HHS Public Access

Author manuscript

Dev Sci. Author manuscript; available in PMC 2016 September 01.

Published in final edited form as:

Dev Sci. 2015 September ; 18(5): 713–722. doi:10.1111/desc.12261.

The Effects of Early Foster Care Intervention on Attention Biases in Previously Institutionalized Children in Romania

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Abstract

Children raised in institutions experience psychosocial deprivation that can negatively impact attention skills and emotion regulation, which subsequently may influence behavioral regulation and social relationships. The current study examined visual attention biases in eight-year-old children who were part of the Bucharest Early Intervention Project (BEIP). Relations among attention biases and concurrent social outcomes were also investigated.

In early childhood, 136 children abandoned at birth or shortly thereafter into institutional care were randomized to receive a high-quality foster care intervention or care-as-usual within the context of the Bucharest Early Intervention Project (BEIP). At 8 years of age, 50 care-as-usual, 55 foster care, and 52 community controls performed a behavioral dot-probe task and indices of attention biases to threat and positive stimuli were calculated. Concurrent data on social behavior were collected.

Children placed into the foster care intervention had a significant attention bias toward positive stimuli, while children who received care-as-usual had a significant bias toward threat. Children in the foster care intervention had a significantly larger positive bias when compared to the care-as-usual group. A positive bias was related to more social engagement, more prosocial behavior, less externalizing disorders, and less emotionally withdrawn behavior. The magnitude of positive bias was predicted by age of placement into foster care among children with a history of institutionalization. An attention bias towards positive stimuli was associated with reduced risk for behavioral problems amongst children who experienced early psychosocial deprivation. Research assessing attention biases in children experiencing early environmental stress may refine our

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Financial disclosures: The authors report no biomedical financial interests or potential conflicts of interest.

understanding of the mechanisms underlying risk for later psychiatric and social disorders and inform prevention efforts.

Keywords

Attention Bias; Institutionalization; Psychiatric Risk; Social Behavior; Attachment

Introduction

Children raised in institutional settings experience severe psychosocial deprivation and display a myriad of negative developmental outcomes in cognitive, behavioral, and social domains (Nelson, Fox, & Zeanah, 2014; Reeb-Sutherland, Fox, Nelson, & Zeanah, 2009). These adverse outcomes are thought to be related to a lack of sensitive, contingent caregiving and absence of an "expectable" environment (Nelson et al., 2007) . Non-human primate studies have provided further evidence of the deleterious effects of early psychosocial deprivation on cognitive and social behaviors, suggesting underlying mechanisms for the effect of stress on the developing brain (Harlow, Dodsworth, & Harlow, 1965). Across numerous studies, both longer periods of adversity and later age of removal from adverse environments have been associated with greater impairment in attention skills and social competence (Colvert et al., 2008; Pollak et al., 2010).

While it is clear that both cognition and social functioning are influenced by institutional care (Colvert et al., 2008; Pollak et al., 2010; Reeb-Sutherland et al., 2009), few studies have identified the mechanisms underlying these outcomes. One possible mechanism linking these areas involves biases in visual attention. Attention biases act as "gate keepers," influencing which aspects of the environment are selected and processed (Crick, 1994; Pérez-Edgar et al., 2011). Attention biases are thought to shape how a child experiences and interacts with their social world and are commonly measured by assessing where a child instantaneously and preferentially allocates their attention via eye-tracking and processing times. Studies have shown attention biases are useful cognitive endophenotypes that are linked to personality traits, resilience, and vulnerability (E. Fox, Ridgewell, & Ashwin, 2009).

