The Development of Decoding of Emotions in Children with Externalizing Behavioral Disturbances and Their Normally Developing Peers

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This investigation examined children’s capacity to decode verbal and nonverbal emotional stimuli. Children with externalizing behavioral symptoms were compared to two types of controls, including chronically ill and normally developing children. Children were requested to identify whether video scenes were happy, angry, sad, or neutral, across four different modalities including verbal, prosody, facial, and combined. Findings were that chronological age was a significant predictor of children’s ability to decode emotions with older children having better developed abilities than their younger peers. Verbal intelligence also was found to be a significant predictor of the ability to decode facial expressions and combined scenes. Although the data did not support the original hypotheses that children with externalizing behavior disorders would be less accurate than controls in the decoding of emotions, findings did support a developmental progression of decoding accuracy. Recommendations within the limitations of the study design are provided which support a developmental framework in children’s acquisition of the decoding of emotions. © 1998 National Academy of Neuropsychology.

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There has been a documented presence of neurological dysfunction in children who exhibit specific types of psychopathology (for review see Tramontana & Hooper, 1989). In particular,
one line of research has suggested that deficits in the decoding of emotions may be associated with brain dysfunction. There is a corpus of research to suggest that adults with neurological impairments, specifically lesions in the right cerebral hemisphere, exhibit marked difficulty with emotional decoding tasks (Benowitz et al., 1983; Bowers & Bauer, 1985; Heilman, Scholes, & Watson, 1975; Ross, 1981; Tompkins & Flowers, 1985). Further, some preliminary research conducted with children evidencing neurological disorders has associated specific brain damage with impairments in verbal and nonverbal decoding of emotion (Cohen, Prather, Town, & Hynd, 1990; Deonna, Chevrrie, & Hornung, 1987).

A similar line of research has indicated that children rated by parents and teachers with externalizing behavioral problems are characterized by basic deficits in social skills (Dodge, 1983, 1989; Whalen & Henker, 1985). In addition to this sociometric literature, increased attention has been paid to the neurocognitive factors associated with children’s social skills. Specifically, researchers have examined the role of nonverbal processing in social cognition (Gross & Ballif, 1991; Harper, Wiens, & Matarazzo, 1978). The ability to decode facial expressions is a potentially important form of nonverbal processing, since the inability to reliably interpret nonverbal communications of both peers and adults has been found to be associated with poor social adjustment and psychopathology (Bull, 1983; Izard, 1977).

Several investigations have indicated that the inability to accurately decode nonverbal information is related to various types of neuropsychiatric impairments, developmental disabilities, and childhood psychopathology. In one of the earlier studies focusing on the decoding of emotions, Walker (1981) examined normally developing children and those from various diagnostic groups, including schizophrenic, anxious-depressed, and unsocialized-aggressive groups, ranging in age from 9- to 13-years. In the decoding of a facial recognition task of expressions of male and female adults developed by Izard (1971), Walker (1981) found that children with schizophrenia were less accurate in comparison to those with other psychiatric disturbances, and that overanxious children were less accurate decoders than their normally developing peers. Similarly, a number of investigations have documented significant degrees of neurocognitive impairment in children identified with schizophrenia, although no clear patterns have been found with respect to neurostructural findings (Tramontana & Hooper, 1989).

Consistent with Walker’s (1981) findings, 12-year-old autistic children (with a mean mental age of 8 years) have been found to have more difficulty decoding facial expression of adults than their normally developing peers (Hobson, 1986; Tantam, Monaghan, Nicholson, & Stirling, 1989). Similarly, Bartak, Rutter, and Cox (1975) have noted that children with autism demonstrate more deviant language development, comprehension deficits, and impairments in the social use of language. Tramontana and Hooper (1989) have concluded that the communication deficits in autistic children are qualitatively different from those children identified with other expressive or receptive language disorders. Similarly, Bryan and colleagues (Bryan, 1977; Bryan & Bryan, 1978) and LaGreca (1981) have consistently found that school-aged children with learning disabilities have difficulty decoding social cues from both adults and peers. Children with learning disabilities have been demonstrated to exhibit a number of neurological impairments as indicated by various tests of neuroimaging (for review see Brown & Donegan, 1996). Thus, there is an accumulating body of research to suggest that children diagnosed with severe psychopathology and developmental disabilities, including autism schizophrenia, and learning disabilities, have basic neurocognitive processing deficits in the decoding of emotional stimuli of both adults and peers that may be associated with organic involvement (Hobson, 1986; Tantam et al., 1989; Walker, 1981).

