Social behavior in young twins : are fearfulness, prosocial and aggressive behavior related to frontal asymmetry?

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CHAPTER 6

Supplementary Material

Supplemental material

Chapter 2

Univariate models for Fear, EC, and FA and additional bivariate model Fear and FA

Here we present the results of the univariate behavioral genetic models and the bivariate behavioral genetic model for Fear and FA only, including the participants with complete data for both variables.

Fear. The results of the univariate model with Fear showed that the AE model has the best fit, $\Delta\chi^2$ (3) < 3.84, p > .05. Path loadings revealed that variation in Fear is explained by genetic factors (35%) and by unique environmental factors (65%), which is quite similar to the path loadings for Fear in the bivariate models.

Effortful control. For EC, the univariate model showed that AE has the best fit, $\Delta\chi^2$ (3) < 3.84, p > .05. Path loadings indicated that the individual differences in EC are explained by genetic factors (26%) and by unique environmental factors (74%). This ratio between AE is highly comparable to path loadings for EC in the bivariate models.

Frontal asymmetry. The results of the univariate model with FA showed that AE and CE are both significantly better than ACE ($\Delta\chi^2$(3) < 3.84; p > .05). However, the CE model has a slightly lower AIC value (AIC = -571.26), than the AE model (AIC = -570.58) meaning that shared and unique environmental factors can best explain individual differences in FA. Path loadings showed that individual differences in FA are explained by shared environmental factors (23%) and by unique environmental factors (77%). This is comparable to the path loadings of unique environmental factors of FA in the bivariate models.

Fear and Frontal asymmetry. The bivariate model with Fear and FA containing only participants with complete data on Fear and FA (n = 107 with 67 MZ and 40 DZ twin pairs) also shows that the AE model had the best fit, $\Delta\chi^2 < 3.84$, $p > .05$, showing that genetic and unique environmental factors account for the variation in Fear and FA. The path loadings show that individual differences in Fear were explained by genetic factors (38%) and unique environmental factors (62%). Variation in FA was explained by genetic factors (19%) and unique environmental factors (81%). These path loadings are similar to the bivariate model with Fear and FA containing imputed FA data, indicating that FIML modeling estimated the missing data correctly.

Supplemental material

Chapter 3

Table 1. Items from MCQ and SDQ questionnaires with PCA factor loadings

			Factor loadings			
			test sample		replication sample	
Factor	Items	Question-naire	PP	OP	PP	OP
1 Empathy	Likely to ask, "What's wrong?" when seeing someone in distress	MCQ	.71	.64	.62	.58
	Often volunteers to help others	SDQ	.69	.73	.58	.65
	Can tell at just a glance how others are feeling	MCQ	.69	.68	.55	.56
	Helpful if someone is hurt	SDQ	.67	.72	.81	.72
	Considerate of other people's feelings	SDQ	.66	.69	.71	.69
	Will try to comfort or reassure another in distress	MCQ	.59	.68	.64	.68
	Will feel sorry for other people who are hurt, sick, or unhappy	MCQ	.57	.57	.31	.26
	Shares readily with other children	SDQ	.55	.59	.58	.67
	Likely to offer toys or candy to a crying playmate even without parental suggestion	MCQ	.45	.75	.42	.54
	Likely to show spontaneous nurturing and care-giving behavior toward an animal	MCQ	.38	.32	.34	.56
	Kind to younger children	SDQ	.23	.11	.58	.33
2 Contagion	Is upset by stories in which characters are hurt or die	MCQ	.83	.74	.86	.86
	Gets angry at aggressor, "Bad Guy", who hurts a TV character	MCQ	.64	.63	.75	.64
	Acts upset when she or he sees a hurt animal	MCQ	.57	.56	.52	.72
	Is not likely to become upset if a playmate cries.	MCQ	.54	.43	.28	.03

Note: PP = primary parent; OP = other parent. Factor loadings from rotated component matrix (Varimax with Kaiser rotation).

Supplemental material

Chapter 4

Here we present the results of the mediation models including the contrasts neutral versus positive social judgments and negative versus neutral social judgments.

