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The Effects of Early Institutionalization on the Discrimination of Facial Expressions of Emotion in Young Children

Hana Jeon,
David Geffen School of Medicine, University of California – Los Angeles

Margaret C. Moulson,
Department of Brain and Cognitive Sciences, Massachusetts Institute of Technology

Nathan Fox,
Department of Human Development, University of Maryland

Charles Zeanah, and
Department of Psychiatry and Neurology, Tulane University School of Medicine

Charles A. Nelson III
Division of Developmental Medicine, Children's Hospital Boston/Harvard Medical School

Abstract

The current study examined the effects of institutionalization on the discrimination of facial expressions of emotion in 3 groups of 42-month-old children. One group consisted of children abandoned at birth who were randomly assigned to Care as Usual (institutional care) following a baseline assessment. Another group consisted of children abandoned at birth who were randomly assigned to high-quality foster care following a baseline assessment. A third group consisted of never-institutionalized children who were reared by their biological parents. All children were familiarized to happy, sad, fearful, and neutral facial expressions and tested on their ability to discriminate familiar versus novel facial expressions. Contrary to our prediction, all three groups of children were equally able to discriminate among the different expressions. Furthermore, in contrast to findings at 13–30 months of age, these same children showed familiarity rather than novelty preferences toward different expressions. There were also asymmetries in children's discrimination of facial expressions depending on which facial expression served as the familiar versus the novel stimulus. Collectively, early institutionalization appears not to impact the development of the ability to discriminate facial expressions of emotion, at least when preferential looking serves as the dependent measure. These findings are discussed in the context of the myriad domains that *are* affected by early institutionalization.

Keywords

Institutionalization; Emotion Recognition; Visual Paired Comparison

Direct correspondence about this paper to Charles A. Nelson, at the Developmental Medicine Center Laboratory of Cognitive Neuroscience, Children's Hospital Boston, Harvard Medical School, 1 Autumn Street, Mailbox #713, Office AU 621, Boston, MA 02215-5365; charles.nelson@childrens.harvard.edu.

The ability to recognize different emotions plays a central role in typical human social interactions. Although the ability to discriminate and recognize facial expressions of emotion is apparent in the first months of life (for a review, see Leppänen & Nelson, 2006; 2009), these abilities are not adult-like until late childhood or adolescence. Indeed, a number of important asymmetries in tests of emotion discrimination suggest that infants' emotion discrimination abilities are not robust. For example, 7-month-old infants can discriminate between facial expressions of happy and fear when familiarized to happy first, then tested on fear, but not when familiarized to fear first, then tested on happy (Nelson & Dolgin, 1985; Nelson, Morse, & Leavitt, 1979). These findings are likely explained by young infants' preferential looking bias towards fearful faces (Kotsoni, de Haan, & Johnson, 2001; Nelson & Dolgin, 1985; Nelson et al., 1979).

Research suggests that early experience is crucial in shaping an infant's face perception skills (for a review, see Nelson, 2001). As infants tend to have limited interactions with other people, the quality of interactions with their caregivers likely plays a particularly important role in their social experiences in the early years of life. In a study examining typically developing infants' ability to recognize facial expressions, researchers found that infants whose mothers had highly positive facial expressions were better capable of discriminating between happy and fearful expressions and also looked longer at fearful expressions (de Haan, Belsky, Reid, Volein, & Johnson, 2004).

Given that early experiences likely play an important role in shaping an infant's ability to recognize different emotions, one might expect that children growing up in environments characterized by psychosocial deprivation would be at risk for impairments in emotion recognition. Indeed, recent studies have demonstrated that parental neglect is associated with children's impaired ability to discriminate and recognize different facial expressions of emotion (Pollak, Cicchetti, Hornung, & Reed, 2000), and parental abuse is associated with altered perception of facial expressions of anger (Pollak & Sinha, 2002). Another group of children at risk are those abandoned at birth and raised in institutions. The quality of care in institutions is often impoverished – high child-to-caregiver ratios and high caregiver turnover lead to a lack of quality interactions between child and caregiver (Smyke et al., 2007; Zeanah et al., 2003). Institutionalized infants spend most of their time in their individual cribs, experiencing restricted access to other people and having a preponderance of atypical social interactions likely to translate into limited and/or atypical exposure to different facial expressions of emotion (Zeanah et al., 2003). In fact, in a recent study, Romanian and Russian children adopted by U.S. families performed more poorly than noninstitutionalized children when asked to match pictures of facial expressions to appropriate emotion labels (Fries & Pollak, 2004).