Two patterns have been studied in the visual attention bias literature: threat biases and positive biases. Each has been linked to a distinct socioemotional profile. Children who display an attention bias to threat (commonly measured by faster reaction times to an angry facial expression) tend to have more anxiety symptoms (Vasey, el-Hag, & Daleiden, 1996), social avoidance (Mogg, Philippot, & Bradley, 2004), and poorer emotion regulation (Cisler & Koster, 2010) compared to children without threat biases. Additionally, a bias towards threat has been shown to amplify the effects of stress (Derryberry & Reed, 2002; Ellenbogen, Schwartzman, Stewart, & Walker, 2002; Paunovic, Lundh, & Öst, 2002). Children displaying a bias toward positive stimuli (commonly measured by faster reaction times to a happy facial expression) show increased reward sensitivity (Grafton, Ang, & MacLeod, 2012), positive affect (Grafton et al., 2012), prosocial behavior (Derryberry & Reed, 1994), approach behavior (Frewen, Dozois, Joanisse, & Neufeld, 2008), adaptive

emotion regulation (Joormann & Gotlib, 2007), and lower rates of anxiety (Frewen et al., 2008).

While no published studies have addressed the influence of institutional care on attentional biases, a number of studies have documented the influence of early maltreatment on attention biases. This work has demonstrated that children who experienced early adversity showed a bias towards negatively-valenced faces (Dalgleish, Moradi, Taghavi, Neshat-Doost, & Yule, 2001; Romens & Pollak, 2012). However, studies showing contradictory findings call into question the directional specificity of threat biases. For example, Pine and colleagues (2005) found attention bias away from threat was associated with severity of physical abuse and diagnosis of psychiatric disorders. These results suggest that although early maltreatment may bias threat-based attentional systems, the direction of these effects may be due to the type, timing, and severity of exposure.

There is also evidence suggesting that psychosocial deprivation may disrupt certain aspects of emotion processing. Wismer Fries and Pollak (2004) reported that internationally adopted children who had spent some portion of their early years in an institution had deficits in identifying facial expressions as well as matching happy, sad, and fearful faces when compared to non-adopted controls. International adoptees, however, performed as well as non-adopted controls when asked to match angry faces, perhaps suggesting both deficits in processing positive faces and more efficient processing of threatening faces. Parker and Nelson (2005) demonstrated that children who experienced early psychosocial deprivation had enhanced neural processing when viewing fearful faces, but reduced neural amplitudes when processing happy faces when compared to non-institutionalized peers, suggesting again that negatively valenced faces may receive more attentional resources. And, Tottenham and colleagues (2010) found that, when compared to never-institutionalized children, post-institutionalized children performed slower and less accurately on negatively valenced trials of an emotional Go/Nogo paradigm. This behavioral deficit points toward a differential processing of negatively valenced faces and suggests that threatening stimuli may require more resources for processing, thus interrupting other cognitive processes among children who experienced early psychosocial deprivation.

While there is evidence that both positive and negative valence processing systems may be impacted by early adversity, a number important questions remain unanswered. First, do children who are removed from institutional care in early childhood and placed into a foster care intervention have different attention biases than those who remained in institutional care? Second, are attention biases amongst children with a history of early institutionalization associated with social outcomes? Third, can attention biases amongst children with a history of institutionalization be predicted by age of placement into foster care? Finally, do children with a history of institutional care show different attention biases than never institutionalized children?

The current study attempted to answer the above questions by examining the associations between visual attention biases and social developmental outcomes in a sample of children who experienced early institutionalization and were enrolled in the Bucharest Early Intervention Project (BEIP; Nelson et al., 2014; Zeanah et al., 2003). Children in the study

were randomized to one of two conditions: (1) to be taken out of an institution and placed into foster care (Foster Care Group; FCG) or (2) to remain in institutional care (Care as Usual Group; CAUG). Following randomization, children placed into the Foster Care Group received high quality care that was supported by project staff through age 54 months. Most of these children remained subsequently in these foster care placements, though some were reunited with their biological families and others left for a variety of reasons (see Figure 1). Children randomized to the CAUG received care as designated by the Romanian government, including continued institutional care, reunion with the biological family, placement into a government-run foster care program (not associated with the BEIP foster care), and national or international adoption (see Figure 1 for consort diagram). In addition, a typically developing sample of children (Never Institutionalized Group; NIG) was recruited from the community. The primary reason for recruiting these typically developing children from the Bucharest community was to insure that measures collected at each age point provided normative data. Behavioral responses and reaction times were collected during a dot-probe task when children were 8 years of age.

