

Recognizing Emotion in Faces: Developmental Effects of Child Abuse and Neglect

Seth D. Pollak
University of Wisconsin—Madison

Dante Cicchetti, Katherine Hornung, and Alex Reed
University of Rochester

The contributions to the recognition of emotional signals of (a) experience and learning versus (b) internal predispositions are difficult to investigate because children are virtually always exposed to complex emotional experiences from birth. The recognition of emotion among physically abused and physically neglected preschoolers was assessed in order to examine the effects of atypical experience on emotional development. In Experiment 1, children matched a facial expression to an emotional situation. Neglected children had more difficulty discriminating emotional expressions than did control or physically abused children. Physically abused children displayed a response bias for angry facial expressions. In Experiment 2, children rated the similarity of facial expressions. Control children viewed discrete emotions as dissimilar, neglected children saw fewer distinctions between emotions, and physically abused children showed the most variance across emotions. These results suggest that to the extent that children's experience with the world varies, so too will their interpretation and understanding of emotional signals.

Beginning with Darwin (1872/1965), opposing hypotheses have been proposed regarding the initial state of the complex systems that children use to recognize what others are feeling. The nativist position is supported by evidence such as the production of facial expressions very early in postnatal life (Caron, Caron, & Meyers, 1982; Haviland & Lelwica, 1987; Oster, 1978; Oster & Ekman, 1977) and cross-cultural similarities in emotion recognition (Ekman, Sorenson, & Friesen, 1969; Izard, 1971).¹ The contrasting empiricist argument, that recognition of emotion is learned through experience, is based on the gradual refinement with age of children's production and recognition of emotional signals (Fogel et al., 1992; Klinnert, Emde, Butterfield, & Campos, 1986). Parsing the relative contributions of experience and learning versus inter-

nal predispositions for emotion recognition remains complicated, however, because children are virtually always exposed to rich, complex, and perhaps even cross-culturally similar emotional experiences from birth. The research described in this article focused on the influences of learning in the ontogenesis of emotional processing by employing "natural experiments" involving children who had atypical emotional experiences.

In this research, we investigated how children who experienced two different types of aberrant parenting—physical abuse (acts of commission) and physical neglect (acts of omission)—recognized facial displays of emotion. The primary benefit of studying the ontogenesis of emotion among maltreated children is that the basic emotional environment experienced by most children may be so invariant that environmental influences are masked. For the physically abused child, displays of anger may be the strongest predictor of threat; however, increased sensitivity to anger could result in decreased attention to other emotional cues. The neglected child, in contrast, may suffer from an extremely limited emotional learning environment.

Studies of maltreating families suggest that neglectful and physically abusive parents differ from nonmaltreating parents in both the frequency and content of their emotional interactions with their children. Compared with control parents, maltreating parents show less positive emotion (Bugental, Blue, & Lewis, 1990; Burgess & Conger, 1978; Kavanagh, Youngblade, Reid, & Fagot, 1988) and more negative emotion (Herrenkol, Herrenkol, Egolf, & Wu, 1991; Lyons-Ruth, Connell, Zoll, & Stahl, 1987). Maltreating parents also tend to isolate themselves and their families from others, leaving their children exposed to fewer nonparental models of

Seth D. Pollak, Department of Psychology, University of Wisconsin—Madison; Dante Cicchetti, Katherine Hornung, and Alex Reed, Mount Hope Family Center, University of Rochester.

This research was supported by grants from the National Institutes of Health (MH55365) and from The Spunk Fund, Inc.

We thank Elissa Newport, Colleen Moore, and Rick Jenison for their helpful discussions and insights. Deb Smarsh, Mette Strommes, the teachers at the Mount Hope Family Center Preschool, Neil Herendeen, and the staff of the Pediatric Continuity Clinic at the University of Rochester Medical Center provided valuable assistance in recruiting children for these studies. We also thank the following colleagues for their generous efforts in reviewing the case records used to determine maltreatment subclassifications: Kathleen Holt, Michael Lynch, Jenny Macfie, Jody Todd Manly, Fred Rogosch, Ann Shields, and Sheree Toth. These studies would not have been possible without the participation of many preschool children, for whose collaboration we are extremely grateful.

Correspondence concerning this article should be addressed to Seth D. Pollak, Department of Psychology, 1202 West Johnson Street, University of Wisconsin, Madison, Wisconsin 53706-1696. Electronic mail may be sent to spollak@facstaff.wisc.edu.

¹ For in-depth coverage of this issue, see the debate in *Psychological Bulletin* between J. A. Russell (1994), P. Ekman (1994), and C. Izard (1994).

emotional communication (Salzinger, Feldman, Hammer, & Rosario, 1993). Studies contrasting different types of maltreating families have suggested that physically abusive parents interact with their children more frequently than neglectful parents but are more negative and direct higher rates of verbal and physical aggression toward their young children (Bousha & Twentyman, 1984; Crittenden, 1981). Therefore, not only do physically abused children receive sporadic, high-intensity aggressive outbursts from their parents, but they also experience stable, frequent patterns of aggression. In these same studies it was reported that neglectful parents are less expressive toward, and less engaged with, their children and provide relatively little exchange of affective information (Bousha & Twentyman, 1984; Crittenden, 1981). Although research on maltreatment has not specifically related children's knowledge about emotions to family emotional environment, there is evidence from both laboratory and observational studies that neglected children suffer from impoverished opportunities for interactions with adults and receive less support in learning to decode emotional signals, whereas children in physically abusive environments are also exposed to episodes of heightened hostility and interpersonal threat.

Recognition of emotion is particularly important because it represents the early utilization of social cues on which children's subsequent interpretations and behavioral responses will depend. Maltreated children have myriad problems involving the recognition (Cummings, Hennessy, Rabideau, & Cicchetti, 1994; George & Main, 1979; Hennessy, Rabideau, Cicchetti, & Cummings, 1994; Klimes-Dougan & Kistner, 1990), expression (Gaensbauer, Mrazek, & Harmon, 1981), and understanding of emotions (for a review, see Camras, Sachs-Alter, & Ribordy, 1996). Of particular concern is the association between such difficulties in emotion processes and increased risk for the development of various psychological disorders in these children (Cicchetti & Toth, 1995a).

