

Supporting Information

**Evaluating the sensitivity to threat and affiliative reward (STAR) model in relation to the
development of conduct problems and callous-unemotional traits
across early adolescence**

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Table S1. Descriptive statistics and missingness patterns.

	T1 (N= 11,878)	T2 (n= 11,225)	T2 attrition (n=653)	difference		T3 (n= 10,414)	T3 attrition (n= 1,462)	difference		T3-SD (n= 2,300)	T3-SD attrition (n= 9,578)	difference	
	% Female	% Female	% Female	χ^2	<i>p</i>	% Female	% Female	χ^2	<i>p</i>	% Female	% Female	χ^2	<i>p</i>
Sex (% female; T1)	47.8	47.7	50.4	1.80	.183	47.6	49.2	1.22	.276	47.8	47.8	.00	1.00
	<i>M (sd)</i>	<i>M (sd)</i>	<i>M (sd)</i>	<i>t</i>	<i>p</i>	<i>M (sd)</i>	<i>M (sd)</i>	<i>t</i>	<i>p</i>	<i>M (sd)</i>	<i>M (sd)</i>	<i>t</i>	<i>p</i>
Age (months; T1)	118.98 (7.50)	118.98 (7.51)	119.06 (7.26)	-.29	.775	119.01 (7.51)	118.77 (7.42)	-1.13	.258	118.19 (7.50)	119.17 (7.48)	-5.62	<.001
Income (T1)	7.22 (2.42)	7.30 (2.30)	5.83 (2.77)	13.99	<.001	7.33 (2.34)	6.46 (2.84)	12.00	<.001	6.81 (2.68)	7.32 (2.34)	-8.65	<.001
Child-reported threat sensitivity (T1)	.00 (.65)	.00 (.65)	.00 (.74)	.01	.993	.00 (.65)	.00 (.70)	.15	.883	-.01 (.67)	.00 (.65)	-.53	.598
Parent-reported affiliation (T2)	n/a	.00 (.68)	n/a	n/a	n/a	.00 (.67)	-.02 (.75)	1.08	.282	.00 (.68)	.00 (.68)	-.18	.860
Parent-reported Fear (T3)	n/a	n/a	n/a	n/a	n/a	14.72 (4.13)	n/a	n/a	n/a	14.63 (4.04)	14.75 (4.15)	-1.22	.222
Parent-reported affiliation (T3)	n/a	n/a	n/a	n/a	n/a	22.70 (4.04)	n/a	n/a	n/a	22.44 (4.17)	22.77 (4.00)	-3.31	<.001
Parent-reported CU traits (T2)	n/a	0.97 (1.43)	n/a	n/a	n/a	.97 (1.42)	1.06 (1.50)	2.03	.043	.99 (1.46)	.97 (1.42)	.37	.711
Parent-reported CU traits (T3)	n/a	n/a	n/a	n/a	n/a	.98 (1.45)	n/a	n/a	n/a	.99 (1.46)	.98 (1.45)	.22	.825
Parent-reported CP (T2)	n/a	1.04 (2.03)	n/a	n/a	n/a	1.01 (1.98)	1.27 (2.45)	3.84	<.001	1.25 (2.35)	.98 (1.93)	5.56	<.001
Parent-reported CP (T3)	n/a	n/a	n/a	n/a	n/a	.99 (2.00)	n/a	n/a	n/a	1.09 (2.24)	.96 (1.93)	2.68	.007
Parent-reported anxiety (T2)	n/a	2.06 (2.46)	n/a	n/a	n/a	2.06 (2.45)	2.07 (2.51)	.10	.923	2.00 (2.39)	2.08 (2.47)	-1.37	.172

Parent-reported anxiety (T3)	n/a	n/a	n/a	n/a	n/a	1.81 (2.31)	n/a	n/a	n/a	1.79 (2.31)	1.82 (2.31)	-.41	.682
Parent-reported depression (T2)	n/a	1.39 (12.19)	n/a	n/a	n/a	1.39 (2.17)	1.47 (2.38)	1.18	.277	1.46 (2.25)	1.38 (2.17)	1.69	.091
Parent-reported depression (T3)	n/a	n/a	n/a	n/a	n/a	1.47 (2.24)	n/a	n/a	n/a	1.53 (2.21)	1.46 (2.24)	1.16	.248
Child-reported CU traits (T3)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	.57 (.42)	n/a	n/a	n/a
Child-reported aggression (T3)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	.26 (.22)	n/a	n/a	n/a

Note. T1, Time 1; T2, Time 2; T3, Time 3; CU, callous-unemotional; CP, conduct problems; ABCD-SD, ABCD Social Development sub-study. The race distribution did not differ between T1 and T2 samples, $\chi^2(4)=8.36$, $p=.079$, but did between T1 and T3, $\chi^2(4)=18.38$, $p=.001$ (higher representation of White participants and lower representation of Black participants). There was also a difference between T1 and the T3 subsample, $\chi^2(4)=16.89$, $p=.002$ (higher representation of Black participants and lower representation of White participants). For measures assessed only at T2 or T3, missingness effects between time points could not be assessed.

Table S2. Summary of questionnaires by informant and time point.