Although investigations of children with severe psychopathology have typically indicated deficits in the ability to accurately decode emotions, the studies pertaining to children with
externalizing behavioral difficulties have been somewhat conflicting and inconclusive. Some studies have suggested basic deficits in the decoding of facial emotions (Nowicki & DiGiroldo, 1989; Zabel, 1979) with children characterized by “acting out” externalizing behaviors performing more poorly in the decoding of emotions. Tramontana and Hooper (1989) have concluded that children and adolescents with conduct disorders have more limited verbal abilities and a greater evidence of neurological impairments than do their normal peers. Although Reilly and Muzekari (1979) found that emotionally disturbed adults performed more poorly than normal adults, children in their sample characterized by externalizing “acting-out” behavior, performed no more poorly than their normal peers on verbal and nonverbal tasks. Consistent with these results, Walker (1981) found that unsocialized-aggressive children performed similarly to their normally developing peers on a facial recognition task.

In addition to the research on psychopathology, there also has been a line of developmental research examining the relationship among the ability to decode emotions, age, intellectual functioning, and social competence. For example, Hoffner and Badzinski (1989) examined decoding ability of normally developing children at four developmental levels (3–5, 6–7, 8–9, and 10–12 years) on a task presenting a series of pictures in which facial and situational cues were presented. Children were requested to rate the type (happy or sad) and intensity of emotions. Hoffner and Badzinski (1989) found that children’s reliance on situational cues increased with age, while their reliance on facial expression decreased with age. There also was a developmental trend for the children to use more combined information with age; that is, older children integrated facial and situational cues in order to determine the appropriate emotion for each of the stimuli. Consistent with these findings, Lightfoot and Bullock (1990) found that older subjects were more likely to use both the verbal and facial components in the decoding of videotaped communications depicting an actor, while younger children were more likely to focus on the more literal contents of the actors. Consistent with the findings of Lightfoot and Bullock (1990), Zabel (1979) found junior high school students to be better identifiers of emotions than the younger groups, yet precise relationships between mental age and ability to decode emotions were not clear. Finally, Custrini and Feldman (1989) found gender differences in the ability to decode emotions with girls exhibiting higher social competence as being more accurate in the coding of facial expression. No differences were found for males.

Overall, based on the aforementioned developmental literature, there seems to be a trend in the capacity to decode emotions, such that older children perform more accurately and integrate more components of information than their younger counterparts. There also is a body of evidence indicating that higher social competence is directly associated with better decoding ability. However, with the exception of children who have sustained abuse (Dur- ing & McMahon, 1991) no studies can be located that have examined the development of capacity to decode emotions in children with various internalizing and externalizing behavioral problems.

In an extension of previous literature, the purpose of the present study was to examine the ability of children with symptoms of psychopathology to decode human emotions. The present investigation is unique as it examined emotional perception, not only through the decoding of facial expressions but also the decoding of prosody (tone of voice) and verbal content. Externalizing and internalizing symptoms of psychopathology, social competence, chronological age, and verbal intelligence were examined as predictors of these children’s capacity to decode emotion. Due to the high incidence of neurological disorders that are frequently comorbid with behavior disorders, it was hypothesized that children with externalizing behavior disorders would exhibit a lag in the development of the decoding of emotions relative to their normally developing peers.
METHOD

Subjects

The sample consisted of 65 male youth (age range, 5 years, 5 months to 14 years, 6 months) ($M = 10$ years, 0 months, $SD = 2$ years, 6 months) receiving their medical and psychiatric care in an outpatient clinic of a large inner-city teaching hospital. Only male subjects were recruited for this study, since the predominant gender of children with externalizing disruptive behavior disorders is male. All of the youth were from low socioeconomic status backgrounds as measured by the Hollingshead 4-factor solution. Sixty-two of the youth were African American and three were Caucasian. Two of the Caucasian children were in the externalizing group, and one was in the chronically ill group. Exclusion criteria included a diagnosis of mental retardation and/or sensory or neurological deficits. Inclusion criteria are described separately below. All of the youth and their parents who were invited to participate in the study, consented to do so. Informed consent was obtained from the parent or guardian of each child and assent was obtained from each of the children.