Methods

Participants

The sample comprised 136 children, abandoned in infancy and placed into institutions in Bucharest, Romania, and who were part of the BEIP. At 8 years, 50 CAUG (26 female), 55 FCG (29 female), and 52 NIG (28 female) completed the dot-probe task. The mean age of test was 8.68 years (SD=.35) for the CAUG, 8.50 years (SD=.41) for the FCG, and 8.44 (SD=.38) years for the NIG. By age 8, less than a third of the CAUG remained in institutional care, with the other two thirds placed into government foster care, reunited with their biological family, or adopted. Although many of the institutionalized children at age 8 were no longer in their original randomized placement, the data presented in this paper use an intent-to-treat approach such that data are analyzed using a child's initial placement. The intent-to-treat approach allows direct assessment of the BEIP randomized clinical trial by comparing the intervention group (FCG) and the control group (CAUG). Age of placement into any foster care home (BEIP or Government) was recorded for children in the CAUG and FCG and ranged from 207 days to 2915 days.

The University Institutional Review Boards of the principal investigators (Fox, Nelson & Zeanah) and of the University of Bucharest, Romania approved the study protocol. Consent for participation of institutionalized children was provided by the local Commission on Child Protection for each child participant who lived in their sector of Bucharest.

Measures and Procedures

Dot-Probe Task—The dot-probe task (Bradley, Mogg, White, Groom, & Bono, 1999; Mogg, Bradley, De Bono, & Painter, 1997) assesses children’s ability to respond to the location of a stimulus when preceded by a pair of emotional faces (see Figure 2). Trials began with the presentation of a central fixation cross (+) for 500 ms, followed by the presentation of an emotional face pair for 500 ms. Immediately after the presentation of the face pair, the probe was presented behind one of the images on either the left or right side of

the screen (50 percent probability) directly behind the face for 200 ms. The inter-trial interval was 1000 ms. Children were required to respond within 1600 ms of the presentation of the probe. Participants were instructed to respond as quickly and correctly as possible to indicate which side of the monitor (left or right) an asterisk probe appeared.

Emotional face pairs presented were neutral-neutral, happy-neutral, or angry-neutral. Expressions were portrayed by 32 different actors (50% male) taken from the NimStim stimulus set (Tottenham et al., 2009). Prior to the task, a practice block of 16 trials (6 happy-neutral, 6 angry-neutral, 4 neutral-neutral) was presented to familiarize children with the stimuli and button box. The test trials consisted of 60 happy-neutral and 60 angry-neutral and 40 neutral-neutral trials for a total of 160 test trials presented in a pseudo random order across two test blocks of 80 trials. Trials were congruent if the probe appeared in the same location as the emotion face (angry or happy) and incongruent if it appeared behind the neutral face.

Stimulus presentation was controlled by computer software (STIM stimulus presentation system from James Long Company, Caroga Lake, NY) run on an IBM PC on which the dot-probe task was programmed. Measures of response time and response accuracy per trial were directly recorded by CAS program software. Data were subsequently cleaned and both threat and positive biases were calculated using the TAU/NIMH Toolbox (toolbox available at http://tau.ac.il/~yair1/ABMT.html). The TAU/NIMH toolbox removes trials with reaction times shorter than 150 ms or in which an incorrect response was made. Additionally, z-scores were calculated by trial type and responses with z-scores greater than |2.5| were removed. After cleaning, reaction times from the happy-neutral and angry-neutral trials were used to create threat and positive attention bias scores.

