Supplemental Material

Why should I? Examining how childhood callous-unemotional traits relate to prosocial and affiliative behaviors and motivations

Validating the ECHO stimuli

Adult Sample. To ensure that the ECHO stimuli depicted instrumental need, emotional need, and neutral situations, we validated images in an independent sample of 80 young adults (M_{age}=19.86, 72.5% female). Participants completed a survey in which they rated the extent to which the person in the picture required instrumental/practical help (e.g., assistance with something they were trying to do) versus emotional help (e.g., comforting) on a 4-point Likert scale ranging from 1 ("not at all") to 4 ("a lot"). We considered ratings > 2 ("a little bit") to index whether or not the situation provoked that help type. For the four pictures selected to depict situations of instrumental need, participants rated the person's need for instrumental help as significantly greater than 2 (t(18.06), p<.001). Likewise, for the four pictures depicting emotional distress, participants rated the person's need for emotional help as significantly greater than 2 (t(23.19), p<.001). Images depicting instrumental need were rated as requiring significantly more instrumental than emotional help (t(22.56), p<.001) and the situations depicting emotional need were rated as requiring significantly more comforting than instrumental help (t(13.32), p<.001). All the neutral situations were rated as significantly less than 2 (t(-18.37), p<.001) for instrumental or emotional need. Overall, the ratings yielded separated three groups, representing emotional need (high need for emotional help/comforting), instrumental need (low need for comforting and high instrumental need), and neutral stimuli (low emotional and low instrumental need) (**Figure S1**).

Main Sample. To further establish construct validity, we examined the convergence of children's ECHO task data with parent-reported prosociality on the validated SDQ questionnaire (Goodman, 1997). Higher levels of parent-reported prosociality were corelated with better prosocial recognition (r=.24, p=.005, 95% CI=.07,.40) and more offers of help (r=.34, p<.001,

95% CI=.18,.49) (i.e., using summed scores combining across trials at the individual level) In terms of discriminant validity, the magnitude of the correlations with the SDQ prosocial scale were significantly larger than with other SDQ subscales, including the emotion problems (recognition: r=-.05, p=.62; help offering: r=-.14, p=.11) and hyperactivity (recognition: r=-.01, p=.88; help offering: r=-.02, p=.83) subscales.

Examining associations between prosocial and affiliative behaviors

As exploratory *post hoc* analysis we examined convergence across the neutral and prosocial contexts, controlling for gender and age (**Table S12**). Unlike our main analyses conducted the trial level, analyses were conducted using summed scores combining across trials at the individual level. Higher recognition accuracy for prosocial need and more prosocial offers were related to more cooperative affiliation offers and greater social motivation for affiliative behavior. Denial of help was related to more parallel affiliative behavior, less cooperative behavior, and lower social motivation. Self-oriented prosocial motivation was related to more affiliative behavior offers and greater social motivation for affiliative behavior, while other-oriented prosocial motivation was related to less parallel and more cooperative affiliative behavior.

Examining moderation by gender

In response to the feedback of an anonymous Reviewer, we also conducted a *post hoc* exploratory analysis to examine moderation by gender. We have added the interaction between gender and CU traits (product of centered variables) to the main analysis and then repeated the analysis for each of the dependent variables (e.g., prosocial recognition, help offering, affiliative initiatives, etc.). The interaction between gender and CU traits significantly predicted prosocial recognition (B=.13, SE=.07, OR=1.59, p=.037; 95% CI=1.03,2.45) and help offering (B=.15,

SE=.06, *OR*=1.64, *p*=.013; 95% CI=1.11,2.42), results are presented at **Table S6** (gender moderation analyses for the other dependent variables are available in the study OSF page https://osf.io/26rtw/?view_only=e8377234b2ef44709b61b5fa0d32204a). Higher CU traits were linked with poorer recognition accuracy in boys (β=-.19, *p*<.001) but not girls (β=-.04, *p*=.32). Similarly, higher CU traits related to a lower probability of offering help in boys (β=-.20, *p*<.001) but not girls (β=-.05, *p*=.15) (**Figure S2**).