Within-subjects mediation model – neutral versus positive social judgments

The within-subjects mediation model for neutral versus positive social judgments showed a significant effect of condition on aggression in the pilot sample (total effect: b = 410.08, SE = 145.45, p = .01). On average neutral social judgments elicited 410 ms longer button presses than positive social judgments, which corresponds to about 1 more destroyed balloon. This effect was not significantly mediated by frontal asymmetry (indirect effect: b = -36.18, bootstrapped SE = 62.94, 95% confidence interval (CI): -164.15 – 96.23), and the effect of condition on aggression remained significant when taking frontal asymmetry into account (direct effect: b = 446.26, SE = 132.50, p < .01).

These effects were replicated in test sample 1: On average children pressed the button 382 ms longer after a neutral social judgment compared to a positive social judgment (total effect: b = 382.47, SE = 144.64, p = .01, direct effect: b = 380.32, SE = 149.82, p = .02). Again, this effect was not mediated by frontal asymmetry (indirect effect: b = 2.15, bootstrapped SE = 29.74, 95% CI: -71.30 – 56.46).

In test sample 2, the direct and total effect were marginally significant: children pressed the button on average 198 ms longer after neutral social judgments compared to positive social judgments (total effect: b = 197.70, SE = 103.00, p = .06, direct effect: b = 190.36, SE = 104.47, p = .08). Furthermore, this effect was not mediated by frontal asymmetry (indirect effect: b = 7.34, bootstrapped SE = 32.19, 95% CI: -66.34 – 68.19).

Average frontal asymmetry significantly moderated effects of condition on aggressive behavior in two of the three samples (pilot: b = -1128.93, SE =526.04, p = .05, test 1: b = 91.80, SE = 618.83, p = .88 and test 2: b = 1136.05, SE = 555.42, p = .05).

The total effect of neutral versus positive judgments on aggression showed a small to medium combined effect size (r = .17, 95% CI: .07 – .26, p < .01). The indirect effect via frontal asymmetry was very small and not significant (r = -.01, 95%: -.11 – .10, p = .91). The direct effect of negative versus positive judgments on aggression was similar to the total effect and significant (r = .22, 95% CI: .12 – .32, p < .01). All studies were homogenous (p > .05).

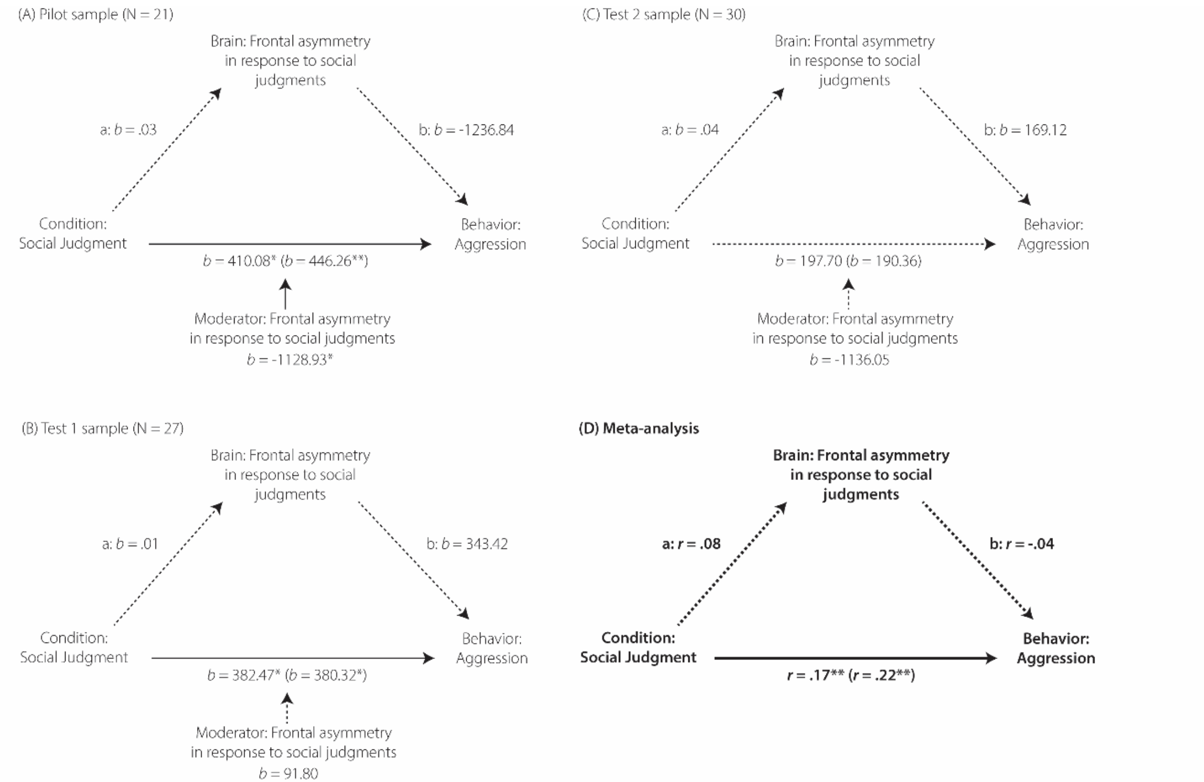
Within-subjects mediation model – negative versus neutral social judgments

