

Externalizing behavior severity in youths with callous-unemotional traits corresponds to patterns of amygdala activity and connectivity during judgments of causing fear

SUPPLEMENTARY MATERIAL

Complete Set of EEST Stimuli

Anger:

Don't you have any real friends?
Everything you say is stupid.
I am better than you in so many ways.
I broke your phone on purpose.
I heard someone talking trash about you behind your back.
I stole 20\$ from your wallet.
I think you cheated on the test.
I told someone your secret.
I told you to shut up.
I'm going to hurt your friend.

Disgust

I found hair in my food.
I haven't showered in days.
I haven't washed my hair in weeks.
I just blew my nose on my sleeve.
I just picked off my scab.
I never wash my hands.
I never wear deodorant.
I reuse my dirty Kleenex.
I saw our waiter sneeze on our food.
I saw someone spit into their hands.

Fear

I am going to make you bleed.
I could easily hurt you.
I could kill you if I wanted to.
I don't think you are safe here.
I hope something bad will happen to you.
I think something moved behind you.
I think you are being followed.
I want to hurt you.
I want to make you suffer.
I want to punch you.

You always ruin everything.
You are a disgrace.
You are a huge idiot.
You are a waste of my time.
You are completely useless.
You are so ignorant sometimes.
You aren't very smart.
You really suck.
You're always wrong.
You're so stupid it's unbelievable.

I wear dirty underwear.
I'm chewing gum I found on the ground.
I'm going to spit into my soda.
It smelled like someone pooped in here.
It smells like vomit in the bathroom.
It smells like vomit.
It smells like you stepped in dog poop.
There is a fly in your food.
Your desk looks like a bird pooped on it.
Your lunch smells rotten.

I will hurt you if you tell anyone my secret.
I'll be stalking you.
I'll be watching everything you do.
I'll kill your family.
I'm about ready to hit you.
I'm going to beat you up.
I'm going to push you down the stairs.
If you don't leave now you'll be sorry.
You better watch your back.
You can't protect yourself from me.

Happiness

I always feel better when I am with you.
I always love spending time with you.
I baked you cookies.
I bought you a present.
I found that thing you lost.
I got you tickets to the concert you wanted to go to.
I have an extra ticket to the movie—you should come.
I like you.
I love you.

Sadness

Everything you own is gone.
I can't stand you.
I don't like you anymore.
I don't trust you.
I don't want to be friends anymore.
I feel really distant from you.
I forgot your birthday.
I have no respect for you.
I heard your best friend is moving away.
I hope I never see your face again.

Neutral

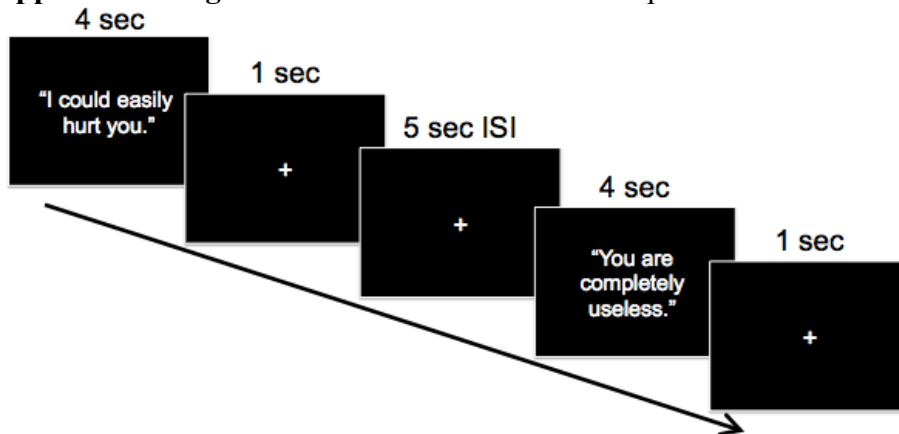
I had a sandwich for lunch.
I have soccer practice after school.
I have to clean my room.
I just finished a long book.
I need to go grocery shopping.
I saw a movie last night.
I'm getting my hair cut tomorrow.
I'm going on vacation soon.
I'm going out for a jog.
I'm going shopping today.