Table S1. ECHO coding examples

Situation	Construct	Response	Code
Prosocial	*Recognition of need*	There is a boy	No recognition
		The groceries fell	Instrumental recognition
		She is crying	Distress recognition
		He needs help	Recognition
	Helping offer	I will keep playing	No help offering
		I would help her reach the toy	Instrumental helping
		I would cheer him up	Comforting
	Help motivation	I will leave	No clear motivation
		They will thank me	Self-oriented
		They will feel better	Other-oriented
Neutral Social	*Recognition of lack of need*	He needs help	Incorrect recognition
		She is upset	Incorrect recognition
		He's reading a book	Correct recognition
	Initiation	I would leave	No initiation
		I don't know	No initiation
		I would sing along	Affiliative initiation
	Subtype of affiliative behavior	I would read a different book	Parallel
		I would watch the movie too	Associative
		I would play the game with her	Cooperative
	Affiliative motivation	She will put on more makeup	No social reward
		We will be friends	Social reward

Table S2. Descriptive statistics

	M	*SD*	*Range*
1. Child age	5.48	.50	5-6
2. Child gender	.58	.50	
3. Family income	10,414	8805	0-66,667
4. Parental education	5.16	1.18	1-6
5. CU traits	13.49	6.84	0-34
6. Conduct problems	1.32	1.40	0-10
7. Prosocial recognition	7.48	.96	0-8
8. Help offering	6.70	1.78	0-8
9. Denial of help	.78	1.29	0-8
10. Instrumental helping	3.89	1.17	0-8
11. Emotional helping	2.83	1.22	0-8
12. Self-oriented motivation	1.31	1.73	0-8
13. Other-oriented motivation	2.05	2.40	0-8
14. Recognition neutral	5.61	.79	0-6
15. Initiation of social interaction	4.69	1.65	0-6
16. Parallel play	1.58	1.62	0-6
17. Associative play	.64	.62	0-6
18. Cooperative play	2.47	1.77	0-6

Notes: Child gender was coded male=0 and female=1. For descriptive statistics and correlations, the motivations and play type were coded as 0 = didn't occur or 1 = occur, at each trial, and summed across 8 trials for prosocial variables or 6 trials for affiliative behavior variables. CU traits scores were assessed using a sum of 22 out of the 24 items of the ICU questionnaire, items 3 and 10 were removed based on findings from previous studies (Waller et al., 2015).

Table S3. Zero order correlations between study variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Child age	-																	
2. Child gender	-.11	-																
3. Family income	-.12	.01	-															
4. Parental education	-.21*	-.22*	.42***	-														
5. CU traits	-.21*	.04	.11	.06	-													
6. Conduct problems	-.01	-.13	.01	.05	.34***	-												
7. Prosocial recognition	.22*	.09	-.13	.01	-.10	.08	-											
8. Help offering	.14	.08	-.09	-.03	-.09	-.06	.71***	-										
9. Denial of help	-.03	-.05	.02	.05	.05	.14	-.23**	-.85***	-									
10. Instrumental helping	.24**	.04	-.07	-.03	-.13	.01	.69***	.72***	-.47***	-								
11. Emotional helping	.03	.07	-.09	-.03	-.02	-.10	.38***	.76***	-.76***	.14	-							
12. Self-oriented motivation	.16	-.11	-.08	.09	-.15	-.04	.25**	.33***	-.28**	.25**	.24**	-						
13. Other-oriented motivation	.13	-.02	-.07	-.19*	.05	-.10	.29***	.37***	-.30***	.22*	.33***	-.23**	-					
14. Recognition neutral	-.01	.15	.01	.06	-.10	-.20*	.09	.00	.07	.14	-.10	.01	-.12	-				
15. Affiliative behavior offer	.14	.02	-.20*	.06	-.18*	-.06	.44***	.36***	-.17	.35***	.20*	.24**	.10	.17*	-			
16. Parallel interaction	-.09	.18*	.02	.07	-.21*	-.07	.05	-.16	.25**	.01	-.22*	-.08	-.18*	.20*	.36***	-		
17. Associative interaction	.02	-.02	-.08	.04	-.11	-.08	.11	.14	-.11	.10	.08	.03	.08	.20*	.25**	-.03	-	
18. Cooperative interaction	.21*	.14	-.15	-.03	.05	.03	.32***	.42***	-.35***	.28**	.35***	.27**	.22*	-.10	.49***	-.57***	-.08	
19. Social motivation	.07	-.06	-.06	.00	-.05	.02	.31***	.30***	-.18*	.25**	.22*	.53***	.07	-.12	.33***	-.07	.04	.36***