	Informant	Measure	Time point	N	Range
Threat sensitivity	Child	BIS/BAS	T1	11,854	-1.11-2.00 ^a
<i>T3 Alternative (Fear)</i>	Parent	EATQ-R	T3	10,869	6-30
Affiliation	Parent	SRS	T2	11,210	-4.18-.60 ^a
<i>T3 Alternative</i>	Parent	EATQ-R	T3	10,865	6-30
CU traits	Parent	SDQ, CBCL ^b	T2	11,202	0-8
			T3	10,903	0-8
CP	Child	ICU ^c	T3 subsample	2,293	0-3
	Parent	CBCL	T2	11,206	0-32
			T3	10,356	0-32
Aggression	Child	RPQ	T3 subsample	2,293	0-2
Anxiety symptoms	Parent	CBCL	T2	11,206	0-18
			T3	8,085	0-18
Depressive symptoms	Parent	CBCL	T2	11,205	0-26
			T3	8,085	0-26
ODD/CD diagnosis	Parent	KSADS	T1	11,725	Yes/No

Note. CU, callous-unemotional; CP, conduct problems; ODD, oppositional defiant disorder; CD, conduct disorder; BIS/BAS, Behavioral Inhibition System/Behavioral Activation System; SRS, Social Responsiveness Scale; EATQ-R, Early Adolescent Temperament Questionnaire Revised; SDQ, Strengths and Difficulties Questionnaire; CBCL, Child Behavior Checklist; ICU, Inventory of Callous-Unemotional Traits; RPQ, Reactive-Proactive Aggression Questionnaire; KSADS, Kiddie Schedule for Affective Disorders and Schizophrenia; T1, Time 1; T2, Time 2; T3, Time 3. ^a For Threat sensitivity (T1) and affiliation (T2) scores represent the mean of standardized items. ^b Parent-reported CU traits comprised three reversed items from the SDQ ("Considerate of other people's feelings," "Helpful if someone is hurt, upset, or feeling ill," and "Often offers to help others (parents, teachers, other children)") and one item from the CBCL ("Doesn't seem to feel guilty after misbehaving").

^c Out of the 24 original items of ICU, only 18 items were available in the ABCD sub-sample. These items excluded the 6 items of the unemotional subscale of the ICU, which has been argued to show less predictive and construct validity than items assessing callousness (e.g., "Do not feel remorseful when I do something wrong") or uncaring (e.g., "Do not care who I hurt to get what I want") and has been shown to be etiologically divergent from them (Henry et al., 2016; Kimonis et al., 2013).

Table S3. Confirmatory factor analysis of the two-factor STAR model.

Latent variable	Observed indicator	<i>B</i> (<i>SE</i>)	β
Threat sensitivity (child-reported; T1)	Get very tense	1.00 (.00)	.39***
	Hurt when people scold me	1.94 (.06)	.75***
	Upset when I think that someone is angry	1.78 (.06)	.69***
	Very fearful	0.83 (.04)	.32***
Affiliative reward (parent-reported; T2)	Rather be alone (R)	1.00 (.00)	.51***
	Understand tone of voice and facial expression	0.57 (.03)	.29***
	Difficulty making friends (R)	1.75 (.04)	.89***
	Difficulty relating to peers (R)	1.79 (.05)	.91***
Covariances		<i>B</i> (<i>SE</i>)	β
Threat sensitivity	Affiliative reward	0.03 (.00)	.13***

Note. Model provided excellent fit to the data: $\chi^2(19) = 144.35$, $p < .001$, CFI = .99, TLI = .99, RMSEA = .024, WRMR = 1.57 (evaluator for WLSMV estimator). * $p < .05$, ** $p < .01$, *** $p < .001$.

Table S4. Regression analyses examining child-reported threat sensitivity at T1 and parent-reported affiliation at T2 in relation to parent-reported temperament at T3 (N=11,878).

<i>Independent variables</i>	<i>Parent-reported affiliation (T3)</i>					<i>Parent-reported fear (T3)</i>				
	<i>B (SE)</i>	β	<i>p</i>	<i>CI low</i>	<i>CI high</i>	<i>B (SE)</i>	β	<i>p</i>	<i>CI low</i>	<i>CI high</i>
Sex (T1)	.85 (.08)	.10	<.001	.08	.12	.82 (.08)	.10	<.001	.07	.12
Age (T1)	-.04 (.01)	-.07	<.001	-.09	-.05	-.04 (.01)	-.07	<.001	-.09	-.05
Income (T1)	.32 (.02)	.19	<.001	.16	.21	-.25 (.02)	-.15	<.001	-.18	-.13
Child-reported threat sensitivity (T1)	.29 (.06)	.05	<.001	.02	.06	.74 (.06)	.12	<.001	.09	.13
Parent-reported affiliation (T2)	1.42 (.06)	.24	<.001	.21	.26	-.72 (.06)	-.12	<.001	-.15	-.10