In the current study, a visual paired comparison (VPC) procedure was used to assess emotion discrimination in three groups of 42-month-old children in Romania: institutionalized children, previously institutionalized children who had been placed into high-quality foster care, and never-institutionalized children. This study is part of the Bucharest Early Intervention Project (BEIP), a longitudinal study of the effects of institutionalization on brain and behavioral development (Zeanah et al., 2003), and it is a follow-up to an initial assessment using the VPC task that occurred between 13 and 30

months of age (Nelson, Parker, Guthrie, & the BEIP Core Group, 2006). At the initial assessment, there were no differences between institutionalized and never-institutionalized children in their ability to discriminate facial expressions of emotion. However, we hypothesized that continued institutional care would result in increasing impairments in emotion discrimination abilities by altering the neural systems that subserve facial emotion perception. In addition to examining the effect of increasing time spent in an institution, this study was designed to examine whether foster care would ameliorate any deficits shown by institutionalized children.

As the VPC task was used with this sample when they were infants, we used the same paradigm at 42 months in order to examine continuity over time. Although the VPC task has primarily been used with infants (Fagan, 1971), its utility has also been demonstrated in children and adults (Morgan & Hayne, 2006; Richmond, Sowerby, Columbo, & Hayne, 2004). Infants generally show discrimination in the VPC task by looking longer at the novel stimulus than the familiarized stimulus (Fagan, 1970, 1971, 1972; Fagan, Fantz, & Miranda, 1971; Fantz, 1964; Fantz & Nevis, 1967; Saayman, Ames, & Moffett, 1964). However, it is unclear whether this visual preference for novelty is found consistently throughout childhood, and thus, whether it would be observed in this sample of 42-month-old children.

Method

Participants

In 2001, 208 children between 5 and 31 months of age were recruited in Bucharest, Romania. Of these participants, 136 children were institutionalized and 72 had never been institutionalized. After an initial assessment, institutionalized children were randomized to either continued institutional care (Care as Usual Group, (CAUG)) or high-quality foster care (Foster Care Group (FCG)). Children in the Never-Institutionalized Group (NIG) were recruited from the maternity hospitals where the institutionalized children were born and matched to the institutionalized children on age and gender (for a thorough description of this sample, see Nelson et al., 2007; Smyke et al., 2007; Zeanah et al., 2003). Of the 208 children initially recruited into the BEIP, 34 CAUG, 36 FCG, and 23 NIG participated in this study. Of these 93 children, three (two CAUG and one FCG) were excluded from final data analyses due to technical errors. The final sample ranged in age from 42.0 to 44.4 months (M = 42.5, SD = .05; 46 girls and 44 boys).

Although the study randomly assigned half of the institutionalized children to foster care, for ethical reasons it did not interfere with other changes in the rearing environment of any child participating in the study.[1] Thus, children originally assigned to the institutionalized or foster care group could return to their families, be placed into government foster homes, or be adopted when those opportunities became available. Regardless of any changes in their rearing environment, children were considered to be part of their originally assigned group

[1]The BEIP was conducted under very strict ethical guidelines, including the need for institutional review board (IRB) approval from three United States universities (University of Minnesota, Tulane University, University of Maryland), as well as approval from relevant government authorities in Bucharest, Romania. For details about the ethical issues involved in this project, see Nelson et al., 2007; Zeanah et al., 2006a,b.

for the purposes of this study. This intent-to-treat design maintains random assignment and permits the strongest test of the effects of early experience on later development.