*p< .05, **p< .01, ***p< .001. All correlations are two tailed. Child gender was coded male=0 and female=1. For descriptive statistics and correlations, the motivations and play type were coded as 0 = didn't occur or 1 = occur, at each trial and summed across 8 trials for prosocial variables or 6 trials for affiliative behavior variables.

Table S4. Mixed-effect logistic regression analyses examining whether CU traits and conduct problems predict offers of help only including correctly recognized trials (n = 980).

Predictor	*Help offering*					
	Model 1			**Model 2**		
	B	*SE*	*p*	*B*	*SE*	*p*
Type of need	-4.67	1.89	.014	-2.78	1.21	.022
Actor age	.97	.44	.029	.89	.41	.032
Child age	.51	.56	.363	.27	.54	.623
Child gender	.36	.55	.514	.19	.55	.733
CU traits				-.16	.05	.001
Conduct problems				-.02	.21	.933
Type of need x CU traits				.14	.07	.059

Notes. Need type was coded: instrumental=-0.5 and emotional=0.5. Actor age was coded: adult=-0.5 and child=0.5. Child gender was coded male=0 and female=1.

Table S5. Multinomial mixed linear regression analyses examining whether CU traits and conduct problems distinguish between motivations for help only in trials where help was offered (n = 881)

	Self vs. Other-oriented						*Neither motivation vs. Self-oriented*						*Neither motivation vs. Other-oriented*					
Predictor	**Model 1**			**Model 2**			**Model 1**			**Model 2**			**Model 1**			**Model 2**		
	B	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
Need type	1.17	.38	.003	1.24	.36	<.001	-.26	.32	.451	-.33	.42	.465	.96	.54	.069	.99	.60	.694
Actor age	.33	.40	.413	.23	.34	.515	.60	.32	.066	.61	.44	.196	.85	.55	.133	.80	.57	.729
Child age	.14	.55	.799	.30	.60	.629	.62	.33	.064	.52	.37	.163	.76	.52	.146	.77	.56	.722
Child gender	.34	.56	.543	.45	.59	.453	- .63	.34	.063	-.80	.38	.033	-.28	.55	.609	-.36	.56	.872
CU traits				.05	.05	.280				-.03	.03	.327				.02	.04	.906
Conduct problems				.02	.23	.935				-.20	.15	.199				-.19	.21	.813
Need type x CU traits				.07	.04	.086				-.03	.03	.401				.04	.03	.739

Notes. Need type was coded: instrumental=-0.5 and emotional=0.5. Actor age was coded: adult=-0.5 and child=0.5. Child gender was coded male=0 and female=1. On the self and other oriented motivation, self-oriented was coded as the reference group. At the other comparisons, neither motivation was coded as the reference group.

Table S6. Mixed-effect logistic regression analyses examining whether interaction between child gender and CU traits predict recognition of prosocial need and help offering.

