Effects of Institutional Deprivation on a Continuous Recognition Memory Task

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INTRODUCTION

- An increase in adoption of children who have spent some time in institutional care has lead to questions about long-term effects of early deprivation.
- Institutionalized children exhibit delays in both physical (Johnson, 2001) and behavioral development (Gunnar, 2001; Maclean, 2003; Nelson et al., 2007).
- Cognitive development is known to be affected in children adopted from institutional/orphanage care.
  - Previous studies have reported adverse outcomes in scholastic achievement for children who experienced longer periods of early deprivation (Beckett et al., 2007; van Ijzendoorn & Juffer, 2006).
  - Differences in brain activity that support higher-level cognition (Chugani et al., 2001; Marhsall et al., 2005; Parker et al., 2005) and in white matter integrity (Eluvathingal et al., 2006) were reported in post-institutionalized children.
- Pollak et al. (in press) found that post-institutionalized children showed deficits in spatial working memory, paired associates learning and visual attention skills compared to non-adopted children at age 8 years.
- Relatively few studies have examined specific cognitive domains in post-institutionalized children.
- It is hypothesized that early adversity can lead to hippocampal damage via glucocorticoids, which in turn can impact explicit memory (see McEwen, 2007, for a review).

OBJECTIVES

- To compare the performance of post-institutionalized adopted children and two control groups on two forms of memory:
  - immediate and delayed recognition memory using a computerized continuous recognition memory (CRM) task
  - Paired Associates Learning (PAL)

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PARTICIPANTS

87 children ages 9-11 years in 3 groups:

1. Post-institutionalized group (PI) : adopted internationally at 12 months of age or older; spent 75% of pre-adoption life in institutional care
2. Early-adopted comparison group (EA): adopted internationally before 8 months of age from foster care; spent less than 2 months in institutional care
3. Non-adopted comparison group (NA): born and raised in their birth families

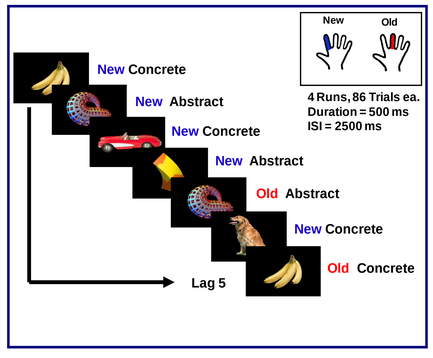
	PI (N = 30)	EA (N = 28)	NA (N = 29)
Sex (% female)	50	46	50
Age *(SD)*	9.96 *(.72)*	10.08 *(.67)*	9.91 *(.67)*
Age at Adoption in Months *(SD)*	25.67 *(14.22)*	4.92 *(2.10)*	N/A
Time in Institution in Months *(SD)*	24.52 (12.74)	1.73 (.47)	N/A
Years of parent education *(SD)*	16.22 *(2.00)*	16.44 *(1.83)*	15.76 *(1.76)*
Median Family Income	75-100K	75-100K	100-125K

Note: 5 children (4 PI, 1 NA) were excluded from the analyses due to low IQ

PROCEDURE

Continuous Recognition Memory (CRM) task:

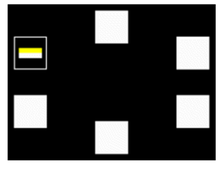
- Previously shown with brain imaging to activate the hippocampus in adults (Brozinsky et al. 2005; Johnson et al. 2008) and in children (Jorgenson et al., 2007).
- Instructed to press with their index finger when they viewed a picture for the first time ("New") and with their middle finger if the same picture appeared for the second time ("Old")
- Stimuli: concrete and abstract images
- Trials consisted of:
  - 30 target stimuli (that repeated after 5, 10 or 15 lags (intervening stimuli)
  - 10 foil stimuli (that repeated after lags other than 5, 10, and 15)
  - 6 distracters (that never repeated)



Delayed memory measure: 30-minutes after the CRM task, children completed a post-test during which they sorted a stack of picture cards into "seen in the game" or "entirely new" categories.

