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Emotion understanding in postinstitutionalized Eastern European children

ALISON B. WISMER FRIES AND SETH D. POLLAK
University of Wisconsin at Madison

Abstract

To examine the effects of early emotional neglect on children's affective development, we assessed children who had experienced institutionalized care prior to adoption into family environments. One task required children to identify photographs of facial expressions of emotion. A second task required children to match facial expressions to an emotional situation. Internationally adopted, postinstitutionalized children had difficulty identifying facial expressions of emotion. In addition, postinstitutionalized children had significant difficulty matching appropriate facial expressions to happy, sad, and fearful scenarios. However, postinstitutionalized children performed as well as comparison children when asked to identify and match angry facial expressions. These results are discussed in terms of the importance of emotional input early in life on later developmental organization.

Over the last decade, the adoption of children across nations has increased substantially. In the United States alone, such adoptions now exceed 20,000 children per year (Immigration and Naturalization Service [INS], 2002). Today, approximately 85% of international adoptees have spent some or all of their lives in institutional, as opposed to family, care where the children have experienced combinations of physical and social deprivation (US State Department, 1999). Although the deprivation experienced by these children is often impossible to precisely quantify, it is apparent that these environments fall below the quality needed to sustain normal behavioral development, as evidenced by the rate at which children arrive in their adoptive homes with poor health, growth failure, and developmental delays (Johnson, 2000a; Johnson, Miller, Iverson, Thomas, Franchino, Dole, Kiernan, Georgieff, & Hostetter, 1992; Miller, 2000). Current estimates are that institutionalized infants and toddlers loose about 1 month of linear growth for every 3 months in institutional care, with behavioral development exhibiting similar dramatic reductions (Gunnar, 2001; Johnson, 2000b).

Institutionally reared children have captured attention for decades. Early research on these children emphasized the deprivation of

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Address correspondence and reprint requests to: Seth D. Pollak, 1202 West Johnson Street, University of Wisconsin at Madison, Madison, WI 53706-8190; E-mail: spollak@wisc.edu.

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maternal care, although as Rutter (1981) rightly noted, not only maternal stimulation, but also many other types of stimulation needed for normal development is deficient in institutional environments. Thus, the study of these children addresses both basic science issues about the role of early experience on brain development and also applied issues about the kinds of interventions that are likely to support and foster optimal development for these children. Indeed, early studies revealed that postinstitutionalized (PI) children showed marked improvements when removed from orphanage settings and placed in family environments; nonetheless, persistent developmental differences in these children could be detected long after adoption, including deficits in emotional and social development (Fisher, Ames, Chisholm, & Savoie, 1997; Hodges & Tizard, 1989a, 1989b; O'Connor, Rutter, Beckett, Keaveney, Kreppner, & ERA Study Team, 2000; Rutter & ERA Study Team, 1998). Yet, little is known about the processes through which early experiences of neglect lead to these developmental problems.

Although studies of PI children suggest multiple domains of development in which persistent problems may remain, the present article is motivated by numerous reports that institutional care dramatically increases the risk for social behavioral difficulties, including social attachment and relationship disturbances, disruptive behavior problems, sensitivity to social boundaries, establishment and maintenance of intimacy, and emotional regulation (Ames, 1997; Groze & Ileana, 1996; O'Connor, Bredenkamp, Rutter, & ERA Study Team, 1999; Rutter et al., 1999; Zeanah, 2000). Hodges and Tizard conducted the most comprehensive, long-term study of children who had been institutionalized until at least 2 years of age. When these children were 8 and 16 years of age their teachers reported high levels of aggressive problem behaviors that could contribute to social difficulties (Hodges & Tizard, 1989b; Tizard & Hodges, 1978). Later studies indicated that PI children might also experience high levels of sadness, depression, and anxiety. Fisher et al. (1997) found that 31-month-old children adopted from Romanian orphanages after 8 months of age scored significantly higher on the Child Behavior Checklist internalizing scale than early adopted (i.e., before age 4 months) and nonadopted children. In this same study, parent interviews suggested that PI children experienced social difficulties, including tendencies to withdraw or avoid peers and siblings. Curiously, while some PI children tend to avoid social interactions, indiscriminate friendliness is also commonly reported in studies of PI children (Chisholm, 1998; Chisholm, Carter, Ames, Morison, 1995; Tizard & Hodges, 1978; Zeanah, 2000). One explanation offered to account for such inappropriate social behavior is that PI children lack awareness of interpersonal boundaries. In support of this view, O'Connor et al. (1999) note that these indiscriminately friendly interactions are often superficial, impersonal, rarely reciprocal, and are maintained into adolescence. Taken together, these observations suggest that PI children may have deficits or delays related to the understanding of social cues.

Studies of institutionally reared children consistently yield evidence that early deprivation can have long-term consequences for behavioral functioning. Yet, extant research has employed relatively gross measures of functioning, such as parent reports, interviews, or global IQ tests (Gunnar, 2001). These macrolevel observations provide rich descriptive data about areas in which PI children experience difficulties. However, while such global measures provide some suggestion about processes that may be affected by early experience, they cannot test hypotheses about the development of specific processes that underlie children's social behavior. An attempt to further assess the bases of PI children's socioemotional difficulties motivates the present study.