Typically, preschoolers can accurately identify basic emotions from both facial and contextual cues (Reichenbach & Masters, 1983; Walden & Field, 1982); yet maltreated children are reported to have lower accuracy in recognizing emotions than nonmaltreated children, even after cognitive ability is controlled for (Camras, Grow, & Ribordy, 1983; Camras et al., 1988; During & McMahon, 1991). Other studies have indicated that maltreated children may be more, rather than less, likely to respond to angry or aggressive emotional cues (Dodge, Pettit, Bates, & Valente, 1995; Pollak, Cicchetti, Klorman, & Brumaghim, 1997; Pollak, Klorman, Brumaghim, & Cicchetti, in press; Rieder & Cicchetti, 1989). These findings may not be as contradictory as they appear. For example, despite maltreated children's poor overall performance in recognizing emotions, Camras, Ribordy, Hill, and Martino (1990) noted a marginal trend for them to perform better than control children in detecting masked expressions of emotion and a tendency for maltreated children's errors to reflect a bias toward detection of anger. Thus, it is possible that subtle task demands or subject-related factors may obscure processing differences among maltreated children.

In this article we report two studies that examine the effects of different forms of aberrant experience on the development of emotion recognition. We reasoned that acts of emotional omission, reflected in physical neglect, would result in generalized and global delays in the recognition and understanding of emotional signals. In contrast, children who experienced acts of unusual

emotional commission, such as physical abuse, were expected to display increased accuracy for the detection of threat-related information such as anger despite poor performance in recognizing other emotions.

Experiment 1

This experiment examined children's ability to match a facial display with an emotional context. Individual differences in children's ability to make optimal developmental use of their emotional experiences may be contingent on their environmental input (Camras et al., 1990). Because experiences of threat may heighten children's awareness of angry cues, we predicted that physically abused children would be better at recognizing anger than would physically neglected children. The neglected children's presumed limited experiences with emotion learning were expected to be reflected in low accuracy scores across emotions. Finally, on the basis of reports of inattention and misinterpretation of emotional cues among heterogeneous samples of maltreated children (Dodge et al., 1995), we predicted that the emotion recognition abilities of physically abused children would show deficits relative to those of nonmaltreated children for emotions other than anger.

Method

Participants. Participants were 16 physically neglected, 17 physically abused, and 15 nonmaltreated children, ranging in age from 3 years 3 months to 5 years 6 months. Using Child Protective Service (CPS), clinical, and medical records, seven doctoral-level psychologists with expertise in child maltreatment research classified the children's maltreatment histories using the classification system described by Barnett, Manly, and Cicchetti (1993). These raters had previously achieved reliability on a common set of case records (see Toth, Cicchetti, Macfie, & Emde, 1997); the authors of the present article did not code the records of children participating in this experiment. *Physical abuse* was indicated when there was evidence of a caregiver inflicting physical injury on a child by other than accidental means. *Physical neglect* was coded when it was documented that a caregiver failed to meet the child's minimum physical needs.² Specific hypotheses were not advanced for children who were sexually abused, who witnessed violence, or who experienced emotional abuse in the absence of physical abuse or neglect; therefore, these groups were not included in this study. The maltreated children were participating in a therapeutic preschool program, and the nonmaltreated children were recruited from a university pediatric clinic that serves low-income families. Receipt of services from either program was not contingent upon voluntary participation in this research. Nonmaltreating parents gave permission for us to verify that they were free of CPS preventive or protective service records. Each child was rewarded with a small toy, and parents were reimbursed only for transportation expenses. Because nonmaltreated children were recruited to match

² In the present samples, physical abuse included bruises, abrasions, or welts to the child's body; CPS references to excessive physical punishment; burns or lacerations; disfiguring or life-threatening injuries; and severe injuries requiring hospital treatment. Examples of physical neglect included failure to ensure medical care or follow through on medical recommendations; reports of children being very hungry and missing meals frequently; a child's living environment being condemned as unfit for habitation; and young children being left unsupervised for several hours in potentially life-threatening situations. Maltreatment subtypes were classified hierarchically such that none of the children had documented sexual abuse, neglected children did not have records indicating physical abuse, and physically abused children may also have experienced neglect.

the maltreated samples as closely as possible on background variables, the three groups did not differ with respect to age, $F(2, 47) < 1$, *ns*; Peabody Picture Vocabulary Test—Revised (PPVT-R) standard score, $F(2, 47) < 1$, *ns*; socioeconomic status, $F(2, 47) = 1.15$, *ns*; race, $\chi^2(2, N = 48) < 1$, *ns*; or sex, $\chi^2(2, N = 48) < 1$, *ns*. (See Table 1.)

Procedure and materials. The emotion recognition task was originally developed by Dashiell (1927) and adapted by both Ekman and Friesen (1971) and Ribordy, Camras, Stefani, and Spaccarelli (1988). Children were individually presented with 25 brief vignettes (see Appendix) depicting five stories each in which the protagonist experienced happiness, sadness, disgust, fear, and anger. Because the present sample was younger than that used by Ribordy et al. (1988), we did not include the emotion category of surprise, for which accuracy was less than 75% for typically developing 6–8-year-old children. After hearing each story, the child was shown three 5 × 7 in. black-and-white photographs (Ekman, 1976) of models exhibiting different facial expressions (the correct expression and two distractors) and was asked to point to the face appropriate for the protagonist in the story. The gender of the model was matched to the gender of the child. Both the order in which stories were presented and the placement of target and foil photographs (from right to left) were randomized. Each emotion was presented equally with every other emotion as foils. Each child received accuracy scores for each of the five emotion categories that reflected his or her percentages of correct responses. Following the emotion recognition task, children were administered the PPVT-R (L. M. Dunn & Dunn, 1981).

Results

Children's accuracy scores were submitted to a repeated measures analysis of covariance with maltreatment group (control, neglect, or physical abuse) and child's gender as between-subjects factors and emotion (anger, disgust, fear, happiness, and sadness) as a within-subject factor. Children's receptive vocabulary scores and age were treated as covariates. Probability values for repeated measures are reported with Greenhouse–Geisser corrections.

Nonmaltreated children correctly recognized a higher percentage (66%) of emotions than did neglected (51%) and physically abused (59%) children, $F(2, 47) = 3.80$, $p < .05$. Across samples, children's accuracy did not differ on the basis of emotion, $F(4, 160) = 1.36$, *ns*; gender, $F(1, 40) = 1.28$, *ns*; or age, $F(1,$

40) = 3.17, *ns*. However, children with higher receptive vocabulary scores performed better on the task, $F(1, 40) = 5.47$, $p < .05$. A significant interaction of maltreatment group and emotion, $F(8, 160) = 2.26$, $p < .05$, was followed up by one-way analyses of variance conducted separately for each emotion. These analyses indicated that accuracy scores for the three groups of children differed for anger, $F(2, 47) = 8.27$, $p < .01$, and sadness, $F(2, 47) = 3.45$, $p < .05$; there was also a marginal trend for the groups to differ in the recognition of disgust, $F(2, 47) = 3.07$, $p = .056$ (see Figure 1). Post hoc Scheffé tests revealed that physically abused children did not differ from controls in the recognition of anger, $t(45) = -1.57$, *ns*, whereas neglected children's accuracy for anger was below that of both control children, $t(45) = 2.51$, $p < .05$, and physically abused children, $t(45) = -4.05$, $p < .01$. Physically abused children were less accurate in recognizing sadness than were controls, $t(45) = 2.60$, $p < .05$, whereas the neglect group did not differ from either controls, $t(45) = 1.59$, *ns*, or physically abused children, $t(45) = 1.05$, *ns*. The marginal group effect for disgust reflects the fact that neglected children's scores were significantly lower than those of controls, $t(45) = 2.87$, $p < .01$, but not those of physically abused children, $t(45) = -1.52$, *ns*.