Externalizing disorders. Of the subjects, 28 were receiving treatment in an outpatient child psychiatric clinic and were diagnosed with some type of externalizing disruptive disorder. The externalizing sample was homogeneous for long-standing difficulties (since early childhood) associated with emotional lability, impulsivity, attention, and socialization problems with peers including poor peer acceptance. In fact, mean scores for the group on the narrow band factors of the Child Behavior Checklist (CBC) (Achenbach & Edelbrock, 1991) were above the 90th percentile for aggressive behavior ($\geq 98$th percentile), attentional problems ($\geq 98$th percentile), delinquent behavior ($\geq 95$th percentile), and social problems ($\geq 93$rd percentile). Specific diagnoses based upon the Diagnostic Interview Schedule for Children-Revised (DISC-R) (Costello, Edelbrock, Kalas, Kessler, & Klaric, 1984) for this sample included attention deficit hyperactivity disorder ($n = 10$), oppositional defiant disorder ($n = 8$), conduct disorder ($n = 4$), and 6 subjects had comorbidity of attention deficit disorder and oppositional defiant disorder/or conduct disorder. The mean age for this externalizing group was 10.1 years, $SD = 2.3$ years, and the mean Peabody Picture Vocabulary Test (PPVT) receptive language score (Dunn & Dunn, 1981) was 76.3, $SD = 21.2$.

Control groups. Two separate control groups were incorporated in the present study to control for the presence of psychopathology. Both control groups were selected to represent alternative groups of children receiving services at this hospital. Exclusionary criteria for these children included no known neurological or psychiatric history and the absence of endorsed internalizing or externalizing symptoms (above 70th percentile) on the CBC with the exception of somatic complaints for the chronically ill group due to their physical symptoms. The first control group consisted of children and adolescents with a prolonged history of chronic illnesses ($n = 15$) (including asthma ($n = 3$), diabetes ($n = 2$), corrective orthopedic surgeries ($n = 3$) and sickle cell syndromes ($n = 7$). The mean chronological age of this chronic illness group was 10.1 years, $SD = 2.9$ years and the mean PPVT receptive language score was 84.9, $SD = 20.9$. The second control group consisted of normally developing children ($n = 22$) recruited from a walk-in clinic that serves children with various mild illnesses. The mean chronological age of this normal control group was 9.9 years, $SD = 2.5$ years and the mean PPVT receptive language score was 77.1, $SD = 10.1$.

Because decoding is potentially related to several demographic factors including age (Cohen et al., 1990; Hoffner & Badzinski, 1989; Lightfoot & Bullock, 1990), univariate analyses of variance (ANOVAs) were performed across the three groups for chronological age, PPVT scores, and Hollingshead ratings. No differences were obtained for any of these measures,
TABLE 1
Subject Characteristics

<table>
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<th>Measures</th>
<th>Controls</th>
<th>Controls</th>
<th>Controls</th>
<th>Contrasts</th>
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<td>Chronically Ill</td>
<td>Normals</td>
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<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
<td>$SD$</td>
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<tr>
<td>CBC$^a$</td>
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<td>10.22</td>
<td>53.83</td>
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<td>4.44</td>
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<td>53.42</td>
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<td>53.50</td>
<td>4.91</td>
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<tr>
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<td>66.25</td>
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<tr>
<td>Social</td>
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<td>51.30</td>
<td>4.45</td>
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<tr>
<td>School</td>
<td>30.20</td>
<td>8.38</td>
<td>49.00</td>
<td>4.81</td>
</tr>
</tbody>
</table>

$^a$Child Behavior Checklist.

including chronological age. As expected, for the CBC scores, the externalizing sample differed from the other two control groups on the social problems [$F(2, 62) = 4.87, p < .01$], attention problems, [$F(2, 62) = 23.44, p < .0001$], delinquent [$F(2, 62) = 10.80, p < .0001$], and aggressive behavior [$F(2, 62) = 15.28, p < .0001$] factors of the CBC. A Tukey-HSD multiple range post-hoc analysis performed on each of these factors indicated that the externalizing group exhibited significantly more symptoms of psychopathology than did the other two groups ($p < .05$), who were no different from one another in this regard. Significant differences also were obtained on the social [$F(2, 62) = 5.72, p < .007$] and the school [$F(2, 62) = 16.40, p < .0001$] competency factors of the CBC. Again, a Tukey-HSD post-hoc analysis indicated that the externalizing group exhibited significantly less social and school competency than the other two groups, who were no different from one another in this regard. No differences were found on the internalizing scales (withdrawn, somatic, anxious/depressed), the thought problems scale, or the activity competency scale.

Table 1 presents a summary of significant factors and competency scores of the CBC completed by parents.

