



Original Article

Testing the prediction from sexual selection of a positive genetic correlation between human mate preferences and corresponding traits



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ABSTRACT

Sexual selection can cause evolution in traits that affect mating success, and it has thus been implicated in the evolution of human physical and behavioural traits that influence attractiveness. We use a large sample of identical and nonidentical female twins to test the prediction from mate choice models that a trait under sexual selection will be positively genetically correlated with preference for that trait. Six of the eight preferences we investigated, i.e. height, hair colour, intelligence, creativity, exciting personality, and religiosity, exhibited significant positive genetic correlations with the corresponding traits, while the personality measures 'easy going' and 'kind and understanding' exhibited no phenotypic or genetic correlation between preference and trait. The positive results provide important evidence consistent with the involvement of sexual selection in the evolution of these human traits.

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1. Introduction

Sexual selection is an evolutionary process generated by individual differences in number and identity of mates (Andersson, 1994). These differences can result from interactions between individuals of the same-sex (intrasexual selection; e.g. male–male competition) or opposite-sex (intersexual selection; i.e. mate choice). Here we focus on the latter, in which heritable traits in one sex are subject to selection pressure from mate preferences of the opposite sex.

Humans are highly selective when choosing a partner, and mate choices are based on a variety of traits providing cues to quality or compatibility (Buss & Barnes, 1986). These attractive traits can potentially affect reproduction, and it has been suggested that the consequent sexual selection has played an important role in shaping our physical and behavioural characteristics (Darwin, 1859, 1871; Miller, 2000). Sexual selection tends to result in traits that differ greatly between even closely related species (Andersson, 1994; Darwin, 1871) and also show wide heritable variation within species (Pomiankowski & Moller, 1995). Many defining human characteristics are of known importance in mate selection, differ greatly from those of other apes, and exhibit large heritable variation between

individuals, begging investigation into the possible role of sexual selection in their evolution.

Such traits include intelligence, creativity, personality characteristics, and morphological characteristics including body shape and size, and hair colour. As well as differing distinctly from those of apes, these traits exhibit substantial heritable variation within humans (Bouchard & McGue, 2003; Zietsch, Verweij, Heath, & Martin, 2011), and recent evidence indicates substantial heritable variation in unconstrained mate preferences for these traits (Verweij, Burri, & Zietsch, 2012; Zietsch, Verweij, & Burri, 2012). Despite these clues, formulating tests of the historical influence of sexual selection on the traits has proven difficult. However, evolutionary genetics does provide a testable prediction for traits under sexual selection. Given heritable variation in traits and trait preferences, individuals with stronger-than-average preference for a certain trait will tend to choose a mate with above-average values of that trait, with the resulting offspring tending to inherit alleles predisposing to both stronger-than-average trait and stronger-than-average preference. This co-inheritance leads to linkage disequilibrium (i.e. correlated allelic values across loci, and therefore genetic correlation) between a trait and the preference for it. As such, a prediction from mate choice models is that a trait under sexual selection will be positively genetically correlated with preference for that trait (Fuller, Houle, & Travis, 2005; Lande, 1981).

In many animals, apparent sexual displays are only present (or highly exaggerated) in the male, and female preference for these

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displays drives sexual selection. As such, animal studies have generally tested for a genetic correlation between male display and female preference, since while genes for preference and display are expected to be present in each individual, phenotypic expression of the genes will only be observed in one or the other sex. Using designs such as artificial selection and full-sib/half-sib breeding, these studies have yielded positive genetic correlations between female preferences and corresponding male traits in some studies (of insects and fish; Bakker, 1993; Blows, 1999; Houde, 1994; Simmons & Kotiaho, 2007; Wilkinson & Reillo, 1994), but not in other studies (of insects, caterpillars, fish, and birds; Allison, Roff, & Carde, 2008; Breden & Hornaday, 1994; Lofstedt, Hansson, Roelofs, & Bengtsson, 1989; Morris, Wagner, & Ryan, 1996; Muhlhauer & Blanckenhorn, 2004; Qvarnstrom, Brommer, & Gustafsson, 2006; Ritchie, Saarikettu, & Hoikkala, 2005; Zhou, Kelly, & Greenfield, 2011). In humans, many of the traits that most contribute strongly to attractiveness are exhibited in both sexes, and the vast majority of traits that can be measured in both sexes (e.g. height, body mass index, personality traits, intelligence) do not exhibit marked genetic sex-limitation—that is, for most human traits, underlying genes express similar effects in males and females (Vink et al., 2012). As such, genetic correlation between trait and preference should be observable within-sex. Only one human study has tested this, using a relatively small sample of female twins to find significant genetic correlation between altruism and preference for altruism in a mate (Phillips, Ferguson, & Rijdsdijk, 2010).

In the present study we investigate a range of mate preferences for traits of known salience in human mate selection, along with the corresponding traits themselves, in a large sample of identical and nonidentical female twins. Using bivariate genetic modelling, we test the prediction from sexual selection that each trait preference will be positively genetically correlated with the trait itself.