I love your new idea.
I love your new shirt.
I'm so glad to see you.
You always make me smile.
You are in great shape.
You are really attractive.
You are really smart.
You are the nicest person I know.
You look really good.
You're a great friend.
You're amazing

I saw your friend get hit by a car.
I used to think you were special.
I'm disappointed in you.
I'm not attracted to you.
Leave me alone.
None of your friends really like you.
Our friendship is over.
You abandoned me when I needed you most
You really let me down.
You're not invited to my party.

I'm going to take a nap.
I'm on my way to school.
I'm taking my dog out for a walk.
I'm writing a letter to my grandparents.
My cousins are coming to visit me.
My father is a teacher.
My neighbor is mowing his lawn.
My sister is in college.
My uncle lives next door to me.
Tonight I am going out to dinner.

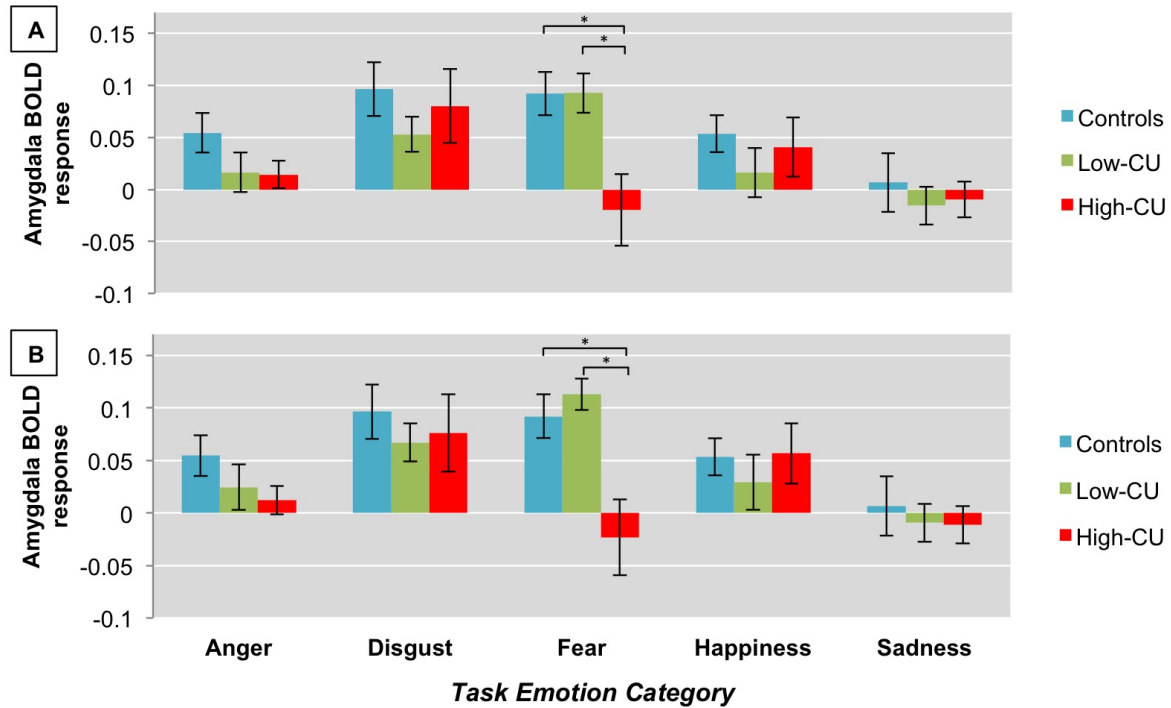
Supplemental Figure S.1. Schema of the fMRI adapted version of the EEST.



Supplemental Table S.1. Mean and standard deviations for proportion of “no” responses to total number of moral judgments for each of the EEST Factors.