Consistent with past research (Bar-Haim et al., 2010; Pérez-Edgar et al., 2010; White, Suway, Pine, Bar-Haim, & Fox, 2011), bias scores were calculated by subtracting reaction times for trials in which the probe appeared in the location of the emotion face (i.e., congruent trials) from reaction times on trials in which the probe appeared behind the neutral face (incongruent trials). Positive scores indicate a bias towards threat or positive stimuli, while negative scores indicate a bias away from threat or positive stimuli. A score of 0 indicates no bias was exhibited.

Health and Behavior Questionnaire (HBQ, MacArthur)—For the present paper, four behavioral subscales of the HBQ were examined: internalizing behaviors, externalizing behaviors, prosocial behavior, and social withdrawal. The internalizing scale comprises items related to depression and overanxious behaviors. The externalizing scale comprises measures of oppositional defiance, conduct problems, overt hostility, and relational aggression. The prosocial scale measures helping behavior and peer inclusion. Finally, the social withdrawal scale comprises asocial behavior with peers and social inhibition. The HBQ was completed by each participant's primary teacher.

Peer Interaction Composites—To better understand the social behaviors of the previously institutionalized participants (CAUG, FCG), children were observed interacting with an age and gender-matched, unfamiliar, non-institutionalized peer during two

cooperative tasks where children were asked to work together to first build a Lego structure and then put together a set of puzzles (Legos and Puzzles; Almas et al., 2014). Videotapes were event-coded in 30-second epochs by teams of Romanian research assistants who were blind to group assignment. After establishing reliability on 5 practice videos, the coding team independently coded twenty percent of all videos to achieve reliability (intra-class correlations, or ICCs). Behaviors coded included cooperation, independent work, off-task, on-looking, conversation, fidgeting, social referencing, positive affect, and negative affect. Task-oriented behavior (cooperation, independent work, off-task, on-looking) displayed by each child was coded following each 30-second epoch. The presence or absence of conversation, fidgeting, or social referencing was coded for each 30-second epoch. Finally, each child's primary affect (positive, negative, and neutral) was coded for each 30-second epoch. Behaviors were subsequently averaged and analyzed using a Principal Components Analysis, which found two factors: Social Engagement (α = .51; *M* = .01, *SD* = .71) and Task Orientation (α = .61; *M* = .00, *SD* = .59) (for more information on methods, consult Almas et. al, 2014). The Social Engagement score consisted of Cooperation, Independent Work (reverse-scored), Conversation, and Positive Affect. The Task Orientation score consisted of Off-task Behavior, On-looking, Fidgeting, Social Referencing, and Negative Affect. All codes in the Task Orientation composite were reverse-scored. Average reliability (ICCs) across the two tasks and all codes was .93 for Social Engagement and .91 for Task Orientation.

Disturbances of Attachment Interview (DAI)—The DAI is a semi-structured interview that was administered to caregivers who knew the child well in order to characterize disordered attachment behaviors (Anna T Smyke, Dumitrescu, & Zeanah, 2002). One score from the DAI (A. T. Smyke & Zeanah, 1999) was included in the present paper: signs of reactive attachment disorder RAD-emotionally withdrawn/inhibited type. The signs of RAD-emotionally withdrawn/inhibited score indicates absence of age-appropriate preference for any caregivers (scores range from 0-10).

Participant Inclusion—To verify capacity to complete the dot-probe task, children who had less than 60% accuracy (Pérez-Edgar et al., 2011) were excluded from analysis (7 CAUG, 3 FCG, 2 NIG) ($\chi^2(2, N = 157) = 4.297$, p = .117). The final sample for behavioral analysis included 43 (20 female) CAUG children, 52 (27 female) FCG children and 50 (26 female) NIG children. An additional nine participants (5 CAUG, 3 FCG, 1 NIG) were excluded from all analyses using the HBQ due to teacher non-response. Three participants (all FCG) did not complete the peer interaction tasks and were excluded from all analyses using the Social Engagement and Task Orientation composites. All participants who completed the dot-probe with at least 60% accuracy had valid scores on the DAI.

