

**Effects of Early Life Adversity on the Trajectory of Executive Functioning
Development**

by

Elizabeth Thurrell

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ABSTRACT

This study examined the effects of different forms of early adversity, specifically, foster care and international adoption, on the development of children's executive functioning capabilities. Executive functioning was measured using the Dimensional Change Card Sort (Beck, Schaefer, Pang, & Carlson, 2011) administered when the children were 36, 48, and 60 months old. To represent different conditions of early life adversity, foster children, children adopted internationally, and children from a low-risk community group were studied. The foster children and internationally adopted children represent early life adversity in the forms of instability, changing caregivers, and lack of attachment figures. Results showed that at 36 months of age all three groups displayed similar executive functioning capabilities. However, both children adopted internationally and low-risk children demonstrated improvements in executive functioning over time, demonstrating better capabilities at 48 and 60 months of age, compared to 36 months. Foster children also displayed an increase in executive functioning capabilities over time, but their abilities remained significantly lower than both the low-risk biological comparison group and internationally adopted group at both 48 and 60 months. These results suggest that early adversity places children at risk for lower executive functioning capabilities, but that an enhanced environment can remediate these effects.

Chapter 1

INTRODUCTION

Experiencing stress and adversity early in life has the potential of leading to an array of adverse psychological outcomes in the future (Dozier & Peloso, 2006; Raposa, Hammen, Brennan, O'Callaghan, & Najman, 2014). Early life adversity can be experienced in many different ways, including maltreatment, neglect, adoption, and disruptions in caregiving (McDermott, Westerlund, Zeanah, Nelson, & Fox, 2012). These stressors are particularly salient for children in foster care or who are institutionalized. Children in institutions often lack dedicated attachment figures, and cognitive stimulation, but also may not have basic nutritional needs met. They are also at an increased risk for cognitive deficits and behavioral problems (Judge, 2003; Miller, Chan, Tirella, & Perrin, 2009). Children in domestic foster care experience changing caregivers and the being removed from their biological parents. These experiences of early adversity have a negative impact on the development of many important capabilities, including executive functioning (Judge, 2003; Miller, Chan, Tirella, & Perrin, 2009).

Executive functions commonly refer to the cognitive processes involved in monitoring and controlling emotions and behaviors. This includes working memory, inhibitory control, planning, attention, and cognitive flexibility (Bernier, Carlson, & Whipple, 2010; Lewis-Morrarty, Dozier, Bernard, Moore, & Terraciano, 2012). Executive functioning begins to develop early in life, and continues developing through adolescence (Carlson, Mandell, & Williams, 2004; Diamond, Barnett,

Thomas, & Munro, 2007; Hughes, Dunn, & White, 1998; Zelazo, Muller, Frye & Marcovitch, 2003). Some executive functioning can be assessed as early as preschool with some aspects emerging by the first year of life (Carlson, Mandell, & Williams, 2004; Diamond, Barnett, Thomas, & Munro, 2007; Hughes, Dunn, & White, 1998; Zelazo, Muller, Frye & Marcovitch, 2003). By studying executive functioning, variations in self-regulatory capabilities among typically developing children are illustrated (Bernier, Carlson, & Whipple, 2010).

Long-term outcomes associated with poor executive functioning capabilities early in life are seen both behaviorally and in brain development. Difficulties with executive functioning have been associated with various neuropsychological disorders and neuroanatomical abnormalities (Conway & Stifter, 2012). Additionally, children with poor executive functioning are at higher risk for having poorer school performance and school readiness (Hammond, Muller, Carpendale, Bibok, & Liebermann-Finestone, 2011). Impairments are also linked to developmental disorders such as autism, and attention deficit/hyperactivity disorder (Hammond, Muller, Carpendale, Bibok, & Liebermann-Finestone, 2011).

