**Supplementary Material**

Did sexual selection shape human music? Testing predictions from the sexual selection hypothesis of music evolution using a large genetically informative sample of over 10,000 twins

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Supplementary results: Genetic modelling - Preliminary analyses

Before fitting univariate and bivariate twin models to estimate the A, C, and E variance components as well as the genetic and environmental correlations between traits, we tested the effects of age and zygosity on the means and variances of each of the traits (α = 0.01).

We found significant mean differences in height between MZ and DZ twins for both sexes (both *p*<0.01), where DZ twins were on average taller than MZ twins. Further, females from opposite-sex pairs had significantly more sex partners than females from same-sex pairs (*p*=0.001) and the variance in number of sex partners could not be equated within DZ-male pairs, or between MZ and DZ females (both *p*<0.01).

Older individuals scored on average lower on the musical aptitude and musical achievement measures, lower on the IQ test, had more lifetime sex partners, had more children, and scored lower on sociosexuality (all *p*<0.01). The age effects for musical aptitude and sociosexuality were stronger for males than for females (both *p*<0.01).

When means or variances differed significantly within twin pairs, or between zygosities they were left unequated in subsequent genetic modelling. Furthermore, all genetic analyses were performed separately for males and females and age effects were taken into account (also when not significant).

Supplementary Table S1. Twin pair correlations (95% confidence intervals) for each of the traits.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Musical aptitude | Music achievement | Number of sex partners | Age at first intercourse | Sociosexuality | Number of children | IQ | Simple reaction time | Height |
| MZM | 0.72 (0.66; 0.77) | 0.70 (0.65; 0.75) | 0.70 (0.63; 0.76) | 0.68 (0.62; 0.73) | 0.23 (0.11; 0.34) | 0.27 (0.12; 0.41) | 0.60 (0.53; 0.66) | 0.27 (0.15; 0.38) | 0.91 (0.91; 0.92) |
| MZF | 0.72 (0.68; 0.76) | 0.55 (0.48; 0.60) | 0.63 (0.58; 0.68) | 0.75 (0.72; 0.78) | 0.16 (0.07; 0.24) | 0.38 (0.28; 0.48) | 0.57 (0.52; 0.62) | 0.23 (0.15; 0.31) | 0.89 (0.89; 0.90) |
| DZM | 0.53 (0.40; 0.62) | 0.42 (0.29; 0.53) | 0.32 (-0.02; 0.51) | 0.41 (0.24; 0.54) | 0.10 (-0.04; 0.23) | 0.00 (-0.17; 0.18) | 0.36 (0.24; 0.47) | 0.06 (-0.11; 0.22) | 0.43 (0.31; 0.53) |
| DZF | 0.47 (0.35; 0.56) | 0.50 (0.40; 0.58) | 0.30 (0.17; 0.41) | 0.56 (0.48; 0.62) | 0.11 (-0.01; 0.22) | 0.17 (0.02; 0.32) | 0.37 (0.28; 0.45) | 0.02 (-0.12; 0.17) | 0.46 (0.39; 0.53) |
| DZOS | 0.31 (0.21; 0.40) | 0.39 (0.29; 0.47) | 0.13 (0.02; 0.24) | 0.27 (0.18; 0.35) | 0.10 (0.00; 0.19) | 0.08 (-0.03; 0.19) | 0.27 (0.18; 0.35) | 0.17 (0.06; 0.28) | 0.51 (0.45; 0.57) |

MZM = Monozygotic males; MZF=Monozygotic females; DZM=Dizygotic males, DZF= Dizygotic females; DZOS= Dizygotic opposite sex twins

Supplementary Table S2. Results from the univariate twin models (including same-sex twins only). Shown are estimates (and 95% CIs) of the proportion of variance in each of the variables accounted for by additive genetic (A), shared environmental (C), and residual (E) influences.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Trait | Males | | | Females | | |
|  | A | C | E | A | C | E |
| Musical aptitude | 0.38  (0.16; 0.63) | 0.33  (0.09; 0.53) | 0.29  (0.24; 0.35) | 0.51  (0.32; 0.74) | 0.20  (0.14; 0.39) | 0.28  (0.25; 0.33) |
| Music Achievement | 0.57  (0.33; 0.75) | 0.13  (0.00; 0.36) | 0.30  (0.25; 0.35) | 0.09  (0.00; 0.32) | 0.46  (0.25; 0.58) | 0.45  (0.40; 0.52) |
| Number of  sex-partners | 0.70  (0.34; 0.76) | 0.00  (0.00; 0.34) | 0.30  (0.24; 0.37) | 0.63  (0.42; 0.68) | 0.00  (0.00; 0.20) | 0.37  (0.32; 0.42) |
| Age of first intercourse | 0.54  (0.26; 0.73) | 0.13  (0.00; 0.40) | 0.32  (0.27; 0.39) | 0.39  (0.25; 0.55) | 0.37  (0.22; 0.50) | 0.24  (0.21; 0.27) |
| Sociosexuality | 0.23  (0.00; 0.33) | 0.00  (0.00; 0.24) | 0.77  (0.67; 0.89) | 0.09  (0.00; 0.24) | 0.06  (0.00; 0.20) | 0.84  (0.76; 0.93) |
| Number of children | 0.25  (0.00; 0.38) | 0.00  (0.00; 0.20) | 0.75  (0.62; 0.90) | 0.40  (0.08; 0.49) | 0.00  (0.00; 0.27) | 0.60  (0.51; 0.71) |
| IQ | 0.47  (0.22; 0.65) | 0.13  (0.00; 0.34) | 0.40  (0.34; 0.47) | 0.40  (0.21; 0.61) | 0.17  (0.00; 0.35) | 0.42  (0.38; 0.48) |
| Simple reaction time | 0.25  (0.00; 0.36) | 0.00  (0.00; 0.22) | 0.75  (0.64; 0.87) | 0.22  (0.03; 0.30) | 0.00  (0.00; 0.17) | 0.78  (0.70; 0.86) |
| Height | 0.91  (0.89; 0.92) | 0.00  (0.00; 0.15) | 0.09  (0.07; 0.10) | 0.86  (0.73; 0.89) | 0.04  (0.00; 0.17) | 0.11  (0.09; 0.12) |