Data Analytic Plan—Data were analyzed in two ways for the present study: first, analyses were conducted on all three groups. Second, analyses compared just the two focal groups, the foster care and the care as usual groups, in an effort to examine the effects of the intervention.

For the comparison of the treatment groups to the NIG community sample analyses, a 3 Group (CAUG, FCG, NIG) by 2 Valence (Threat, Positive) RM ANOVA was conducted.

Next, one-sample t-tests were conducted against a reference value of zero (no bias) for all groups to assess within group attention biases.

Next, to examine the efficacy of the randomized intervention, we focused on the two treatment groups (CAUG, FCG). First, a 2 Group (CAUG, FCG) by 2 Valence (Threat, Positive) RM ANOVA was conducted, followed up by two one-way ANOVAs with Group (CAUG, FCG) as a between-subject variable to assess threat and positive biases separately. Additionally, to investigate the relations between bias and concurrent socio-emotional outcomes (HBQ, Peer Interaction, DAI), bivariate correlations were conducted. All of these analyses utilized an intent-to-treat approach, meaning that children's data were analyzed as if they remained in the groups to which they were initially assigned.

Finally, to examine whether early intervention (age of placement into foster care) predicted the size of positive biases at age 8, a linear regression was conducted. Due to the high number of CAUG placed into foster care by age 8 and in order to increase statistical power, children who were placed in either BEIP or government foster care were included in this analysis.

Results

Table 1 presents the means and standard deviations for the measures of interest for all groups. In order to examine whether the NIG children significantly differed from the CAUG and FCG in their biases toward threatening and positive stimuli, a 3 Group (CAUG, FCG, NIG) by 2 Bias (Threat, Positive) was conducted. There was not a significant main effect of group (F (1,142) = 2.341, p = .100), main effect of bias (F (1,142) = .083, p = .774), or group by bias interaction (F (2,142) = 2.268, p = .107).

To examine whether individual groups displayed differential attention bias patterns worthy of further investigation, separate one-sample t-tests were conducted for each group to determine if attention biases to both positive and negative faces were significantly different than zero. For the CAUG, analyses revealed a significant bias towards threatening faces (t (42) = 2.204, p =.033), and no significant bias for positive faces (t (42) = −.485, p=.630). Within the FCG, analyses revealed a significant bias towards positive (t (49) = 3.560, p =.001) and no significant threat bias (t (49) = 1.385, p =.172). The NIG did not have a significant positive (t (49) = .655, p =.515) or threat bias (t (49) = −.481, p =.632). These results suggest that exposure to institutional care may produce differential attention patterns not present in children who do not experience early adversity. The lack of bias in the NIG is typical for non-anxious and non-selected populations (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007).

Comparing randomized groups

In order to examine whether children who experience early institutionalization and intervention differed in their biases toward threatening and positive stimuli, a 2 Group (CAUG, FCG) by 2 Bias (Threat, Positive) was conducted. There was not a significant main effect of group (F (1, 93) = .640, p = .462) or bias (F (1, 93) = 1.665, p = .200). A marginally significant group by bias interaction emerged (F (1, 93) = 3.158. p = .079).

Given our a priori hypotheses that there would be between group differences in magnitude of threat and positive biases, follow-up analyses were conducted for each bias individually in order to probe the marginal group by bias interaction.

To illuminate the relations between group assignment and both positive and threat biases, FCG children were compared to the CAUG children using a one-way ANOVA with Group (CAUG, FCG) as a between-subject variable. Separate analyses were conducted for threat and positive biases. Results indicated that the FCG (M = 19.91, SD = 40.32) had a significantly larger bias towards positive faces (F (1, 93) = 5.122, p = .026) when compared to the CAUG (M = −4.82, SD = 65.17). There was no significant difference between the CAUG and FCG for the threat bias (F (1, 93) = .310, p = .579). Additionally, to ensure results were not due to differences in response speed, reaction times on neutral-neutral trials were compared and no differences were found (F (1, 93) = .394, p = .532).