Note. T1, Time 1; T2, Time 2; T3, Time 3; SE, standard error; CI, 95% confidence interval. Affiliation and fear at T3 were measured using the validated EATQ-R questionnaire (Ellis & Rothbart, 1999) and were used to validate the early assessment of affiliation (T2; 4 items from the parent reported SRS-S) and threat sensitivity (T1; 4 items from the child-reported BIS/BAS). The T2 affiliation measure showed moderate convergence with the T3 affiliation measure ($\beta = .24$, $p < .001$, CI: .21, .26), with a significantly larger effect size (i.e., non-overlapping confidence intervals) than T1 threat sensitivity ($\beta = .05$, $p < .001$, CI: .02, .06). The difference in the magnitude of these effect sizes provides evidence for both convergent validity of the earlier affiliation measure with this later, more established measure, as well as discriminant validity relative to our earlier threat sensitivity measure. For threat sensitivity, both T1 threat sensitivity ($\beta = .12$, $p < .001$, CI: .09, .13) and T2 affiliation ($\beta = -.12$, $p < .001$, CI: -.15, -.10) were similarly related, albeit in opposite directions. Although this analysis provides some additional support for convergent validity, the lack of discriminant validity may reflect the fact that the T3 fear subscale includes items relating to social interaction (e.g., "Worries about our family when s/he is not with us").

Table S5. Zero-order correlations between study variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Sex (T1)	-															
2. Age (T1)	-.02*	-														
3. Income (T1)	-.01	.04***	-													
4. Child-reported threat sensitivity (T1)	.07***	-.02*	-.02*	-												
5. Parent-reported affiliation (T2)	.08***	-.03**	.10***	-.08***	-											
6. Parent-reported Fear (T3)	.10***	-.07**	-.16***	.14***	-.13***	-										
7. Parent-reported affiliation (T3)	.13***	-.07***	.20***	.03***	.26***	.04***	-									
8. Parent-reported CU traits (T2)	-.14***	.01	-.05***	-.01	-.33***	.00	-.33***	-								
9. Parent-reported CU traits (T3)	-.12***	.05***	-.07***	-.01	-.28***	-.01	-.46***	.57***	-							
10. Parent-reported CP (T2)	-.12***	-.01	-.20***	.03***	-.32***	.10***	-.15***	.43***	.37***	-						
11. Parent-reported CP (T3)	-.11***	.02	-.16***	.03**	-.26***	.11***	-.16***	.33***	.46***	.66***	-					
12. Parent-reported anxiety (T2)	.01	-.02	-.05***	.12***	-.37***	.36***	-.06***	.16***	.15***	.33***	.27***	-				
13. Parent-reported anxiety (T3)	.03**	-.01	-.04**	.13***	-.31***	.43***	-.06***	.13***	.16***	.23***	.33***	.67***	-			
14. Parent-reported depression (T2)	-.05***	.02	-.08***	.08***	-.46***	.21***	-.14***	.27***	.24***	.43***	.35***	.62***	.46***	-		
15. Parent-reported depression (T3)	-.01	.04***	-.07***	.10***	-.37***	.26***	-.16***	.22***	.30***	.32***	.46***	.47***	.63***	.63***	-	
16. Child-reported CU traits (T3)	-.18***	.12***	-.17***	-.04*	-.13***	-.03	-.22***	.21***	.22***	.18***	.22***	.02	.05	.10***	.16***	-
17. Child-reported aggression (T3)	-.14***	.08***	-.19***	.08***	-.09***	.02	-.11***	.17***	.17***	.24***	.25***	.08***	.06*	.12***	.13***	.40***

Note. T1, Time 1; T2, Time 2; T3, Time 3; CU, callous-unemotional; CP, conduct problems. * $p < .05$, ** $p < .01$, *** $p < .001$.

Table S6. Regression analyses examining child-reported threat sensitivity at T1 and parent-reported affiliation at T2 in relation to parent-reported CU traits and CP at T3 (N=11,878).

	<i>Parent-reported CU traits (T3)</i>									<i>Parent-reported CP (T3)</i>								
	Model 1			Model 2			Model 3			Model 1			Model 2			Model 3		
<i>Independent variables</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>
Sex (T1)	-.21 (.03)	-.07	<.001	-.18 (.03)	-.06	<.001	-.18 (.03)	-.06	<.001	-.21 (.04)	-.05	<.001	-.19 (.04)	-.05	<.001	-.19 (.04)	-.05	<.001
Age (T1)	.01 (.00)	.04	<.001	.01 (.00)	.04	<.001	.01 (.00)	.04	<.001	.00 (.00)	.00	.802	.00 (.00)	-.01	.591	.00 (.00)	-.01	.589
Income (T1)	.00 (.01)	.01	.672	.00 (.01)	.01	.516	.00 (.01)	.01	.485	-.11 (.01)	-.13	.007	-.10 (.01)	-.12	.007	-.10 (.01)	-.12	.007
Parent-reported CP (T3)	.33 (.01)	.45	<.001	.30 (.01)	.41	<.001	.30 (.01)	.41	<.001									
Parent-reported CU (T3)										.61 (.02)	.44	<.001	.56 (.02)	.41	<.001	.56 (.02)	.41	<.001
Child-reported threat sensitivity (T1)				-.07 (.02)	-.03	<.001	-.07 (.02)	-.03	<.001				.07 (.03)	.02	.009	.07 (.03)	.02	.007
Parent-reported affiliation (T2)				-.38 (.02)	-.18	<.001	-.39 (.02)	-.18	<.001				-.37 (.04)	-.13	<.001	-.37 (.04)	-.12	<.001
Threat x affiliation							.09 (.03)	.03	.009							.01 (.03)	.14	.866
R²		.22	<.001		.25	<.001		.25	<.001		.23	<.001		.25	<.001		.25	<.001

Note. T1, Time 1; T2, Time 2; T3, Time 3; CU, callous-unemotional; CP, conduct problems. Models regressed parent-reported CU traits and CP at T3 on earlier threat sensitivity and affiliation. Both longitudinal models replicate the concurrent findings from T2 presented in Table 1.

