2008)—their age (Buss & Barnes, 1986), personality (Buss & Barnes, 1986), pathogen disgust sensitivity (DeBruine, Jones, Tybur, Lieberman, & Griskevicius, 2010; Jones, Fincher, Little, & DeBruine, 2013), sociosexual orientation (Simpson & Gangestad, 1992; Waynforth, Delwadia, & Camm, 2005; Provost, Kormos, Kosakoski, & Quinsey, 2006), education (Mare, 1991), and, for women, whether they are at the fertile phase of the menstrual cycle (Penton-Voak et al., 1999). Adding to the complexity, contextual factors or environmental influences also play a role in moderating the strength and direction of mate preferences. Factors such as local aggregate and individual economic circumstances (Stone, Shackelford, & Buss, 2008), health conditions (DeBruine, Jones, Crawford, Welling, & Little, 2010; Moore et al., 2013), sex ratio (Stone, Shackelford, & Buss, 2007), and gender parity (Zentner & Mitura, 2012) can influence the weighting given to different mate choice criteria. Many other individual differences or contextual effects no doubt remain to be discovered.

In addition to the multivariate nature of mate choice, individuals in search of a mate can vary in their motivation to choose, and in the strength and direction of their preferences (Jennions & Petrie, 1997). Some of this variation can arise due to genetic variation between

* Corresponding authors. School of Psychology, The University of Queensland, St. Lucia, 4072, Brisbane, Queensland, Australia.
E-mail addresses: anthony.lee@uqconnect.edu.au (A.J. Lee), Brendan.Zietsch@qimrberghofer.edu.au (B.P. Zietsch).

1090-5138/$ – see front matter.
http://dx.doi.org/10.1016/j.evolhumbehav.2014.01.003

individuals (Verweij, Burri, & Zietsch, 2012; Zietsch, Verweij, & Burri, 2012), idiosyncratic issues of adaptive compatibility (e.g. genetic compatibility; Roberts & Little, 2008), or as a plastic response to the context in which individual "choosers" find themselves (Lee & Zietsch, 2011; Little, Cohen, Jones, & Belsky, 2007; Little et al., 2011).

Previous studies on human mate choice have predominantly focused on one or two mate choice criteria at a time, which are useful for identifying potential effects or testing specific hypotheses, but often over-simplify the multivariate complexity of mate choice. Such a picture could be incomplete for several reasons: Firstly, multiple mate choice criteria may interact with each other in ways that cannot be detected by experimental tests of mate preferences under tightly controlled conditions. Most studies also further simplified mate choice by focusing on linear relationships, ignoring the possibility of nonlinear effects on mate preferences (such as exponential or quadratic relationships).

Multivariate studies of animal mate choice have shown that interactions between traits can add important nonlinearity to the overall pattern of selection (Blows & Brooks, 2003; Blows, Chenoweth, & Hine, 2004; Brooks et al., 2005; A. J. Moore, 1990). Interactions among color pattern traits in guppies (Blows & Brooks, 2003; Blows, Brooks, & Kraft, 2003) revealed selection on those patterns and a complex multi-peak fitness surface that linear selection analyses failed to detect (Brooks & Endler, 2001a). Likewise, simultaneous manipulations of suites of acoustic traits in crickets (Brooks et al., 2005; Bentsen, Hunt, Jennions, & Brooks, 2006) and frogs (Gerhardt & Brooks, 2009) revealed strong stabilizing selection and exponential (positive quadratic) selection that univariate manipulations had not exposed. Studies on human mate preferences have also revealed nonlinear effects; for example, men's body preferences for intermediate shoulder, hip, and waist widths over larger or smaller widths (Donohoe, von Hippel, & Brooks, 2009). Other studies of human mate preferences have also found complex interactions among a handful of factors; for example Penton-Voak et al. (2003) found that women's preference for facial sexual dimorphism was influenced by an interaction between their condition and whether they were rating for short- or long-term attractiveness. Brooks, Shelly, Fan, Zhai, and Chau (2010) found that multivariate nonlinear selection analyses consistently outperformed indices and ratios such as body mass index (BMI), waist-to-hip ratio and age in predicting the attractiveness of scanned images of female bodies. These examples further emphasize the need to look beyond focused studies.