Although PI children have experienced a variety of extreme early adversities including poor nutrition and poor prenatal care, there is good reason to consider the role of emotional neglect in the ontogenesis of the social difficulties apparent in these children. A prominent lack of emotional and physical contact from caregivers is consistently found throughout institutional settings in Eastern Europe (Human Rights Watch, 1998); although any

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individual child's experience may be different, the probability of a child receiving warm, consistent care giving in these setting is quite low. Although there are variations in the degree of neglectfulness both across and within orphanages, these settings have been characterized as ranging from poor to appalling (Human Rights Watch, 1998). Although some orphanages may provide very basic stimulation to meet children's cognitive, motor, and linguistic needs, none of the orphanages previously studied have adequately met the relationship needs of infants such as providing stable, consistent relationships that foster emotional learning and social bonds (Gunnar, 2001). This is because in orphanage settings children receive minimal communication or attention from caregivers, and experience little responsiveness to their individual needs (Johnson, 2000b; Rutter et al., 1998). The ratios of adult staff to children in these settings is extremely high, in some cases one adult can be responsible for upwards of 20 infants. Such a job is no doubt overwhelming for the adults as well as the children and, as might be expected, staff turnover is high, making it especially difficult for children to form an emotional attachment to any particular caregiver. In addition, institutional care tends to be strictly regimented (Ames, 1990), allowing children few opportunities to learn that their actions produce reliable and consistent consequences. Such environmental contingencies are understood and used by even very young infants (Rovee–Collier & Capatides, 1979).

The possibility that developmental processes are affected by children's early experiences is further supported by observations that persistent socioemotional problems tend to correlate with the duration of institutional care (e.g., Ames, 1997; O'Connor et al., 2000) and with the degree of preadoption privation (Verhulst, Althaus, & Versluis den Bieman 1990, 1992). For example, clinically significant behavior problems such as aggression tend to correlate with health problems at adoption associated with neglect and with parent report of preadoption neglect (Verhulst et al., 1992). Rather than improving with age, the psychosocial problems experienced by PI children tend to persist or even increase with age (Chisholm, 1998; Hodges & Tizard, 1989b; Rutter et al., 1998). In fact, adoptive parents tend to note emotional/interpersonal functioning as the developmental domain in which they observe the least improvement following adoption (compared to other domains including eating, medical, sleeping, physical growth, and stereotyped behavior problems; Fisher et al., 1997). In addition, there is a suggestion that variation in environment, such as relative quality of the institutionalized care, is a predictor of general cognitive catchup above and beyond the effects of duration of institutionalization and degree of malnutrition (Castle, Groothues, Bredenkamp, Beckett, O'Connor, Rutter, & ERA Study Team, 1999).

In the present study, we examine children's competence at two rudimentary emotional processes: the ability to identify basic emotional expressions, and the ability to match emotional expressions with appropriate social contexts. The developmental progression of this ability is that children first recognize facial expressions of happiness, then learn to distinguish between negative expressions of sadness, anger, and fear (Camras & Allison, 1985; Denham & Couchoud, 1990; Izard, 1971). As children learn to distinguish emotional expressions during the preschool years, they also begin to understand the causes of emotional reactions (Southam–Gerow & Kendall, 2002). By 3 years of age, most children can infer another's emotional state, for example, by matching a facial expression to a puppet following an emotional vignette (Denham, 1986). These skills may be relevant to populations of PI children not only because they underlie more complex social behaviors, but also because children's early experiences and relationships may importantly impact children's abilities to decode and process emotion cues. Sensitive, responsive, and contingent care giving is correlated with the development of emotion understanding (Denham, Zoller, & Couchoud, 1994). For example, in a normative sample of 3- to 6-year-old children, attachment status was a significant predictor of performance on an emotion-understanding task (Harris, Johnson, Hutton, Andrews, & Cooke, 1989). Maternal emotional expressiveness has also been related to the development of emotion understanding

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abilities in children (Camras, Ribordy, Hill, Martino, Sachs, Spaccarelli, & Stefani, 1990). Although relatively little research has been conducted specifically with neglected children, Pollak, Cicchetti, Hornung, and Reed (2000) reported that neglect was associated with an overall impairment in the ability to recognize and discriminate between different facial expressions of emotion. Similarly, research with heterogeneous samples of maltreated children suggests that abusive parenting is related to poorer recognition of facial expression of emotion, in particular happiness, and poorer understanding of the causes of emotion (Camras, Grow, & Ribordy, 1983; Pollak et al., 2000; Pollak, Kalish, & Perlman, 2004; Rogosch, Cicchetti, Aber, 1995). In addition, deficits in understanding the situational causes of negative emotions were found to mediate the relationship between maltreatment and behavioral dysregulation (Rogosch et al., 1995).