To examine whether the size of positive bias was associated with adaptive social outcomes in the ever institutionalized group, bias scores were correlated with measures from the HBQ, DAI, and coded peer interactions (See Table 2). Results indicate that a positive bias was correlated with fewer externalizing problems (r (85) = −.226, p = .035), more prosocial behaviors (r (89) = .244, p = .023), better social engagement (r (90) = .209, p = .045), and fewer signs of emotionally withdrawn/inhibited RAD (r (93) = −.303, p = .003). The magnitude of threat bias was unrelated to all social outcomes.

In order to examine whether age of placement into any type of foster care (government foster care or BEIP intervention) predicted the size of positive biases at age 8, a linear regression was conducted. Results indicated that age of placement significantly predicted positive bias at age 8 (β = −0.238, t (68) = −2.005, p = 0.049). The negative relation between age of placement and size of positive bias suggests that a younger age of placement predicted a larger positive attention bias. Age of placement into foster care did not predict the size of threat biases at age 8 years.

Discussion

Children abandoned early in infancy to institutional care but then placed into high quality foster care displayed a significant positive bias to happy facial expressions at 8 years of age, whereas children who were randomly assigned to care as usual (generally institutional care) displayed a significant attention bias to threat. Additionally, as expected, the typically developing community sample showed no positive or threat biases. Multiple studies from a variety of groups describe the negative effects of institutionalization on cognitive, social, and adaptive behavioral outcomes. The current data provide a possible mechanism for understanding both these negative effects and the positive effects of early intervention. Children in the CAUG had a significant within-group bias towards threatening faces. Biases toward threatening information have been linked to a number of maladaptive behaviors including higher risk for anxiety disorders (Mathews & MacLeod, 2002), social avoidance (Mogg et al., 2004), and poor emotion regulation (Cisler & Koster, 2010). This constellation of behaviors has been previously identified in institutionalized children (Tottenham et al., 2010; Wismer Fries & Pollak, 2004; Zeanah et al., 2009).

Few studies have investigated the relations among positive attention biases to social outcomes and psychopathology. Some studies argue that selective processing for positive material may play an integral role in mental health and well-being (E. Fox et al., 2009). For instance, in a study by Taylor and colleagues (2011), participants who developed a positive bias showed less anxiety and more positive emotionality when confronted with a stressful situation than participants who did not develop a positive bias. Additionally, a meta-analysis by Frewen and colleagues (2008) showed that participants with a bias towards positive/rewarding stimuli were less likely to have psychiatric disorders than those with biases towards threatening stimuli. In the current study, children in the BEIP foster intervention had a larger positive bias than their CAUG peers. And the magnitude of the happy bias among the CAUG and FCG children was significantly correlated with both better social skills and less internalizing and withdrawn behavior. We were unable to identify precursors of positive biases in the sample. Perhaps parent-to-child attachment, environmental expectancy and stability, parental support, and/or parental emotion regulation may produce these bias patterns since these components of caregiving were emphasized in the BEIP foster care program (Tibu, Humphreys, Fox, Nelson, & Zeanah, 2014).

The results of the current study further suggest that earlier foster care placement (BEIP or government) is related to a larger positivity bias among the CAUG and FCG, with younger ages of placement related to larger positive bias. This finding, in conjunction with the positive correlation between the magnitude of positive attention bias and better behavioral and social outcomes, suggests that positive attention bias may be one cognitive mechanism underlying the relations between early psychosocial deprivation and social development. While the present study does not identify the precise mechanism linking positive biases to adaptive outcomes, there is converging evidence that positive biases may be one cognitive mechanism that causally impacts positive affect (Grafton et al., 2012). In turn, positive affect has been associated with all of the positive outcomes found in the present study.