In addition, the different properties that alter the value of a potential mate are often correlated—sometimes positively but also sometimes negatively. Positively correlated preferences could indicate that traits are preferred because they reflect the same underlying quality (e.g., cues for the same trait). However, preference for correlated traits may also solely be driven by one of the traits (e.g., preferences for facial symmetry could be driven by preference for a correlated trait such as facial sexual dimorphism; Scheib, Gangestad, & Thornhill, 1999). Conversely, unrelated or negatively correlated traits (e.g. between a potential mate's attractiveness and faithfulness) can turn choice into an exercise in optimization. Such possibilities cannot be captured in studies that assess effects in isolation.

The multivariate complexity of mate choice and the many sources of variation among individual choosers combine to make mate choice more complex and varied than it might appear from the experiments often used to test focused hypotheses. Fortunately, evolutionary biology has well-established multivariate methods for estimating linear and nonlinear selection (fitness surfaces) on suites of correlated traits (Lande & Arnold, 1983; Phillips & Arnold, 1989), for comparing fitness surfaces among groups or experimental treatments (Chenoweth & Blows, 2005), and for visualizing complex fitness surfaces (Brodie, Moore, & Janzen, 1995; Blows & Brooks, 2003). It is also possible to combine multivariate response surface analysis with independent manipulations of suites of continuous traits that are ordinarily correlated in order to establish how each trait contributes to selection (Brooks et al., 2005; Donohoe et al., 2009; Gerhardt & Brooks, 2009; Mautz, Wong, Peters, & Jennions, 2013).

Here we use a large data set generated from an experiment testing the factorial effects of facial attractiveness, facial masculinization or feminization, and intelligence on the attractiveness ratings participants gave to online dating profiles. These three traits have received much attention in the mate preference literature as putative fitness indicators; it is unknown if they contribute additively or non-additively (i.e. interactively) to overall attractiveness. We also measured individual variation on 17 traits of the profile-raters and entered these traits simultaneously in a hierarchical linear model to determine how these could independently affect preference for facial attractiveness, perceived facial masculinity/femininity, and perceived intelligence of the dating profiles.

2. Methods

2.1. Participants

Participants were 430 men ($M \pm SD = 23.07 \pm 4.86$ years) and 422 women ($M \pm SD = 24.07 \pm 6.80$ years) who were recruited from an online survey Web site (http://www.socialsci.com) in return for online store credit. Participation was conditional on being heterosexual and not currently in a long-term relationship. Participants who completed the incorrect survey (i.e., males who completed the female survey and vice versa; 33 males, 5 females), did not identify as being heterosexual (34 males; 71 females), or did not report their age (6 males; 2 females) were removed from analyses. A further 1 male and 6 females were removed for completing the survey in an unrealistic time ($<$5 min), which suggested a lack of attention to the questions, and a further 5 females were removed for substantial missing data. This reduced the sample size to 356 men ($M \pm SD = 23.27 \pm 4.93$ years) and 333 women ($M \pm SD = 24.15 \pm 6.18$ years). The study was administered online and participants completed it in one sitting.

2.2. Stimuli

Participants were first asked to rate the attractiveness of a series of individuals in ostensible online dating profiles. Each profile consisted of a facial photo, as well as a short personal description embedded in a realistic dating profile template. These profiles varied independently across three dimensions: facial attractiveness, perceived facial masculinity/femininity, and perceived intelligence. Facial images were collected from stock image Web sites, while profile descriptions were adapted from self-descriptions obtained on real dating Web sites. Independent online volunteers recruited from SocialSci.com evaluated the facial attractiveness of the individuals in the photos (75 males and 65 females) and the perceived intelligence of the personal descriptions (136 males and 131 females) in the absence of other stimuli. From these ratings, 32 facial photographs and personal descriptions of each sex were chosen to represent the full spectrum of facial attractiveness and perceived intelligence (mean facial attractiveness $\pm$ $SD = 47.21 \pm 13.91$ and 57.87 ± 13.68 for male and female images respectively; mean perceived intelligence $\pm$ $SD = 54.97 \pm 20.21$ and 49.46 ± 20.59 for male and female descriptions respectively). Inter-rater reliability was high for both traits ($\alpha = .87$ and .91 for facial attractiveness of male and female photographs respectively; $\alpha = .86$ and .87 for perceived intelligence of the descriptions for male and females respectively). Perceived facial masculinity/femininity was manipulated by morphing each facial photograph with either a masculine or feminine template, which was developed through a combination of averaged male and female faces and perceived masculine and feminine caricatures as developed by Johnston, Hagel, Franklin, Fink, and Grammer (2001). Facial photographs