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Early Implicit–Explicit Discrepancies in Self-Esteem as Correlates of Childhood Depressive Symptoms

Journal of Experimental Child Psychology

1. Preliminary and Correlational Analyses

1.1. No Significant Effects of Attrition in Longitudinal Recruitment. A preliminary multivariate analysis of variance (MANOVA) was conducted with three age 5 measures (i.e., implicit self-esteem, implicit gender identity, and implicit gender attitude) as dependent variables and a dichotomous "attrition" variable indicating whether participants were successfully re-tested for the longitudinal study (0 = no; 1 = yes) as a between-subject factor. The main effect of "attrition" was not significant ($p > .48$). Follow-up independent samples *t*-tests—both overall, as well as separately by gender—also revealed no significant differences between the sample that was retained (i.e., 70% children who participated again at age 9) and the sample that was not retained (i.e., 30% children who declined participation at age 9; all *p*s > .32).

1.2. Intercorrelations Among Measures. Overall, CDI and MASC measures exhibited moderate to strong negative correlations with explicit self-esteem measures, and no significant correlations with implicit self-esteem measures (Table S1).

Table S1
Inter-correlations of Self-Esteem and Overall CDI and MASC Scores

Measure	Age 5 ISE	Age 9 ISE	Age 9 ESE	Age 9 CDI
Age 9 ISE	.29*	—		
Age 9 ESE	-.10	-.05	—	
Age 9 CDI	.12	-.05	-.54**	—
Age 9 MASC	-.09	-.06	-.27*	.49**

Note. ISE = Implicit Self-Esteem; ESE = Explicit Self-Esteem; CDI = Children's Depression Inventory; MASC = Multidimensional Anxiety Scale for Children. ISE and ESE measures were coded such that higher scores indicated higher self-esteem. CDI and MASC measures were coded such that higher scores indicated higher depression and anxiety, respectively. **$p < .001$. *$p < .01$. $N = 121$.

2. Analyses Excluding Subjects Above CDI Cutoff

Analyses were repeated after excluding the children whose CDI score was above the cutoff score of 19 for depression (n = 3).

2.1. Intercorrelations Among the Measures. The correlations between all implicit and explicit scores were examined first. Age 5 implicit self-esteem scores correlated with age 9 implicit self-esteem scores, r = .32, p < .001. Age 9 explicit self-esteem scores correlated negatively with depressive, r = -.48, p < .001, and anxiety symptoms, r = -.25, p = .01. Depressive and anxiety symptoms were also correlated, r = .50, p < .001.

2.2. Implicit × Explicit Interaction Approach. In a model examining the main effects of age 5 implicit and age 9 explicit self-esteem scores (Table S2), age 9 explicit self-esteem scores were significantly and uniquely related to depressive symptoms (β = -0.48, p < .001) and anxiety symptoms (β = -0.26, p = .01). No significant relations of age 5 implicit self-esteem scores were found with age 9 depressive symptoms (β = 0.05, p = .52) or anxiety symptoms (β = -0.11, p = .22). In Step 2, the interaction between Implicit × Explicit scores was entered, but was not statistically significant for either depressive or anxiety symptoms ($|\beta|$s ≤ 0.16, ps > .46).

The same analyses were repeated examining the relations of age 9 implicit and age 9 explicit self-esteem scores with CDI and MASC scores. These analyses yielded highly similar results: Age 9 explicit self-esteem scores were significantly related to both depressive symptoms and anxiety symptoms ($|\beta|$s ≥ 0.25, ps < 0.01). Neither the effect of age 9 implicit scores, nor the Implicit × Explicit interaction was significant.