Table S7. Regression analyses examining alternative (EAT-Q) measures of parent-reported fear at T3 and parent-reported affiliation at T3 in relation to parent- and child-reported CU traits at T3 ($N=11,878$ and $N=2300$, respectively).

<i>Independent variables</i>	<i>Parent-reported CU traits (T3)</i>									<i>Child-reported CU traits (T3)</i>								
	Model 1			Model 2			Model 3			Model 1			Model 2			Model 3		
	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>
Sex (T1)	-.21 (.03)	-.02	.003	-.07 (.03)	-.02	.003	-.07 (.03)	-.03	.003	-.10 (.02)	-.12	<.001	-.09 (.02)	-.11	<.001	-.09 (.02)	-.11	<.001
Age (T1)	.01 (.00)	.04	<.001	.00 (.00)	.01	.181	.00 (.00)	.01	.189	.00 (.00)	.08	<.001	.00 (.00)	.07	<.001	.00 (.00)	.07	<.001
Income (T1)	.00 (.01)	.00	.672	.04 (.01)	.07	<.001	.04 (.01)	.07	<.001	-.02 (.00)	-.10	<.001	-.01 (.00)	-.07	.002	-.01 (.00)	-.07	.001
Parent-reported CP (T3)	.33 (.01)	.45	<.001	.29 (.01)	.40	<.001	.29 (.01)	.40	<.001	.67 (.05)	.36	<.001	.66 (.05)	.35	<.001	.66 (.05)	.35	<.001
EAT-Q parent-reported fear (T3)				-.01 (.00)	-.03	.001	-.01 (.00)	-.03	.001				-.00 (.00)	-.01	.478	-.00 (.00)	-.02	.443
EAT-Q parent-reported affiliation (T3)				-.15 (.00)	-.40	<.001	-.15 (.00)	-.41	<.001				-.01 (.00)	-.15	<.001	-.02 (.00)	-.15	<.001
Fear x affiliation							.00 (.00)	.01	.568							.00 (.00)	-.02	.264
R²		.22	<.001		.37	<.001		.37	<.001		.19	<.001		.21	<.001		.22	<.001

Note. T1, Time 1; T3, Time 3; CU, callous-unemotional; CP, conduct problems. Models regressed CU at T3 on concurrent fear and affiliation assessed at T3 using the EATQ-R. Parent-report results replicate the same main effects shown in Tables 1 and S6; child-report findings replicate only the main effect of affiliation (Table 2).

Table S8. Regression analyses examining child-reported threat sensitivity at T1 and parent-reported affiliation at T2 in relation to parent-reported CU traits at T2 in the full ABCD study sample for controlling ASD status ($N=11,878$) and excluding children with reported ASD diagnosis ($N=11,480$).

	<i>Parent-reported CU traits (T2) - controlling for ASD status</i>									<i>Parent-reported CU traits (T2) - excluding participants with ASD</i>								
	Model 1			Model 2			Model 3			Model 1			Model 2			Model 3		
<i>Independent variables</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>
Sex (T1)	-.25 (.02)	-.09	<.001	-.22 (.02)	-.08	<.001	-.22 (.02)	-.08	<.001	-.23 (.03)	-.08	<.001	-.21 (.03)	-.08	<.001	-.21 (.03)	-.08	<.001
Age (T1)	.00 (.00)	.01	.298	.00 (.00)	.00	.786	.00 (.00)	.00	.775	.00 (.00)	.00	.368	.00 (.00)	.00	.697	.00 (.00)	.00	.677
Income (T1)	.02 (.01)	.04	.001	.03 (.01)	.04	<.001	.03 (.01)	.05	<.001	.02 (.01)	.03	.002	.03 (.01)	.04	<.001	.03 (.01)	.04	<.001
Parent-reported CP (T2)	.30 (.01)	.42	<.001	.25 (.01)	.36	<.001	.25 (.01)	.36	<.001	.29 (.01)	.42	<.001	.25 (.01)	.36	<.001	.25 (.01)	.36	<.001
Parent-reported ASD status (T1)	.11 (.11)	.03	.081	.02 (.04)	.01	.425	.02 (.04)	.01	.420									
Child-reported threat sensitivity (T1)				-.06 (.02)	-.03	.001	-.06 (.02)	-.03	.002				-.07 (.02)	-.03	.001	-.07 (.02)	-.03	.001
Parent-reported affiliation (T2)				-.45 (.02)	-.22	<.001	-.46 (.02)	-.22	<.001				-.43 (.02)	-.20	<.001	-.43 (.02)	-.20	<.001
Threat x affiliation							.08 (.03)	.03	.020							.10 (.03)	.03	.004
R²		.19	<.001		.23	<.001		.23	<.001		.18	<.001		.22	<.001		.22	<.001

Note. T1, Time 1; T2, Time 2; CU, callous-unemotional; CP, conduct problems; ASD, autism spectrum disorder. Parents reported on prior ASD diagnosis in the ABCD screener ($n=201$ diagnosed). Children's ASD status was coded as 0=absent, 1=present for the first set of models. The second set of models excluded children with an ASD diagnosis or missing ASD diagnostic data. Models regressed CU traits assessed at T2 on threat sensitivity and affiliation. Results replicate the main findings presented in Table 1.