Caregivers play an important role in the self-regulation development of their children, including the ability to regulate attention. When children are young, parents act as external regulators for the infant's affect and attention and facilitate the child's ability to self-regulate through secure attachments (Grossman & Grossman, 1991; Hofer, 1995; Splanger, Schieche, Ilg, Maier, & Ackermann, 1994). Thus, parenting is a crucial factor in the development of a child's executive functioning (Bernier, Carlson, Whipple, 2010). Disruptions in care and neglecting caregiving environments have been shown to negatively influence development of the prefrontal cortex, which

is a brain region involved in executive functioning (McDermott, Westerlund, Zeanah, Nelson, & Fox, 2012). Conversely, favorable environments with nurturing caregivers have a positive effect on brain development and thus executive functioning.

Domestic Foster Care

Children in foster care often face many difficulties, including early experiences of abuse or neglect, followed by transitions in caregivers. These circumstances represent an on-going level of early adversity that often continues throughout children's early development. Removal from the biological parents can have a destabilizing impact on children's development (Sanchirico & Jablonka, 2000). In addition, children are typically removed from their biological parents for reasons of physical abuse, sexual abuse, neglect, parental mental health issues, parental incarceration, and parental substance abuse and then placed with foster parents (Leslie, Gordon, Meneken, Premji, Michelmore, & Ganger, 2005). Once in foster care, children often experience multiple transitions in caregivers, on average being placed with 3 different families (Child Welfare Information Gateway, 2013).

While not as severe as other forms of early adversity, such as continuing maltreatment or institutionalization, foster care represents an environment of continuous instability that can have negative influences on children's development. Placement changes in foster care have been shown to be associated with a wide range of biological and physiological developmental consequences, including abnormal cortisol levels and disorganized attachments (Dozier & Bick, 2007). Early life trauma and instability are also associated with cognitive impairment, poor executive functioning, and lower verbal ability (Bucker et al., 2012). Therefore, due to the instability typically associated with foster care, we predicted that foster children would

display poorer executive functioning capabilities when compared to internationally adopted children and the low-risk comparison group.

International Adoption

Compared with children in foster care, internationally adopted children often experience severe early environmental deprivation, followed by an enriched and positive caregiving environment once adopted. The majority of internationally adopted children experience institutionalization and inconsistent caregiving. While in institutions, children are often cared for by many different caretakers (Chisholm, Carter, Ames, & Morison, 2009). While international institutions vary, the living conditions are typically characterized by lack of stimulation, inadequate nutrition, minimal contact with caregivers, limited resources for the children, exposure to infectious diseases, and physical and emotional neglect (Judge, 2003; Miller, Chan, Tirella, & Perrin, 2009). In short, these environments are highly deleterious to children's development.

In contrast to children in foster care, who frequently experience many placement changes and ongoing uncertainty about their future, internationally adopted children typically have a permanent and stable caregiving environment once adopted. In general, families who adopt internationally are extremely committed to becoming parents, and offer many advantages such as nurturance and a reparative family environment (Hodges & Tizard, 1989; Howe, 1998). Once adopted, internationally adopted children transition from an extremely high-risk environment to a stable environment with consistent caregivers. Therefore, we predicted that children adopted internationally, with more stable environments and attachment figures, are most likely

less susceptible to cognitive impairments than foster children in consistently unstable environments.

Eastern European Institutionalization

Children who are adopted from Eastern Europe constitute a large percentage of the children adopted internationally each year (Miller, Chan, Tirella, & Perrin, 2009). These children from Eastern Europe are among the highest risk for a wide range of cognitive, behavioral, and physical complications due to their pre-adoptive history (Miller, Chan, Tirella, & Perrin, 2009). Such children are reported to have increased rates of developmental delays, medical problems, behavioral difficulties, attachment disturbances, and emotional issues (Albers, Johnson, Hostetter, Iverson, & Miller, 1997; Johnson, 2000, Pomerleau et al., 2005). Additionally, the risk of prenatal exposure to alcohol and drugs is of utmost concern for children adopted from Eastern European countries because of the widespread use and patterns of consumption in this region (Miller, Chan, Tirella, & Perrin, 2009).