Because there is little experimental research with this population of children to address ancillary questions, the present study is motivated by the general hypothesis that the interpersonal problems observed among PI children reflect difficulties in decoding, understanding, and responding appropriately to social cues. We view these basic aspects of emotional communication as a foundation, upon which more complex interpersonal skills are based. Our speculation is that orphanage settings provide impoverished emotional learning environments, lacking the socioemotional contingencies for acquiring efficient expertise in affective processing skills. Based upon existing research with domestically neglected children, we predicted that PI children would show deficits in their ability to infer emotional states based on situational cues, as measured by their ability to match facial expressions with emotional situations. We also tested children to determine whether group differences in this more complex situation-expression matching task could be reflected in problems in a less complex facial expression labeling task. Because prior research has found length of institutionalization to be a strong predictor of subsequent cognitive and behavioral developmental outcomes (Castle et al., 1999; Fisher et al., 1997; O'Connor et al., 1999; Rutter & the ERA Study Team, 1998), we examined whether the length of time children spent in orphanage settings would be negatively related to these emotion processing abilities. Exploratory analyses were also carried out to investigate whether or not these emotion understanding abilities improve as the length of time spent in the adoptive home increases. For example, Sloutsky (1997) investigated emotion understanding in 6- and 7-year-old children currently residing in a Russian orphanage. These institutionalized children performed poorly on an emotion identification task, and their performance was negatively related to time spent in the orphanage. However, because these children were currently living in an orphanage setting, it is not possible to test whether these effects persist, following placement in an enriched environment. From a developmental perspective, such analyses can be quite informative. At adoption, institutionally reared children move into enriched middle- to upper middle-class families who are generally stable, well educated, and child focused. In short, adoption marks a dramatic termination of deprivation, allowing an examination of the impact of early deprivation/neglect on subsequent development. Thus, studying these children affords a window into understanding the impact of a circumscribed period of neglect on development that is not available in most populations of maltreated children.

Method

Participants

Eighteen PI adopted children (12 females, 6 males) were compared to 21 comparison children residing with their biological parents (12 females, 9 males). The average age of the PI group was 53.7 months (SD = 4.4 months) and the average age for the comparison group was 54.1 months (SD = 7.1 months). The PI children had resided in orphanages for an average of 16.6 months prior to adoption, beginning at birth (range = 7–42 months). To ensure that children had opportunities to acclimate to their adoptive homes, we did not include children who had recently arrived in the United

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States; PI children had been residing in their adoptive homes for an average of 34.6 months (range = 10–48 months). Twelve of the PI children were adopted from Russian orphanages and six children were adopted from Romanian orphanages. PI children's performance on the emotion identification and situation tasks did not differ by country of birth, $F(1, 16) = 3.76$, *ns*; $F(1, 16) = 1.64$, *ns*, respectively. Adoptive and control families were drawn from similar socioeconomic levels, and did not differ on family income, $F(1, 36) = 1.8$, *ns*. To address the possibility that internationally adopted children could have more difficulty understanding task instructions because of second language acquisition, we conducted a separate session with PI children in which we administered two standardized tests of English receptive language ability. Children's scores on the Peabody Picture Vocabulary Test III (Standard Score $M = 105.6$, $SD = 13.07$) and NEPSY Sentence Comprehension Test (Scaled Score $M = 11.07$, $SD = 2.71$) were within the normal range, $t(14) = 1.66$, *ns* and $t(14) = 1.52$, *ns*, respectively. We were unable to schedule three PI children for subsequent language testing; these three children did not significantly differ from the rest of the PI children on emotion situation and identification accuracy scores, time in orphanage, or time in adoptive home.

Stimuli and Procedure

The *Emotion Situation Task* consisted of short vignettes about emotion eliciting incidents that were accompanied by simple color illustrations. Vignettes were portrayed by four different automated adult voices (2 male, 2 female). The drawings did not depict facial expressions, and were race neutral. The protagonist in each story was counterbalanced to be either a child (boy or girl) or an adult (mom or dad). Children were presented with 32 stories (8 each of happy, sad, anger, fear; see Appendix). Emotion labels were not provided in the stories. Following each story, children were asked to indicate what the protagonist in the story was likely to feel. Children responded by selecting one of four digitized photographs of adult (Ekman, 1976) or one of four child (Camras & Allison, 1985; Camras et al., 1990) faces. The correct emotion and three foils appeared on the screen, one in each quadrant, and children selected one of the facial expressions of emotion by touching the face on a touch-sensitive monitor. Foils were randomly selected from the following emotions: happy, sad, angry, fear, surprise, and disgust. Location of the correct face was randomized for each trial. Variants of this procedure have been used successfully with young children (Camras & Allison, 1985; Dashiell, 1927; Pollak et al., 2000; Ribordy, Camras, Stefani, & Spaccarelli, 1988).

Half of the emotion situation vignettes were presented during each of the two testing sessions. The order of story presentations across testing sessions was randomized for each child and stories within each testing session were randomized. Stories were not repeated within a testing session, and each vignette was associated with a unique protagonist model. Children's performance did not vary based upon testing session, $F(1, 37) < 1$, *ns*, nor did performance differ based upon whether the protagonist was an adult or child, $t(41) < 1$, *ns*.

