Recognition of Emotional-Prosodic Meanings in Speech by Autistic, Schizophrenic, and Normal Children

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The abilities of autistic, schizophrenic, and normal-control children to label four emotional intonations (the emotional task) in speech were tested, along with a linguistic task. All stimuli were pretested on normal adults. Older (≥ 8 years of age) normal children performed as well as adults on both tasks; younger normal children and both younger and older autistic children performed poorly on the emotional task; children (all older) diagnosed as schizophrenic were not significantly impaired in either task. Mental age was not correlated with performance in autistic children. The relevance of these results to other findings regarding emotional and linguistic behaviors in normal and disabled children is considered.

Every speech utterance carries both linguistic (propositional) and paralinguistic meanings. Linguistic meanings are carried by the consonants and vowels; paralinguistic information is carried mainly by the “melody” of speech, or prosody (Crystal, 1975; Cutler & Ladd, 1983). Paralinguistic information includes such “tone of voice” material as attitude, emotion, mood, and per-
sonal voice identify. The sentence You are going? can be said with many “shades” of paralinguistic meaning: surprise, cheerfulness, anger, fear, enthusiasm; it can communicate any number of attitudes toward the listener, such as doubt, authority, or permission, and so on; and it carries information about the sex, age, size, education, personality, and geographic background of the speaker. Normal adult listeners make consistent judgments about many of these parameters from the auditory stimulus alone (e.g., Apple, Streeter, & Krauss, 1979; Bricker & Pruzansky, 1976; Laver, 1980; Ptacek & Sander, 1966). In this study, we examine the relative abilities of autistic, schizophrenic, and normal children to identify the linguistic and prosodic content of speech. In particular, we hypothesize that of the clinical groups, autistic children will be more impaired in identifying the emotional and linguistic content of utterances, when compared to schizophrenic and normal children. Furthermore, we hypothesize that both clinical groups will perform less well in recognizing emotional meanings than in recognizing comparable linguistic meanings.

Although the importance of social skills has recently been recognized in language development (Bruner, 1981), with research extending into the field of pragmatics (Bates, Benigni, Breherton, Camaioni, & Volterra, 1979; Bates & MacWhinney, 1979; Sachs & Devin, 1976), only a few studies have looked closely at such aspects of the emotional lives of children as abilities to talk about feelings (Glasberg & Aboud, 1982; W. C. Lewis, Wolman, & King, 1971) and to infer emotional meaning from verbal texts (Gnepp, Klayman, & Trabasso, 1982). A child’s emotional “makeup,” including responses to perceived emotions, impacts powerfully on the quality of his or her life. The importance of these factors is obvious to all who work and live with children, yet only recently have researchers tackled the problem of describing, assessing, and quantifying emotional behaviors and abilities of children (Izard, Kagan, & Zajonc, 1984; Schwartz & Trabasso, 1984; Yarrow, 1980). Despite recent interest in the development of social skills (Cicchetti & Schneider-Rosen, 1984; Izard et al., 1984; M. Lewis & Michalson, 1982; Mundy & Sigman, in press; Mundy, Sigman, Ungerer, & Sherman, in press; Murphy, 1983; Sigman, Mundy, Sherman, & Ungerer, 1986; Yarrow, 1980; Zuckerman, Lipsct, Koivumaki, & Rosenthal, 1975), with a few exceptions (e.g., M. Lewis & Rosenbaum, 1978; W. C. Lewis, Wolman, & King, 1970; Murphy 1983; for a review, see M. Lewis & Michalson, 1983) research on normal children has instead focused primarily on the development of cognitive abilities, using measures of intelligence.

A study of children’s comprehension of emotional meanings in speech is interesting for several reasons. Normal children produce and comprehend subtle prosodic nuances of speech, signaling both linguistic and paralinguistic information, well before uttering their first phonological word (Crystal, 1973; Delack & Fowlow, 1978; Friedlander, 1970; Garnica, 1977; Sheppard & Lane, 1968). It has been claimed, for example, that linguistic contrasts cue in prosodic material (including question vs. statement), and cues for turn-taking in conversation, are produced and comprehended by 6 to 9 months (Crystal, 1978; Tonoova-Yampolskaya, 1969). This has been well investigated in the speech of caretakers, who adopt specific prosodic features in talking to infants and young children (Chapman, 1981; Garnica, 1977; Newport, 1976; Papousek & Papousek, 1975; Sachs, Brown, & Salerno, 1976; Schaffler, Collins, & Parsons, 1977; Snow, 1972; Stern, 1982; Stern, Spieker, Barnett, & MacKain, 1983). The ability of infants to respond specifically to emotions has been described in empathetic distress crying (Sagi & Hoffman, 1976; Simner, 1971) and in studies using emotional stimuli (Dimitrovsky, 1964; Walker, 1981). Studies on the development of voice recognition show that infants (De Casper & Fifer, 1980; Martin & Clarke, 1982; Mills & Melhirsh, 1974) and grammar-school children (Mann, Diamond, & Careg, 1979) can easily recognize voices of caretakers and peers. These studies point to another kind of very early competence for comprehension of prosodic information in speech.

