Executive function in previously-institutionalized youth: Relations among set-shifting, inhibitory control, and cognitive conflict

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Background

Children who experience early institutional (orphanage) care tend to have poorer cognitive outcomes than peers raised in families (Pollak et al., 2010), including deficits in some executive functions (EF) (e.g., Bos et al.2009; Pollak et al., 2010). The majority of post-institutionalized (PI) children in previous EF work had been adopted later (i.e. after at least 12 months of age). In the present study we examined whether EF is similarly disrupted in 12- to 14-year-old youth who had been adopted earlier versus later in childhood.

Executive function has been shown to be associated with both attention difficulties (Barkley, 1997) and school performance (Beckett, et al., 2010). Because previously we have reported attention difficulties in the present PI sample (Gunnar, et al. 2012), we also examined the relation between EF, attention, and school performance.

Questions

1. **Compared to youth raised in their biological families, is executive function disrupted in post-institutionalized youth?**
2. **Does the duration of deprivation (i.e., earlier versus later adoption) affect EF performance?**
3. **Are sub-components of EF equally disrupted by early-life deprivation?**
4. **Is EF performance related to attention and/or academic difficulties?**

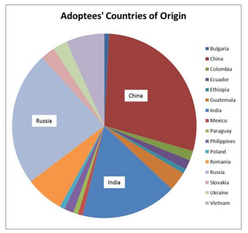
Methods

Participants

- 119 youth adopted from institutional care; 33 youth raised in their Minnesota-based biological families
- Adopted youth had been living with their families for an average of 11.6 years.
- Screened for FAS, IQ < 80, and pervasive developmental disorders
- Attention difficulties and school functioning was measured via parent report (Essex, et al., 2002).

Table 1. Participant characteristics.

	n	Gender (% female)	Age of adoption (mean months (range))	Age at time of parent report (mean years (SD))	Age at test time of EF testing (mean years (SD))	IQ (mean (SD))
Non-Adopted (NA)	33	64	--	12.78 (.56)	12.78 (.56)	122.36 (13.32)
Earlier Adopted (EA)	61	66	8.51 (4-12)	12.74 (.77)	13.23 (.60)	106.65 (13.09)
Later Adopted (LA)	58	60	27.57 (13-60)	12.42 (.83)	13.12 (.57)	99.86 (13.24)



Adoptees were from 16 different countries with the majority from China (22%), Russia (18%), India (13%), Romania (5%), and Vietnam (5%).

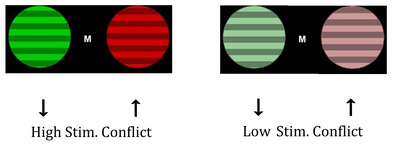
Executive Function Tasks

Conflict Task

Participants shift between two rules

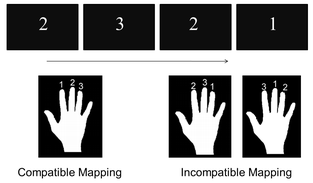
- Motion rule: Choose the circle with the upward-moving lines
- Color rule: Choose the red circle

Color saturation of the circles and intensity of the lines' motion varied to yield high and low stimulus conflict.



Response Mapping Task

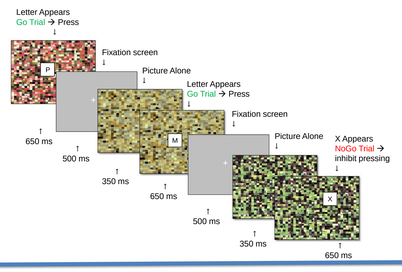
Participants are required to associate a finger with a number. Once a compatible mapping association is established, the mapping is changed to a less intuitive, incompatible one.



Inhibitory Control Task

Participants were instructed to push a button for all letters except 'x'.

Participants built up a prepotent tendency to press (Go trials = 75% of all trials) and must inhibit the tendency on NoGo trials.



Results

Composite score. Preliminary analyses indicated that the 3 EF tasks had high internal consistency (Cronbach's alpha = .839) for the sample as a whole and for each adoption group separately. Therefore, a composite score of the average accuracy across tasks was calculated.

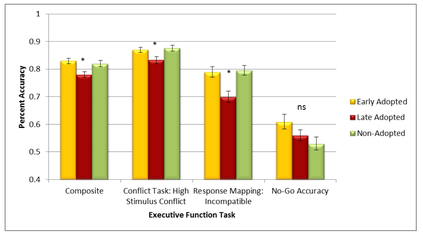


Figure 2. Group comparisons for the composite and sub-tasks.

- For the Composite score and the sub-component tasks Stimulus Conflict and Response-Mapping, Later adopted youth were less accurate than the Earlier adopted and Non-adopted youth (*p*s < .01).
- The groups did not differ on the No-Go task.
- Results held when accounting for participant IQ.

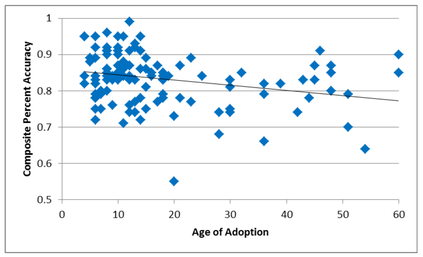


Figure 3. Relation between duration of deprivation and EF Composite score.

- Over and above IQ, adopted youths' age of adoption was negatively associated with EF accuracy (std. beta = -.258, *p* < .005).
- Age of adoption was correlated with Response Conflict (Incompatible) accuracy (*r* = -.316, *p* < .005) when controlling for IQ. It was not correlated with Stimulus Conflict or NG accuracy.

Results, cont.

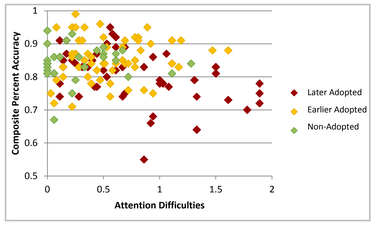


Figure 4. Relation between attention difficulties and EF. Scores on the Composite were negatively correlated with attention difficulties, after controlling for IQ (std. beta = -.202, *p* < .02). The effect was driven primarily by the Later Adopted youth.

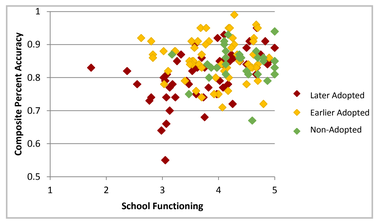


Figure 5. Relation between school performance and EF. Scores on the Composite were positively correlated with academic functioning, after controlling for IQ (std. beta = .254, *p* < .02). The effect was driven primarily by the Later Adopted youth.

Discussion

- Children adopted out of institutional care later than 12 months perform more poorly on tests of executive function relative to those adopted earlier and those raised in their biological families.
- Within the PI group, duration of deprivation was negatively associated with EF performance.
- Cognitive conflict was particularly challenging for the later-adopted youth.
- The inhibition task was not sensitive to adoption status, perhaps because all groups had difficulty with the task.
- Performance on the EF composite was associated with attention difficulties (negatively) and school performance (positively), an effect primarily driven by the later-adopted youth. This finding suggests that chronic stress early in life confers long-term risk in a variety of cognitive domains.

Acknowledgments

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