Measures

Children were administered the Peabody Picture Vocabulary Test (PPVT) a test of receptive language that correlates highly with verbal intelligence (Dunn & Dunn, 1981). Their parents were requested to complete the Child Behavior Checklist (CBC) (Achenbach & Edelbrock, 1991), a 113-item checklist that addresses a broad range of internalizing and externalizing symptoms and competency scores for children 4 to 18 years. The CBC provides a generally comprehensive assessment of parents’ ratings of the commonly occurring dimensions of psychopathology in children and has been demonstrated to reliably discriminate children with disruptive behavior disorders from their normally developing peers (Edelbrock, Costello, & Kessler, 1984). The scale also has adequate reliability and validity (Barkley, 1988; Edelbrock et al., 1984).

Decoding ability. Subjects also were administered a task designed previously to assess decoding of emotions in adults based upon scenes presented by means of a videotape. The development of this instrument is discussed in detail in Egan (1990). A videotape format
was chosen for this particular study, as it is the only decoding methodology available that assesses multiple modalities in a relatively ecologically valid format (e.g., video rather than photographs). The most widely employed existing measure of decoding ability, the Profile of Nonverbal Sensitivity (PONS) (Rosenthal, Hall, DiMatteo, Rogers, & Archer, 1979) is not appropriate for children because it requires complex verbal responses to nonverbal stimuli thereby confounding verbal fluency with decoding ability. Other measures of decoding ability that employ photographs of faces were not selected for use in this study because they allow for assessment of only one modality (i.e., facial expression) and do not provide for an adequate assessment of verbal and prosody modalities.

The instrument employed in this study was piloted on 11 college students who exhibited intact intellectual functioning, vision, and hearing and no evidence of neurological or psychiatric impairments, to determine whether or not the emotion could be correctly identified at an acceptable level by adult subjects (Egan, 1990). The results indicated that an average of 94% of the verbal content scenes, 85% of the prosody scenes, 93% of the facial scenes, and 99% of the combined scenes could be correctly identified by these subjects (Egan, 1990). Test-retest results were evaluated on another group of college students with overall reliability at the .72 level (Egan, 1990). Further, in a study of adult patients with cerebral vascular accidents (CVAs), where the same stimuli and similar methodology were employed, patients with CVAs were found to perform significantly more poorly than non-brain-damaged subjects (Egan, 1990). When patients with right and left hemisphere CVAs were compared, subjects with right hemisphere CVAs performed better on the verbal content scenes than those with left hemisphere strokes, who performed better on the prosody scenes (Egan, 1990).

The scenes were portrayed by two Caucasian men and women, all of whom had professional acting experience. Example items were portrayed by a man and a woman who did not act in the regular scenes to reduce the chance that the children might use the same answers they were provided in the examples for the regular scenes. The task employed posed scenes rather than naturally occurring scenes because posed scenes provide more control over technical quality and provide greater certainty about the emotions being portrayed. In support of our presentation of scenes, Zuckerman, Hall, De Franck, and Rosenthal (1977) conducted a study in which they compared posed and spontaneous expressions and found a high level of communication accuracy of both types as well as a significant correlation between the two.

The tape used in this study contains 64 scenes presented in random order either in an auditory or visual format. Each scene is 6 seconds long and is followed by an 8-second response period in which the subject is instructed to select the emotion portrayed in the scene by pointing to one of the four responses pictured. These response pictures are presented in the Figure 1. The auditory format presents a set of scripts which contain emotionally suggestive verbal content which is presented in a neutral tone of voice (verbal content scenes). Another set of scenes presents emotions through prosody (verbal tonality) alone by using scripts (short statements) comprised of emotionally neutral verbal content (prosody scenes). Using the visual modality alone, a third set of scenes presents facial emotional expressions without any sounds (facial scenes). Finally, a fourth set of scenes combines the three presentation channels—verbal content, prosody, and facial affect (combined scenes). The presentation of the emotional categories (angry, happy, sad, and neutral) varies such that each is presented randomly four times for each of the four types of scenes.

The emotions selected for this task were considered to be those that could be easily distinguished by normally developing children. These emotions (happiness, sadness, anger and the lack of any emotion, or neutrality) also were chosen for this particular task as they were the emotional categories most frequently distinguished in studies of both facial expressions (Ekman, 1982; Ekman, Friesen, & Tomkins, 1971; Wiggers, 1982) and of vocal affect (Heilman & Satz, 1983). Other emotional behaviors (e.g., surprise, disgust, and fear) were given
consideration in the decoding task, although the limiting of the emotional behaviors to three types plus one neutral category also kept the length and complexity of the task at a level that would be appropriate for children. Thus, there are 16 scenes in each subtest (64 scenes in the total task). The task takes approximately one-half hour to complete.