This article reports on preliminary studies of the abilities of normal and disabled children to recognize emotional meanings in speech utterances. We chose to compare autistic and schizophrenic children with a normal control group for several reasons. Both clinical groups have emotional/social disorders. Kanner (1968) referred specifically to the disturbances of “affective contact” of autistic children. More recently, Hobson (1986a, 1986b) demonstrated that older autistic children were not able to match videotaped emotional scenes to faces picturing those emotions. The prosodic deficits in the speech production of autistic children are well known (Baltaxe, 1986; Baltaxe & Simmons, 1975; Brooker & Mareth, 1982; Prizant, 1983; Ricks & Wing, 1975; Rutter, 1976, 1983; Rutter, Bartak, & Newman, 1971; Sigman, Ungerer, Mundy, & Sherman, 1987). Some never develop language; others develop rudiments of speech, using imitation (Simone, 1975) and ritual, holistic phrases, but fail to develop grammatical abilities associated with left-hemisphere specialization for language (DeMyer, Alpern, Barton, & Kimberlin, 1972). Many autistic children who attain some language ability speak in a monotone or “mechanical” tone of voice. It is not known, however, whether these deficits in prosody are specific to linguistic functions (e.g., distinguishing between questions and statements by rising versus falling intonation), or whether they encompass paralinguistic communication (e.g., recognizing emotions in the speech of others). For the schizophrenic group, observed social/affective and language disorders have been attributed to underlying thought disorder. Hence the abilities of schizophrenic children to comprehend emotions in speech ought to be unimpaired. However, componential deficits in language, social skills, and emotional development in this group remain to be carefully investigated.

A further reason for investigating the emotional abilities of normal and disabled children comes from the laterality work in this field. Paralinguistic meanings are processed by cerebral mechanisms different from those under-
ing abilities for propositional language. Studies of brain-damaged adults suggest that the perception and production of paralinguistic meanings are represented in the right hemisphere (Blumstein & Cooper, 1974; Kent & Rosenbek, 1982; Ross, 1983; Van Lancker & Kreiman, 1987), whereas perception and production of linguistic ability is represented primarily in the left hemisphere of most right-handed adults (Bryden, 1982). For example, nonverbal auditory patterns have been associated with right-hemisphere processing (King & Kimura, 1972). For emotional prosody in speech, recent studies indicate that recognition of emotional meanings in sentences is superior at the left ear in dichotic listening, whereas linguistic meaning in the same stimuli is better recognized at the right ear in most children and adults (Bryden, 1982; Ley & Bryden, 1982; Saxby & Bryden, 1982). This laterality is strongly established by age 5. The language deficits of autistic children have led to questions about abnormal hemispheric specialization in these groups. Alongside the linguistic deficit, the relative superiority of visuospatial processes in many autistic children has led to the hypothesis that autism may involve primarily a left-hemisphere dysfunction. Some studies have claimed a relative superiority in autistic children for right-hemisphere functions such as visual and auditory patterns (e.g., music; Applebaum, Egel, Koegel, & Imhoff, 1979). Dawson, Warrenburg, and Fuller (1982) found an atypical laterality pattern in autistic children; however, proposals that the left hemisphere is selectively impaired have been disputed (Arnold & Schwartz, 1983; H. Damasio, Maurer, A. Damasio, & Chin, 1970). Most researchers now agree that the disorder has an organic basis (A. Damasio, 1984); bilateral, including frontal, as well as subcortical brain damage has been implicated. An investigation of the abilities of autistic children to comprehend emotional meanings in speech may add to our understanding of the deficits in this population.

Similarly, in schizophrenic adults, converging evidence suggests that no clear picture of hemispheric impairment emerges (Van Lancker, 1985). Our interest in testing schizophrenic children stems from observations of emotional disorders in this population. Although symptomatology for language and emotional behaviors is highly variable in this group, language abilities are generally relatively intact, in comparison to children diagnosed with autism, and many of these children show inappropriate affect and abnormal conversational interaction. Little is known about their abilities to comprehend emotional meanings in speech. A finding that schizophrenic children are specifically impaired in perceiving the emotional content of speech would suggest one source of instances of bizarre interactional output.

In this study, autistic, schizophrenic, and normal-control children were compared in their abilities to comprehend linguistic versus emotional meanings in speech. "Bidimensional" stimuli were used—each stimulus contained two channels of information, a linguistic meaning carried by the vowels and consonants, and an emotional meaning carried in the intonation, or prosody, of the utterance. Children were directed by the response condition to process either the linguistic or the emotional channel in the stimuli.