2.3. Size × Direction Approach. As shown in Table S3, there was no significant relation between the Size of the discrepancy and depressive symptoms (β = -.16, p = .10) or anxiety symptoms (β = .04, p = .67). However, the Direction of the discrepancy was significantly related to depressive symptoms (β = .22, p = .02), but not anxiety symptoms (β = .16, p = .10). Moreover, the Size × Direction interaction was related to depressive symptoms (β = .36, p = .01), but not anxiety symptoms (β = .04, p = .75). For children with damaged self-esteem (implicit > explicit), the relation between the Size of the discrepancy and the development of depressive symptoms was positive, r = .37, p = .04; for children with fragile self-esteem (explicit > implicit), the relation between the Size of the discrepancy and the development of depressive symptoms was negative, r = -.26, p =.01. Neither damaged nor fragile self-esteem was related to anxiety symptoms (all ps > .57). These findings indicate that discrepancies between age 5 implicit and age 9 explicit self-esteem are significantly related to higher levels of depressive symptoms at age 9, but not to higher levels of anxiety symptoms.

The same analyses were repeated using age 9 implicit and age 9 explicit self-esteem scores. The results of the analyses of age 9 implicit–explicit discrepancy were directionally similar, but somewhat weaker than the result in the analyses of the discrepancy between age 5 implicit and age 9 explicit self-esteem. There was no significant relation between the Size of the discrepancy and depressive symptoms (β = -.06, p = .51) or anxiety symptoms (β = -.03, p = .73). The Direction of the discrepancy was significantly related to depressive symptoms (β = .28, p = .003), but not anxiety symptoms (β = .12, p = .22) d. The Size × Direction interaction was not related to depressive symptoms (β = .22, p = .13) or anxiety symptoms (β = .01, p = .93).

Table S2

Hierarchical Regression Analysis Examining Relations of CDI and MASC Scores With Implicit and Explicit Self-Esteem

	Step 1							Step 2			
		ISE			ESE				ISE × ESE Interaction		
Comparison/Criterion	ΔR^2	*B*	*SE*	β	*B*	*SE*	β	ΔR^2	*B*	*SE*	β
ISE_5–ESE_9 (longitudinal)											
Depression (CDI)	.23	0.59	0.92	.05	-3.62	0.62	-.48***	.00	1.18	1.59	.16
Anxiety (MASC)	.07	-3.67	2.98	-.11	-5.75	2.03	-.26**	.00	0.60	5.20	.03
ISE_9–ESE_9 (concurrent)											
Depression (CDI)	.23	-0.45	1.01	-.04	-3.67	0.62	-.48***	.00	0.97	1.84	.12
Anxiety (MASC)	.07	-3.07	3.28	-.08	-5.72	2.03	-.25**	.01	-6.74	5.96	-.27

Note. ISE_5 = age 5 Implicit Self-Esteem; ISE_9 = age 9 Implicit Self-Esteem; ESE_9 = age 9 Explicit Self-Esteem; CDI = Children's Depression Inventory; MASC = Multidimensional Anxiety Scale for Children. ***p < .001, **p < .01, *p < .05. N = 118.

Table S3

Hierarchical Regression Analysis Examining Relations of CDI and MASC Scores With Implicit–Explicit Discrepancies

	Step 1							Step 2			
		Size of Discrepancy			Direction of Discrepancy				Size × Direction Interaction		
Comparison/Criterion	ΔR^2	*B*	*SE*	β	*B*	*SE*	β	ΔR^2	*B*	*SE*	β
ISE_5–ESE_9 (longitudinal)											
Depression (CDI)	.10	-0.68	0.41	-.16	2.24	0.98	.22*	.06	3.47	1.27	.36**
Anxiety (MASC)	.02	0.53	1.25	.04	5.01	3.01	.16	.00	1.28	4.03	.04
ISE_9–ESE_9 (concurrent)											
Depression (CDI)	.09	-0.30	0.45	-.06	2.73	0.91	.28**	.02	1.84	1.22	.22
Anxiety (MASC)	.02	-0.47	1.37	-.03	3.48	2.81	.12	.00	0.34	3.79	.01

Note. ISE_5 = age 5 Implicit Self-Esteem; ISE_9 = age 9 Implicit Self-Esteem; ESE_9 = age 9 Explicit Self-Esteem; CDI = Children's Depression Inventory; MASC = Multidimensional Anxiety Scale for Children. ***p < .001, **p < .01, *p < .05. N = 118.