Table S9. Regression analyses examining child-reported threat sensitivity at T1 and parent-reported affiliation at T2 in relation to parent-reported CU traits at T2 and child-reported CU traits at T3 in the disruptive behavior disorder subsample of the ABCD study ($N=1799$ and $N=372$, respectively).

<i>Independent variables</i>	<i>Parent-reported CU traits (T2)</i>									<i>Child-reported CU traits (T3)</i>								
	Model 1			Model 2			Model 3			Model 1			Model 2			Model 3		
	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>
Sex (T1)	-.11 (.08)	-.03	.160	-.05 (.08)	-.01	.508	-.06 (.08)	-.02	.460	-.14 (.04)	-.15	.002	-.12 (.04)	-.13	.006	-.12 (.04)	-.13	.007
Age (T1)	.00 (.01)	.00	.942	.00 (.01)	-.01	.511	.00 (.01)	-.02	.482	.01 (.00)	.09	.059	.00 (.00)	.07	.125	.01 (.00)	.08	.083
Income (T1)	.05 (.02)	.08	.003	.06 (.02)	.08	.002	.06 (.02)	.08	.002	-.02 (.01)	-.10	.048	-.02 (.01)	-.09	.099	-.02 (.01)	-.09	.097
CP/aggression (at assessment)	.23 (.02)	.43	<.001	.20 (.02)	.38	<.001	.20 (.02)	.38	<.001	.65 (.12)	.35	<.001	.66 (.11)	.35	<.001	.65 (.11)	.35	<.001
Child-reported threat sensitivity (T1)				-.21 (.06)	-.08	.001	-.16 (.06)	-.06	.015				-.05 (.03)	-.07	.190	-.07 (.04)	-.09	.043
Parent-reported affiliation (T2)				-.43 (.05)	-.22	<.001	-.43 (.05)	-.22	<.001				-.05 (.02)	-.09	.035	-.04 (.02)	-.11	.042
Threat x affiliation							.10 (.07)	.04	.128							-.07 (.03)	-.11	.018
R²		.18	<.001		.22	<.001		.22	<.001		.20	<.001		.21	<.001		.22	<.001

Note. T1, Time 1; T2, Time 2; T3, Time 3; CU, callous-unemotional; CP, conduct problems. Models predicting CU traits at T2 and T3 included covariates of CP or aggression levels at the corresponding time point, per the corresponding informant. Both analyses replicate the main effects presented in Tables 1 and 2, but here in the subgroup of children in the sample meeting current or past clinical criteria for oppositional defiant disorder or conduct disorder at T1. In this disruptive behavior disorder subsample (unlike the overall sample), the interaction between threat sensitivity and affiliation was observed for child-reported but not parent-reported CU traits. Figure 1 depicts the significant interaction for child-reported CU traits in this disruptive behavior disorder subsample.

Table S10. Regression analyses examining child-reported threat sensitivity at T1 and parent-reported affiliation at T2 in relation to parent-reported CU traits at T2 and child-reported CU traits at T3 in the non-disruptive behavior disorder subsample of the ABCD study ($N=9926$ and $N=1895$, respectively).

<i>Independent variables</i>	<i>Parent-reported CU traits (T2)</i>									<i>Child-reported CU traits (T3)</i>								
	Model 1			Model 2			Model 3			Model 1			Model 2			Model 3		
	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>
Sex (T1)	-.25 (.03)	-.10	<.001	-.23 (.03)	-.09	<.001	-.23 (.03)	-.09	<.001	-.09 (.02)	-.11	<.001	-.09 (.02)	-.11	<.001	-.09 (.02)	-.11	<.001
Age (T1)	.00 (.00)	.01	.190	.00 (.00)	.01	.416	.00 (.00)	.01	.406	.00 (.00)	.08	<.001	.00 (.00)	.08	<.001	.00 (.00)	.08	<.001
Income (T1)	.01 (.01)	.02	.092	.02 (.01)	.03	.005	.02 (.01)	.03	.004	-.01 (.00)	-.10	<.001	-.01 (.00)	-.09	.001	-.01 (.00)	-.09	.001
CP/ aggression (at assessment)	.29 (.01)	.32	<.001	.25 (.01)	.28	<.001	.25 (.01)	.28	<.001	.66 (.05)	.35	<.001	.67 (.05)	.36	<.001	.67 (.05)	.36	<.001
Child-reported threat sensitivity (T1)				-.04 (.02)	-.02	.037	-.04 (.02)	-.02	.034				-.05 (.01)	-.08	<.001	-.05 (.01)	-.08	<.001
Parent- reported affiliation (T2)				-.41 (.03)	-.19	<.001	-.41 (.03)	-.20	<.001				-.04 (.02)	-.06	.014	-.04 (.02)	-.06	.015
Threat x affiliation							.04 (.04)	.02	.313							.01 (.02)	.01	.818
R²		.12	<.001		.15	<.001		.15	<.001		.18	<.001		.19	<.001		.19	<.001

Note. T1, Time 1; T2, Time 2; T3, Time 3; CU, callous-unemotional; CP, conduct problems. Models predicting CU traits at T2 and T3 included covariates of CP or aggression levels at the corresponding time point, per the corresponding informant. Both analyses replicate the main effects presented in Tables 1 and 2, but here in the subgroup of children in the sample who did not meet current or past clinical criteria for oppositional defiant disorder or conduct disorder at T1. In this non-disruptive behavior disorder subsample (unlike the overall sample), no interaction between threat sensitivity and affiliation was observed for child- or parent-reported CU traits.