Predictor	*Prosocial recognition*			*Help offering*		
	B	*SE*	*p*	*B*	*SE*	*p*
Need type	2.98	1.25	.02	-.02	.49	.97
Actor age	-.29	.54	.59	.16	.37	.67
Child age	1.12	.44	.01	.69	.38	.07
Child gender	.40	.46	.38	.12	.40	.76
CU traits	-.17	.05	<.001	-.13	.03	<.001
Conduct problems	.35	.18	.05	.20	.16	.20
Need type x CU traits	-.17	.09	.06	-.01	.04	.77
Child gender x CU traits	.13	.07	.04	.14	.06	.01

Notes. Actor age was coded: adult=-0.5 and child=0.5. Child gender was coded male=0 and female=1. Probing the interactions reveled that both lower prosocial recognition and help offering relates to CU traits only for boys, but not for girls (see **Figure S2**).

Table S7. Mixed-effect logistic regression analyses examining whether interaction between child CP and CU traits predict recognition of prosocial need and redontion of neutral situation.

Predictor	*Prosocial recognition*			*Recognition of neutral situation*		
	Model 3			**Model 3**		
	B	*SE*	*p*	*B*	*SE*	*p*
Type of need	2.78	1.24	.03			
Actor age	-.27	.55	.62	.03	.45	.95
Child age	1.07	.44	.02	.04	.49	.93
Child gender	.59	.43	.17	.61	.50	.22
CU traits	-.16	.05	<.001	.05	.04	.22
Conduct problems	.37	.26	.15	-.43	.23	.04
Type of need x CU traits	-.18	.08	.04			
Type of need x Conduct problems	.26	.40	.52			
Conduct problems x CU traits	.02	.03	.51	.00	.02	.91

Notes. Need type was coded: instrumental=-0.5 and emotional=0.5. Actor age was coded: adult=-0.5 and child=0.5. Child gender was coded male=0 and female=1. Models 1 and 2 are presented in Table 1 for prosocial need and in Table 3 for recognition of neutral situation.

Table S8. Mixed-effect logistic regression analyses examining whether CU traits and conduct problems predict initiation of affiliation behavior only for correctly recognized trials (n = 735).

Predictor	*Affiliative intiation*					
	Model 1			**Model 2**		
	B	*SE*	*p*	*B*	*SE*	*p*
Actor age	.83	.26	.002	.85	.27	.002
Child age	.77	.45	.087	.52	.43	.220
Child gender	.19	.45	.669	.08	.43	.838
CU traits				-.10	.03	.003
Conduct problems				.06	.16	.690

Notes. Actor age was coded: adult=-0.5 and child=0.5. Child gender was coded male=0 and female=1.

Table S9. Multinomial mixed linear regression analyses examining whether CU traits and conduct problems relate to interaction type

Predictor	*No initiation vs. parallel*						*No initiation vs. associative*						*No initiation vs. cooperative*					
	Model 1			**Model 2**			**Model 1**			**Model 2**			**Model 1**			**Model 2**		
	B	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*P*	*B*	*SE*	*p*
Actor age	.46	.75	.596	.53	1.01	.610	1.97	.77	.016	2.00	.78	.016	-.26	.74	.733	-.22	.79	.787
Child age	.11	.38	.773	-.02	.41	.960	.45	.32	.155	.27	.33	.418	.83	.34	.016	.77	.34	.022
Child gender	.76	.39	.053	.55	.41	.184	.05	.31	.875	-.08	.32	.803	-.13	.32	.689	-.11	.33	.741
CU traits				-.11	.03	<.001				-.08	.03	.004				-.05	.03	.050
Conduct problems				.00	.16	1.00				-.01	.13	.936				.01	.13	.936

Predictor	*Parallel vs. associative*						*Parallel vs. cooperative*						*Associative vs. cooperative*					
	Model 1			**Model 2**			**Model 1**			**Model 2**			**Model 1**			**Model 2**		
	B	*SE*	*P*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*P*
Actor age	1.50	.76	.064	1.45	1.01	.170	-.74	1.00	.465	-.85	1.06	.465	-2.16	1.06	.050	-2.19	1.22	.099
Child age	.25	.29	.377	.18	.29	.542	.64	.33	.050	.69	.34	.050	.32	.33	.315	.45	.34	.188
Child gender	-.47	.30	.110	-.44	.31	.159	-.70	.35	.043	-.53	.35	.124	-.16	.33	.635	-.07	.34	.834
CU traits				.01	.02	.700				.05	.03	.075				.03	.03	.285
Conduct problems				-.03	.12	.810				.00	.13	1.00				.01	.14	.943