Finally, the current study replicates a number of findings previously reported in maltreatment literature. For instance, the finding that the CAUG has an attention bias towards threatening stimuli parallels two studies that show the same effect in maltreated children (Dalgleish et al., 2001; Romens & Pollak, 2012). However it is important to note that biases away from threatening stimuli also have been reported in maltreated children (e.g., Pine et al., 2005) suggesting that timing and type of maltreatment may produce different attention bias profiles. Threat biases may be particularly maladaptive for institutionalized and maltreated children not only because of their association with psychiatric and social outcomes, but also because threat biases have been shown to exacerbate the effects of stress (Derryberry & Reed, 2002; Ellenbogen et al., 2002; Paunovic et al., 2002). Although positive biases have not been previously reported in maltreated children, positive biases have been reported in typically-developing children. Data from the current study suggest that the BEIP foster care intervention may reduce attention bias to threat and increase a positive bias.

It is worth providing some cautionary notes to these results. First, positive attention biases have received little research focus up to this point. Therefore, the adaptive nature and functional significance of such attention biases should be interpreted cautiously.

Additionally, all social data reported in the current study were measured at the same time point as the attention biases and thus it is not possible to determine whether positive attention biases precede, follow, or develop concurrently with adaptive social profiles. Furthermore, the social engagement composite used in the current study had a low internal consistency, so results using this measure should be interpreted with caution. Future research should examine the causality of positive biases and the relation to both adaptive and maladaptive outcomes later in life. Furthermore, our regression model looks at early foster care intervention regardless of type of foster care intervention (BEIP or government). It is important to note that children placed into government foster care were placed into foster care over a wide range of ages and were not randomly assigned. Finally, the results from this analysis may be a conservative estimate of contribution of high-quality foster care interventions, since past research has shown BEIP foster care produces significantly better outcomes than the Romanian government foster care (N. A. Fox, Almas, Degnan, Nelson, & Zeanah, 2011; Tibu et al., 2014).

In sum, the assessment of attention biases in the BEIP sample provides important information regarding the effects of early psychosocial deprivation and intervention in both cognitive and social domains. The data suggest that children placed into foster care have significant positive attention biases related to better social outcomes, while their CAUG peers have significant biases towards threat, which is related to increased anxiety disorders and poor emotion regulation in the broader literature. Additionally, children with large positive biases, mostly children who received the foster care intervention, tended to have better social outcomes. Finally, younger ages of placement into foster care – either BEIP or government foster care – were associated with larger positive attention biases, which indicates that earlier interventions may prove more effective in producing more adaptive attention biases towards positive stimuli. In conclusion, for children raised in extremely adverse environments, these results emphasize the importance of both early experiences and the need for early intervention for promoting adaptive attention biases associated with positive psychiatric and social outcomes.

Acknowledgements

This project was supported by the John D. and Catherine T. MacArthur Foundation, the Binder Family Foundation, NIMH (1RO1MH091363 to Charles A. Nelson), and by a National Science Foundation Graduate Research Fellowship to STR.

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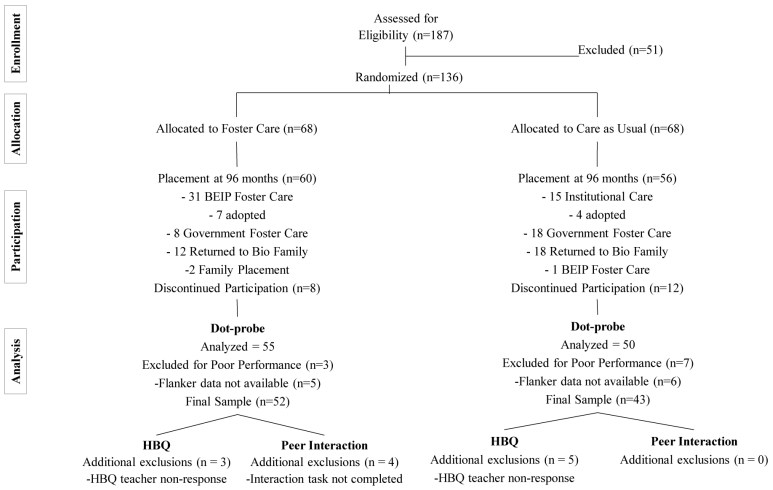

Figure 1.
Group assignment over time: current status at 8 years of age.