As seen in the English and Romanian Adoptee Study (ERA) and the Bucharest Early Intervention Project (BEIP), Eastern European countries such as Romania are frequently used as examples of extreme early life adversity (Nelson, Zeanah, Fox, Marshall, Smyke, & Guthrie, 2007; Rutter et al. 2007). Due to the lasting impacts of the Soviet era, in which institutionalization was promoted widely but the facilities lacked adequate resources, institutions in Eastern Europe contain the most extreme problems inherent to institutions (Nelson, Zeanah, Fox, Marshall, Smyke, & Guthrie, 2007; Rutter et al. 2007). One study describing conditions in Romanian orphanages reported that children received five to six minutes of attention per day from adult caregiver and were confined to their beds without stimulation (Rutter et al. 2007). In

addition, children were lacking access to medical treatments, washing facilities, and adequate nutrition (Rutter et al. 2007).

Because of these adverse early conditions, children adopted from Eastern Europe are at greater risk for cognitive deficits than children adopted from other regions. Therefore, we hypothesized that compared to children adopted from non-Eastern European countries and children who had never been institutionalized, children adopted from Eastern European countries would display the poorest executive functioning capabilities.

Current Study

The current study aimed to track trajectories of executive functioning development in internationally adopted children, foster children, and a low-risk biological comparison group at the ages of 36 months, 48 months, and 60 months. We hypothesized that the environmental differences, such as stability or a lack thereof, between adopted and foster children would lead to group differences in executive functioning task performance when controlling for verbal intelligence and age. Specifically, we hypothesized that children adopted internationally would demonstrate early deficiencies in executive functioning due to their experience of environmental deprivation, but then exhibit increases in functioning once adopted into a stable, remedial environment. In contrast, we hypothesized that children in foster care would exhibit early and continuing deficits in executive functioning, given that they are more likely to continue to experience transitions and uncertainty. As a secondary question, we sought to examine whether the area from which children were adopted internationally would play a role in their executive functioning capabilities. We hypothesized that children adopted from Eastern Europe, who experienced the most

severe forms of institutionalization, would exhibit higher deficits in executive functioning.

Chapter 2

METHODS

Participants

To represent different types of early life adversity, three groups were identified: children in United States foster care, children adopted internationally, and low-risk biological children. Secondary analyses examined differences between children adopted internationally who were institutionalized in an Eastern European country, children who were institutionalized in a non-Eastern European country, and children who were never institutionalized. Specifics regarding each individual group are described below.

Foster Care Group

This sample consisted of 95 children who entered the foster care system as infants or toddlers due to cases of biological parental neglect, abuse, or inability to care for the child. Participants ranged in age from 34.4 months to 76.6 months ($M = 34.6$, $SD = 4.4$). Age at placement into foster care ranged from 0 months to 47.0 months old ($M = 9.9$, $SD = 12.2$). The length of time the foster children had been in their current placements ranged from 2.7 months to 34.3 months ($M = 7.1$, $SD = 5.2$). Please see Tables 1 and 2 for child demographics, and Tables 3 and 4 for caregiver demographics.

Children Adopted Internationally

This sample consisted of 106 children adopted from China, South Korea, Russia, Ethiopia, Kazakhstan, and other countries. Participants ranged in age from 30.0 months to 53.3 months ($M = 41.3$, $SD = 3.0$). Age of adoption ranged from 5.0 months to 35.0 months old ($M = 16.3$, $SD = 6.8$). Please see Tables 1 and 2 for child demographics, and Tables 3 and 4 for caregiver demographics.

Biological Comparison Group

The biological comparison group consisted of 85 children who were recruited from a childcare center and local preschools. The children in the comparison sample did not receive ABC intervention services. Participants ranged in age from 27.1 months to 45.4 months ($M = 48.7$, $SD = 0.9$). Please see Tables 1 and 2 for child demographics, and Tables 3 and 4 for caregiver demographics.