Following the Emotion Situation Task, children were given a short rest and then completed the *Emotion Identification Task*. This task utilized the same sets of digitized photographs presented in the Situation Task. On each trial children were presented with four faces (the correct choice and three foils), and were asked by a computer automated voice to select the happy, sad, mad, or scared faces on the touch screen monitor. Location of the correct face and order of stimulus presentation was randomized for each participant. Faces stayed in full view until children responded. Children completed half of the trials during each testing session (total trials = 32, 8 of each emotion).

For both tasks, presentation of stimuli and recording of children's responses was done through a Dell Inspiron 3200 laptop computer and a View Sonic VE150 touch screen monitor. Children were tested on two occasions in a quiet room in their home 1 to 2 weeks apart ($M = 9.5$ days). Following each experimental session children were rewarded with a small prize (i.e., sticker book, T-shirt). Parents of children gave informed consent and completed a set of

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Table 1. *Emotion Situation Task accuracy*

Measure	PI		Control			
	M	*SD*	*M*	*SD*	*F* (1, 37)	*p*
Overall emotion situations[a]	13.78	6.62	19.71	5.68	9.10	<.01
Causes of happiness[b]	4.22	2.65	6.19	2.25	6.31	<.05
Causes of sadness[b]	3.61	2.35	5.76	1.87	10.11	<.01
Causes of anger[b]	3.11	1.84	3.43	1.86	<1	*ns*
Causes of fear[b]	2.83	1.65	4.33	2.08	6.10	<.05

[a]Total possible score = 32.
[b]Total possible score = 8.

questionnaires about their child's developmental and, if relevant, adoption history.

Results

Children's ability to match expressions with situations

Accuracy. We first examined whether PI children were able to correctly map facial expressions to emotional contexts. Children's accuracy data on the Emotion Situation Task was submitted to a repeated measures analysis of variance, with Group (PI, Comparison) as a between subjects factor and Emotion as a within subjects factor. The Greenhouse–Geisser correction was applied to probability values as an adjustment for repeated measures. Overall, PI children performed this task with less accuracy than their typically developing peers, F (1, 37) = 9.10, $p < .01$. An interaction of Group × Emotion suggested that children's performance differed depending upon the emotional situation, F (3, 111) = 2.46, $p = .06$. Group means are presented in Table 1. To determine the source of this interaction, one-way analyses of variance were conducted separately for each emotion. These analyses revealed that PI children had difficulty matching expressions to situations involving happiness, sadness, and fear. However, PI children performed similarly to the comparison group when the situations involved anger.

Individual differences. We next undertook a series of analyses to evaluate the extent to which key individual difference variables affected task performance. A one-way analysis of variance indicated that children's overall accuracy did not differ on the basis of gender, F (1, 36) = .51, *ns*. As expected, older children demonstrated better understanding of emotions, F (1, 37) = 4.63, $p = .038$, $\beta = .38$, $SE = .177$. Because chronological age was a significant predictor of task performance, subsequent regression analyses were carried out controlling for age. To begin to explore developmental factors that might affect children's emotion understanding abilities, we examined the amount of time (from birth to adoption) that the child lived in an institutionalized setting, and the amount of time (from adoption to testing) the child had been living in their adoptive home as predictors of emotion understanding task performance. PI children performed worse on the Emotion Situation Task the longer they had lived in an orphanage prior to adoption, F (2, 15) = 4.76, $p = .025$, $\beta = -.271$, $SE = .139$. Yet, children's performance also increased the longer they had lived in their adoptive homes, F (2, 15) = 4.66, $p = .027$, $\beta = .233$, $SE = .122$.

Sensitivity and response bias. One potential problem with general measures of accuracy is that children's sensitivity to correct responses is confounded with biases to select (or avoid) particular emotions. To address this concern, we employed signal detection statistics to further examine the nature of children's emotion understanding performance. Two indices were calculated: Pr, a discrimination index repre-

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Table 2. *Means and standard deviations by group and emotion for sensitivity and bias scores*

	Happy		Sad		Anger		Fear	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Emotion understanding								
Sensitivity (Pr)								
Control	.65	.31	.49	.26	.35	.24	.41	.26
PI	.29	$.45_a$	.24	$.26_b$	.24	.26	.15	$.27_c$
Bias (Br)								
Control	.34	.21	.47	.22	.13	.09	.25	.19
PI	.34	.17	.31	$.24_d$	.19	.14	.24	.13
Emotion identification								
Sensitivity (Pr)								
Control	.89	.04	.80	.16	.62	.19	.56	.28
PI	.69	$.32_e$	.56	$.35_f$	.51	.34	.32	$.37_g$
Bias (Br)								
Control	.50	.09	.47	.15	.22	.14	.21	.13
PI	.46	.13	.40	.20	.32	$.13_h$	.18	.10

Note: Subscript letters indicate significant differences between groups ($ps < .05$).

senting the probability that an item will cross a recognition threshold, and Br, a bias index that reflects how much certainty the child requires to select a particular emotional expression. Formulae used to calculate these measures were taken from Pollak et al. (2000). Means of signal detection measures are reported in Table 2.