The same instructions were read to all of the subjects in the externalizing group and to the subjects in the two control conditions. The children were informed that they would be presented scenes of actors displaying anger, happiness, sadness, or no emotion at all. Each child was asked to indicate what emotion was being displayed in each scene by pointing to one of four pictures exhibiting that particular emotion. The examiner marked the answer sheet. Subjects were told to select the ‘neutral’ picture only when none of the other three emotions were being expressed. Before the task began, the children were provided with five examples to make certain that they were able to proceed with the task.

After parental consent was obtained, children were tested individually by a trained psychology graduate student. The children in each of the groups were informed that they could take short breaks during the test if they became fatigued.

RESULTS

The decoding task produced four dependent measures according to modality of presentation (verbal, prosody, facial expression, and combined contents). In addition, the data were examined according to the four emotions that were presented (angry, happy, sad, and neutral).

Table 2 presents a correlation matrix that was constructed including each of the dependent variables from the decoding task, internalizing and externalizing broad band scores from the CBC, CBC total competency scores, PPVT IQ scores, and chronological age.

Pearson product-moment correlation coefficients revealed that higher internalizing broadband factor scores on the CBC were positively associated with greater accuracy in the decoding of angry emotion. Age was positively associated with successful decoding on angry, sad, and neutral presentations. Additionally, age was positively related to accuracy on the verbal,
TABLE 2
Correlations Among PPVT, Chronological Age, CBC Internalizing, Externalizing, and Competency Scores, and Number Correct on Decoding Task

<table>
<thead>
<tr>
<th>Decoding task Modality</th>
<th>PPVT</th>
<th>Age</th>
<th>Internalizing</th>
<th>Externalizing</th>
<th>Competency</th>
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<td>Verbal</td>
<td>.12</td>
<td>.30*</td>
<td>.07</td>
<td>.07</td>
<td>-.14</td>
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<tr>
<td>Prosody</td>
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<td>.52**</td>
<td>.16</td>
<td>.16</td>
<td>.06</td>
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<tr>
<td>Facial</td>
<td>.44**</td>
<td>.44**</td>
<td>.15</td>
<td>.24</td>
<td>.08</td>
</tr>
<tr>
<td>Combined</td>
<td>.42**</td>
<td>.52**</td>
<td>.05</td>
<td>.24</td>
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<tr>
<td>Emotions</td>
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<td></td>
</tr>
<tr>
<td>Angry</td>
<td>.15</td>
<td>.46**</td>
<td>.31*</td>
<td>.24</td>
<td>.04</td>
</tr>
<tr>
<td>Happy</td>
<td>.13</td>
<td>.19</td>
<td>-.08</td>
<td>.12</td>
<td>.05</td>
</tr>
<tr>
<td>Sad</td>
<td>.34*</td>
<td>.26*</td>
<td>-.04</td>
<td>.09</td>
<td>.30*</td>
</tr>
<tr>
<td>Neutral</td>
<td>.29</td>
<td>.45**</td>
<td>.10</td>
<td>.13</td>
<td>-.15</td>
</tr>
</tbody>
</table>

*p < .01.  
**p < .001.

facial, prosody and combined scenes of the decoding task. PPVT scores were significantly associated with number of correct responses to sad and neutral scenes and to accuracy on the facial and combined modalities. Finally, higher social competency ratings were related to greater accurately on the sad emotions.

Based on the bivariate correlation coefficients, a series of step-wise multiple regression analyses were performed in which broad band internalizing CBC ratings, broad-band externalizing CBC ratings, PPVT scores, and chronological age were simultaneously entered to predict subjects’ accuracy of identification for each of the four modalities (verbal content, prosody, facial expression, and combined presentation) and four emotions (angry, happy, sad, and neutral) on the decoding task. Since the total competency score of the CBC was significantly associated with the sad emotions measure of the decoding task, the total competency score also was calculated in this regression equation.

Results revealed significant predictability for the Angry, $F(1, 60) = 9.6, p < .003, R^2 = .17$ and the Neutral scales, $F(1, 60) = 8.4, p < .006, R^2 = .15$. For both of these regression equations, only chronological age was found to be predictive of accuracy of emotional perception. When controlling for age, no other variables contributed significantly to the equation.