3. Analyses Pertaining to Normal Distributions of Outcome Measures (CDI and MASC)
We have examined the distribution of the CDI and MASC scores in order to determine which distribution is the best fit for each of these outcomes (see Figure S1). A Kolmogorov-Smirnov test indicated that MASC scores at age 9 followed a normal distribution, $D(121) = 0.068$, $p = .20$; whereas CDI scores at age 9 did not, $D(121) = 0.13$, $p < .001$. A square root transform was used to reduce right skewness of CDI scores. The resulting square-root-transformed distribution was normal, $D(121) = 0.077$, $p = .076$. We re-ran all the analyses using square-root-transformed CDI scores and obtained the same results: no significant effect disappeared, and no new effects achieved significance (see Tables S4–S6 for details). The data reported in Main Text are therefore reported using untransformed variables in order to facilitate comparisons with other studies and ease of interpretation with the original scale.

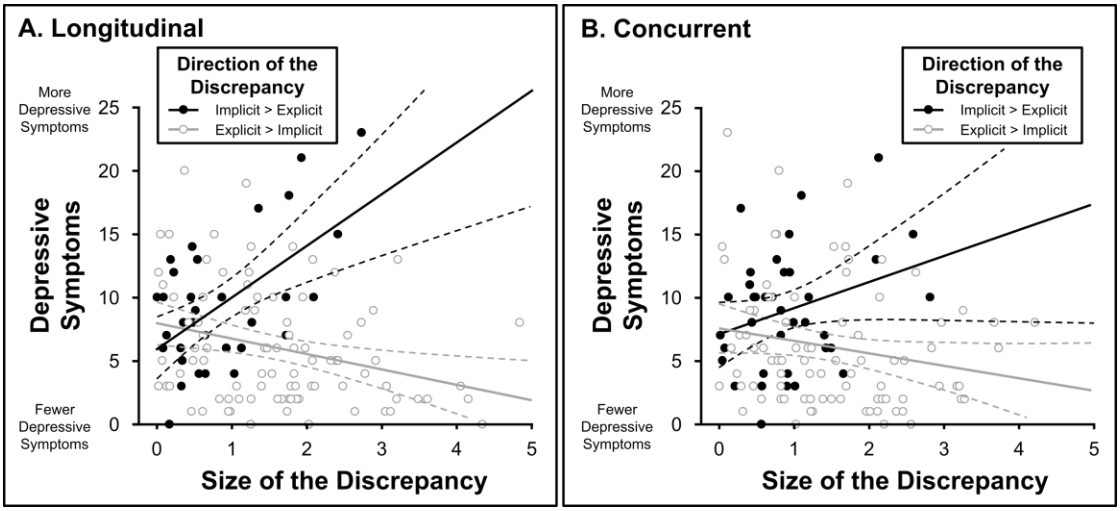

Figure S1. Scatterplot of the relationship between depressive symptoms at age 9 and (longitudinal) discrepancies between age 5 implicit and age 9 explicit self-esteem (panel A), and depressive symptoms at age 9 and (concurrent) discrepancies between age 9 implicit and age 9 explicit self-esteem (panel B). Black circles indicate damaged (implicit > explicit) self-esteem; white circles indicate fragile (implicit < explicit) self-esteem. Dashed lines indicate 95% confidence intervals. $N = 121$. In Panel A, $n = 89$ children were classified as having fragile self-esteem and $n = 32$ children were classified as having damaged self-esteem. In panel B, $n = 84$ children were classified as having fragile self-esteem and $n = 37$ children were classified as having damaged self-esteem.