Signal detection statistics were used to further examine the nature of children's emotion recognition performance. Each child's performance was represented as follows: Hit rate (HR) was the probability of selecting the facial expression that matched the context of the vignette; false alarm rate (FAR) was the probability of selecting a facial expression that did not match the emotion vignette; a correct rejection was the probability of not selecting an incorrect face; and a miss was the probability of not selecting the correct facial expression. In this three-alternative forced-choice design, the probabilities of hits plus misses sum to 1.0, and the false alarm and correct rejection rates also sum to 1.0. Therefore, the HR sufficiently describes children's responses to correct items, and the FAR sufficiently describes children's responses to incorrect items. Taken together, the HR and the FAR completely summarize the performance of a single subject in a single emotion condition.

HRs and FARs were combined into two statistics that describe children's (a) sensitivity to differences between emotion expressions and (b) response biases or willingness to define an ambiguous stimulus as a target. Typically, signal detection measures such as d' and β (or the nonparametric approximations, A' and B'') are used to measure sensitivity and bias, respectively. However, when subjects' recognition accuracy is low, these statistics have been shown to lack independence, and threshold models have been suggested as more appropriate measures (Snodgrass & Corwin, 1988).³ The threshold model assumes that false alarms occur when the subject is uncertain. Hits represent both the proportion of

Table 1
Experiment 1: Demographic Data for Each Group

Characteristic	Group			
	Physical abuse (<i>n</i> = 16)	Neglect (<i>n</i> = 17)	Control (<i>n</i> = 15)	Marginal (<i>n</i> = 48)
Age (in months)				
<i>M</i>	52.0	53.7	51.9	52.7
<i>SD</i>	6.3	8.1	6.5	6.9
PPVT-R (standard score)				
<i>M</i>	88.7	87.2	90.4	88.7
<i>SD</i>	17.9	16.6	24.2	19.3
SES (Hollingshead Index)				
<i>M</i>	21.3	18.8	24.3	21.4
<i>SD</i>	6.8	8.6	14.1	10.2
Race (% Caucasian)	44	53	60	52
Sex (% female)	31	42	47	40

Note. PPVT-R = Peabody Picture Vocabulary Test—Revised; SES = socioeconomic status.

³ In contrast to high-threshold models, both the standard signal detection and nonparametric functions asymptotically reach the hit and false alarm axes quickly. Thus, P_r (the discrimination index) and B_r (the bias index) allow observation of bias differences among participants even when they are responding at close to chance levels (as was the case with our physically neglected participants), whereas other measures are less effective as overall accuracy decreases. Although nonparametric models do not require assumptions about the form of HR and FAR distributions, the dependence of bias on discrimination in these models violates the goal of independent assessment of these responses.

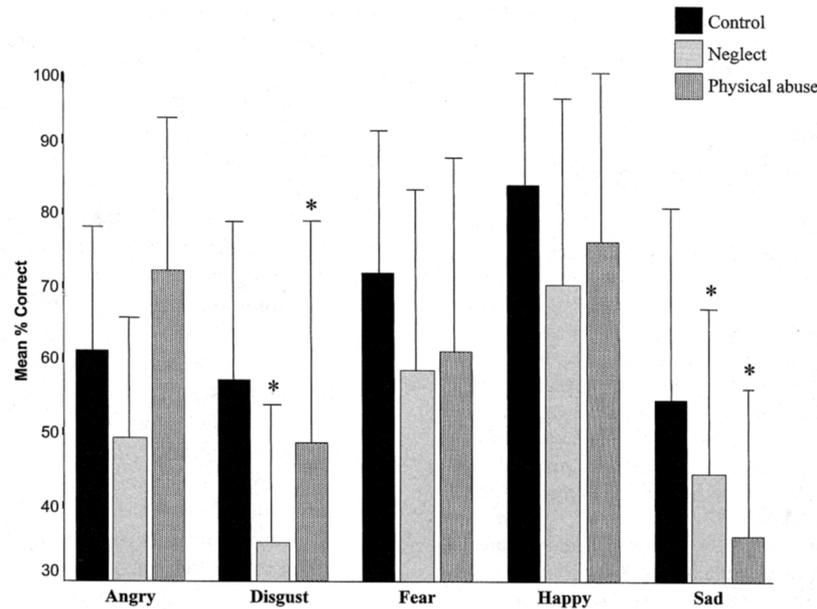


Figure 1. Recognition scores by emotion and maltreatment group. *Not statistically different from chance (33%), $p > .05$.

correct identifications when the subject is certain plus any “lucky” correct guesses during states of uncertainty. The discrimination index, P_r (the probability that an item will cross a recognition threshold), is thus

$$P_r = HR - FAR. \quad (1)$$

P_r is similar to the more commonly used index, d' , which is calculated using the z -score transformations of these same values: $d' = z(HR) - z(FAR)$. The bias index (B_r) reflects how much evidence or certainty the child requires to select an emotional expression. False alarms occur when the child fails to correctly match a target face with the emotion conveyed in the vignette (which occurs with a probability $1 - P_r$). Thus B_r is expressed as

$$B_r = FAR/[1 - (HR - FAR)]. \quad (2)$$

Higher values of B_r indicate a liberal or lax response criterion, and lower values indicate a conservative or strict criterion for selecting an emotion expression.

Separate repeated measures analyses of variance were computed with emotion (anger, disgust, fear, happiness, sadness) as a within-subject variable, maltreatment status (control, neglect or physical abuse) as a between-subjects variable, and either sensitivity (P_r) or response bias (B_r) measures as dependent variables. For sensitivity, a main effect of emotion, $F(4, 180) = 23.23, p < .01$, indicated that children discriminated the happy face most easily. A main effect of maltreatment status, $F(2, 45) = 3.84, p < .05$, revealed that neglected children discriminated emotions more poorly than did the other two groups (neglect, $P_r = .29$; physical abuse, $P_r = .42$; control, $P_r = .52$). These results are presented in Figure 2. The interaction of emotion and maltreatment status for sensitivity was not significant.