Stimuli

Pictures of eight Caucasian female faces expressing happy, sad, fearful and neutral emotions were chosen from the MacBrain Face Stimulus Set (Tottenham et al., 2009). These facial expressions were reliably and accurately identified by children and adults. The NimStim pictures were in 8-bit color and 800 × 600 pixel resolution. All models wore a gray scarf around their necks and posed in front of a gray background.

Procedure

Participants were brought in to the laboratory built in St. Catherine's, Bucharest's oldest and largest institution for abandoned children. For all participants in the CAUG and FCG, informed consent was obtained from the Commission for Child Protection in Bucharest. For all participants in the NIG, informed consent was obtained from their biological parents. Each participant sat on his/her parent's or caregiver's lap facing two computer monitors approximately 40 cm away. Black panels set up around the monitors ensured that the participant's attention was directed to the monitors. The caregiver was instructed to keep quiet but to soothe the child if he/she became fussy. Room lights were turned off, unless the participant was known to have a fear of the dark. When the participant looked away during stimulus presentation, the experimenter standing behind the monitors tapped the monitors or rattled a toy to guide the participant's attention back to the stimuli.

Each participant was tested on four pairs of facial expressions in a VPC procedure. The four emotion pairs were Sad-Fear, Fear-Neutral, Happy-Sad, and Fear-Happy. Participants saw three examples of each emotion pair (problem sets), each of which used a different female model. Thus, participants saw 12 total problem sets (four emotion pairs x three examples). In each problem set, the participant was first familiarized to a pair of identical stimuli (one on each monitor) for 7 seconds. Half of the participants were familiarized to the first emotion in each pair above; the other half were familiarized to the second emotion in each pair. Following familiarization, participants saw two 3.5-second test trials of the familiar stimulus and a novel stimulus on separate monitors. These familiarization and test times are generally shorter than what is commonly used in younger infants. As so little work has been performed with 42-month-olds using the VPC, we were unable to depend on the extant literature for guidance as to appropriate familiarization and test times with this age group. However, as the VPC literature consistently suggests that infants require less familiarization as they get older, we decided to reduce the familiarization time at 42 months. The left-right positions of the familiar and novel stimuli were counterbalanced across the two test trials. The order in which participants saw the four emotion pairs was also counterbalanced. All study sessions were recorded by a digital camcorder so that they could be coded and analyzed.

Data Coding

Following the initial conversion of the study sessions to computer media files, each participant's eye movements throughout the session were coded—categorized as left, right,

or not looking—at one-fifth normal speed using the coding program Noldus 5.0. A second observer coded approximately 20% of the study sessions for reliability. Inter-observer reliability was calculated and Cohen's Kappas were 0.90 or greater for all sessions. Participants' preference scores for the novel stimulus in each emotion pair were calculated as a fraction (novelty preference score = time spent looking at novel stimulus/total time spent looking at both familiar and novel stimuli).

Results

To ensure that children in the three groups did not differ in terms of their overall attention to the VPC task, we compared the familiarization times for the three groups averaged across all four emotion pairs. A one-way ANOVA revealed no differences in familiarization time among the groups, $F(2,89) = 0.06$, p = ns. The novelty preference score for each emotion pair was then analyzed by separate two-tailed t-tests against a chance level of 0.50 to examine whether the children were able to discriminate between different facial expressions, and to determine whether the children showed overall novelty preferences as expected. Next, a four (emotion pair) x three (group) x two (gender) x two (order within emotion pairs) x two (order of emotion pairs) repeated measures analysis of variance (ANOVA) tested the main hypothesis of the study, that group membership would affect looking preferences for particular emotion pairs.

Overall Looking Preferences

Overall, the children looked longer at the familiar stimulus than the novel stimulus for all four emotion pairs as seen in Figure 1. Of the four pairs, children showed significant familiarity preferences for Sad-Fear ($M = .46$, $SD = .092$, $d = .44$), $t(89) = -4.16$, $p < .001$; Happy-Sad ($M = .47$, $SD = .099$, $d = .29$), $t(89) = -2.78$, $p = .007$; and Fear-Happy ($M = .46$, $SD = .12$, $d = .32$), $t(89) = -3.00$, $p = .004$, respectively. Notice in Figure 1 that although children did not show a significant preference for the emotion pair Fear-Neutral, $t(89) = -1.80$, $p = .075$, the mean novelty preference score was still below .50 ($M = .48$, $SD = .12$, $d = .19$). Thus, children's overall looking preferences ran contrary to prediction. Unlike what is typically observed among younger infants, children in this study looked longer at the familiar facial expressions compared with the novel facial expressions. However, these results do indicate that the children were generally capable of discriminating between the two different facial expressions within each pair.