Supplementary Table S3. Results from the bivariate twin models between the musical ability measures and the measures of mating success and putative indicators of genetic quality. Shown are the genetic (rA), shared environmental (rC) and residual (rE) correlations as well as the bivariate genetic (Biv h2), shared environmental (Biv c2), and residual (Biv e2) contribution to the phenotypic correlation between the traits. Parameters were only estimated when the phenotypic correlation between the traits was significant (otherwise NA).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Musical Aptitude** | | | | | | | | | **Music Achievement** | | | | | | | | |
| **sex** | **Genetic (A)** | | | **Shared environmental (C)** | | | **Residual (E)** | | | **Genetic (A)** | | | **Shared environmental (C)** | | | **Residual (E)** | | |
|  | **rA** | **Biv h2** | **p-value** | **rC** | **Biv c2** | **p-value** | **rE** | **Biv e2** | **p-value** | **rA** | **Biv h2** | **p-value** | **rC** | **Biv c2** | **p-value** | **rE** | **Biv e2** | **p-value** |
| Number of sex-partners | M | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| F | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0.06 | 0.01 | 0.80 | -0.90 | -0.06 | 0.48 | -0.04 | -0.01 | 0.52 |
| Age at first intercourse | M | -0.12 | -0.05 | 0.70 | 0.42 | 0.08 | 0.48 | 0.12 | 0.04 | 0.13 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| F | -0.06 | -0.03 | 0.75 | 0.56 | 0.14 | 0.06 | 0.05 | 0.01 | 0.31 | 0.29 | 0.06 | 0.46 | 0.29 | 0.12 | 0.09 | 0.07 | 0.02 | 0.19 |
| Sociosexuality | M | -0.66 | -0.17 | 0.10 | 0.98 | 0.11 | 0.24 | -0.05 | -0.02 | 0.45 | -0.10 | -0.03 | 0.88 | -0.20 | -0.01 | 0.76 | -0.02 | -0.01 | 0.97 |
|  | F | 0.98 | 0.07 | 0.27 | -1.00 | -0.18 | <0.01 | -0.01 | 0.00 | 0.87 | -0.09 | -0.01 | 0.82 | -0.60 | -0.07 | 0.34 | -0.05 | -0.03 | 0.26 |
| Number of children | M | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0.41 | 0.14 | 0.19 | -1.00 | -0.01 | 0.87 | -0.02 | -0.01 | 0.82 |
|  | F | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| IQ | M | 0.56 | 0.24 | <0.01 | 0.58 | 0.12 | 0.18 | 0.02 | 0.01 | 0.74 | 0.12 | 0.06 | 0.50 | 0.69 | 0.09 | 0.32 | 0.03 | 0.01 | 0.62 |
|  | F | 0.31 | 0.14 | 0.05 | 0.81 | 0.16 | 0.03 | 0.13 | 0.04 | <0.01 | 0.77 | 0.14 | 0.06 | 0.07 | 0.02 | 0.79 | 0.04 | 0.02 | 0.42 |
| Simple reaction time | M | -0.63 | -0.18 | 0.07 | 0.99 | 0.08 | 0.39 | 0.03 | 0.01 | 0.66 | 0.09 | 0.03 | 0.73 | -1.00 | -0.05 | 0.51 | -0.05 | -0.03 | 0.38 |
| F | -0.12 | -0.04 | 0.58 | -1.00 | -0.04 | 0.57 | -0.04 | -0.02 | 0.42 | 0.80 | 0.11 | 0.20 | -1.00 | -0.09 | 0.23 | -0.09 | -0.05 | 0.05 |
| Height | M | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
|  | F | -0.03 | -0.02 | 0.87 | 0.57 | 0.05 | 0.54 | 0.12 | 0.02 | 0.02 | NA | NA | NA | NA | NA | NA | NA | NA | NA |

M=male, F=female