Neither the main effect of emotion, $F(4, 180) = 2.28, p < .07$, nor the main effect of maltreatment status, $F(2, 45) < 1, ns$, on

children's response bias was significant. However, the interaction of maltreatment status and emotion was significant, $F(8, 180) = 2.60, p < .01$. This was a result of physically abused children using more liberal criteria for selecting angry faces than either the control, $t(45) = -4.32, p < .01$, or neglected, $t(45) = -3.80, p < .01$, children. In contrast, neglected children used more liberal criteria to select sad faces than did either the control, $t(45) = -2.03, p < .05$, or physically abused, $t(45) = 4.06, p < .05$, children (see Figure 3).

In summary, neglected children had more difficulty discriminating between emotional expressions than did control or physically abused children. Neglected children also evidenced a response bias, with a lower standard for selecting sad faces than that of the other children. Physically abused children were as sensitive to differences between facial expressions as were control children; however, they set a lower standard for selecting angry faces than did their peers.

Experiment 2

Performance on the emotion recognition task used in Experiment 1 may reflect either children's visual discrimination of facial expressions or their conceptual understanding of the emotions represented by each facial expression. In Experiment 2 we investigated both of these possibilities. Both groups of maltreated children were expected to indicate less differentiation of negative emotional displays than were nonmaltreated children—with the exception that physically abused children were expected to differentiate anger from other negative displays to a greater extent than were neglected children. Thus, differences in similarity ratings were used to draw inferences about children's understanding of emotion expressions.

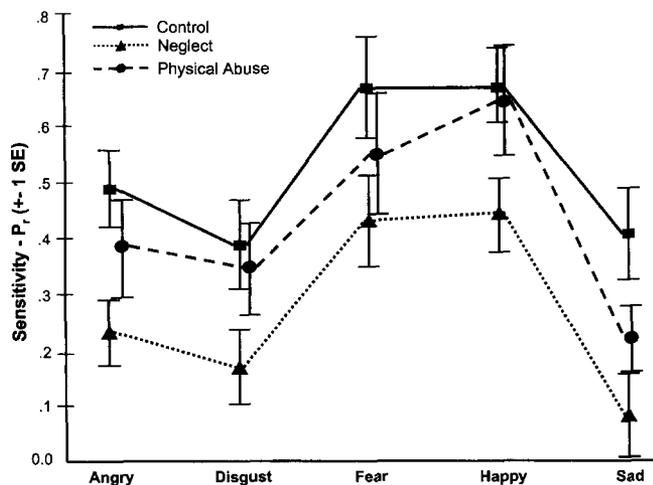


Figure 2. Mean sensitivity (P_i) and standard errors for control ($n = 15$), neglected ($n = 17$), and physically abused ($n = 16$) children in response to differing stimulus conditions.

Method

Participants. Participants were 15 physically neglected, 13 physically abused, and 11 nonmaltreated children, ranging in age from 3 years 5 months to 5 years 8 months. Procedures for recruitment and classification of children were identical to those described in Experiment 1. As shown in Table 2, the samples did not differ with respect to age, $F(2, 38) = 1.93, ns$; PPVT-R scores, $F(2, 38) < 1, ns$, socioeconomic status, $F(2, 38) = 2.80, ns$; race, $\chi^2(2, N = 39) = 4.8, ns$; or gender, $\chi^2(2, N = 39) = 1.43, ns$.

Procedure and materials. Stimuli were 42 black-and-white 8×10 in. glossy photographs of facial expressions representing anger, happiness, sadness, fear, disgust, and neutrality (Ekman, 1976).

Emotion discrimination task. This paradigm was adapted from Borod et al. (1990) to evaluate perceptual discrimination of emotions. Each child was tested individually and was shown two photographs of different

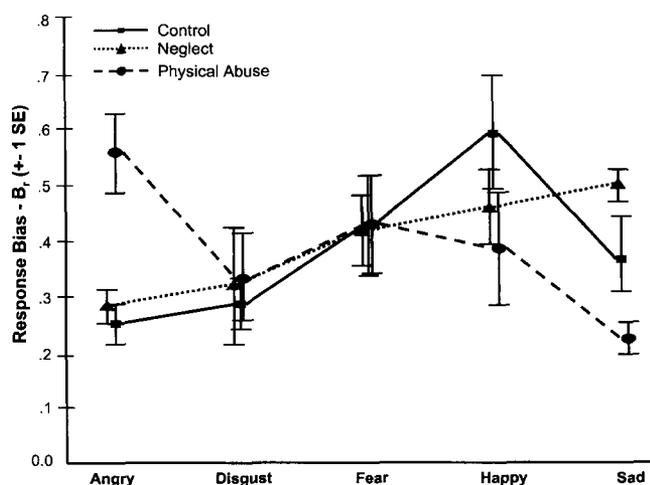


Figure 3. Mean response bias (B_i) and standard errors for control ($n = 15$), neglected ($n = 17$), and physically abused ($n = 16$) children in response to differing stimulus conditions. Higher values on this index denote a more liberal or lax response bias, and lower values indicate a more conservative or strict bias.

Table 2
Experiment 2: Demographic Data for Each Group

Characteristic	Group			Marginal ($n = 39$)
	Physical abuse ($n = 13$)	Neglect ($n = 15$)	Control ($n = 11$)	
Age (in months)				
<i>M</i>	56.6	60.6	54.1	56.7
<i>SD</i>	4.0	5.9	7.1	5.8
PPVT-R (standard score)				
<i>M</i>	82.0	75.8	81.8	79.6
<i>SD</i>	15.6	13.5	16.4	14.9
SES (Hollingshead Index)				
<i>M</i>	22.4	15.9	24.6	20.5
<i>SD</i>	8.1	5.9	14.8	10.3
Race (% Caucasian)	53.8	26.7	63.6	46.2
Sex (% female)	21.4	42.9	35.7	35.9

Note. PPVT-R = Peabody Picture Vocabulary Test—Revised; SES = socioeconomic status.

models posing emotional expressions. The child indicated whether the two models were expressing the same or different feelings. Each of the six emotions was paired twice with every other emotion, resulting in 42 trial pairs. Children's responses (1 = correct, 0 = incorrect) were summed and averaged for each pairing.

Emotion differentiation task. Children were shown the same photographs used in the emotion discrimination task and were asked to indicate how similar or different they perceived the two facial expressions in the pair to be. Similarity ratings were assessed with the use of a 36-in. long wooden board that contained a single row of six shelves. For each trial, the experimenter placed one photograph at the left end of the board and then asked the child to place the other photograph on one of the five remaining shelves. For each trial, the child received either a score of 0 (the two faces were the same) or a score ranging from 1 (adjacent to the target face) to 5 (furthest from the target face). To help children understand the continuous nature of this rating "scale," we used practice trials with colored cards that allowed the experimenter to demonstrate that similar colors were placed next to each other and different colors were placed farther apart. Children demonstrated understanding of the task by rating sets of white, grey, and black cards and white, pink, and red cards. All children completed at least the second practice trial correctly.