Separate repeated measures analyses of variance were computed with Group (PI, Comparison) as a between-subject factor, Emotion (happy, sad, anger, fear) as a within-subject factor, and either sensitivity (Pr) or bias (Br) as dependent variables. Significant main effects were followed up with Tukey's LSD post hoc tests using an alpha cut off of .05. Across groups, children were more sensitive to the match between happy situations and happy facial expressions compared to the other emotions, $F\ (3, 111) = 9.75$, $p < .001$. PI children discriminated the relationship between stories and their corresponding facial expressions more poorly than did control children, $F\ (1, 37) = 9.03$, $p < .01$. Yet, an interaction of Group × Emotion suggested that PI children did not have difficulty with all emotions, $F\ (3, 111) = 3.41$, $p < .05$. Specifically, PI and comparison children's sensitivity scores differed in the happy, $t\ (37) = 2.93$, $p < .01$, sad, $t\ (37) = 3.0$, $p < .001$, and fear, $t\ (37) = 3.04$, $p < .01$, conditions, but not in response to angry vignettes, $t\ (37) = 1.40$, *ns*.

These results are not attributable to a differential response bias on the part of the PI children. A main effect of emotion suggested that all children altered their response criterion by emotion, $F\ (3, 111) = 10.57$, $p < .001$. Specifically, children had more liberal response criteria for trials involving happiness or sadness and were more conservative about situations involving anger or fear. However, neither the main effect for Group, $F\ (1, 37) = 1.65$, *ns*, nor the interaction of Group × Emotion, $F\ (3, 111) = 2.23$, *ns*, were significant. Overall sensitivity and bias values are shown in Figure 1.

Children's ability to identify facial expressions of emotion

Because the Emotion Situation Task is more complex, requiring children to infer the emotional reaction of another, we also included a simpler task to assess children's ability to identify facial expressions of emotion without contextual or inferential processing.

Accuracy. Overall, PI children ($M = 21.11$, $SD = 7.69$) correctly identified fewer facial expressions of emotion than controls ($M =$

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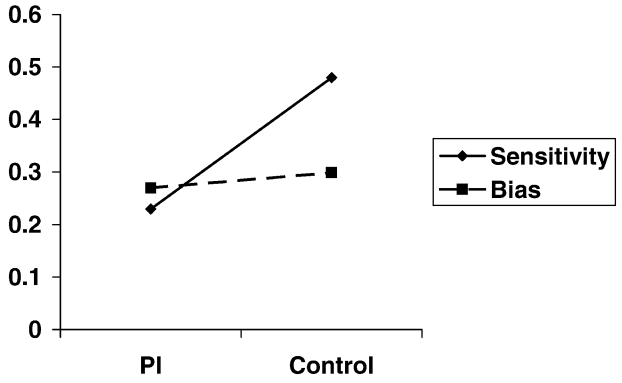


Figure 1. The sensitivity and response bias scores for postinstitutionalized (PI) and control children for the Emotion Situation Task.

25.90, $SD = 3.92$), $F\ (1, 37) = 6.27$, $p = .017$. No interactions between emotion and group emerged, $F\ (3, 111) = 2.19$, *ns*.

Individual differences. Across groups, a one-way analysis of variance indicated that there was no difference in the identification abilities of boys and girls, $F\ (1, 37) < 1$, *ns*. In addition, age was not related to number of correct identifications, $F\ (1, 37) = 1.77$, *ns*. However, controlling for chronological age, within the PI group, children identified fewer facial expressions correctly as length of stay in the orphanage increased, $F\ (1, 16) = 4.70$, $p = .048$, $\beta = -.358$, $SE = .165$. Children's accuracy increased the longer PI children had lived in their adoptive homes, $F\ (1, 16) = 8.28$, $p = .011$, $\beta = .406$, $SE = .141$.

Sensitivity and response bias. Signal detection statistics were computed as described above. A main effect of Emotion (and related contrasts) reflected that children discriminated happy faces more easily than anger or fear faces, and sad faces more easily than fear faces, omnibus, $F\ (3, 111) = 31.13$, $p < .001$. Overall, comparison children were better at discriminating facial expressions of emotion than PI children, $F\ (1, 37) = 7.11$, $p = .01$. No interactions between group and emotion emerged.

Across groups, children assumed a more liberal response bias for selecting happy and sad faces compared with angry or fearful faces, $F\ (3, 111) = 34.5$, $p < .001$. Although there was not a main effect of Group on response bias, an Group × Emotion interaction revealed that PI children used more liberal criteria for selecting angry faces than comparison children, $t\ (37) = -2.34$, $p = .025$. Sensitivity and response bias scores for the Emotion Identification Task are shown in Figure 2.

