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CORRIGENDUM

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

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Figure 1 in the original online article contained a program artifact. The entire page containing the corrected figure is reprinted herein. We regret this error and any problems it may have caused.

Reference

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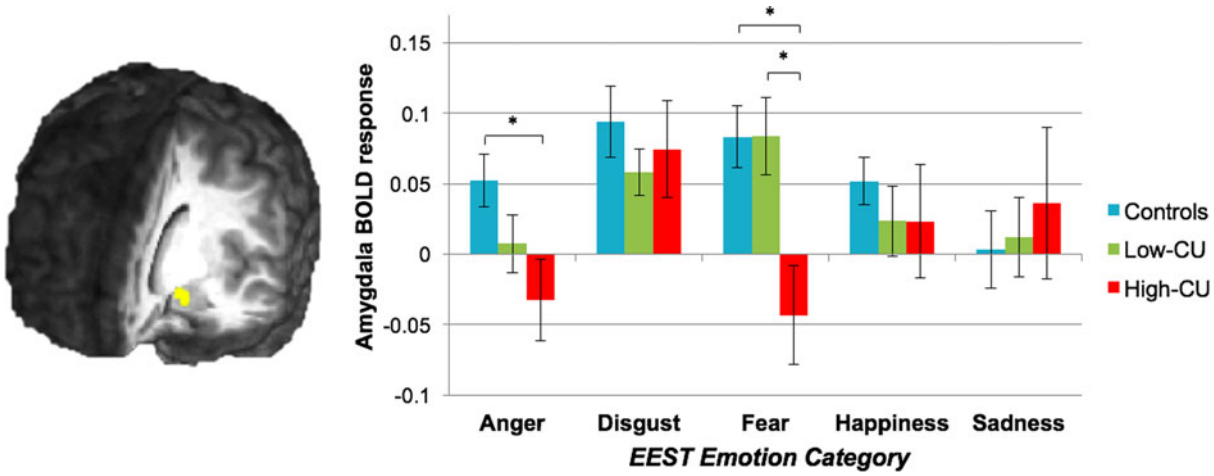

Figure 1. (Color online) The results of a repeated measures analysis of covariance ($N = 48$) found a significant Group × Emotion interaction in the left amygdala such that during judgments of the permissibility of causing others' fear, high callous–unemotional (CU) youths show decreased amygdala activity in comparison to both healthy controls (HC) and low-CU youths. Error bars represent the standard error. BOLD, blood oxygen level dependent; EEST, Emotionally Evocative Statements Task.

analyses, and to confirm results are significant when activity is confined to the amygdala, we used an anatomically defined left amygdala mask, created using the AFNI Talaraich Atlas, to extract parameter estimates for amygdala blood oxygen level dependent (BOLD) activity during judgments of causing fear. The results of a multiple regression analysis in SPSS with ICU scores entered as a continuous predictor of amygdala BOLD activity, while controlling for age and IQ, confirmed that across all participants ($n = 35$), CU traits are predictive of decreased amygdala activity when evaluating causing others fear, $t\ (34) = -2.02$, $p = .05$. We repeated these analyses including only youths with elevated conduct problems and without medication or increased movement ($n = 18$) and again confirmed that the negative association between CU traits and amygdala activity, when evaluating causing others fear, persists even within this subset, $t\ (17) = -2.63$, $p = .02$.

CU traits, amygdala activity, and externalizing behaviors. We next examined the relationship between externalizing behaviors and amygdala hypoactivation during judgments of causing others fear. Again, we used an anatomically defined left amygdala mask to extract parameter estimates. Externalizing behavior scores were derived from the externalizing behaviors subscale of the CBCL. The results of a regression analysis found that, when considered in isolation, increased externalizing behaviors predicted decreased amygdala BOLD activity during judgments of causing others fear, while controlling for age and IQ. This effect held both across all youths ($n = 35$), $t\ (34) = -2.09$, $p = .05$, and among only youths with elevated conduct problems ($n = 18$), $t\ (17) = -2.94$, $p = .01$.

Next, CU traits were examined as a moderator of the relationship between externalizing behaviors and amygdala BOLD activity. In AFNI, we conducted a whole-brain full factorial multiple regression analysis with externalizing behaviors, CU traits, and the interaction between the two (while controlling for age and IQ) as predictors of amygdala activity during judgments of causing fear (Table 3). The results revealed a significant interaction between externalizing behaviors and CU traits in the left amygdala across all subjects ($n = 35$; $xyz = -22, -7, -16$, $k = 10$, $t = -3.28$) such that CU traits significantly moderated the relationship between externalizing behaviors and amygdala activity. As CU traits increased, the relationship between externalizing behaviors and amygdala hypoactivition during judgments of causing fear increased in magnitude. Moreover, the inclusion of the interaction between externalizing behaviors and CU traits resulted in a significant increase in explained variance of amygdala BOLD activity, $\Delta R^2 = .57$, $F\ (1, 29) = 14.38$, $p < .001$, confirming again that CU traits are a significant moderator of the relationship between externalizing behaviors and amygdala activity during the task, $t\ (34) = -3.63$, $p = .001$.

We applied the Johnson–Neyman technique (Johnson & Neyman, 1936) to identify the ICU score at which the simple slope of amygdala BOLD activity during judgments of causing fear, regressed on externalizing behavior problems, differs from zero. The results revealed that the relationship between externalizing behaviors and reduced amygdala activity was only significant at or above an ICU score of 47.29, $t\ (34) = -2.05$, $p = .05$ (Figure 2). Follow-up analyses restricted to only youths with conduct problems ($n = 18$) found nearly identical results. Among these youths, the relationship between externalizing behaviors and amygdala BOLD activity was moderated by CU traits, $t\ (17) = -2.70$, $p = .02$, with the relationship between externalizing behaviors and amygdala activity only significant at or above an ICU score of 47.84, $t\ (17) = -2.18$, $p = .05$.

The externalizing subscale of the CBCL comprises three subscales: attention problems, rule-breaking behaviors, and