For modality of presentation, significant regressions were found for the Verbal, $F(1, 60) = 6.5, p < .01, R^2 = .12$, and Prosody modalities of the presentation, $F(1, 60) = 10.4, p < .002, R^2 = .18$, again with age being a significant predictor for each of these modalities.

When the facial modality was examined, PPVT IQ score was found to be the most efficient predictor of decoding accuracy, $F(1, 60) = 12.8, p < .0008, R^2 = .21$. Knowledge of the youths’ age further added to the efficiency of the prediction equation $F(2, 60) = 10.3, p < .02, R^2 = .30$. Finally, in respect to the combined modality, both age $F(1, 60) = 14.2, p < .0004, R^2 = .23$, and PPVT IQ $F(2, 60) = 11.9, p < .008, R^2 = .34$, again were found to be the most efficient predictors. Table 3 presents a summary of the regressions for the significant dependent measures.

A series of ANOVAs were performed on each of the dependent measures in which group membership served as the independent variable. No significant effects were obtained as a function of group membership.

Because chronological age was found to be a significant predictor on many of the dependent measures on the decoding task, the authors were interested in determining at which
Decoding of Emotions

TABLE 3
Results of Regression Analyses

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Steps</th>
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<th>$F$</th>
<th>$B$</th>
<th>$T$</th>
<th>$p$</th>
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<td>.003</td>
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<tr>
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<tr>
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<td>11.92</td>
<td>.33</td>
<td>2.76</td>
<td>.008</td>
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*a* Peabody Picture Vocabulary Test.

age the children demonstrated significant developmental change in their capacity to decode emotions. Thus, as a group, the subjects were trichotomized according to solely chronological age. The mean ages for each of the groups respectively was 7 years, 3 months ($SD = 12$ months), 9 years, 11 months ($SD = 10$ months) and 12 years, 10 months, ($SD = 10$ months). The means and standard deviations for the decoding data for each of the age groups are presented in Table 4.

The results of a one-way multivariate analysis of variance (MANOVA), with only solely age serving as the independent variable, performed for the modality variables yielded a significant main effect for age, $F(8, 110) = 3.80$, $p < .001$. Subsequently, one-way ANOVAs were performed for each of the modality variables again with only age serving as the only independent variable, and results of these ANOVAs yielded significant effects for the Prosody $F(2, 58) = 8.69$, $p < .001$, Facial $F(2, 58) = 8.11$, $p < .001$, and Combined modalities, $F(2, 58) = 15.34$, $p < .001$. A Tukey-HSD multiple range post-hoc test indicated that the youngest group was less accurate than the older two age groups on each of these measures ($p < .05$).

A significant MANOVA, with only age serving as the independent variable, also was obtained for the emotions measures $F(8, 110) = 5.12$, $p < .001$. One-way ANOVAs also

TABLE 4
Means and Standard Deviations for Decoding Task by Age Groups

<table>
<thead>
<tr>
<th></th>
<th>7-Year-Olds</th>
<th>9-Year-Olds</th>
<th>12-Year-Olds</th>
<th>$F$</th>
<th>$p$</th>
<th>Contrast</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>Modality</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal</td>
<td>8.60</td>
<td>3.53</td>
<td>10.35</td>
<td>2.30</td>
<td>10.43</td>
<td>3.06</td>
</tr>
<tr>
<td>Prosody</td>
<td>7.10</td>
<td>2.40</td>
<td>9.00</td>
<td>1.34</td>
<td>9.57</td>
<td>2.04</td>
</tr>
<tr>
<td>Facial</td>
<td>10.85</td>
<td>3.39</td>
<td>13.15</td>
<td>2.08</td>
<td>13.81</td>
<td>1.57</td>
</tr>
<tr>
<td>Combined</td>
<td>11.20</td>
<td>3.59</td>
<td>14.45</td>
<td>1.64</td>
<td>15.10</td>
<td>1.37</td>
</tr>
<tr>
<td>Emotions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Angry</td>
<td>9.55</td>
<td>4.11</td>
<td>13.90</td>
<td>1.86</td>
<td>12.67</td>
<td>1.49</td>
</tr>
<tr>
<td>Happy</td>
<td>11.15</td>
<td>3.27</td>
<td>10.90</td>
<td>2.15</td>
<td>11.71</td>
<td>1.68</td>
</tr>
<tr>
<td>Sad</td>
<td>10.50</td>
<td>4.33</td>
<td>13.35</td>
<td>1.46</td>
<td>12.33</td>
<td>1.71</td>
</tr>
<tr>
<td>Neutral</td>
<td>6.55</td>
<td>4.14</td>
<td>9.70</td>
<td>4.95</td>
<td>12.19</td>
<td>3.74</td>
</tr>
</tbody>
</table>
were performed for the types of emotions presented and significant age effects were found for the angry $F(2, 58) = 9.79, p < .001$, sad $F(2, 58) = 5.31, p < .008$, and neutral emotions $F(2, 58) = 8.86, p < .001$. A Tukey-HSD multiple range post-hoc test indicated that: (a) the youngest group was less accurate from the two older age groups on the angry emotion ($p < .05$); (b) that the youngest age group performed more poorly than the middle age group on the sad emotion ($p < .05$); and (c) that the youngest age group performed less accurately than the oldest on the neutral emotions.