Table S4

Means and Standard Deviations for all of the Self-Esteem Measures and Square-Root Transformed CDI Scores and Untransformed MASC Scores

	Scores		
Measure	Overall (N = 121)	Girls (n = 61)	Boys (n = 60)
Age 5 (Time 1)			
Implicit Self-Esteem (PSIAT)			
M	**0.41**	**0.41**	**0.40**
(*SD*)	(0.40)	(0.40)	(0.40)
Age 9 (Time 2)			
Implicit Self-Esteem (Child IAT)			
M	**0.44**	**0.45**	**0.43**
(*SD*)	(0.37)	(0.33)	(0.40)
Explicit Self-Esteem (SPPC)			
M	**1.23**	**1.38$_a$**	**1.08$_a$**
(*SD*)	(0.62)	(0.61)	(0.60)
Depression (CDI)			
M	**2.43**	**2.27**	**2.59**
(*SD*)	(1.01)	(1.05)	(0.96)
Anxiety (MASC)			
M	**47.18**	**46.13**	**48.25**
(*SD*)	(13.62)	(14.44)	(12.77)
Discrepancies			
ISE_5–ESE_9 (longitudinal)			
M	**1.42**	**1.51**	**1.33**
(*SD*)	(1.05)	(1.00)	(1.11)
ISE_9–ESE_9 (concurrent)			
M	**1.34**	**1.45**	**1.22**
(*SD*)	(0.94)	(0.93)	(0.96)

Note. ISE_5 = age 5 Implicit Self-Esteem; ISE_9 = age 9 Implicit Self-Esteem; ESE_9 = age 9 Explicit Self-Esteem; IAT = Implicit Association Test; SPPC = Self-Perception Profile for Children; CDI = Square-Root Transformed Scores on Children's Depression Inventory; MASC = Untransformed Multidimensional Anxiety Scale for Children scores. **Boldface** indicates (a) significant difference from the rational zero point in the case of ISE and ESE measures, and (b) significant difference from clinical cutoffs for depression (i.e., score of 19 on CDI) and anxiety (i.e., score of 54 on MASC), $ps < .05$. Means in the same row sharing subscripts are significantly different from each other, $p < .05$.

Table S5

Hierarchical Regression Analysis Examining Relationships of Square-Root Transformed CDI Scores and Untransformed MASC Scores With Implicit and Explicit Self-Esteem

	Step 1						Step 2			
		ISE			ESE			ISE × ESE Interaction		
Comparison/Criterion	ΔR^2	*B*	*SE*	β	*B*	*SE*	β	ΔR^2	*B*	*SE*	β
ISE_5–ESE_9 (longitudinal)											
Depression (CDI)	.28	0.17	0.20	.07	-0.85	0.13	-.52***	.00	0.14	0.33	.08
Anxiety (MASC)	.09	-4.09	3.01	-.12	-6.12	1.95	-.28**	.00	2.28	5.04	.10
ISE_9–ESE_9 (concurrent)											
Depression (CDI)	.28	-0.14	0.22	-.05	-0.86	0.13	-.53***	.00	0.27	0.37	.14
Anxiety (MASC)	.08	-2.53	3.29	-.07	-5.92	1.95	-.27**	.02	-9.24	5.62	-.36

Note. ISE_5 = age 5 Implicit Self-Esteem; ISE_9 = age 9 Implicit Self-Esteem; ESE_9 = age 9 Explicit Self-Esteem; CDI = Square-Root-Transformed; MASC = Untransformed Multidimensional Anxiety Scale for Children scores.
***p < .001, **p < .01, *p < .05. N = 121.