Table S11. Regression analyses examining child-reported threat sensitivity at T1 and parent-reported affiliation at T2 in relation to parent-reported anxiety and depression symptoms at T2, controlling for CU traits and CP levels, in the full ABCD study sample ($N=11,878$).

	<i>Parent-reported anxiety symptoms (T2)</i>									<i>Parent-reported depression symptoms (T2)</i>								
	Model 1			Model 2			Model 3			Model 1			Model 2			Model 3		
<i>Independent variables</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>
Sex (T1)	.22 (.04)	.05	<.001	.22 (.04)	.04	<.001	.22 (.04)	.04	<.001	-.07 (.03)	-.02	.025	-.04 (.03)	-.01	.187	-.04 (.03)	-.01	.189
Age (T1)	-.01 (.00)	-.03	.001	-.01 (.00)	-.03	.001	-.01 (.00)	-.03	.001	.01 (.00)	.02	.001	.01 (.00)	.02	.014	.01 (.00)	.02	.014
Income (T1)	.02 (.01)	.02	.005	.03 (.01)	.03	<.001	.03 (.01)	.03	<.001	-.01 (.01)	-.02	.053	.00 (.01)	.00	.775	.00 (.01)	.00	.750
Parent-reported depression (T2)	.66 (.01)	.58	<.001	.60 (.02)	.53	<.001	.60 (.02)	.53	<.001									
Parent-reported anxiety (T2)										.47 (.01)	.53	<.001	.42 (.01)	.47	<.001	.42 (.01)	.47	<.001
Parent-reported CU traits (T2)	-.05 (.02)	-.03	<.001	-.09 (.02)	-.05	<.001	-.09 (.02)	-.05	<.001	.14 (.02)	.09	<.001	.07 (.01)	.04	<.001	.07 (.01)	.04	<.001
Parent-reported CP (T2)	.13 (.02)	.11	<.001	.12 (.02)	.10	<.001	.12 (.02)	.10	<.001	.23 (.01)	.21	<.001	.21 (.01)	.19	<.001	.21 (.01)	.19	<.001
Child-reported threat sensitivity (T1)				.23 (.03)	.06	<.001	.23 (.03)	.06	<.001				.02 (.02)	.01	.528	.02 (.02)	.00	.526
Parent-reported affiliation (T2)				-.43 (.04)	-.12	<.001	-.42 (.04)	-.12	<.001				-.68 (.04)	-.21	<.001	-.68 (.04)	-.21	<.001
Threat x affiliation							-.08 (.05)	-.02	.109							-.01 (.05)	.00	.821
R²		.39	<.001		.40	<.001		.40	<.001		.45	<.001		.48	<.001		.48	<.001

Note. T1, Time 1; T2, Time 2. CU, callous-unemotional; CP, conduct problems. Models regressed parent-reported depression and anxiety symptoms at T2 on threat sensitivity and affiliation while controlling for CU and CP. For both anxiety and depression, results replicate the pattern presented in Table 3.

Table S12. Regression analyses examining child-reported threat sensitivity at T1 and parent-reported affiliation at T2 in relation to parent-reported anxiety and depression at T3 ($N=11,878$).

	<i>Parent-reported anxiety symptoms (T3)</i>									<i>Parent-reported depression symptoms (T3)</i>								
	Model 1			Model 2			Model 3			Model 1			Model 2			Model 3		
<i>Independent variables</i>	<i>B</i> (<i>SE</i>)	<i>B</i>	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>	<i>B</i> (<i>SE</i>)	β	<i>p</i>
Sex (T1)	.17 (.04)	.04	<.001	.17 (.04)	.04	<.001	.18 (.04)	.04	<.001	-.13 (.04)	-.03	.001	-.06 (.04)	-.01	.142	-.06 (.04)	-.01	.145
Age (T1)	-.01 (.00)	-.03	<.001	-.01 (.00)	-.04	<.001	-.01 (.00)	-.04	<.001	.01 (.00)	.05	<.001	.01 (.00)	.04	<.001	.01 (.00)	.04	<.001
Income (T1)	.01 (.01)	.01	.540	.01 (.01)	.02	.121	.01 (.01)	.02	.123	-.04 (.01)	-.05	<.001	-.03 (.01)	-.03	.002	-.03 (.01)	-.03	.002
Parent-reported depression (T3)	.65 (.01)	.63	<.001	.61 (.01)	.59	<.001	.61 (.01)	.59	<.001									
Parent-reported anxiety (T3)										.61 (.01)	.63	<.001	.55 (.02)	.57	<.001	.55 (.02)	.57	<.001
Child-reported threat sensitivity (T1)				.22 (.03)	.06	<.001	.22 (.03)	.06	<.001				.03 (.03)	.01	.370	.03 (.03)	.01	.376
Parent-reported affiliation (T2)				-.31 (.04)	-.09	<.001	-.31 (.04)	-.09	<.001				-.63 (.04)	-.19	<.001	-.63 (.04)	-.19	<.001
Threat x affiliation							-.04 (.05)	-.01	.503							-.02 (.06)	.00	.706
R²		.40	<.001		.41	<.001		.41	<.001		.40	<.001		.43	<.001		.43	<.001

Note. T1, Time 1; T2, Time 2; T3, Time 3. Models regressed anxiety and depression at T3 on threat sensitivity at T1, affiliation at T2, and covariates. Both analyses replicate the main findings from T2 presented in Table 3.