Finally, the decoding task also was analyzed by MANOVA in which both emotions and modality of presentation were examined separately by group, with only age serving as the independent measure. The results of these two MANOVAs were not significant.

**DISCUSSION**

The purpose of this investigation was to examine the ability of children with externalizing behavioral symptoms to decode various emotions expressed by adults on videotape. While the capacity to decode emotions was not found to be related to symptoms of externalizing behaviors, decoding ability was very much age dependent, with older children generally being more accurate in their neurocognitive perceptions of emotions than their younger peers.

Consistent with previous developmental literature (Hoffner & Badzinski, 1989; Lightfoot & Bullock, 1990; Zabel, 1979), the present findings suggest that the capacity to decode emotions is age related. In our study, age was the best predictor of the capacity to decode angry and neutral types of emotions. When the children were trichotomized by age, findings indicated that the youngest children (7-year-olds) were least accurate in their capacity to decode angry, sad, and neutral emotions. Similarly, the youngest children also were least accurate in their capacity to utilize prosody, facial, and combined modalities in decoding emotions. Thus, the present findings extend those of the developmental literature (Hoffner & Badzinski, 1989; Lightfoot & Bullock, 1990; Zabel, 1979) in suggesting that in addition to the decoding of facial expressions, children learn to decode emotions across other modalities as well (verbal content and prosody).

Hoffner and Badzinski (1989) have suggested that children’s reliance on situational cues increases with age while their reliance on facial expression decreases with age. In our study, when facial modality was examined singularly, verbal intelligence was found to be an efficient predictor of decoding accuracy. This was the only occasion when verbal intelligence exceeded the predictive power of age. Taken together with our data, these findings suggest that as children mature, they seem to begin to rely more heavily on verbal information including verbal content and prosody than on facial expressions, despite the fact that they may be no better at utilizing verbal content to process emotional stimuli as they become older. This suggests that as they become older, children may rely less on facial expressions and come to symbolize these emotions by means of verbal representation.

Contrary to our hypothesis, the study provided no support for the notion that capacity to decode emotions was impeded by the presence of symptoms, history of externalizing behaviors, or diagnostic group membership. Much to our surprise there were no differences across the three groups (externalizing and two controls). Taken with the other literature reviewed earlier (e.g., Camras et al., 1988; During & McMahon, 1991; Hobson, 1986; Tantam et al., 1989) the present findings suggest that for other than more severe forms of psychopathology and developmental disabilities in children (e.g. autism and schizophrenia), it is difficult to make a definitive conclusion regarding the decoding skills of behaviorally disordered children. In fact, our findings are consistent with those of Walker (1981) indicating that while children with schizophrenia were less accurate than their normally developing peers in the
Decoding of Emotions

decoding of facial expressions, unsocialized-aggressive children performed similarly to normal controls. This appears in rather striking contrast to the oft-cited clinical observations of these children, which typically reveal them as socially inadequate (Dodge, 1989). However, in their extensive and lucid review of the social skills of children with attention deficit hyperactivity and related externalizing disorders, Whalen and Henker (1985) conclude that the essential deficit of these children is the emission of appropriate social skills, not their cognizance of appropriate social nuances. Although our clinical sample was described by their parents and teachers as having significant clinical problems with socialization with peers, the data suggest that they were able to identify the emotions portrayed in the scenes correctly. As Whalen and Henker (1985) have so poignantly observed, “These youngsters (attention deficit hyperactivity and related externalizing disorder children) may know the right answers when presented with a slate of alternatives, but difficulties surface when they are required to create the course of action on their own” (parentheses added; p. 460). Taken together with this investigation, these children’s primary deficits seem to be in the encoding of emotions rather than the decoding of emotions.