	HC N = 18		Low-CU N = 15		High-CU N = 15	
	Mean	SD	Mean	SD	Mean	SD
Anger	0.89	0.20	0.86	0.14	0.78	0.25
Disgust	0.70	0.30	0.78	0.32	0.81	0.23
Fear	0.82	0.18	0.83	0.15	0.76	0.22
Happiness	0.04	0.07	0.03	0.05	0.06	0.09
Sadness	0.72	0.29	0.60	0.27	0.64	0.28
Neutral	0.03	0.05	0.03	0.05	0.07	0.12

Supplemental Figure S.2. Results of repeated measures ANOVAs including (A) only subjects with no movement issues and (B) only subjects with no movement issues or who were medicated during the time of the scan.



Supplemental Table S.2. Demographic and behavioral characteristics for sample excluding youths with movement issues and who were medicated during the time of the scan.

Participant Characteristics	Healthy Controls (n = 17)	Low-CU (n = 9)	High-CU (n = 9)	Omnibus P Value
Demographic variable				
Male:female ratio	11:6	6:3	7:2	.784
Age, mean (SD)	13.64 (2.19) ^a	15.98 (2.21) ^b	15.38 (2.56) ^{a,b}	.038
Cognitive intelligence ¹ , mean (SD)	108.18 (11.58) ^a	99.56 (13.95) ^{a,b}	90.78 (5.78) ^b	.002
Race				.210
White, No.	8	3	1	
Black or African American, No.	8	6	5	
Asian, No.	1	0	2	
Other, No.	0	0	1	
Behavioral measures				
ICU, mean (SD)	25.71 (6.20) ^a	35.22 (5.67) ^b	53.56 (3.36) ^c	<.001
Unemotional, mean (SD)	8.06 (2.08) ^a	9.22 (2.91) ^{a,b}	11.11 (2.15) ^b	.012
Callous, mean (SD)	5.71 (2.57) ^a	10.22 (2.77) ^b	20.78 (4.66) ^c	<.001
Uncaring, mean (SD)	10.53 (4.53) ^a	14.33 (2.78) ^b	19.89 (3.66) ^c	<.001
CBCL Externalizing ² , mean (SD)	42.47 (8.41) ^a	68.67 (4.36) ^b	76.33 (6.08) ^c	<.001
CBCL Affective ³ , No.	0 ^a	4 ^b	5 ^b	.003
CBCL Anxiety ³ , No.	0 ^a	2 ^b	3 ^b	.051
CBCL ADHD ³ , No.	0 ^a	1 ^{a,b}	4 ^b	.008
Alcohol use ⁴ , No.	0 ^a	4 ^b	2 ^b	.006
Drug use ⁴ , No.	0 ^a	2 ^b	3 ^b	.051

^{a,b,c} Cell values marked with different letters are significantly different from one another.

1. As measured by the full-scale IQ from the Kaufman Brief Intelligence Test-2.
2. Age and sex standardized T score of externalizing behavior (aggression and rule breaking).
3. Number of participants who exceeded clinical threshold (score above the 98th percentile).
4. Drug and alcohol use as measured by parent report indicating frequent use.

Supplemental Table S.3. Neural clusters for significant main effect of group and follow-up group contrasts.

Cluster	TLRC Coordinates				k	F/t
	BA	X	Y	Z		
Main Effect of Group						
Left Precuneus	7	-1	-49	44	190	16.56
Right Middle Frontal Gyrus	6	29	11	53	88	17.35
Left Precentral Gyrus	4	-55	-10	32	73	12.96
HC > High-CU Contrast						
Left/Right Precuneus	7	2	-52	41	373	4.09
Left Precentral Gyrus	3/4	-52	-10	50	129	4.27
Right Superior Temporal Gyrus		53	-49	20	83	3.18
Right Postcentral Gyrus	5	35	-43	62	67	2.85
High-CU > HC Contrast						
Left Middle Frontal Gyrus	6	-40	-1	56	86	4.75
Low-CU > High-CU Contrast						
Left Precuneus	7	-4	-58	53	128	3.20
Right Middle Frontal Gyrus	6	32	11	59	108	2.84