Group comparisons

There were no significant differences in child age between the foster care group, internationally adopted group, and low-risk biological comparison group. Additionally, the three groups did not vary significantly with regard to gender. The children did differ in ethnicity ($p < 0.05$), with more African American foster children and more Asian internationally adopted children than from the comparison sample..

There were no significant differences between the three groups in caregiver gender, as all participating caregivers were predominantly female. There were some significant differences between the three groups in caregiver age ($p < 0.05$), with foster parents being the oldest and low risk biological parents the youngest. Additionally, there were significant differences in caregiver ethnicity among the three groups ($p < 0.05$).

There were some significant differences between the three groups in caregiver marital status ($\chi^2(10, n = 201) = 63.2, p < 0.05$). The low-risk biological comparison group and internationally adopted groups did not vary significantly in terms of marital status. However, the foster care group differed significantly compared to the other two groups with lower rates of intact marriage. The groups also differed in caregiver education. The foster parents had the lowest levels of education and were significantly different from the adoptive parents and low-risk biological parents, ($F(2, 188) = 22.6, p < 0.05$). Additionally, there were significant differences in terms of caregiver income level, ($\chi^2(12, n = 195) = 85.3, p < 0.05$.)

Table 1 Child Demographic Characteristics

	Gender		Ethnicity					
	Male	Female	African American	Asian American	European American	Hispanic	Biracial	Other
Internationally Adopted (<i>n</i> = 106)	51 (48%)	55 (52%)	12 (11%)	68 (64%)	16 (15%)	1 (1%)	2 (2%)	7 (7%)
Foster Care (<i>n</i> = 95)	35 (51%)	34 (49%)	40 (58%)	0 (0%)	19 (28%)	5 (7%)	5 (7%)	0 (0%)
Low-risk Biological (<i>n</i> = 85)	21 (51%)	20 (49%)	3 (7%)	3 (7%)	26 (63%)	5 (12%)	4 (10%)	0 (0%)

Table 2 Child Age

	Testing Age 36MO		Testing Age 48MO		Testing Age 60MO	
	M	SD	M	SD	M	SD
Internationally Adopted (<i>n</i> = 106)	37.0	1.6	49.2	1.8	63.4	5.7
Foster Care (<i>n</i> = 95)	39.5	3.0	47.8	5.0	62.7	5.2
Low-risk Biological (<i>n</i> = 85)	36.3	0.5	49.2	1.2	60.5	0.9

Table 3 Caregiver Demographic Characteristics

	Gender		Ethnicity					
	Male	Female	African American	Asian American	European American	Hispanic	Biracial	Other
Internationally Adopted (<i>n</i> = 106)	5 (5%)	101 (95%)	1 (1%)	3 (3%)	101 (95%)	1 (1%)	0 (0%)	0 (0%)
Foster Care (<i>n</i> = 60)	4 (7%)	56 (93%)	28 (48%)	0 (0%)	22 (38%)	4 (7%)	3 (5%)	1 (2%)
Low-risk Biological (<i>n</i> = 41)	2 (5%)	39 (95%)	4 (10%)	5 (12%)	27 (66%)	5 (12%)	0 (0%)	0 (0%)

Table 4 Caregiver Age and Education in Years

	Age		Education	
	M	SD	M	SD
Internationally Adopted (<i>n</i> = 106)	41.3	5.5	16.8	2.3
Foster Care (<i>n</i> = 60)	49.2	12.5	14.3	2.0
Low-risk Biological (<i>n</i> = 41)	34.6	4.0	16.0	2.3