Table S13. Regression analyses examining child-reported threat sensitivity at T1 and parent-reported affiliation at T2 in relation to parent-reported CU traits, CP, anxiety, and depression at T2, in a single correlated dependent variables model ($N=11,878$) – main effects.

<i>Independent variables</i>	<i>CU traits</i>			<i>CP</i>			<i>Anxiety symptoms</i>			<i>Depression symptoms</i>		
	<i>B (SE)</i>	β	<i>p</i>	<i>B (SE)</i>	β	<i>p</i>	<i>B (SE)</i>	β	<i>p</i>	<i>B (SE)</i>	β	<i>p</i>
Sex (T1)	-.32 (.03)	-.11	<.001	-.40 (.03)	-.10	<.001	.15 (.04)	.03	.001	-.08 (.03)	-.02	.031
Age (T1)	.00 (.00)	.00	.954	.00 (.00)	-.01	.380	-.01 (.00)	-.02	.006	.00 (.00)	.00	.615
Income (T1)	-.01 (.01)	-.02	.100	-.14 (.01)	-.17	<.001	-.01 (.01)	-.01	.468	-.04 (.01)	-.04	<.001
Child-reported threat sensitivity (T1)	-.05 (.02)	-.02	.013	.04 (.03)	.01	.166	.34 (.04)	.09	<.001	.16 (.03)	.05	<.001
Parent-reported affiliation (T2)	-.67 (.02)	-.32	<.001	-.86 (.04)	-.29	<.001	-1.34 (.04)	-.37	<.001	-1.45 (.05)	-.45	<.001
Dependent variable correlations:												
CU traits				.90 (.04)	.36	<.001	.17 (.03)	.06	<.001	.37 (.03)	.14	<.001
CP	.90 (.04)	.36	<.001				1.08 (.06)	.25	<.001	1.23 (.06)	.34	<.001
Anxiety	.17 (.03)	.06	<.001	1.08 (.06)	.25	<.001				2.36 (.08)	.54	<.001
Depression	.37 (.03)	.14	<.001	1.23 (.06)	.34	<.001	2.36 (.08)	.54	<.001			
R²		.12	<.001		.14	<.001		.15	<.001		.22	<.001

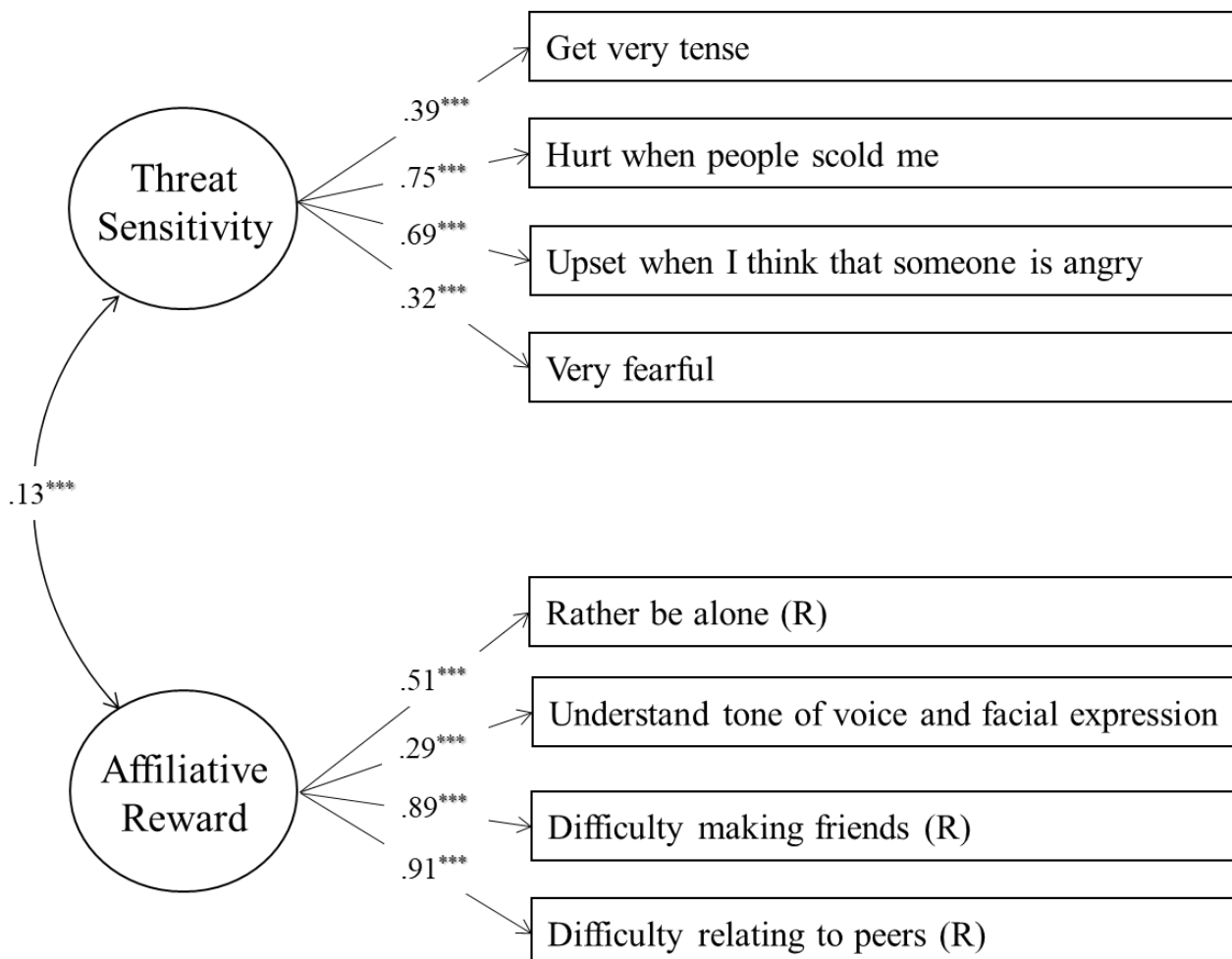
Note. T1, Time 1; T2, Time 2; CU, callous-unemotional; CP, conduct problems. All outcomes were parent-reported at T2. The model included four regressions, one for each psychopathology dimension. Each outcome was regressed on the demographic covariates (child age and sex and family income) and the STAR dimensions (child-reported threat sensitivity and parent-reported affiliation). In addition, the covariances between all dependent variables were modeled. The results largely replicate the main-effects findings from separate models in Tables 1 and 3.