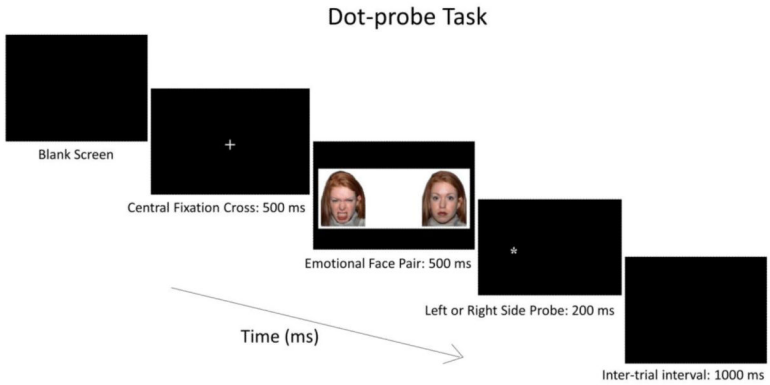

Figure 2.

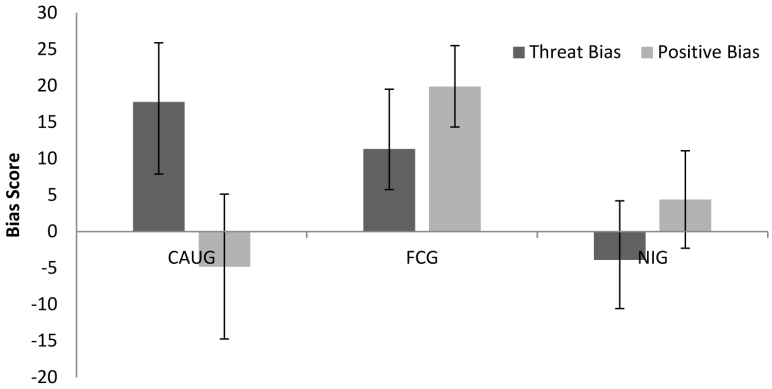

Figure 3.
Threat and positive biases by placement group. Means and standard error bars.

Table 1

Demographics, descriptive statistics, and accuracy by placement group. Means and standard deviations in parentheses.

	CAUG	FCG	NIG
Age	8.71 (.33)	8.51 (.41)	8.47 (.39)
Gender % Female	46.5	51.9	52.0
% Life in Institution	55.19 (27.69)	21.10 (7.81)	-
Age of placement into Inst. (days)	83.37 (121.55)	93.46 (131.33)	-
Age of placement into FC (days)	1503.56 (746.38)	704.90 (206.23)	-
Overall Accuracy	87.38 (11.53)	87.81 (10.08)	92.55 (8.32)
Threat-Neutral Accuracy	86.95 (11.82)	86.52 (10.69)	92.52 (8.35)
Happy-Neutral Accuracy	88.08 (11.80)	89.01 (9.73)	92.56 (9.18)
Neutral-Neutral Accuracy	86.80 (14.06)	88.07 (12.62)	92.65 (9.44)

Table 2

Correlations between positive bias and concurrent social outcomes among the CAUG and FCG.

Measure		1.	2.	3.	4.	5.	6.	7.	8.
1.	Positive Bias	-							
2.	Internalizing Behaviors	.140	-						
3.	Externalizing Behaviors	−.226*	.337*	-					
4.	Social Withdrawal	.168	.632*	−.018	-				
5.	Prosocial Behavior	.244*	−.164	−.542*	−.174	-			
6.	Task Orientation	.017	.256*	.112	.157	−.083	-		
7.	Social Engagement	.209*	.215*	−.020	.043	.066	.070	-	
8.	RAD-inhibited	−.303*	−.075	.229*	−.110	−.232*	−.005	−.222*	-

* signifies correlation is significant at $p = .05$ or less