Table 5 Caregiver Income

	Income						
	Less than \$10,000	\$10,000-\$19,999	\$20,000-\$29,999	\$30,000-\$39,999	\$40,000-\$59,999	\$60,000-\$99,999	More than \$100,000
Internationally Adopted (<i>n</i> = 106)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (7%)	33 (31%)	66 (62%)
Foster Care (<i>n</i> = 60)	3 (6%)	5 (10%)	6 (12%)	9 (18%)	5 (10%)	13 (26%)	9 (18%)
Low-risk Biological (<i>n</i> = 41)	0 (0%)	0 (0%)	0 (0%)	5 (13%)	3 (8%)	22 (56%)	9 (23%)

Table 6 Caregiver Marital Status

	Marital Status					
	Married	Separated	Divorced	Widowed	Living Together	Single
Internationally Adopted (<i>n</i> = 106)	98 (92%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	7 (7%)
Foster Care (<i>n</i> = 60)	23 (42%)	3 (5%)	8 (15%)	3 (5%)	5 (9%)	13 (24%)
Low-risk Biological (<i>n</i> = 41)	34 (85%)	1 (3%)	0 (0%)	0 (0%)	2 (5%)	3 (7%)

Procedure

Data Collection

Visits were conducted either in the families' own home or in a lab setting at the University of Delaware. The participants were involved in a larger, randomized clinical trial of the Attachment Biobehavioral Catch-Up Intervention through the university. The entire visit was videotaped. During these visits, a research assistant administered the Dimensional Change Card Sort, the Peabody Picture Vocabulary Test, and other psychointellectual tests to examine the child's cognitive development.

Measures

Dimensional Change Card Sort

The Dimensional Change Card Sort (DCCS) (Beck, Schaefer, Pang, & Carlson, 2011) is a reliable assessment of executive functioning in which children sort bivalent cards by one dimension, such as shape, and then are instructed to sort by a different dimension, such as color (Doebel & Zelazo, 2013). This measure was adapted for use with young preschoolers (Zelazo, 2006). The children are instructed to sort cards into the appropriate boxes, which are labeled with pictures of a big cat and a small cat, or a red star and a blue truck, depending on level of difficulty. The starting dimension is determined by the child's age. After two practice administrations and a rule check by the examiner, the children complete six sorting trials per dimension. As children pass by correctly sorting at least five out of the six cards, the trials become more difficult. For example, during Separated Card Sorting, children are asked first to sort cards with a black truck or star on red or blue background by shape and then, upon passing, to sort cards by color when the same cards are administered. Before each card is given to the child to sort, examiners repeat the current dimension's rule (e.g. "All of the blue ones go here and all of the red ones go here") (Hostinar et al., 2012). Scores can range from 0 to 72 with higher scores showing greater executive functioning. See Tables 7 and 8 for executive functioning scores.

Peabody Picture Vocabulary Test

The Peabody Picture Vocabulary Test, or PPVT, (Dunn & Dunn, 1981) is a reliable test of receptive verbal intelligence (Freedman, Brown, Shen, & Schaefer, (2015). During this test, the child is shown a page consisting of four pictures. The examiner asks the child to point to one of the four pictures on the page. To

standardize the PPVT, raw scores are converted to standard scores (z scores) by using the mean and standard deviation observed in each tested sample by age group (Freedman, Brown, Shen, & Schaefer, (2015).

Chapter 3

RESULTS

A one-way between groups analysis of variance was conducted to examine the differences in executive functioning between groups of children who experienced different forms of early adversity. Children who were adopted internationally were compared to children in domestic foster care, as well as to a low-risk comparison group. Differences were compared across three time points, when children were approximately 36 months old, 48 months old, and 60 months old. When children were 36 months old, there were no significant differences between executive functioning scores among the three groups ($F(2, 129) = 0.8, p > 0.05$).

However, when children were approximately 48 months old, there was a significant difference between the groups, ($F(2, 143) = 6.2, p < 0.05$), with children in the foster care group scoring significantly lower than children in the low-risk comparison group and in the internationally adopted group. Differences between groups were also found when children were approximately 60 months old, ($F(2, 127) = 5.9, p < 0.05$), with children in the foster care group scoring significantly lower than children in the international adoption group and low-risk biological comparison group. Please see Table 7 and Figure 1.