Results

Discrimination accuracy. A repeated measures analysis of covariance on children's perceptual discrimination of facial expressions was conducted with maltreatment group (control, neglect, or physical abuse) and child's gender as between-subjects factors and emotion (anger, disgust, fear, happiness, sadness, or neutrality) as a within-subject factor. Age and PPVT-R scores were treated as covariates. Children's ability to discriminate facial expressions did not differ on the basis of emotion, $F(5, 155) = 1.19, ns$; maltreatment group, $F(2, 31) < 1, ns$; age, $F(1, 31) < 1, ns$; or receptive vocabulary, $F(1, 31) = 3.11, ns$.

Emotion similarity ratings. Children's ratings of the similarity between emotional expressions were examined through a repeated measures analysis of covariance with maltreatment group (control, neglect, or physical abuse) and child's gender as between-subjects factors and emotion pair (angry–disgusted, angry–fearful, angry–happy, angry–neutral, angry–sad, fearful–disgusted, happy–

disgusted, happy–fearful, happy–neutral, happy–sad, neutral–disgusted, neutral–fearful, sad–disgusted, sad–fearful, and sad–neutral) as a within-subjects factor. Age and PPVT–R scores were treated as covariates, and Greenhouse–Geisser corrections for repeated measures are reported.

Children's similarity ratings were not related to age, $F(1, 31) < 1$, *ns*, or gender, $F(1, 31) < 1$, *ns*, although children with higher receptive vocabulary scores rated emotion exemplars as more dissimilar, $F(1, 31) = 7.16$, $p < .05$. Nonmaltreated children ($M = 3.7$, $SD = .26$) rated exemplars as more dissimilar than neglected ($M = 2.5$, $SD = .22$) or physically abused ($M = 2.5$, $SD = .27$) children, $F(2, 31) = 6.37$, $p < .01$. To qualify the significant Emotion \times Maltreatment group interaction, $F(28, 434) = 2.22$, $p < .001$, we conducted separate one-way analyses of variance on each emotion pairing. These analyses resulted in three patterns of results, as shown in Figure 4 and Table 3. One pattern of ratings indicated that both groups of maltreated children perceived less dissimilarity between expressions than did nonmaltreated children: angry–neutral, $F(2, 38) = 3.93$, $p < .05$; sad–neutral, $F(2, 38) = 4.66$, $p < .05$; fearful–sad, $F(2, 38) = 7.35$, $p < .01$. A second set of findings suggested that only neglected, but not physically abused, children differed from nonmaltreated controls: angry–disgusted, $F(2, 38) = 4.37$, $p < .05$; angry–fearful, $F(2, 38) = 21.47$, $p < .001$; angry–sad, $F(2, 38) = 5.21$, $p < .01$; happy–sad, $F(2, 38) = 8.21$, $p < .01$. Children in all three groups had equivalent similarity ratings for the remaining pairs (all $ps > .2$).

To summarize, neglected children perceived less distinction between angry, sad, and fearful expressions than did control children; physically abused children and control children perceived more distinction between anger and other negative emotional expressions than did neglected children.

General Discussion

The present data demonstrate that the nature of children's emotional learning environments results in nonrandom effects on the development of their emotion recognition abilities. In Experiment 1, we compared nonmaltreated, physically neglected, and physically abused preschool-age children's ability to recognize emotions through contextual cues. Physically neglected children accurately recognized emotions less frequently than did nonmaltreated or physically abused children, even after we statistically controlled for receptive language. More specifically, neglected children had more difficulty discriminating differences between emotional expressions. Although physically abused children had difficulty recognizing emotions such as sadness and disgust, their accuracy in recognizing anger did not differ from that of nonmaltreated children. Signal detection analyses revealed that physically abused children used a more liberal bias for selecting angry faces, whereas neglected children used more liberal biases in selecting sad faces; no selection bias emerged for the nonmaltreated children. The findings from Experiment 2 indicate that maltreated children's lower recognition accuracy is not secondary to problems at the visuo-perceptual level, such as an impairment in their ability to detect physical differences between facial expressions. Rather, maltreatment seems to affect children's understanding of particular emotional displays.

Our expectation that most children would rate happiness as dissimilar to the negative emotions was confirmed for all three groups with a notable exception: Neglected children saw greater similarity between happy and sad expressions than did the other groups. This finding is especially surprising because recognition of happiness usually emerges developmentally early (Sroufe, 1979), suggesting that even relatively simple aspects of emotional recog-

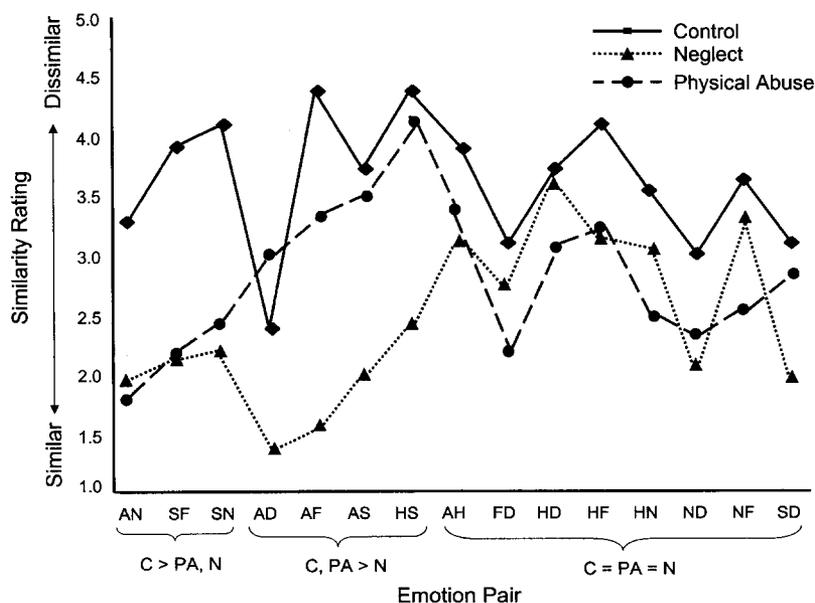


Figure 4. Mean similarity ratings by emotion pair for control (C; solid line), neglected (N; dotted line) and physically abused (PA; dashed line) children. A = angry, N = neutral, S = sad, F = fearful, D = disgusted, H = happy.