Group Effects

Our main hypothesis was that the CAUG, FCG, and NIG would differ in their ability to discriminate different facial expressions. In particular, it was predicted that the CAUG would show deficits in their ability to discriminate between different facial expressions compared with the FCG and the NIG. However, a four (emotion pair) x three (group) x two (gender) x two (order within emotion pair) x two (order of emotion pairs) repeated measures ANOVA revealed no main effect of group, nor a group by emotion pair interaction, indicating that the three groups did not differ in their ability to discriminate any of the emotion pairs. In fact, the only significant effect was a significant emotion pair x order within emotion pair interaction, $F(3,198) = 9.83$, $p < .001$. To determine the effect of

stimulus presentation order for each emotion pair, independent samples t-tests were run separately for each of the four emotion pairs. Post hoc analyses revealed that presentation order significantly affected looking preferences for the Sad-Fear ($t(88) = -3.77$, $p < .001$) and Fear-Neutral ($t(88) = 4.06$, $p < .001$) pairs as shown in Figure 2.

For the Sad-Fear pair, children who were familiarized to the sad face spent a significantly longer time looking at the sad face (familiar stimulus) than the fear face (novel stimulus) during the test trials (Sad = 0.57 versus Fear = 0.43). However, children who were familiarized to the fear face showed no looking preference for either the sad or fear face during the test trials (Sad = 0.50 versus Fear = 0.50). Similarly, for the Fear-Neutral pair, only children who were familiarized to the neutral face showed a significant familiarity preference during the test trials (Neutral = 0.57 versus Fear = 0.43 when familiarized to the neutral face; Neutral = 0.52 versus Fear = 0.48 when familiarized to the fearful face). Thus, for two of three emotion pairs containing the fear stimulus, the children showed a significant familiarity preference only when they were familiarized to the nonfear stimulus as seen in Figure 2. Although there was no significant effect of presentation order for the Fear-Happy pair, the children showed a larger familiarity preference when they were familiarized to the Happy face versus the Fear face (Happy = 0.56 versus Fear = 0.44 when familiarized to the happy face, Happy = 0.48 versus Fear = 0.52 when familiarized to the fear face).

The analyses above were run while respecting our original intent-to-treat design, where children were considered to be part of their originally assigned group. We also re-ran the analyses after violating intent-to-treat, in order to evaluate the competing hypothesis that later experience is as or more important than early experience. For these analyses, we included only children who were still in their assigned rearing environment at 42 months of age; this left 22 children in the CAUG, 31 children in the FCG, and 22 children in the NIG. Our findings did not differ after violating intent-to-treat, which supports the premise that early experience is most important in determining later outcomes. Finally, we also examined the effects of timing of placement in foster care (for details, see Nelson et al., 2007) and again, observed no effects.

Discussion

Children in the current study looked longer at the facial expression to which they had been familiarized rather than at the novel facial expression for all four emotion pairs. Although *infants* generally prefer novel stimuli in the VPC task, there exists a body of evidence supporting adults' and older children's preferences for familiar stimuli (e.g., Kunst-Wilson & Zajonc, 1980; Leder, 2001; Uehara, 2000). For example, studies examining children aged 5 years and older have reported that they show familiarity preferences for letters and words (Busse & Seraydarian, 1978; Colman, Walley, & Sluckin, 1975; Sluckin, Miller, & Franklin, 1973). The evidence for both a preference for novelty in young children and a preference for familiarity in older children and adults suggests that a bias toward novelty may gradually shift to a bias toward familiarity over the course of childhood (Uehara, 2000). The current findings suggest that this shift to familiarity preference occurs some time before 42 months, so that familiarity preferences are robust by 42 months of age. Several previous studies also

suggest that 4 years of age could be a critical time for displaying familiarity rather than novelty preferences (Cain, Baker-Ward, & Eaton, 2005; Uehara, 2000).