Possible Covariates

To consider the influence of cognitive abilities on these group differences in executive functioning, a one-way between-groups analysis of covariance was

conducted. After adjusting for cognitive ability at each time point, differences between foster care children in executive functioning and low-risk comparison children and children adopted internationally were still significant when children were both 48 months old and 60 months old.

Role of Institutionalization in Executive Functioning Development

To examine the differences in children exposed to more and less severe forms of institutionalization, a one-way between groups analysis of variance was conducted to explore the differences in executive functioning between groups of children who were institutionalized in different countries. Children who were adopted from Eastern European countries were compared to children who were adopted from non-Eastern European countries, as well as to children who had never been institutionalized. Differences were compared across three times points, when children were approximately 36 months old, 48 months old, and 60 months old. When children were 36 months old, there were significant differences between executive functioning scores among the three groups, ($F(2, 74) = 3.8, p < 0.05$), with children adopted from European Eastern countries scoring significantly lower than children adopted from non-Eastern European countries and children who had never been institutionalized. However, when children were 48 months old, ($F(2, 82) = 1.6, p > 0.05$), and 60 months old, ($F(2, 64) = 0.7, p > 0.05$), there were no significant differences between executive functioning scores among the three groups. Please see Table 8 and Figure 2.

Table 7 Executive Functioning Scores – Group Differences Among Foster, Adopted, and Biological Children

	Testing Age 36MO		Testing Age 48MO		Testing Age 60MO	
	M	SD	M	SD	M	SD
Internationally Adopted (<i>n</i> = 229)	14.7	12.1	29.7	14.7	43.0	14.7
Foster Care (<i>n</i> = 95)	12.2	8.5	22.4	12.8	33.4	18.6
Low-risk Biological (<i>n</i> = 85)	12.4	7.8	35.7	17.7	45.7	15.9

Table 8 Executive Functioning Scores – Differences Among Internationally Adopted Children

	Testing Age 36MO		Testing Age 48MO		Testing Age 60MO	
	M	SD	M	SD	M	SD
Adopted from Eastern European Country (n = 47)	8.6	7.5	25.6	17.5	40.9	16.7
Adopted from Non-Eastern European Country (n = 131)	15.5	12.9	29.2	13.3	42.2	14.2
Never Been Institutionalized (n = 51)	19.8	11.4	34.3	15.3	46.5	14.2