Table 3
*Matrices of Mean Similarity Ratings for Six Emotional Expressions,
 Separately by Maltreatment Group*

Emotional expression	Angry	Disgusted	Fearful	Sad	Happy	Neutral
Control						
Angry	1.6					
Disgusted	2.4	1.4				
Fearful	4.4 _a	3.1	1.2			
Sad	3.7 _b	3.1	3.9 _{e,f}	1.3		
Happy	3.9	3.7	4.1	4.4 _g	1.1	
Neutral	3.3 _{c,d}	3.0	3.6	4.1 _{h,i}	3.6	1.3
Neglect						
Angry	0.9					
Disgusted	1.3 _j	1.0				
Fearful	1.5 _{a,k}	2.7	0.5			
Sad	2.0 _{b,l}	1.9	2.1 _e	0.6		
Happy	3.1	3.7	3.1	2.4 _{g,m}	0.4	
Neutral	1.9 _c	2.1	3.3	2.2	3.1	0.6
Physical abuse						
Angry	1.5					
Disgusted	3.0 _j	1.5				
Fearful	3.3 _k	2.2	0.8			
Sad	3.5 _l	2.9	2.2 _f	0.9		
Happy	3.4	3.1	3.2	4.2 _m	0.5	
Neutral	1.8 _d	2.3	2.5	2.4 _n	2.5	0.7

Note. Scores that share subscripts are significantly different according to post hoc Scheffé tests ($df = 36, p < .05$, two-tailed). Note that the diagonals of the table correspond to pairs that are truly the same, so diagonal entries are expected to be small; off-diagonal entries correspond to pairs that are different and should be larger. In fact, this pattern holds only for control children.

dition are compromised through neglectful parenting. Physically abusive environments appear to compromise children's ability to recognize and differentiate some emotions while concurrently heightening their awareness of other emotions. For example, physically abused children were as able as nonmaltreated preschoolers to perceive dissimilarities between anger and other negative expressions. In comparison, neglected children perceived fewer distinctions between anger and other negative expressions than did either nonmaltreated or physically abused children. Another compelling finding was that, unlike nonmaltreated children, both physically abused and physically neglected children rated expressions of both anger and sadness as very similar to an exemplar of an emotionally neutral face. Although these data do not address interpretations made by the children, one possibility is that maltreated children may have attributed anger or sadness to the model posing the neutral face. A related possibility is that maltreated children may interpret happy or neutral faces as masks for more malevolent emotions.⁴

Neglected children's difficulties discriminating among basic emotional expressions and physically abused children's response bias for angry facial cues may make it difficult for these children to effectively recognize and respond appropriately to the social signals conveyed by others. According to this view, differences in the recognition, understanding, and discrimination of facial expressions between maltreated youngsters and their age- and cognitively matched nonmaltreated peers provide promising in-

sight into why maltreated children tend to develop many social and emotional problems (cf. Dodge et al., 1995; Rogosch, Cicchetti, & Aber, 1995).

The results presented in this article are consistent with previous reports indicating emotion recognition difficulties among maltreated children. New data involve distinctions between abused and neglected children's processing of emotional information. Why might physically abused and physically neglected children differ both from nonmaltreated children and from each other? From a developmental perspective, the two maltreated groups may have some similar emotional experiences—but these two groups of children may also have experienced quite different emotional environments. Dunn and her colleagues (J. Dunn, Brown, & Beardsall, 1988; J. Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991) proposed that emotional experience heightens children's awareness of emotional cues, allowing more efficient processing of this information. However, there does not appear to be a linear relationship between experience and competence. Although little emotional information is learned by children if their parents' expressiveness is quite limited, children whose parents display high levels of anger also show poor understanding of emotions (Denham, Zoller, & Couchoud, 1994). These data sug-

⁴ We thank Paul Ekman for suggesting this "perceived masking" hypothesis.

gest a U-shaped function in which exposure to appropriate emotional expressiveness fosters good learning of emotion in children but in which increasing exposure to nonpathological anger and hostility or impoverished communication both lead to suboptimal learning of emotions. Denham et al. (1994) reported that the distress evoked in children by high levels of hostility undermines their ability to learn about emotions. However, the present data suggest that extreme or pathological hostility directed toward children may produce effects not seen in normative samples, such as relative hypervigilance to anger or threat-related cues.

The present data are consistent with the idea that such variance in emotional experience affects children's recognition and understanding of affective cues. One possible experience-dependent mechanism for these developmental effects is that infants' biological preparedness for emotion includes a general perceptual mechanism that becomes tuned to combinations of signals, which, through experience, combine to form affective categories. In this view, rather than possessing knowledge about specific emotions, the developing child possesses the ability to parse sensory inputs into meaningful units and to track the regularity, predictiveness, and temporal synchrony of this information in a manner similar to that exhibited with other cognitive abilities such as cross-modal matching, phonetic discrimination, and word segmentation (Kuhl, 1987; Kuhl & Meltzoff, 1982; Saffran, Aslin, & Newport, 1996).

Although it appears that neglected children are exposed to fewer emotional learning opportunities and that physically abused children receive more hostile emotional cues, more research is required if we are to form a clear picture of the mechanisms linking children's emotional environments with learning mechanisms for emotions. For example, the emotional signals the maltreated child receives may be disproportionately complicated, inconsistent, poorly conveyed, and possibly distressing, limited, or excessive. A solution to the learning problem created by aberrant emotional signals from parents may be general constraints imposed on children in the form of immature or limited resources, which require young children to filter or select some environmental cues over others (Bjorklund, 1997). This developmentally normal aspect of selective attention suggests that irrespective of the initial state of the organism, emotional development is contingent on the nature of the input or experiences made available to the child. These possibilities should be explored in future research, in which data on other populations of children who receive excessive or unusually limited emotional input (such as the offspring of parents with unipolar or bipolar depression, see Cicchetti & Toth, 1995b) can be used to illuminate the role of experience-dependent processes, such as experience and learning, in the ontogenesis of emotion.

