**Supplementary material**

**Multiple rater twin model**

We applied a univariate multiple rater twin model on wellbeing at respectively age 7, 10, and 12 (see Figure S1 for the model). The inclusion of ratings of both the father and mother in the model allows the decomposition of variance in the part that the reviewers agree upon and the part that is rater specific, separately for the father and mother. Furthermore, because of the modelling in twins, both the variance of the rater agreement part and the rater-specific part can be decomposed in an additive genetic component (A), an environmental component shared by twins (C), and an environmental component not shared by twins (E), as explained in the main methods.



**Figure S1.** Rater bias model where variance in wellbeing is decomposed into rater agreement and rater-specific variance, both for the mother and the father. A = additive genetic effects, C= shared environmental effects, E= unique environmental effects

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Rater-specific |  |  |  |  |  |
|  |  | A |  | C |  | E |  | **Total variance** |
|  |  | Common | Specific | Common | Specific | Common | Specific | **Common** | **Mother** | **Father** |
| **Age 7** | Mother | 9% | 24% | 32% | **19%** | 7% | 8% | 33% | 35% | 32% |
|  | Father | 10% | 14% | 33% | 31% | 8% | 4% |  |  |  |
| **Age 10** | Mother | 22% | 15% | 25% | **22%** | 6% | 10% | 36% | 31% | 33% |
|  | Father | 22% | 11% | 25% | 30% | 6% | 6% |  |  |  |
| **Age 12** | Mother | 21% | 15% | 19% | **27%** | 9% | 9% | 35% | 36% | 29% |
|  | Father | 24% | 6% | 21% | 34% | 10% | 6% |  |  |  |

 **Table S1.** Results of the univariate multiple rater twin models at age 7, 10, and 12.

 **Note**: A = additive genetic effects, C= shared environmental effects, E= unique environmental effects

**Gender specific analyses**

**Table S2.** Tracking coefficients for female (top) and male participants (bottom), with the 95% confidence intervals in brackets.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Female** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Age** | 5 | 7 | 10 | 12 | 14 | 16 | 18 | 19-24 | 25-30 | 31-40 | 41-50 | 51-60 | 61+ |
| 5 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |
| 7 | **0.53**(.47-.54) | **1** |  |  |  |  |  |  |  |  |  |  |  |
| 10 | **0.48**(.42-.54) | **0.54**(.48-.59) | **1** |  |  |  |  |  |  |  |  |  |  |
| 12 | **0.37**(.22-.47) | **0.48**(.40-.56) | **0.54**(.48-.60) | **1** |  |  |  |  |  |  |  |  |  |
| 14 | NA | NA | NA | **0.19**(.12-.26) | **1** |  |  |  |  |  |  |  |  |
| 16 | NA | NA | NA | **0.05**(-.10-.19) | **0.49**(.42-.56.) | **1** |  |  |  |  |  |  |  |
| 18 | NA | NA | NA | **0.35**(.10-.59) | **0.36**(.28-.44) | **0.46**(.40-.53) | **1** |  |  |  |  |  |  |
| 19-24 | NA | NA | NA | **-0.27**(.-.60-.06) | **0.27**(.17-.36) | **0.39**(.31-.46) | **0.44**(.38-.50) | **1** |  |  |  |  |  |
| 25-30 | NA | NA | NA | NA | **0.44**(-.04-.92) | **0.25**(.13-.38) | **0.29**(.22-.37) | **0.44**(.36-.53) | **1** |  |  |  |  |
| 31-40 | NA | NA | NA | NA | NA | NA | NA | **0.48**(.20-.77) | **0.52**(.41-.64) | **1** |  |  |  |
| 41-50 | NA | NA | NA | NA | NA | NA | NA | NA | **0.91**(.38-1.0) | **0.46**(.38-.53) | **1** |  |  |
| 51-60 | NA | NA | NA | NA | NA | NA | NA | NA | NA | **0.03**(-.54-.59) | **0.63**(.47-.79) | **1** |  |
| 61+ | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | **0.63**(.26-.87) | **0.57**(.47-.68) | **1** |
| **Male** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Age** | 5 | 7 | 10 | 12 | 14 | 16 | 18 | 19-24 | 25-30 | 31-40 | 41-50 | 51-60 | 61+ |
| 5 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |
| 7 | **0.53**(.48-.59) | **1** |  |  |  |  |  |  |  |  |  |  |  |
| 10 | **0.48**(.42-.54) | **0.60**(.56-.65) | **1** |  |  |  |  |  |  |  |  |  |  |
| 12 | **0.43**(.33-.53) | **0.50**(.43-.58) | **0.54**(.49-.60) | **1** |  |  |  |  |  |  |  |  |  |
| 14 | NA | NA | NA | **0.27**(.19-.35) | **1** |  |  |  |  |  |  |  |  |
| 16 | NA | NA | NA | **0.28**(.11-.45) | **0.43**(.31-.54) | **1** |  |  |  |  |  |  |  |
| 18 | NA | NA | NA | **0.24**(12-.37) | **0.36**(.27-.44**)** | **0.48**(.40-.56) | **1** |  |  |  |  |  |  |
| 19-24 | NA | NA | NA | **-0.16**(-1-.80) | **0.28**(.17-.38) | **0.38**(.28-.47) | **0.43**(.31-.51) | **1** |  |  |  |  |  |
| 25-30 | NA | NA | NA | NA | **0.01**(-.74.77) | **0.11**(-.03-.25) | **0.34**(.18-.50) | **0.34**(.26-.43) | **1** |  |  |  |  |
| 31-40 | NA | NA | NA | NA | NA | NA | **0.35**(-1-1) | **0.38**(.15-.61) | **0.47**(.26-.69) | **1** |  |  |  |
| 41-50 | NA | NA | NA | NA | NA | NA | NA | NA | **0.61**(.15-1.0) | **0.50**(.37-.63) | **1** |  |  |
| 51-60 | NA | NA | NA | NA | NA | NA | NA | NA | NA | **0.81**(-.3-1.0) | **0.62**(.40-.84) | **1** |  |
| 61+ | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | **0.58**(-.28-1.0) | **.42** (.30-.54) | **1** |