Table S14. Regression analyses examining child-reported threat sensitivity at T1 and parent-reported affiliation at T2 in relation to parent-reported CU traits, CP, anxiety, and depression at T2, on a single correlated dependent variables model ($N=11,878$) – interactions.

<i>Independent variables</i>	<i>CU traits</i>			<i>CP</i>			<i>Anxiety symptoms</i>			<i>Depression symptoms</i>		
	<i>B (SE)</i>	β	<i>p</i>	<i>B (SE)</i>	β	<i>p</i>	<i>B (SE)</i>	<i>B</i>	<i>p</i>	<i>B (SE)</i>	β	<i>p</i>
Sex (T1)	-.32 (.03)	-.11	<.001	-.40 (.04)	-.10	<.001	.15 (.04)	.03	.001	-.08 (.04)	-.02	.033
Age (T1)	.00 (.00)	.00	.964	.00 (.00)	-.01	.377	-.01 (.00)	-.02	.006	.00 (.00)	.00	.620
Income (T1)	-.01 (.01)	-.02	.112	-.14 (.01)	-.17	<.001	-.01 (.01)	-.01	.468	-.04 (.01)	-.04	<.001
Child-reported threat sensitivity (T1)	-.05 (.02)	-.02	.019	.04 (.03)	.01	.160	.34 (.03)	.09	<.001	.16 (.03)	.05	<.001
Parent-reported affiliation (T2)	-.68 (.02)	-.32	<.001	-.86 (.04)	-.29	<.001	-1.33 (.04)	-.37	<.001	-1.45 (.05)	-.45	<.001
Threat x affiliation	.07 (.03)	.02	.049	-.03 (.06)	-.01	.666	-.12 (.06)	-.02	.040	-.06 (.06)	-.01	.308
Dependent variable correlations:												
CU traits				.90 (.04)	.36	<.001	.17 (.03)	.06	<.001	.37 (.03)	.14	<.001
CP	.90 (.04)	.36	<.001				1.08 (.06)	.25	<.001	1.23 (.06)	.34	<.001
Anxiety	.17 (.03)	.06	<.001	1.08 (.06)	.25	<.001				2.36 (.08)	.54	<.001
Depression	.37 (.03)	.14	<.001	1.23 (.06)	.34	<.001	2.36 (.08)	.54	<.001			
R²		.12	<.001		.14	<.001		.15	<.001		.22	<.001

Note. T1, Time 1; T2, Time 2; CU, callous-unemotional; CP, conduct problems. All outcomes were parent-reported at T2. The model included four regressions, one for each psychopathology dimension. Each outcome was regressed on the demographic covariates (child age and sex and family income), the STAR dimensions (child-reported threat sensitivity and parent-reported affiliation), and the interaction between the STAR dimensions. In addition, the covariances between all dependent variables were modeled. The results largely replicate the main findings from separate models in Tables 1 and 3.

Figure S1. Two-factor confirmatory factor analysis of the Sensitivity to Threat and Affiliative Reward (STAR) model in the ABCD data.



Model fit: $\chi^2(19) = 144.35$, $p < .001$, CFI = .99, TLI = .99, RMSEA = .024, WRMR = 1.57.
 * $p < .05$, ** $p < .01$, *** $p < .001$.