Regarding the negative versus neutral judgments the within-subjects mediation model showed a marginally significant effect of condition (negative versus neutral) on aggression in the pilot sample (total effect: b = 383.95, SE = 186.73, p = .05). On average negative social judgments elicited 383 ms longer button presses than neutral social judgments, which corresponds to about 1 more destroyed balloon. This effect was not significantly mediated by frontal asymmetry (indirect effect: b = -11.93, bootstrapped SE = 57.88, 95% CI: -140.31 – 116.29), and the effect of condition on aggression remained marginally significant when taking frontal asymmetry into account (direct effect: b = 395.87, SE = 188.54, p =.05).

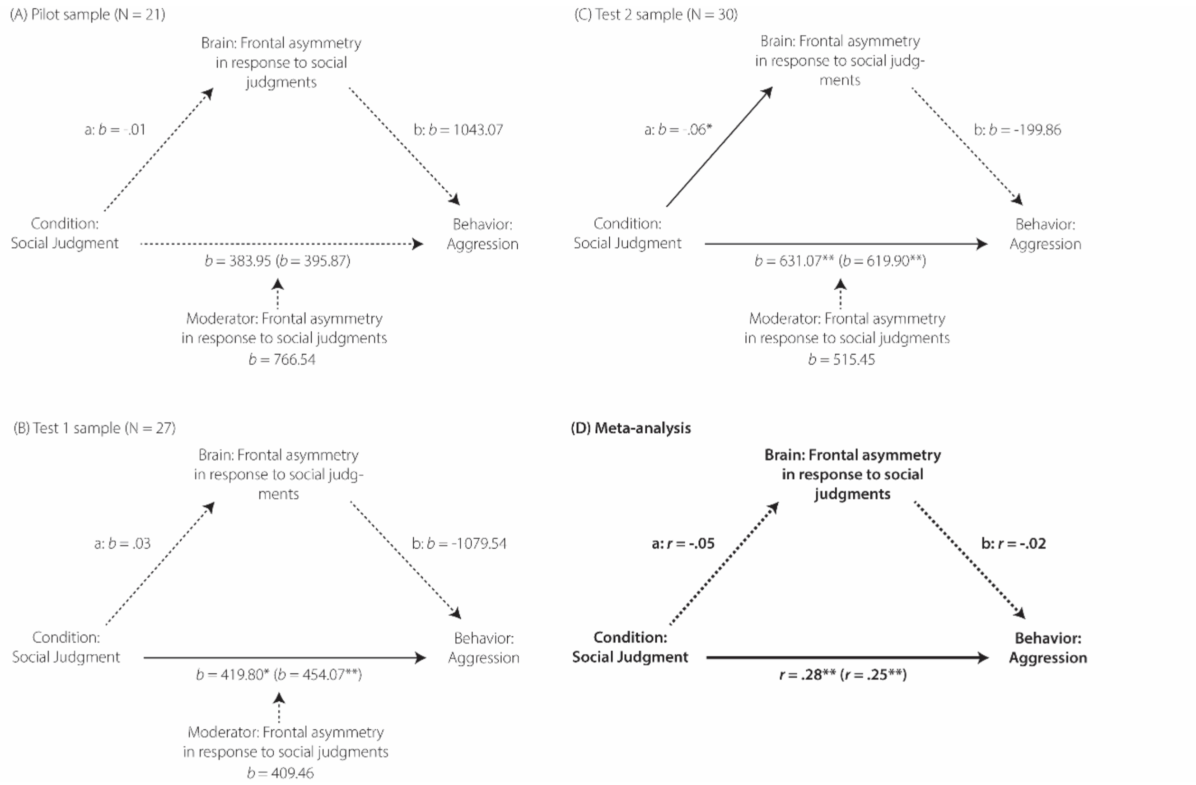
These effects were replicated in test sample 1: On average children pressed the button 420 ms longer after a negative social judgment compared to a neutral social judgment (total effect: b = 419.80, SE = 154.57, p = .01, direct effect: b = 454.07, SE = 153.30, p < .01). Again, this effect was not mediated by frontal asymmetry (indirect effect: b = -34.27, bootstrapped SE = 65.30, 95% CI: -214.30 – 37.02). In test sample 2 the children pressed the button on average 631 ms longer after negative judgments compared to neutral social judgments (total effect: b = 631.07, SE = 167.70, p < .01, direct effect: b = 619.90, SE = 185.34, p < .01), but this effect was not mediated by frontal asymmetry (indirect effect: b = 11.17, bootstrapped SE = 72.61, 95% CI: -141.19 – 163.93).