Regarding the discrimination of emotion, there were no group differences in discriminating the emotion pairs overall, indicating that all three groups performed this emotion discrimination task similarly. The absence of group effects in the 42-month-old children echoes the findings from the baseline assessment when the children were 13- to 30-months old (Nelson et al., 2006), which increases the validity of the current findings. The current findings are also consistent with event-related potential (ERP) findings in these children. At the baseline, 30-, and 42-month assessments, brain activity was recorded from children in all three groups while they watched pictures of happy, sad, fearful, and angry faces. Although there were overall differences between the CAUG, FCG, and NIG in the amplitude of their brain activity, there were few differences among the groups in their neural processing of the different facial expressions of emotion (Moulson, Fox, Zeanah, & Nelson, 2009; Parker, Nelson, & the Bucharest Early Intervention Project Core Group, 2005). The converging findings from the ERP and VPC procedures suggest that the radically different rearing histories experienced by children in the different groups did not impact their ability to discriminate facial expressions of emotion.

As neither the VPC nor ERP tasks are particularly sensitive measures of more sophisticated facial emotion processing skills, it is unclear whether the intact ability to discriminate facial expressions in children with histories of institutionalization will translate to intact higher level emotion recognition and understanding. For 42-month-old children, looking at static pictures of women with prototypical facial expressions may not have tapped subtle deficits in facial emotion processing present in the institutionalized group. Indeed, other studies of postinstitutionalized children have revealed differences in facial emotion processing using more complex tasks (Fries & Pollack, 2004). Thus, it seems that the ideal way to examine the effect of early institutionalization on the development of emotion recognition is to study the phenomenon with more than one task and to compare and contrast the results to gain a better understanding of children's socioemotional processing.

Summary

Overall, the most important finding from both the baseline and follow-up assessments is that children with histories of institutionalization performed as well as those who had been raised with their biological families in discriminating facial expressions of emotion. This finding runs counter to our original hypothesis, and departs significantly from virtually every other domain that has been assessed in this sample; specifically, in other papers we have reported that children with histories of institutionalization differ from those reared with their family of origin in language development (Windsor, Glaze, Koga, & the BEIP Core Group, 2007), brain development (Marshall, Fox and the BEIP Core Group, 2004; Marshall, Reeb, Fox, Nelson, & Zeanah, 2008), attachment (Zeanah, Smyke, Koga, Carlson, & the BEIP Core Group, 2005), and IQ (Nelson et al., 2007; Smyke et al., 2007). Given that the ability to discriminate and recognize faces and facial expressions of emotion likely reflects an experience-expectant, activity-dependent function (for elaboration see Leppanen & Nelson, 2006; 2009; Nelson, 2001), it may be the case that relatively little exposure to faces is

sufficient to facilitate the development of the neural architecture underlying face processing. If correct, it would appear that even children living in profoundly neglectful circumstances, like an institution, still acquire normal face processing skills. Although encouraging, it must also be kept in mind that being capable of perceptually discriminating two different facial emotions is only the beginning of a series of more complex social-cognitive abilities that develop over the first years of life; thus, how the children in the BEIP will fare later in life – for example, when they must recognize facial emotions and use them to guide their behavior – is an open question, one BEIP investigators are only now beginning to explore.