Relationship between situation and identification tasks

Because children's scores on the two tasks were highly correlated, it is possible that children performed poorly on the Emotion Situation Task simply because they could not accurately differentiate the response stimuli. To further explore this possibility, we examined children's performance on the Emotion Situation Task with a partial correlation analysis, controlling for scores on the Identification Task. These results indicated that PI children's performance on the Situation Task remained significant even after controlling for their performance on the Identification Task ($r = -.281$, $p = .04$), demonstrating that PI children performed worse on the Emotion Situation Task than comparison children.

Discussion

The present study sought to examine the effects of early emotional deprivation on two aspects of children's emotional development. As a mea-

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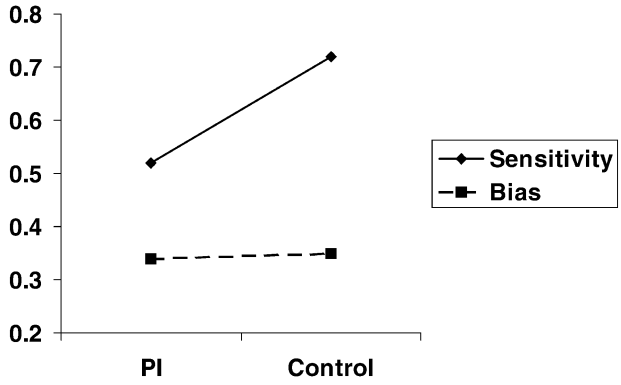


Figure 2. The sensitivity and response bias scores for postinstitutionalized (PI) and control children for the Emotion Identification Task.

sure of atypical early experience, we studied preschool-aged children who spent the early part of their lives in institutional settings where care of infants is highly regimented and impersonal. Because these children were removed from orphanage settings and adopted into relatively enriched family environments, we were able to evaluate the effects of circumscribed periods of neglect on our dependent measures. Such a strategy is not often available in the case of child maltreatment, where young children rarely experience such dramatic and sudden changes in environment. In this article, we focus on two aspects of emotion processing that were selected because they represent skills upon which development of more complex social interactions relies. First, we examined children's ability to accurately infer emotions and match facial expressions to situational cues. Next, we tested children's ability to identify facial expressions of emotion. The present data indicate that children who experienced early institutionalized neglect had considerable difficulty with both of these tasks. Below we review and discuss the implications of these results.

As predicted, PI children had difficulty matching appropriate facial expressions with emotional contexts of happiness, sadness, and fear. An unexpected finding was that PI children performed similarly to their peers in matching angry expressions with anger-evoking situations. One explanation for this pattern of performance is that that arousing emotional experiences lead to more efficient processing and learning of emotions by heightening children's awareness of emotional cues. However, both groups of children performed relatively poorly when recognizing anger—in other words, rather than PI children performing better, it appears that controls performed worse at discriminating anger expressions. Therefore, we conducted a post hoc examination of the mistakes that children in each of the groups made on anger trials. It has been reported that children of this age commonly confuse anger and sadness on similar situational tasks (Denham & Couchoud, 1990; Levine, 1995). In response to vignettes that were intended to elicit anger, comparison children were most likely to choose sadness (30% of the mistakes) when they did not select anger. In contrast, when PI children did not select angry faces, they responded more randomly and did not tend to select sadness (12.5% of the mistakes). To aid interpretation of children's performance, we used signal detection measures to determine that the performance of PI children reflected problems in their sensitivity to correct answers rather than bias in favor of or against particular emotions.

The PI children also had difficulty simply identifying facial expressions of emotion in the absence of contextual cues. PI children displayed more liberal response criterion for anger. This suggests that they required less certainty about whether they were correct to select anger versus other emotions. Because successful performance on the situation task requires children to accurately identify facial expressions

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of emotion, we evaluated their situation-matching ability while statistically adjusting for each child's identification accuracy. The outcome of this analysis suggested that PI children's difficulties understanding the causal relationship between situations and emotional outcomes were not wholly secondary to their difficulties recognizing emotional expressions. A possibility not addressed in the present study is that early experience influences children's emotional responses to stimulus items. Future research might investigate the relationship between difficulties in emotion recognition and potential differences in the emotional experiences of PI children.

Throughout this article, we have avoided using terms such as delay or deficit when referring to differences between our PI and comparison samples. This is because such terms carry distinct developmental implications for which we currently lack the necessary empirical data to draw firm conclusions (e.g., is development slow, delayed, arrested, incomplete, different). However, it is noteworthy that despite their poor overall performance on these tasks, PI children did show the developmental trajectory observed in typically developing samples of children on the identification task, with happiness leading to the most correct responses, followed by sadness, anger, and finally fear. Thus, there is a suggestion that PI children are lagging behind their peers, rather than demonstrating fundamental differences in the processes they use to identify facial expressions of emotion.