Average frontal asymmetry across SNAT-EC conditions did not significantly moderate effects of condition in any of the three samples (pilot: $b = 766.54$, $SE = 890.93$, $p = .40$, test 1: $b = 409.46$, $SE = 667.40$, $p = .55$ and test 2: $b = 515.45$, $SE = 880.76$, $p = .56$).

The total effect of negative versus neutral social judgments on aggression showed a small to medium combined effect size ($r = .28$, 95% CI: .16 – .39, $p < .01$). The indirect effect via frontal asymmetry was very small and not significant ($r = -.02$, 95%: -.12 –.09, $p = .75$). The direct effect of negative versus neutral social judgments on aggression was similar to the total effect and significant ($r = .25$, 95% CI: .15 – .35, $p < .01$). All studies were homogenous ($p > .05$).



Supplementary Material Figure 1. Within-subjects mediation models shown separately for (A) pilot sample, (B) test sample 1 and (C) test sample 1. Combined results from the meta-analysis are shown in (D). Significant effects of social judgments (neutral and positive) on aggressive behavior (mean pressing time) are shown with solid lines (** $p < .01$, * $p < .05$). This relation was not mediated by frontal asymmetry (dotted lines, $p > .05$). The indirect effect was not significant (pilot sample: b = -36.18, 95% CI: -164.16 – 96.23; test sample 1: b = 2.15, 95% CI: -71.30 – 56.46; test sample 2: b = 7.34, 95% CI: -66.34 – 68.19, meta-analysis: r = -.01, p = .91). Meta-analysis revealed a small to medium combined effect size for the total and direct effect (solid line, ** $p < .01$).



Supplementary Material Figure 2. Within-subjects mediation models shown separately for (A) pilot sample, (B) test sample 1 and (C) test sample 1. Combined results from the meta-analysis are shown in (D). Significant effects of social judgments (negative and neutral) on aggressive behavior (mean pressing time) are shown with solid lines (** $p < .01$, * $p < .05$). This relation was not mediated by frontal asymmetry (dotted lines, $p > .05$). The indirect effect was not significant (pilot sample: b = -11.93, 95% CI: -140.31 – 116.29; test sample 1: b = -34.27, 95% CI: -214.30 – 37.02; test sample 2: b = 11.17, 95% CI: -141.19 – 163.93, meta-analysis: r = -.01, p = .91). Meta-analysis revealed a small to medium combined effect size for the total and direct effect (solid line, ** $p < .01$).