References

- Barnett, D., Manly, J. T., & Cicchetti, D. (1993). Defining child maltreatment: The interface between policy and research. In D. Cicchetti & S. L. Toth (Eds.), *Child abuse, child development, and social policy* (pp. 7-73). Norwood, NJ: Ablex.
- Bjorklund, D. F. (1997). The role of immaturity in human development. *Psychological Bulletin*, *122*, 153-169.
- Borod, J. C., Welkowitz, J., Alpert, M., Brozgold, A. Z., Martin, C., Peselow, E., & Diller, L. (1990). Parameters of emotional processing in neuropsychiatric disorders: Conceptual issues and a battery of tests. *Journal of Communication Disorders*, *23*, 247-271.
- Bousha, D., & Twentyman, C. (1984). Mother-child interactional style in abuse, neglect, and control groups: Naturalistic observations in the home. *Journal of Abnormal Psychology*, *93*, 106-114.
- Bugental, D. B., Blue, J., & Lewis, J. (1990). Caregiver beliefs and dysphoric affect directed to difficult children. *Developmental Psychology*, *26*, 631-638.
- Burgess, R., & Conger, R. (1978). Family interaction in abusive, neglectful and normal families. *Child Development*, *49*, 1163-1173.
- Camras, L. A., Grow, G., & Ribordy, S. (1983). Recognition of emotional expressions by abused children. *Journal of Clinical Child Psychology*, *12*, 325-328.
- Camras, L., Ribordy, S., Hill, J., & Martino, S. (1990). Maternal facial behavior and the recognition and production of emotional expression by maltreated and nonmaltreated children. *Developmental Psychology*, *26*, 304-312.
- Camras, L., Ribordy, S., Hill, J., Martino, S., Spacarelli, S., & Stefani, R. (1988). Recognition and posing of emotional expressions by abused children and their mothers. *Developmental Psychology*, *24*, 776-781.
- Camras, L., Sachs-Alter, E., & Ribordy, S. (1996). Emotion understanding in maltreated children: Recognition of facial expressions and integration with other emotion cues. In M. Lewis & M. Sullivan (Eds.), *Emotional development in atypical children* (pp. 203-225). Hillsdale, NJ: Erlbaum.
- Caron, R., Caron, A., & Meyers, R. (1982). Abstraction of invariant facial expressions in infancy. *Child Development*, *53*, 1008-1015.
- Cicchetti, D., & Toth, S. L. (1995a). A developmental psychopathology perspective on child abuse and neglect. *Journal of the American Academy of Child and Adolescent Psychiatry*, *34*, 541-565.
- Cicchetti, D., & Toth, S. L. (1995b). Developmental psychopathology and disorders of affect. In D. Cicchetti & D. Cohen (Eds.), *Developmental psychopathology: Vol. 2. Risk, disorder, and adaptation* (pp. 369-420). New York: Wiley.
- Crittenden, P. (1981). Abusing, neglecting, problematic, and adequate dyads: Differentiating by patterns of interaction. *Merrill-Palmer Quarterly*, *27*, 201-218.
- Cummings, E. M., Hennessy, K., Rabideau, G., & Cicchetti, D. (1994). Responses of physically abused boys to interadult anger involving their mothers. *Development and Psychopathology*, *6*, 31-42.
- Darwin, C. (1965). *The expression of emotions in man and animals*. Chicago: University of Chicago Press. (Original work published 1872)
- Dashiell, J. F. (1927). A new method of measuring reactions to facial expression of emotion. *Psychological Bulletin*, *24*, 174-175.
- Denham, S. A., Zoller, D., & Couchoud, E. A. (1994). Socialization of preschoolers' emotion understanding. *Developmental Psychology*, *30*, 928-936.
- Dodge, K. A., Pettit, G. S., Bates, J. E., & Valente, E. (1995). Social information-processing patterns partially mediate the effect of early physical abuse on later conduct problems. *Journal of Abnormal Psychology*, *104*, 632-643.
- Dunn, J., Brown, J., & Beardsall, L. (1988). Family talk about feeling states and children's later understanding of others' emotions. *Developmental Psychology*, *27*, 448-455.
- Dunn, J., Brown, J., Slomkowski, C., Tesla, C., & Youngblade, L. (1991). Young children's understanding of other people's feelings and beliefs: Individual differences and their antecedents. *Child Development*, *62*, 1352-1366.
- Dunn, L. M., & Dunn, L. M. (1981). *Peabody Picture Vocabulary Test—Revised manual*. Circle Pines, MN: American Guidance Service.
- During, S., & McMahon, R. (1991). Recognition of emotional facial expressions by abusive mothers and their children. *Journal of Clinical Child Psychology*, *20*, 132-139.
- Ekman, P. (1976). *Pictures of facial affect*. Palo Alto, CA: Consulting Psychologists Press.
- Ekman, P. (1994). Strong evidence for universals in facial expressions: A reply to Russell's mistaken critique. *Psychological Bulletin*, *115*, 268-287.