**Table S3.** Results of the simplex model for female (top) and male participants (bottom) , with the standard errors or 95% confidence intervals in brackets.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Female** | **Transmission (β)** | **Innovation (Psi, ζ)** | Residual  | Total variance | Variance decomposition |
| **Age** | A | C | E  | A | C | E  | A | C | E  |   | a2 | c2 | e2 |
| 5 | 2.84 (2.02) | 0.69 (0.06) | 7.48 (10.5) | 0.04 (0.03) | 0.52 (0.04) | 0.00 (0.00) | 0.04 (0.02) | 0.16 (0.03) | 0.05 (0.01) | 0.81(0.73-0.84) | 10%(7-13%) | 84%(81-86%) | 6% (6-7%) |
| 7 | 0.52 (0.12) | 1.06 (0.09) | 0.69 (0.08) | 0.00 (0.23) | 0.06 (0.04) | 0.00 (0.13) | 0.04 (0.02) | 0.16 (0.03) | 0.05 (0.01) | 0.93(0.85-0.97) | 35%(24-40%) | 50%(46-61%) | 15%(13-17%) |
| 10 | 0.69 (0.15) | 0.99 (0.09) | 0.44 (0.09) | 0.17 (0.05) | 0.02 (0.05) | 0.05 (0.01) | 0.04 (0.02) | 0.16 (0.03) | 0.05 (0.01) | 0.95(0.87-0.97) | 30%(25-38%) | 54%(47-59%) | 15%(14-17%) |
| 12 | 0.29 (0.19) | 0.14 (0.15) | 0.20 (0.13) | 0.20 (0.06) | 0.07 (0.07) | 0.14 (0.01) | 0.04 (0.02) | 0.16 (0.03) | 0.05 (0.01) | 1.16(1.11-1.24) | 31%(24-38%) | 51%(44-57%) | 18%(16-20%) |
| 14 | 0.87 (0.09) |  | 0.23 (0.06) | 0.54 (0.05) |  | 0.58 (0.03) | 0.04 (0.02) |  | 0.05 (0.01) | 1.26(1.17-1.31) | 48%(43-54%) |  | 52%(46-57%) |
| 16 | 0.81 (0.06) |  | 0.23 (0.05) | 0.19 (0.07) |  | 0.60 (0.04) | 0.04 (0.02) |  | 0.05 (0.01) | 1.34(1.26-1.43) | 49%(43-54%) |  | 51%(46-57%) |
| 18 | 0.73 (0.06) |  | 0.35 (0.05) | 0.08 (0.05) |  | 0.66 (0.04) | 0.04 (0.02) |  | 0.05 (0.01) | 1.27(1.17-1.32) | 41%(34-46%) |  | 59%(54-66%) |
| 19-24 | 0.93 (0.11) |  | 0.18 (0.06) | 0.11 (0.04) |  | 0.66 (0.04) | 0.04 (0.02) |  | 0.05 (0.01) | 1.20(1.12-1.26) | 34%(22-37%) |  | 66%(64-78%) |
| 25-30 | 0.92 (0.20) |  | 0.38 (0.10) | 0.00 (0.07) |  | 0.62 (0.05) | 0.04 (0.02) |  | 0.05 (0.01) | 1.05(0.96-1.14) | 34%(23-43%) |  | 66%(57-77%) |
| 31-40 | 1.12 (0.23) |  | 0.47 (0.07) | 0.00 (0.10) |  | 0.65 (0.06) | 0.04 (0.02) |  | 0.05 (0.01) | 1.10(1.01-1.17) | 28%(20-36%) |  | 72%(64-80%) |
| 41-50 | 0.86 (0.17) |  | 0.47 (0.06) | 0.01 (0.12) |  | 0.80 (0.07) | 0.04 (0.02) |  | 0.05 (0.01) | 1.41(1.25-1.48) | 28%(14-33%) |  | 72%(67-86%) |
| 51-60 | 0.90 (0.24) |  | 0.53 (0.08) | 0.00 (0.09) |  | 0.60 (0.07) | 0.04 (0.02) |  | 0.05 (0.01) | 1.16(1.07-1.30) | 26%12-35%) |  | 74%(65-88%) |
| 61+ |  NA |   |  NA | 0.00 (0.10) |   | 0.67 (0.08) | 0.04 (0.02) |   | 0.05 (0.01) | 1.20(1.08-1.35) | 21% (8-32%) |  | 79%(68-92%) |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Male** | **Transmission (β)** | **Innovation (Psi, ζ)** | Residual  | Total variance | Variance decomposition |