In comparison to previous investigations that have employed still photographs, a particular strength of the present study is the utilization of videotapes to display emotional expressions. This method more closely approximates actual interactions and, therefore, could be considered to be a more ecologically valid task. In addition, previous studies have primarily examined facial expressions, while we examined several modalities of verbal and nonverbal communication. Thus, the findings of the present study may have greater generalizability to actual interactions that these children encounter on a daily basis.

The primary limitations of the decoding task used in this study are those associated with any new instrument, including the limited evidence regarding its reliability and construct validity with children. As noted previously, the most widely employed existing measure of decoding abilities, the PONS, is inappropriate for use with children because it requires complex verbal responses to nonverbal stimuli. The decoding task employed in this investigation is the only known decoding methodology available that assesses multiple modalities in a relatively ecologically valid format. Although the use of videotape may not replicate precisely the decoding involved in the natural environment, it appears preferable to the stimuli employed in previous studies of children’s decoding abilities (still photographs), which do not allow for an assessment of verbal and prosody modalities. Thus, the findings of the present study may have greater generalizability to children’s daily interactions than those obtained with other decoding tasks.

While the present study extends previous research in many respects, the results obtained must be considered in the context of several other considerations. First, this study examined the ability of children to perceive emotions portrayed by adult actors. Thus, consistent with previous studies of decoding abilities in children (Bryan, 1977; Cohen et al., 1990; Lightfoot & Bullock, 1990; Tantum et al., 1989; Walker, 1981; Zabel, 1979), the generalizability of the findings are limited to the decoding of adults’ emotions. To gain a better understanding of the ways in which children perceive their peers’ emotions, future studies will need to employ child actors. Further, given the contribution of cultural influences to communication patterns, caution should be exercised in generalizing from these data. Greater precision may have been obtained had the children been asked to decode the emotions of culturally similar adults.

Another limitation of this study is the questionable generalizability of the findings to youth with higher verbal skills. The low verbal functioning of the subjects participating in this study (as measured by the PPVT) is highly characteristic of economically disadvantaged youth (Sattler, 1988). Our findings are, therefore, especially relevant for economically disadvantaged and often underserved youth, who frequently display difficulties in communication
competence. Future research should investigate whether the findings of this study are generalizable to children with higher verbal skills.

Another limitation is that the sample under study was quite heterogeneous with respect to diagnoses and age. Many of the children in the externalizing sample had comorbidity of diagnoses, including attention deficit hyperactivity disorder and conduct disorder. While this dual diagnosis is a frequently occurring disorder in many psychiatric clinics, it might be that a more pure classification of either disorder would yield more definitive results. Thus, it would be fruitful for future studies to examine various diagnostic classifications including specific externalizing and internalizing (i.e., overanxious disorder and depression) types of psychopathology with known neurological deficits, as such a constellation of symptoms may impede the capacity to accurately decode emotions. In addition, our post-hoc attempt to trichotomize the children according to age yielded mixed results. It has been demonstrated repeatedly in the developmental literature that various neurocognitive processes develop differentially according to age (Majovski, 1989). Future studies should focus on gathering subjects of specific age groups, including children that are younger than those presently sampled to better delineate the development of capacity to decode emotions.

A final consideration is that the present findings may have been influenced by the manner in which the task was administered. In this study, children were tested individually, where optimal performance likely was obtained. The clinical sample in this study may have benefited from the individual administration, thereby inflating their accuracy scores on the decoding task. Future researchers may utilize a group administration procedure so as to produce an environment that more closely resembles the natural interactions of these children. Moreover, the laboratory context in which the children were evaluated in this study is different from that in which they learn and practice decoding skills. Additional differences may have emerged if the children were examined in a more ecologically valid setting (i.e., a classroom or home environment).

The implications of the present investigation are important for clinical child neuropsychologists in understanding the decoding of emotions with children. The findings underscore the importance of the child’s development in understanding the emotions conveyed by significant adults in the child’s life. For younger children, it would behoove psychologists to make certain that the children are accurately perceiving the emotional intent of various communications, prior to diagnosing any type of language impairment. For younger children in particular, therapists and caretakers may wish to embellish emotional reactions so that the child is clear on what emotion is being conveyed. Further, this study adds to previous findings in suggesting that intellectual functioning also is an important mediator in the decoding of emotions. Thus, it may be useful for practitioners working with intellectually challenged children to pay diligent attention that nonverbal displays of emotions are paired with verbal discourse.

REFERENCES