Notes Actor age was coded: adult=-0.5 and child=0.5. Child gender was coded male=0 and female=1. When a play type was compared to null initiation, the later was coded as the reference group. When another play compared with parallel play, the later was coded as the reference group. On the final compression, associative play was coded as the reference group.

Table S10. Mixed-effect logistic regression analyses examining whether CU traits and conduct problems predict affiliation motivation only in trials following initiated affiliative behavior (n = 615).

Predictor	*Motivation for affiliative behavior*					
	Model 1			**Model 2**		
	B	*SE*	*p*	*B*	*SE*	*p*
Actor age	.72	.30	.016	.67	.25	.007
Child age	.34	.41	.400	.30	.42	.482
Child gender	-.32	.41	.436	-.27	.42	.517
CU traits				-.03	.03	.368
Conduct problems				.11	.16	.497

Notes. Actor age was coded: adult=-0.5 and child=0.5. Child gender was coded male=0 and female=1.

Table S11. Mixed-effect logistic regression analyses examining whether CU traits predicts children prosocial recognition, help offer and denial of help, and initiation on social interactions, without conduct problems included in the model

Predictor	*Prosocial recognition*			*Help offering*			*Denial of help (not offering while need recognized)*			*Initiation of social interaction*		
	Model 2			**Model 2**			**Model 2**			**Model 2**		
	B	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
Type of need	2.84	1.25	.022	-.08	.49	.867	2.67	1.00	.008			
Actor age	-.30	.53	.583	.12	.36	.726	-.81	.38	.036	.73	.25	.003
Child age	1.14	.46	.012	.65	.39	.094	-.21	.48	.654	.54	.40	.180
Child gender	.56	.44	.197	.24	.39	.529	-.07	.49	.884	.11	.40	.781
CU traits	-.13	.04	.002	-.10	.03	<.001	.15	.04	<.001	-.08	.03	.005
Type of need x CU traits	-.16	.08	.039	-.01	.04	.840	-.13	.06	.037			

Notes. Need type was coded: instrumental=-0.5 and emotional=0.5. Actor age was coded: adult=-0.5 and child=0.5. Child gender was coded male=0 and female=1.

Table S12. Partial correlations between prosocial and affiliative behavior controlling for children's age and gender.

	Recognition neutral	Affiliative behavior offers	Parallel interaction	Associative interaction	Cooperative interaction	Social motivation
Prosocial recognition	.07	.42***	.05	.11	.30***	.31***
Help offering	-.02	.34***	-.17	.14	.42***	.30***
Denial of help	.07	-.16	.27**	-.11	-.36***	-.18*
Instrumental helping	.13	.33***	.02	.10	.25**	.25**
Emotional helping	-.11	.20*	-.24**	.08	.36***	.22*
Self-oriented motivation	.03	.22*	-.06	.02	.24**	.52***
Other-oriented motivation	-.12	.08	-.18*	.08	.20*	.06

*p< .05, **p< .01, ***p< .001. All correlations are two tailed. For descriptive statistics and correlations, the motivations and play type were coded as 0 = didn't occur or 1 = occur, at each trial and summed across 8 trials for prosocial variables or 6 trials for affiliative behavior variables.