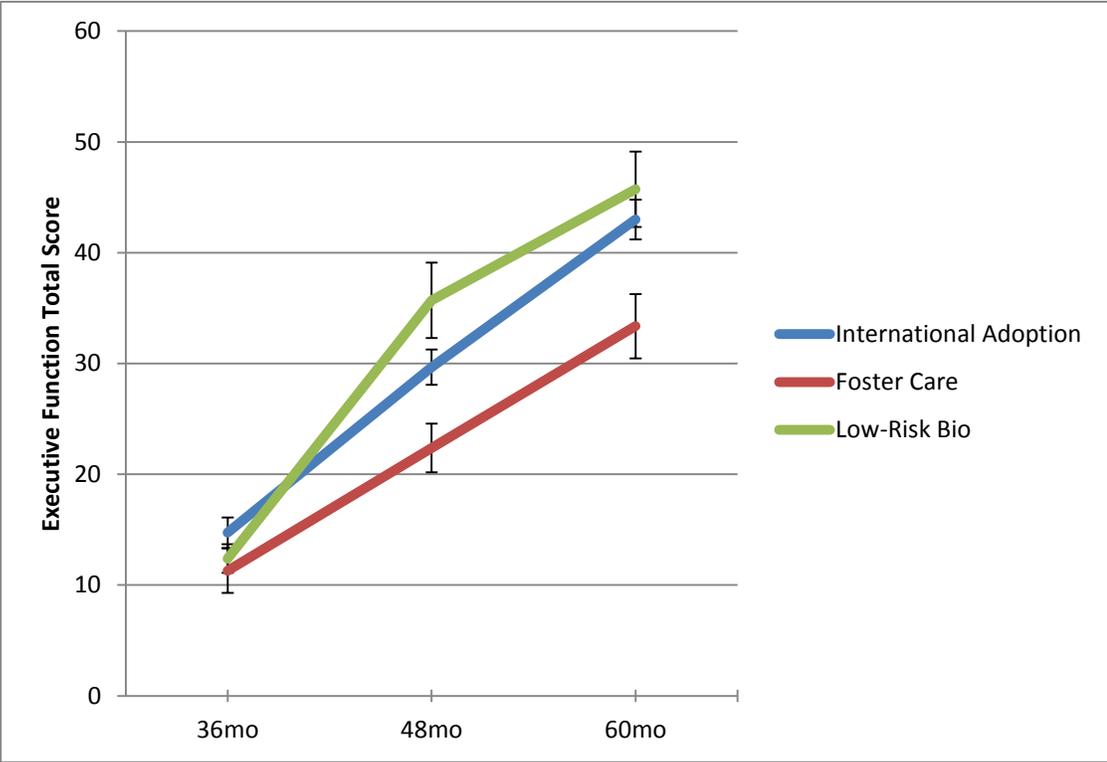


Figure 1 Analysis of variance

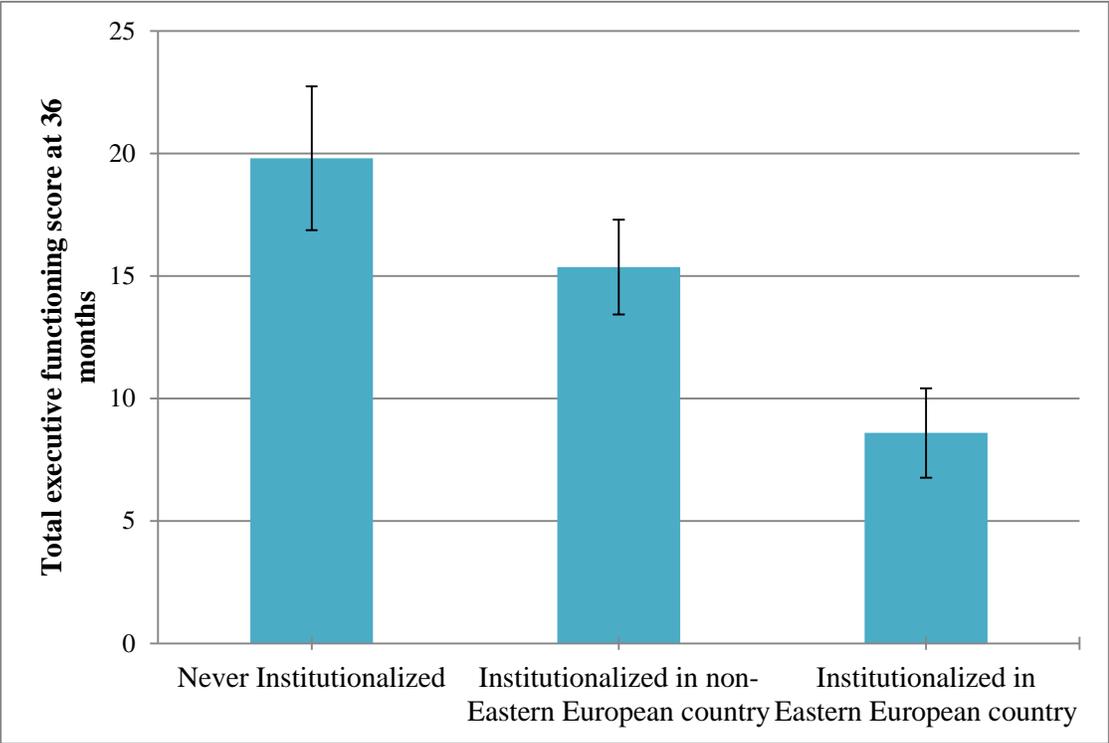


Figure 2 Analysis of co-variance

Chapter 4

DISCUSSION

Executive Functioning

Through this study, we found significant differences in the trajectory of executive functioning development in the three groups when controlling for verbal intelligence. At 36 months of age, foster children, internationally adopted children, and low-risk biological children performed similarly on the Dimensional Change Card Sort. At 48 months of age, all three groups had increased executive functioning scores, with the low-risk biological children and internationally adopted children scoring higher than foster children. These effects were similar at 60 months.

Differences in Executive Functioning Among Children Institutionalized in Eastern European Countries

We found early significant differences in executive functioning capabilities among children institutionalized in Eastern European countries, children institutionalized in non-Eastern European countries, and children who had never been institutionalized at 36 months. At 36 months of age, children who were institutionalized in Eastern European countries displayed the poorest executive functioning capabilities. Comparatively, the children who were institutionalized in countries other than Eastern Europe showed higher executive functioning scores but scored lower than the children who had never been institutionalized. These differences disappeared as the children grew older and were in their adoptive homes for longer periods of time.