Table S6

Hierarchical Regression Analysis Examining Relationships of Square-Root Transformed CDI Scores and Untransformed MASC Scores With the Discrepancy Between Implicit and Explicit Self-Esteem

	Step 1							Step 2			
		Size of Discrepancy			Direction of Discrepancy				Size × Direction Interaction		
Comparison/Criterion	ΔR^2	*B*	*SE*	β	*B*	*SE*	β	ΔR^2	*B*	*SE*	β
ISE_5–ESE_9 (longitudinal)											
Depression (CDI)	.11	-0.13	0.09	-.14	0.60	0.21	.26**	.10	0.91	0.24	.48***
Anxiety (MASC)	.02	0.23	1.24	.02	4.77	2.96	.16	.00	1.25	3.56	.05
ISE_9–ESE_9 (concurrent)											
Depression (CDI)	.09	-0.11	0.10	-.10	0.55	0.20	.25**	.03	0.55	0.26	.31*
Anxiety (MASC)	.02	-0.21	1.38	-.01	4.13	2.81	.14	.00	2.33	3.70	.10

Note. ISE_5 = age 5 Implicit Self-Esteem; ISE_9 = age 9 Implicit Self-Esteem; ESE_9 = age 9 Explicit Self-Esteem; CDI = Square-Root-Transformed Children's Depression Inventory scores; MASC = Untransformed Multidimensional Anxiety Scale for Children scores.
***p < .001, **p < .01, *p < .05. N = 121.

4. Analyses Pertaining to the Average of Age 5 and Age 9 Implicit Self-Esteem Scores

4.1. Predicting Depressive and Anxiety Symptoms From Average Implicit × Age 9 Explicit Interaction. The analyses of Implicit × Explicit interaction reported in main text can also be examined using the average of age 5 and age 9 implicit self-esteem scores (Table S7) instead of the age 5 implicit self-esteem score alone. Age 9 explicit self-esteem scores were correlated with the CDI and MASC scales, but the average implicit self-esteem scores and the interaction between the average Implicit × Age 9 Explicit scores were not.

Table S7
Hierarchical Regression Analysis Predicting Depression and Anxiety with the Average of Implicit Self-Esteem Scores and Age 9 Explicit Self-Esteem Scores

	Step 1						Step 2			
		Average ISE			Age 9 ESE			Average ISE × Age 9 ESE Interaction		
Scale	ΔR^2	*B*	*SE*	β	*B*	*SE*	β	ΔR^2	*B*	*SE*	β
Depression (CDI)	.29	-0.04	1.26	-.003	-4.39	0.63	-.54***	.00	1.94	2.31	.19
Anxiety (MASC)	.08	-5.24	3.91	-.12	-6.10	1.95	-.28**	.00	-4.00	7.18	-.14

Note. ISE = Implicit Self-Esteem. ESE = Explicit Self-Esteem. ***$p < .001$. **$p < .01$. *$p < .05$. $N = 121$.

4.2. Predicting Depressive and Anxiety Symptoms From Discrepancies Between Average Implicit and Age 9 Explicit Self-Esteem. In addition to the analyses reported in main text, analyses predicting overall CDI and MASC scores from implicit–explicit discrepancies were conducted using the average of the self-esteem scores for age 5 and age 9. Table S8 summarizes the results. These analyses produced mostly the same result as the data reported in the main text (which used the age 5 self-esteem score), suggesting that age 5 and age 9 implicit self-esteem scores are close to equally useful.

Table S8
Hierarchical Regression Analysis Predicting Depression and Anxiety with Size and Direction of the Discrepancy Between the Average Implicit Self-Esteem Scores and the Age 9 Explicit Self-Esteem Scores

	Step 1						Step 2			
		Size of Discrepancy			Direction of Discrepancy			Size × Direction Interaction		
Scale	ΔR^2	*B*	*SE*	β	*B*	*SE*	β	ΔR^2	*B*	*SE*	β
Depression (CDI)	.10	-0.76	0.53	-.13	2.67	1.04	.24*	.12	6.12	1.47	.57***
Anxiety (MASC)	.02	-0.11	1.52	-.01	3.60	2.97	.12	.01	5.07	4.46	.17

Note. ***$p < .001$. **$p < .01$. *$p < .05$. $N = 121$.