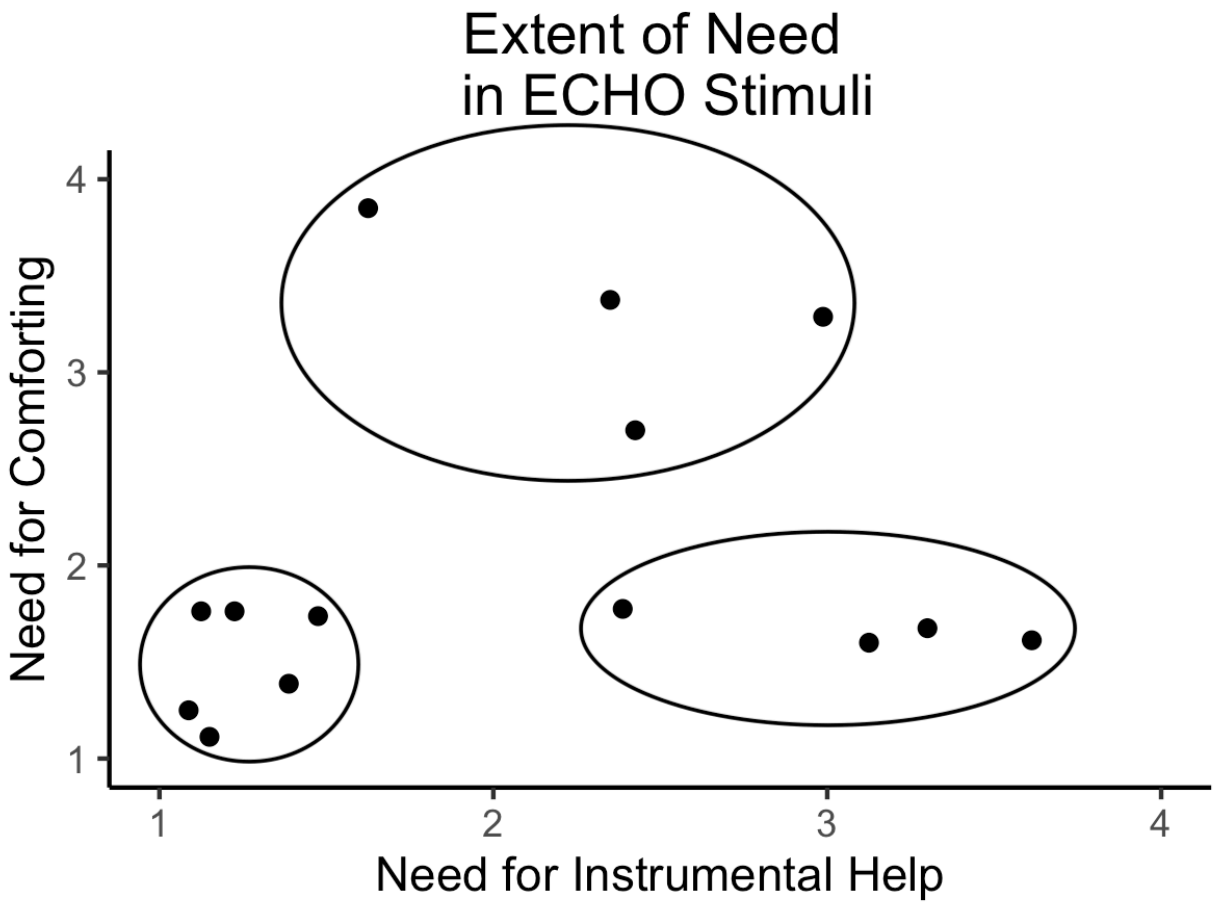
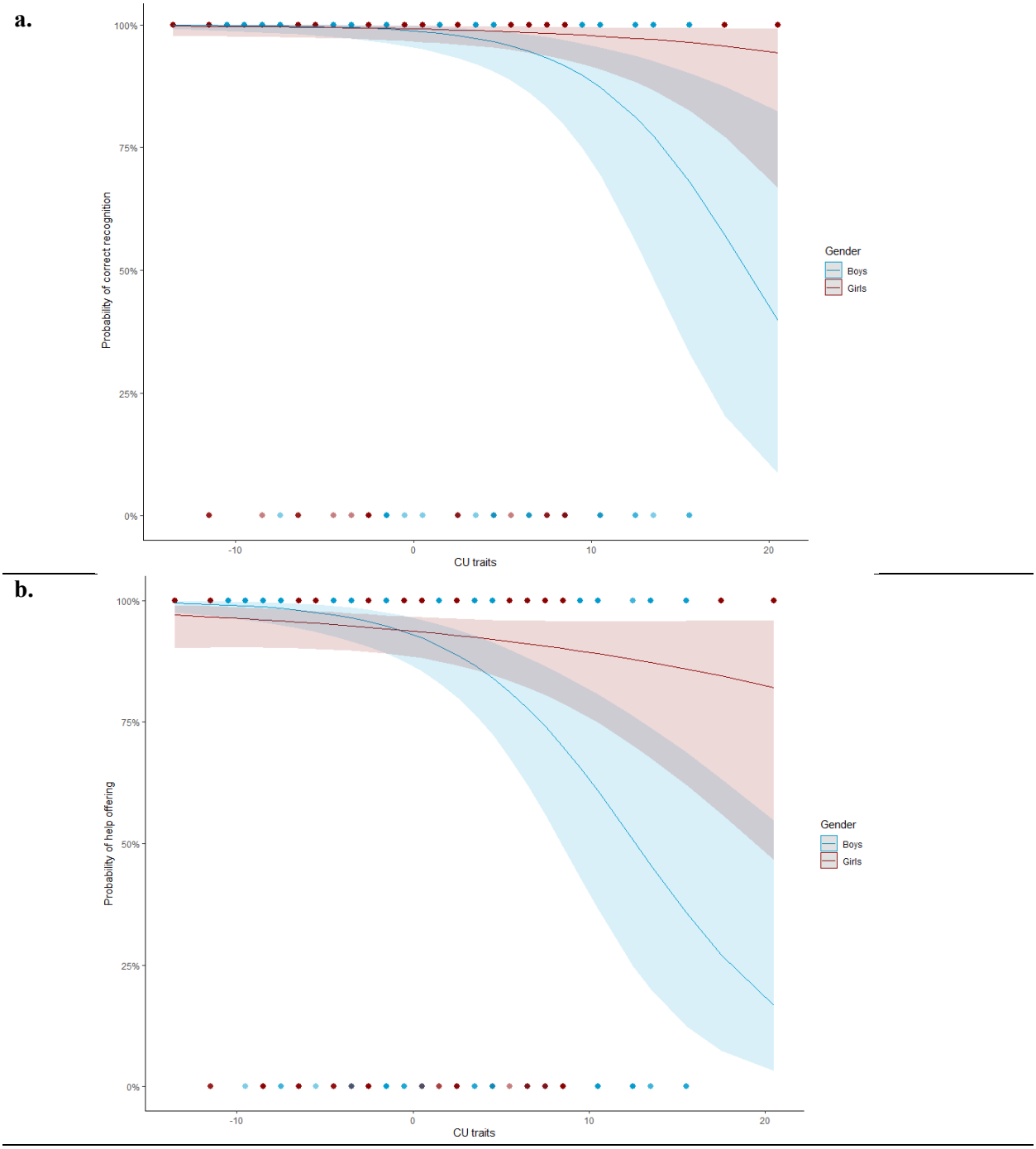


Figure S1. Distribution of pictures based on the scoring of adult validation task. As can be seen, the pictures congregated to three groups: 1) *emotional need* - high need for comforting, 2) *instrumental need* - low need for comforting and high instrumental need, and 3) *neutral stimuli* - low comforting and low instrumental need.

Figure S2. CU traits are related to lower recognition of prosocial need and lower help offering in boys but not in girls.



Note. **a.** Higher CU traits were linked to poorer recognition accuracy in boys (β=-.19, p<.001) but not girls (β=-.04, p=.32). **b.** Higher CU traits related to a lower probability of help offering in boys (β=-.20, p<.001) but not girls (β=-.05, p=.15).