2. Methods

2.1. Participants

We use data on female twins from the UK Adult Twin Registry, a population-based cohort of Caucasian twins (see Spector and Williams, 2006). The twin registry consists primarily of females (because the initial focus of the registry was on osteoporosis and osteoarthritis, conditions with a higher prevalence in females), and the male sample was too small to provide sufficient power for the equivalent analyses in males. Note that Andrew et al. (2001) tested the representativeness of the sample for a number of diseases, traits and environmental factors, and they found the twin sample to be no different to the UK population or a singleton population cohort from North-East London. For the preference data, the sample (collected in 2002) consisted of 1,763 full pairs and 2,823 single twins, the latter group retained to increase precision of the means. Approximately half (49.1%) of the twins were identical (monozygotic; MZ) and half (50.9%) nonidentical (dizygotic; DZ), and ages ranged from 19 to 83 (51.0 ± 12.7). The data on personal traits were collected at several time points as part of various studies between 1999 and 2009. Sample sizes therefore vary considerably between the various measures, and these are noted when describing the measures below.

Zygosity of the twins was determined based on standardised questions about physical similarity that have over 95% accuracy when judged against genotyping and when uncertain checked by genotyping (Peeters et al., 1998). Further details about the sample, data collection, zygosity determination and on the comparability of the twins to age-matched singleton populations can be found elsewhere (Spector and Williams, 2006; Andrew et al., 2001). The data used in this project are available through <http://www.twinsuk.ac.uk/data-access/submission-procedure/>.

2.2. Measures

The mate preferences reported here, shown in Table 1, come from a) a scale on which participants ranked 13 traits according to their relative importance in a long-term mate, validated by Buss and Barnes, (1986) and used in Buss' landmark study of mate preferences across 37 cultures (Buss, 1989), and b) a range of sexually dimorphic physical traits for which participants reported the characteristic they were more likely to be attracted to, via dichotomous response options. The preference measures are described in more detail elsewhere (Verweij et al., 2012; Zietsch et al., 2012). The subset of preferences used in this study were those for which a roughly corresponding trait measure was available on the same sample—those preferences were 'height' (tall/short), 'hair colour' (brown/blonde), 'intelligent', 'creative and artistic', 'exciting personality', 'easygoing', 'kind and understanding', and 'religious'.

As for the corresponding personal traits, height (N pairs = 3349) and hair colour (N pairs = 129) were self-reported, and analysed as ordinal data so as to be able to be analysed with the corresponding dichotomous preference measures. 'Hair colour' was dichotomised into darker colour (black, brown and chestnut) and lighter colours (blonde) (NB: red, strawberry and mouse were treated as missing data, the aforementioned N does not include these). 'Height' was converted into six ordinal categories, so it could be analysed with the dichotomous preference measure of height. 'Intelligence' (N pairs = 308) was measured with the National Adult Reading Test (Nelson, 1982), which is a validated measure of intelligence that is strongly correlated ($r \approx 0.8$) with full-scale and verbal IQ (Crawford, Stewart, Cochrane, Parker, & Besson, 1989; Nelson, 1982). 'Creativity' (N pairs = 2174) was measured with slight variations of an item on which participants rated their creativity from 'not very artistic or creative', to 'extremely artistic or creative' on a five-, seven-, or ten-point rating scale, depending on which questionnaire it was taken from. Similarly, 'religiosity' (N pairs = 2796) was measured with an item on which participants rated their religiosity from 'not at all' to 'extremely' on a ten-point scale (standardised). 'Exciting personality' (N pairs = 1746), 'easygoing' (N pairs = 2455), and 'kind and understanding' (N pairs = 1750) were measured with the TIPI (Ten-Item Personality Inventory; (Gosling, Rentfrow, & Swann, 2003) scales extraversion, emotional stability, and agreeableness, respectively, plus some additional very similar items. For 'creativity', 'religiosity', and the personality measures, scores were standardised per-item, and where scores on multiple items were available for a

Table 1
Identical (MZ) and nonidentical (DZ) twin pair correlations (and 95% confidence intervals) for each trait and preference for that trait.

		MZ twin pair correlation (95% CI)	DZ twin pair correlation (95% CI)
Height ^a	Trait	0.90 (0.89, 0.91)	0.55 (0.51, 0.58)
	Preference	0.31 (0.13, 0.48)	0.12 (−0.10, 0.34)
Hair colour ^a	Trait	1.00 (0.98, 1.00)	0.26 (−0.18, 0.63)
	Preference	0.28 (0.14, 0.41)	−0.12 (−0.27, 0.04)
Intelligent ^b	Trait	0.73 (0.64, 0.79)	0.33 (0.21, 0.44)
	Preference	0.36 (0.28, 0.43)	0.28 (0.20, 0.35)
Creative and artistic ^b	Trait	0.46 (0.42, 0.50)	0.13 (0.06, 0.19)
	Preference	0.23 (0.14, 0.31)	0.16 (0.08, 0.24)
Religious ^b	Trait	0.54 (0.51, 0.57)	0.38 (0.33, 0.42)
	Preference	0.29 (0.21, 0.36)	0.22 (0.13, 0.29)
Exciting personality ^b	Trait	0.46 (0.41, 0.50)	−0.01 (−0.08, 0.06)
	Preference	0.25 (0.17, 0.32)	0.05 (−0.04, 0.13)
Kind and understanding ^b	Trait	0.29 (0.23, 0.34)	0.13 (0.06, 0.20)
	Preference	0.24 (0.16, 0.32)	0.08 (0.00, 0.16)
Easy going ^b	Trait	0.35 (0.30, 0.39)	0.09 (0.02, 0.15)
	Preference	0.20 (0.11, 0.28)	0.13 (0.05, 0.22)

^a Preferences obtained from dichotomous forced-choice items regarding morphological characteristics (tall/short, brown/blonde).

^b Preferences obtained from a scale on which participants ranked 13 traits according to their relative importance in a long-term mate.

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