| **Age** | A | C | E  | A | C | E  | A | C | E  |   | a2 | c2 | e2 |
| 5 | 2.86 (1.53) | 0.64 (0.06) | 2.73 (2.22) | 0.04 (0.02) | 0.55 (0.04) | 0.01 (0.01) | 0.08 (0.02) | 0.12 (0.03) | 0.07 (0.01) | 0.87 (0.80-0.92) | 14%(10-18% | 77%(74-82%) | 9%(8-10%) |
| 7 | 0.88 (0.10) | 0.96 (0.08) | 0.67 (0.12) | 0.00 (0.21) | 0.03 (0.04) | 0.00 (0.07) | 0.08 (0.02) | 0.12 (0.03) | 0.07 (0.01) | 0.95(0.87-0.99) | 45%(37-55%) | 40%(30-48%) | 15%(13-17%) |
| 10 | 0.75 (0.12) | 1.04 (0.14) | 0.45 (0.08) | 0.05 (0.06) | 0.07 (0.04) | 0.08 (0.02) | 0.08 (0.02) | 0.12 (0.03) | 0.07 (0.01) | 1.02(0.95-1.06) | 40%(32-47%) | 43%(35-50%) | 17%(16-20%) |
| 12 | 0.48 (0.15) | 0.15 (0.16) | 0.33 (0.17) | 0.19 (0.06) | 0.05 (0.08) | 0.11 (0.02) | 0.08 (0.02) | 0.12 (0.03) | 0.07 (0.01) | 1.16 (1.09-1.220 | 39% (32-46%) | 44%(37-51%) | 17%(15-19%) |
| 14 | 1.16 (0.23) |  | 0.24 (0.08) | 0.21 (0.06) |  | 0.62 (0.04) | 0.08 (0.02) |  | 0.07 (0.01) | 1.09(1.02-1.16) | 35%(28-43%) |  | 65%(57-72%) |
| 16 | 1.01 (0.12) |  | 0.20 (0.07) | 0.03 (0.10) |  | 0.57 (0.05) | 0.08 (0.02) |  | 0.07 (0.01) | 1.18(1.08-1.25) | 43%(35-50%) |  | 57%(50-65%) |
| 18 | 0.89 (0.10) |  | 0.25 (0.07) | 0.01 (0.07) |  | 0.54 (0.04) | 0.08 (0.02) |  | 0.07 (0.01) | 1.16(1.06-1.23) | 45%(32-50%) |  | 55%(50-68%) |
| 19-24 | 0.62 (0.15) |  | 0.40 (0.13) | 0.13 (0.08) |  | 0.48 (0.06) | 0.08 (0.02) |  | 0.07 (0.01) | 1.14(1.03-1.24) | 49%(36-58%) |  | 51%(42-64%) |
| 25-30 | 0.92 (0.36) |  | 0.33 (0.18) | 0.17 (0.11) |  | 0.60 (0.10) | 0.08 (0.02) |  | 0.07 (0.01) | 1.18(1.02-1.34) | 37%(19-53%) |  | 63%(47-81%) |
| 31-40 | 1.10 (0.29) |  | 0.36 (0.11) | 0.00 (0.23) |  | 0.57 (0.10) | 0.08 (0.02) |  | 0.07 (0.01) | 1.09(0.96-1.22) | 35%(16-46%) |  | 65%(54-84%) |
| 41-50 | 0.67 (0.35) |  | 0.64 (0.19) | 0.00 (0.16) |  | 0.55 (0.10) | 0.08 (0.02) |  | 0.07 (0.01) | 1.14(0.96-1.29) | 39%(8-49% |  | 61% (51-92% |
| 51-60 | 0.81 (0.29) |  | 0.37 (0.12) | 0.22 (0.17) |  | 0.68 (0.17) | 0.08 (0.02) |  | 0.07 (0.01) | 1.47 (1.25-1.77) | 32%(10-46%) |  | 68% (54-90%) |
| 61+ |  NA |   | NA | 0.00 (0.17) |   | 0.49 (0.11) | 0.08 (0.02) |   | 0.07 (0.01) | 1.01 (0.84-1.18) | 33% (15-51%) |  | 67% (49-85%) |

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**Figure S2.** Separately for females and males, the standardized variance estimates at each age bin, including the heritability (proportion of variance that is explained by genetic effects), variance explained by the shared environment and the unique environment (top) and variance due to innovation at each age bin (bottom), including 95% confidence intervals.