- Ekman, P., & Friesen, W. V. (1971). Constants across cultures in the face and emotion. *Journal of Personality and Social Psychology*, *17*, 124–129.
- Ekman, P., Sorenson, E. R., & Friesen, W. V. (1969). Pan-cultural elements in the facial displays of emotions. *Science*, *164*, 86–88.
- Fogel, A., Nwokah, E., Dedo, J. Y., Messinger, P., Dickinson, K. L., Matusou, E., & Holt, S. A. (1992). Social process theory of emotion. A dynamic systems approach. *Social Development*, *2*, 122–142.
- Gaensbauer, T., Mrazek, D., & Harmon, R. (1981). Emotional expression in abused and/or neglected infants. In N. Frude (Ed.), *Psychological approaches to child abuse* (pp. 120–135). Totowa, NJ: Rowman & Littlefield.
- George, C., & Main, M. (1979). Social interactions of young abused children: Approach, avoidance and aggression. *Child Development*, *50*, 306–318.
- Haviland, J., & Lelwica, M. (1987). The induced affect response: 10-week-old infants' responses to three emotional expressions. *Developmental Psychology*, *23*, 97–104.
- Hennessy, K., Rabideau, G., Cicchetti, D., & Cummings, E. M. (1994). Responses of physically abused children to different forms of interadult anger. *Child Development*, *65*, 815–828.
- Herrenkol, R., Herrenkol, E., Egolf, B., & Wu, P. (1991). The developmental consequences of child abuse. In R. Starr & D. Wolfe (Eds.), *The effects of child abuse and neglect* (pp. 57–81). New York: Guilford Press.
- Izard, C. E. (1971). *The face of emotion*. New York: Appleton-Century-Crofts.
- Izard, C. E. (1994). Innate and universal facial expressions: Evidence from developmental and cross-cultural research. *Psychological Bulletin*, *115*, 288–299.
- Kavanagh, K., Youngblade, L., Reid, J., & Fagot, B. (1988). Interactions between children and abusive vs. control parents. *Journal of Clinical Child Psychology*, *17*, 137–142.
- Klimes-Dougan, B., & Kistner, J. (1990). Physically abused preschoolers' responses to peers' distress. *Developmental Psychology*, *26*, 599–602.
- Klennert, M. D., Emde, R. N., Butterfield, P., & Campos, J. J. (1986). Social referencing: The infants use of emotional signals from a friendly adult with mother present. *Developmental Psychology*, *22*, 427–432.
- Kuhl, P. (1987). The special-mechanisms debate in speech research: Categorization tests on animals and infants. In S. Harnad et al. (Eds.), *Categorical perception: The groundwork of cognition* (pp. 355–386). New York: Cambridge University Press.
- Kuhl, P., & Meltzoff, A. N. (1982). The bimodal perception of speech in infancy. *Science*, *218*, 1138–1141.
- Lyons-Ruth, K., Connell, D., Zoll, D., & Stahl, J. (1987). Infants at social risk: Relations among infant maltreatment, maternal behavior, and infant attachment behavior. *Developmental Psychology*, *23*, 223–232.
- Oster, H. (1978). Facial expression and affect development. In M. Lewis & L. A. Rosenblum (Eds.), *The development of affect* (pp. 43–75). New York: Plenum Press.
- Oster, H., & Ekman, P. (1977). Facial behavior in child development. In W. A. Collins (Ed.), *Minnesota Symposia on Child Psychology* (Vol. 11, pp. 231–276). Hillsdale, NJ: Erlbaum.
- Pollak, S. D., Cicchetti, D., Klorman, R., & Brumaghim, J. (1997). Cognitive brain event-related potentials and emotion processing in maltreated children. *Child Development*, *68*, 773–787.
- Pollak, S. D., Klorman, R., Brumaghim, J., & Cicchetti, D. (in press). P3b reflects maltreated children's reactions to facial displays of emotion. *Psychophysiology*.
- Reichenbach, L., & Masters, J. C. (1983). Children's use of expressive and contextual cues in judgments of emotion. *Child Development*, *54*, 993–1004.
- Ribordy, S. C., Camras, L. A., Stefani, R., & Spaccarelli, S. (1988). Vignettes for emotion recognition research and affective therapy with children. *Journal of Clinical Child Psychology*, *17*, 322–325.
- Rieder, C., & Cicchetti, D. (1989). Organizational perspective on cognitive control functioning and cognitive affective balance in maltreated children. *Developmental Psychology*, *25*, 382–393.
- Rogosch, F. A., Cicchetti, D., & Aber, J. L. (1995). The role of child maltreatment in early deviations in cognitive and affective processing abilities and later peer relationship problems. *Development and Psychopathology*, *7*, 591–609.
- Russell, J. A. (1994). Is there universal recognition of emotion from facial expressions? A review of the cross-cultural studies. *Psychological Bulletin*, *115*, 102–141.
- Saffran, J. R., Aslin, R. N., & Newport, E. L. (1996). Statistical learning by 8-month-old infants. *Science*, *274*, 1926–1928.
- Salzinger, S., Feldman, R., Hammer, M., & Rosario, M. (1993). The effects of physical abuse on children's social relationships. *Child Development*, *64*, 109–187.
- Snodgrass, J. G., & Corwin, J. (1988). Pragmatics of measuring recognition memory: Applications to dementia and amnesia. *Journal of Experimental Psychology: General*, *117*, 34–50.
- Sroufe, L. A. (1979). Socioemotional development. In J. Osofsky (Ed.), *Handbook of infant development* (1st ed., pp. 462–516). New York: Wiley.
- Toth, S. L., Cicchetti, D., Macfie, J., & Emde, R. N. (1997). Representations of self and other in the narratives of neglected, physically abused, and sexually abused preschoolers. *Development and Psychopathology*, *9*, 781–796.
- Walden, T. A., & Field, T. M. (1982). Discrimination of facial expressions by preschool children. *Child Development*, *53*, 1312–1319.

(Appendix follows)

Appendix

Emotion Recognition Vignettes

Happy

1. Johnny/Susie wanted his/her friends to come over to play. So he/she asked them, and they came to play with him/her at his/her house.
2. At Christmas, Johnny/Susie got a new toy house that he/she wanted.
3. Johnny/Susie worked hard on a picture and showed it to his/her father. His/her father really liked it and said Johnny/Susie did a good job.
4. Johnny/Susie went to the zoo, and his/her aunt bought him/her a real nice balloon that he/she liked a lot.
5. It is Johnny's/Susie's birthday. He/she is given a party with lots of cake and fun games to play, and presents, too.

Sad

1. Johnny/Susie and his/her little sister have a pet dog. The dog is sick and going to die.
2. Johnny's/Susie's friend, who he/she really liked to play with, moved away. Johnny/Susie couldn't play with his/her friend any more.
3. Johnny/Susie was the only one in class not to get any Valentines on Valentine's Day.
4. Johnny/Susie couldn't play a game, and some of the kids laughed at him/her.
5. Johnny's/Susie's favorite sweater that he/she liked a lot was very old and worn out. He/she had to throw it away and gave it to his/her mom to get rid of it.

Disgusted

1. Someone threw up on Johnny/Susie during lunch at school.
2. A friend gave Johnny/Susie an apple. Johnny/Susie bit into the apple and found a smelly, squashed, dead worm.
3. Johnny's/Susie's friend brought his dog over to Johnny's/Susie's house. The dog made a mess on the carpet and Johnny/Susie stepped in it.
4. Johnny/Susie went to a movie with a friend. In the movie, people were eating bugs and worms.
5. Johnny/Susie saw a friend who had a baloney sandwich with chili on it. He/she thought it was ugly and would taste terrible.

Afraid

1. Johnny/Susie was dreaming about a monster in his/her nightmare.
2. Johnny/Susie and his/her little sister were in their room at night. It was dark, and they saw a tree outside that looked like a person with his hand about to come in the window.
3. When Johnny/Susie went to bed, he/she thought there was something in his/her closet trying to get him/her.
4. Johnny/Susie was walking in the woods and met a hungry bear who liked to eat little children.
5. A bad man was chasing after Johnny/Susie.

Angry

1. Johnny's/Susie's little brother broke his/her favorite toy on purpose.
2. Johnny/Susie was trying to tell his/her mom about something exciting, but his/her little brother kept interrupting.
3. Johnny/Susie let his/her best friend use his/her new ball. His/her friend wasn't careful and lost the ball and wouldn't give Johnny/Susie another one.
4. Johnny's/Susie's friend gave him/her a present because Johnny/Susie helped him with his homework. Later, Johnny's/Susie's friend changed his mind and took the present back.
5. Johnny/Susie made his/her dad an ashtray for his birthday. Johnny/Susie told his/her baby brother not to touch it, but his/her brother did, and the ashtray broke.

Note. Reprinted from "Vignettes for Emotion Recognition Research and Affective Therapy With Children," by S. C. Ribordy, L. A. Camras, R. Stefani, and S. Spaccarelli, 1988, *Journal of Clinical Child Psychology*, 17, 322–325. Copyright 1988 by Lawrence Erlbaum Associates, Inc. Reprinted with permission.

Received August 5, 1999

Revision received April 24, 2000

Accepted April 24, 2000 ■