As expected, the degree of children's impairment on the two emotion processing tasks administered was related to the amount of neglect experienced by the child, as operationalized as the amount of time since birth the child was institutionalized. Such a finding implicates a role of postnatal experience on the behaviors measured in this study. However, a competing hypothesis is that children with higher levels of physical, cognitive, or emotional impairments may spend more time in orphanages awaiting adoption. An important new finding here is that time in adoptive home was related to increased performance on both tasks. Such data offers a suggestion that positive developmental effects may be observed in children following adoption into responsive family environments. Of note, the amount of time children spent in institutions is correlated with time in the adoptive home because these children moved directly from orphanage to family environments. Therefore, a challenge for future research will be to determine the relative influence of each of these variables.

There are several limitations to consider when interpreting these data. First, the children studied were exposed to a variety of antenatal risk factors including malnutrition, possible fetal alcohol exposure, and exposure to a variety of disease pathogens. The nature of their early life circumstances makes it impossible to accurately measure these factors; therefore, causal arguments linking emotional or psychological factors to developmental outcomes are not appropriate. Yet, associations between the amount of time children spent in orphanages and their task performance is consistent with the possibility that children's postnatal experiences are implicated in their current emotional functioning. Another research strategy that may help disentangle confounds such as fetal alcohol exposure would be to study children adopted from different countries. The present sample is composed exclusively of children adopted from Russia and Romania, regions where the relative risk of fetal alcohol exposure is quite high. Comparing these children with other groups of adoptees drawn from geographic regions in which the likelihood of fetal alcohol exposure is relatively lower (e.g., China, India) may provide insight into this problem. A second, related, issue is that these children have experienced dramatic changes in their linguistic and cultural environments as well as in their family contexts. These factors make it difficult to demonstrate with certainty that the lack of emotional input is responsible for the deficits in emotion understanding found in this study. For example, although PI children were screened for second language acquisition abilities, the study does not address how language abilities may influence children's developing understanding of emotion. Future research comparing PI children directly to other groups of children including domestically neglected and domestically adopted children may help to dis-

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entangle the individual effects of these other risk factors.

In addition to the difficulties inherent in this type of research, the present study is bolstered by a number of methodological strengths. For example, we were careful to present children with vignettes that did not include any emotion labels, thereby making the inferences slightly more difficult for young children and avoiding ceiling effects[1]. The use of a computer automated procedure standardized the presentation of auditory and visual stimuli across children. The touchscreen response system was engaging for young participants and helped children to focus attention on the task while also attenuating potential demand characteristics (there was little necessary interaction with the experimenter during the task). One potential concern about testing preschool-aged children is the possibility of measuring behavior when children cannot show peak performance — for example, when they are tired or less attentive. By collecting data on multiple testing sessions, we hoped to minimize this possibility. Finally, to minimize stimulus-specific effects, we used a variety of different facial expressions, posed by male, female, adult, and child models. Children's task performance was not influenced by the stimulus model used, supporting generalizability of these findings.

Although such comparisons are not always straightforward, nonhuman animal studies of deprivation can guide future research into neurodevelopmental processes in PI children. The original impetus for isolate rearing in rhesus monkeys was to study learning unfettered by differences in mother–infant interaction (Harlow, Harlow, & Suomi, 1971). However, these socially deprived animals proved difficult to test in the laboratory because of their heightened emotional reactivity, leading researchers to redirect their studies to emotional processes and behavioral regulation (Harlow et al., 1971). Similarly, isolate-reared monkeys were found to be impaired at both sending and receiving emotional cues to conspecifics (Miller, Caul, & Mirsky, 1967). Rodent studies first implicated the hypothalamic–pituitary–adrenocortical (HPA) axis and its limbic–cortical regulatory pathways in these effects (Liu, Diorio, Day, Francis, & Meaney, 2000). In monkeys, early social deprivation also affects the development of the parietal and prefrontal cortices, as well as the limbic–cortical pathways involved in regulating stress responses (Sanchez, Ladd, & Plotsky, 2001; Siegel, Ginsberg, Hof, Foote, Young, & Draemer, 1993). Complementary human evidence is sparse. Chugani, Behen, Muzik, Juhasz, Nagy, & Chugani (2001) reported that PI children from Romania showed decreased glucose metabolic rates in distributed regions including the orbital frontal gyrus, infralimbic prefrontal cortex, medial temporal structures, lateral temporal cortex, and brain stem. However, the children studied were not randomly selected, but were volunteered by parents who were particularly concerned about their children's behavior. Still, certain clues remain. First, many of the emotional control problems noted for PI children implicate prefrontal circuitry. Second, both the HPA and sympathetic–adrenomedullary systems in humans undergo reorganization during postnatal life that appears to be tied to the stability of the child's social relationships (Gunnar, 2000). Third, right frontal EEG activation, a neural correlate of social withdrawal and avoidance, and event-related potential activation to emotion, a correlate of attention, has been associated with early social experiences (Davidson, 1994; Pollak, Klorman, Thatcher, & Cicchetti, 2001). Taken together, these data suggest that future research will need to focus on the neural substrates of children's emotional behavior to better understand the effects of experience on developmental organization.