Paired Associates Learning Test (PAL):

- Test of visual episodic memory and associative learning; a subtest of CANTAB
- Participants must learn the location of abstract patterns on the computer screen. The number of stimuli and hence the difficulty level increases as the child correctly identifies the location by touching the screen.



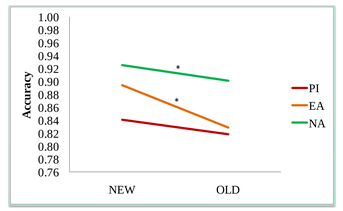
Outcome variables:

1. Response accuracy in the CRM test
2. Reaction time (RT) in the CRM task
3. Response accuracy in the delayed post-test
4. Mean errors and trials to success in the PAL test

RESULTS

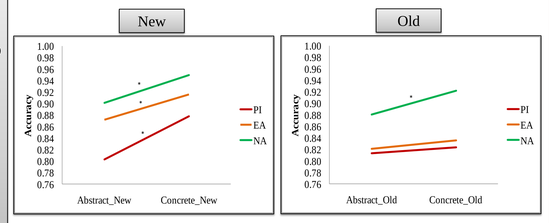
New vs. old

- The EA and NA groups were significantly more accurate when responding to new items than to old items ($p \leq .05$).
- Overall, the PI group was less accurate than the NA group when identifying both new items ($p < .05$) and old items ($p = .08$).



Abstract vs. Concrete

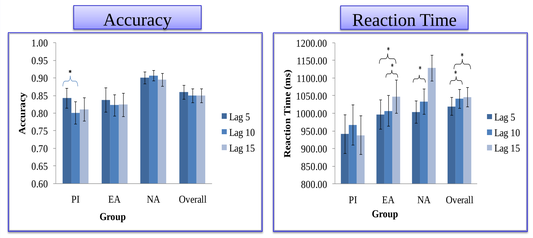
- All groups were significantly better at identifying concrete new items compared to abstract new items ($p < .001$).
- Only the NA group showed an accuracy difference when recalling old concrete and abstract items, with better accuracy for concrete items ($p < .01$).
- The PI group was significantly ($p < .05$) less accurate than the NA group except for the old abstract items.



Lag Effect

Accuracy: The PI group (but not the EA and NA groups) was significantly less accurate when identifying old items after 10 intervening items compared to 5 ($p < .05$).

Reaction Time: Overall, all children were slower when correctly identifying old items after 10 and 15 intervening items compared to 5 ($p < .05$). Lag effects in RT were driven by the EA and NA groups.

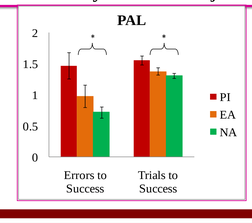


Delayed Sorting Task

- For all groups, accuracy was higher for old items than for new items ($p < .01$) and for concrete items than for abstract items ($p < .001$).
- There were no significant group effects for any of the delayed sorting variables.

Paired Associates Learning

Compared to the NA group, the PI group made significantly more errors and needed significantly more trials to correctly recall the object-location pairs.



DISCUSSION

- The post-institutionalized adopted children showed poorer performance than the non-adopted children on both the continuous recognition memory and the paired associates learning tasks, demonstrating that the negative effects of early institutional deprivation persist into middle childhood.
- Children adopted from foster care sometimes performed comparably to the PI and sometimes to the NA children, suggesting that some of the effects observed for the PI children cannot be attributed to institutional care, but rather to characteristics (poverty, transitions in care) shared by children adopted from either foster or institutional care overseas.
- The findings regarding group differences in the present sample replicate those found by Pollak et al. with an 8-year-old sample on the PAL task, and extend the effects to basic recognition memory.
- The results identify recognition memory as another specific cognitive task that might distinguish children who experienced early deprivation.
- The neural substrates that underlie recognition memory may be affected by early institutional rearing and should be examined more directly in the future.