Implications

These results highlight the importance of children's environment for the development of executive functioning. The results also suggest the critical component of parenting in executive functioning development. Furthermore, implications for the necessity of interventions such as the Bucharest Intervention and Attachment and Biobehavioral Intervention can be drawn.

Conclusion

These findings supported the initial hypothesis that internationally adopted children develop stronger executive functioning capabilities than foster children. Additionally, the hypothesis that children from Eastern European institutions would have lower executive functioning scores than children from institutions in other countries or children who had never been institutionalized was supported by the data at 36 months of age.

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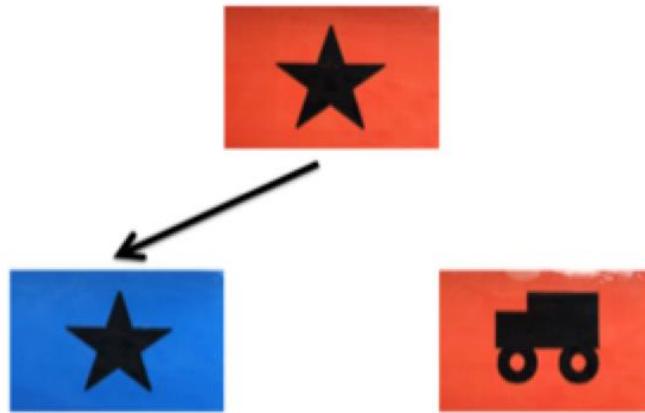
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Appendix

Dimensional Change Card Sort

Pre-Switch: Sort by Shape



Post-Switch: Sort by Color

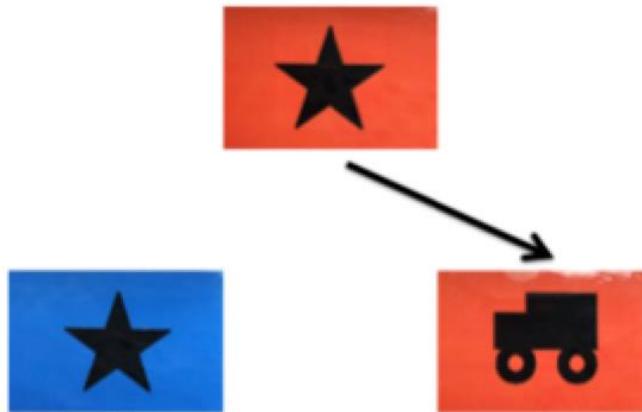


Figure 3 Separated Trials of DCCS

Peabody Picture Vocabulary Test



Figure 4 Peabody Picture Vocabulary Test Example Page