The results of this study are consistent with the view that early social experience plays a significant role in the development of basic affective processes. In particular, the contingencies that children experience in the course of social interactions appear to support learn-

1. Children in this study performed slightly worse than both maltreated and comparison samples of similarly aged children reported in previous studies (e.g., Camras & Allison, 1985; Pollak et al., 2000). This is probably because the present task was made more difficult by providing more response options than previous studies.

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ing through connections between cues, situations, and emotional experiences. Among the many deficiencies of institutionalized care of children is the absence of sufficient emotional learning experiences. Such a conclusion is consistent with studies of normative emotional development. For example, maternal positive responsiveness to children's affective displays is positively correlated with children's emotion understanding (Denham et al., 1994). The skills evaluated in the present study, the ability to recognize emotional signals and match emotion outcomes to contextual cues, appear requisite for competent social interactions (Cassidy, Parke, Butkovsky, & Braungart, 1992; Denham, 1986; Denham, McKinley, Couchoud, & Holt, 1990; Garner, Carlson Jones & Miner, 1994) and predict both prosocial behaviors and positive peer relationships (Izard, Fine, Schultz, Mostrow, Ackerman, & Youngstrom, 2001). Not surprisingly, children who are adept at processing emotional stimuli and understanding the causes of emotions are also better at regulating their own emotional arousal (Schultz, Izard, Ackerman, & Youngstrom, 2001). It appears that emotional neglect may leave children with impoverished emotional learning opportunities and experiences, making it difficult for them to confront increasingly challenging and complex social interactions. Clearly, more research is required to better understand the affective mechanisms affected by early experience and to generate effective interventions to support and promote the most optimal development possible for children who began their lives with such unfortunate adversity.

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Appendix

Happy

Adult

1. It was dinner time at this little girl's house. Her mom was in a hurry trying to finish cooking dinner, so the little girl helped her mom by setting the dinner table.
2. This little boy and his dad just returned from the food store. There were too many bags of food to carry, so the boy helped his dad carry the bags into the house.
3. This little boy worked hard on a picture and showed it to his mom. His mom thought the picture was very nice and told the little boy that he did a good job.
4. This little girl and her dad went together to their favorite movie.

Child

1. This little girl really likes dogs. On her birthday her dad gave her a cute little puppy.
2. This little boy worked hard on a picture and showed it to his mom. His mom thought the picture was very nice and told the little boy that he did a good job.
3. This little girl was in a race. Her mom was cheering for her at the finish line when the little girl won the big race.
4. This little boy and his mom went together to their favorite movie.

Sad

Adult

1. This little girl and her mom planned a trip to their favorite park on Saturday. But when Saturday came it was raining so they couldn't go to the park.

2. This little girl and her dad have a pet hamster named Whiskers. They found out that Whiskers is sick and going to die.

3. This little boy and his mom have to say goodbye to each other. The mom is going away on a trip for work and will not be back for a long time.

4. This little boy was playing a game outside with his dad. The little boy was running fast on the sidewalk when he fell down and hurt his knee.

Child

1. This little girl's best friend, who she really likes to play with, moved away. Now the little girl can't play with her friend anymore.
2. This little girl and her mother planned a trip to their favorite park on Saturday. But when Saturday came it was raining so they couldn't go to the park.
3. This little boy had a pet bird. When he got home from school he saw that the bird was not in its cage. The boy thought that his bird might be gone forever.
4. This little boy was playing a game outside with his dad. The little boy was running fast on the sidewalk when he fell down and hurt his knee.

Anger

Adult

1. This little boy's dad saw him drawing all over a wall in the house with a Magic Marker.
2. This little girl's mom found out that her little girl took a toy away from her brother.
3. This little boy and his mom were eating dinner together. The little boy started throwing his food on the floor on purpose.
4. This little girl and her dad were working hard to build a house made out of blocks. Then the little girl's sister came over and kicked the blocks over on purpose.

Child

1. This little girl gave her dad a picture that she had painted for him. She told her brother not to

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touch it, but her brother scribbled all over the picture and ruined it.
2. This little boy and his mom were working hard to build a house made out of blocks. Then the little boy's sister came over and kicked the blocks over on purpose.
3. This little girl wants to tell her mom something important, but her mom keeps talking on the phone.
4. This little boy's big sister broke his favorite toy on purpose.

Fear

Adult

1. This little boy and his dad were walking through a forest a night. They heard a strange noise coming from the bushes and thought it might be a grizzly bear.
2. This little boy and his mom saw a shadow outside their house. It was dark out and they thought it was a hand of a person about to come in through their window.
3. This little girl and her mom were taking a walk together when a big, mean dog started to chase them.
4. This dad had a bad dream about a monster that tried to eat him.

Child

1. This little girl and her sister were in their room at night all by themselves. It was dark, and they heard a strange noise coming from their closet.
2. This little girl and her mother were taking a walk together when a big, mean dog started to chase them
3. This little boy went shopping with his father. There were a lot of people in the store and the boy got lost and couldn't find his dad anywhere.
4. This little boy woke up in the middle of the night because there was a big thunder and lightening storm outside.

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