5. Analyses Examining Whether Implicit–Explicit Discrepancies Account for Unique Variance in Depression or Anxiety

The preceding hierarchical regressions of Implicit × Explicit interaction showed that both depression and anxiety measures are highly (negatively) correlated with explicit self-esteem measures, and not correlated with implicit self-esteem measures. In addition, the results of hierarchical regressions of implicit–explicit *discrepancies* suggest that higher implicit than explicit (i.e., damaged) self-esteem is related to depression but not anxiety. Both hierarchical models explain comparable variance in outcome measures. It is possible that higher explicit self-esteem predicts weaker depressive symptoms and that implicit self-esteem plays no role. In that case, the Size of the discrepancy would still strongly predict depressive symptoms, but the Size × Direction would not be significant. Given that this interaction was significant in the analyses reported so far, this indicates that implicit self-esteem might add unique predictive power. However, in both subgroups (damaged self-esteem and fragile self-esteem), analyses reported so far are consistent with the idea that, if one were to keep implicit self-esteem constant, higher explicit self-esteem would appear to be more beneficial. This raises an important (and thus far unexplored) question: How much explanatory power does the Size of the discrepancy add to the main effect of explicit self-esteem?

This was tested using a novel hierarchical linear regression approach that was developed as a combination of the previous two analyses to evaluate the usefulness of implicit–explicit discrepancies. Explicit self-esteem was entered in Step 1 and the Size of the discrepancy and the Direction of the discrepancy (dummy) added in Step 2. Size × Direction interaction was added in Step 3. The two critical result were: (a) the main effect of Size at Step 2, and (b) the interaction effect of the Size × Direction interaction at Step 3. If implicit self-esteem adds nothing to the main effect of explicit self-esteem, then the main effect of Size at Step 2 would be statistically significant, and the interaction effect at Step 3 would not be statistically significant. In contrast, if there is something unique about the Size × Direction interaction, then the main effect of Size at Step 2 would not be statistically significant, and the interaction effect at Step 3 would be statistically significant. This latter pattern would indicate that implicit–explicit discrepancies account for unique variance in depressive and/or anxiety scores over and above explicit self-esteem measures.

The critical interaction effect was statistically significant in the positive direction only for the longitudinal relations with CDI ($\beta = 0.29$, $p = .040$), suggesting that longitudinal implicit–explicit discrepancies (in particular implicit > explicit, damaged self-esteem) were related to higher prevalence of depressive symptoms, over and above the effect of explicit self-esteem.

Table S9

Hierarchical Regression Analysis Examining Predictive Power of the Size × Direction Interaction Over Explicit Self-Esteem

		ISE_5–ESE_9 (longitudinal)								ISE_9–ESE_9 (concurrent)							
		Depression (CDI)				Anxiety (MASC)				Depression (CDI)				Anxiety (MASC)			
Step	Predictor	ΔR^2	*SE*	β	*p*	ΔR^2	*SE*	β	*p*	ΔR^2	*SE*	β	*p*	ΔR^2	*SE*	β	*p*
1																	
	ESE_9	.29	0.62	-.54***	<.001	.07	1.94	-.27**	.003	.29	0.62	-.54***	<.001	.07	1.94	-.27**	.003
2																	
	Size	.00	.40	.03	.74	.01	1.26	.08	.39	.02	.45	.08	.37	.01	1.42	.07	.49
	Direction		1.11	-.03	.77		3.47	-.01	.94		1.09	-.14	.16		3.43	-.04	.71
3																	
	S×D	.03	1.30	.29*	.04	.01	4.08	-.20	.22	.00	1.22	.07	.61	.00	3.86	-.05	.77

Note. ISE_5 = age 5 Implicit Self-Esteem; ISE_9 = age 9 Implicit Self-Esteem; ESE_9 = age 9 Explicit Self-Esteem; CDI = Children's Depression Inventory; MASC = Multidimensional Anxiety Scale for Children; S×D = Size × Direction Interaction. ***$p < .001$, **$p < .01$, *$p < .05$. $N = 121$.