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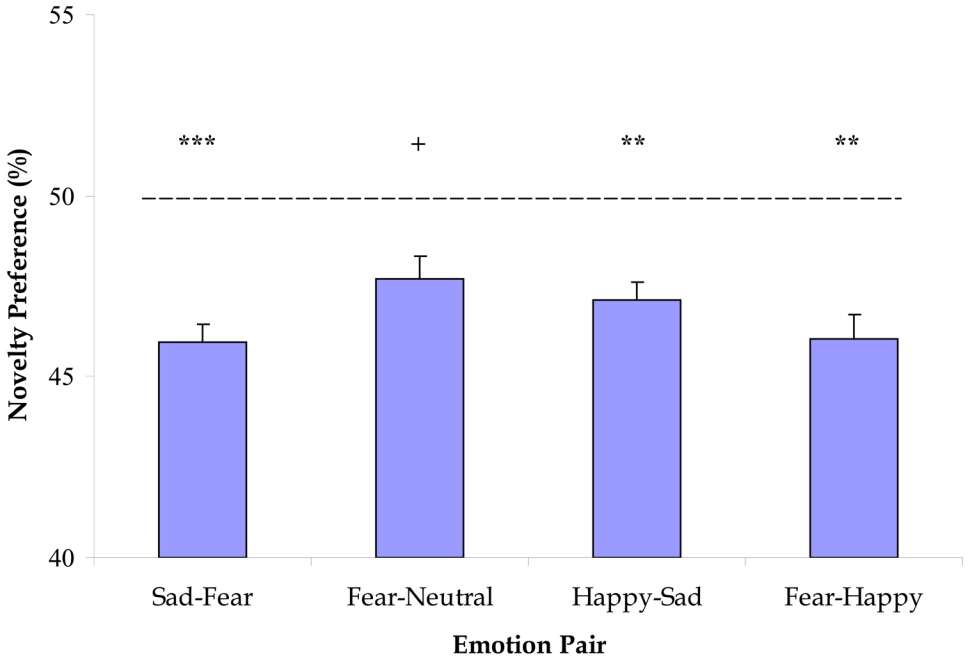

Figure 1.

Children's overall percent novelty preference (percent novelty preference = 100 * [time spent looking at the novel stimulus/time spent looking at either the familiar or the novel stimulus]) for each emotion pair.

** $p < .01$

*** $p < .001$

+ $.05 < p < .1$

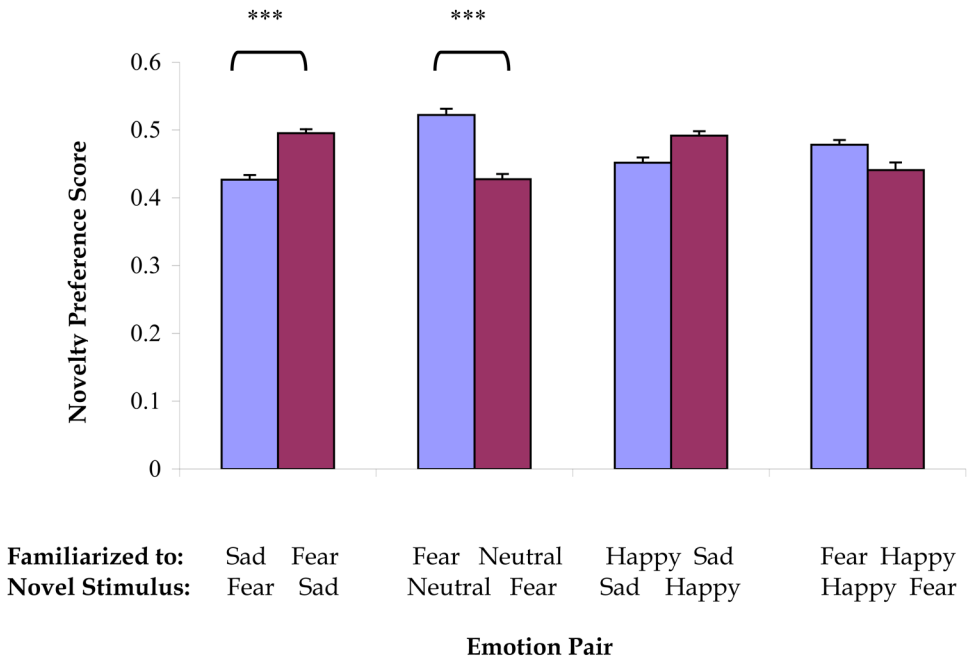

Figure 2.

Children's novelty preference scores according to the presentation order within each emotion pair.

*** $p < .001$