METHOD

Children

Clinical subjects included 28 autistic children and 19 schizophrenic children. Thirty-three normal-control children were also tested. The children were selected and diagnosed by the Child Psychiatry Clinical Research Center at UCLA's Neuropsychiatric Institute. Every child received an extensive evaluation, including a detailed developmental history using a questionnaire, a videotaped psychiatric assessment, psychological and linguistic testing, pediatric and neurological examination, and audiological assessment. All examinations were carried out by a professional team of child psychiatrists and child psychologists, language pathologists, an audiologist, a social worker, and a pediatrician, all expert in dealing with psychotic children. A diagnosis of early infantile autism, or childhood schizophrenia, was reached only if all or all but one member of the team agreed that the child's condition met all the criteria listed in the American Psychiatric Association's (1980) Diagnostic and Statistical Manual of Mental Disorders. Children whose developmental quotient or IQ was less than 40 on a standardized psychological assessment were rejected (Tanguay, Edwards, Buchwald, Schwafel, & Allen, 1982). Mental ages were measured using the Merrill-Palmer Test and the Wechsler Preschool and Primary Test of Intelligence within 6 months of testing. Performance of the autistic children is presented in terms of both chronological age (CA) and mental age (MA; see Figures 3 to 10). Using those data, individual children's scores are plotted to discover whether CA or MA is the more useful measure in predicting performance in autistic children, and to determine the role of mental retardation in the performance of individual autistic children. However, group statistics comparing normal-control, autistic, and schizophrenic children were performed using CA information only, for the following reasons:

1. Normal children younger than 8 years were found to perform poorly on the emotional but not the linguistic task, in contrast to children older than 8. This led us to analyze normal-control performance in terms of a younger and an older group.

2. MA scores for autistic children were not high enough to distribute them into two age groups corresponding to the two significantly different age groups observed in normal-control children.

3. MA information was unavailable on many of the schizophrenic children.

4. Nearly all the children diagnosed as schizophrenic belonged to the older test group (> 8 years).
TABLE 1
Composition of the Three Experimental Groups

<table>
<thead>
<tr>
<th>Group</th>
<th>$n$</th>
<th>$M$ (Years)</th>
<th>SD</th>
<th>$M$</th>
<th>SD</th>
<th>Age Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>33</td>
<td>5.3</td>
<td>1.4</td>
<td>3.3</td>
<td>7.8</td>
<td>3.3 to 7.8</td>
</tr>
<tr>
<td>Younger*</td>
<td>17</td>
<td>6.9</td>
<td>1.2</td>
<td>4.6</td>
<td>1.3</td>
<td>4.0 to 7.9</td>
</tr>
<tr>
<td>Older*</td>
<td>16</td>
<td>11.2</td>
<td>2.5</td>
<td>7.7</td>
<td>2.7</td>
<td>8.0 to 22.0</td>
</tr>
<tr>
<td>Autistic (chronological age)</td>
<td>28</td>
<td>9.6</td>
<td>2.1</td>
<td>5.0</td>
<td>13.0</td>
<td>5.0 to 13.0</td>
</tr>
</tbody>
</table>

*Less than 8 years old. **8 years old or older.
*Included one 5-year-old and one 8-year-old; all other children in this group ranged in age from 8 to 13 years.

Age information for autistic, schizophrenic, and normal-control children is given in Table 1. All normal control children were free of psychiatric or significant medical history.

Stimuli

Five emotionally neutral sentence-types were selected (e.g., *Lizzy is petting her cat, Johnny is walking his dog*). The utterances were spoken by a professional actress who was instructed to say the sentences as naturally as possible with 4 different emotional intonations—sad, angry, happy, or surprised—yielding 20 stimuli. The stimuli were “bidimensional,” in that each sentence contained both a linguistic meaning (e.g., “Johnny is walking his dog”) and an emotional meaning (e.g., “happy”) that were carried in the intonation. The sentences were recorded using a dynamic microphone and an Ampex reel-to-reel tape recorder in a sound-attenuated booth. For each condition, emotional and linguistic, the 20 test sentences were randomized and transferred onto a cassette tape.

Response sheets were prepared so that a linguistic and an emotional judgment could be made for each stimulus. For the linguistic task, children were presented with four line drawings of scenes (see Figure 1) representing the linguistic meaning of the stimuli (e.g., boy walking dog, girl petting cat); for the emotional task, they were presented with line drawings (see Figure 2) of a happy, sad, angry, and surprised face, with the written word for each emotion below the face.

The emotional condition began with tape-recorded instructions in the voice of the actress, stating that “Sometimes I feel sad, sometimes happy, sometimes angry, sometimes surprised; and then when I talk, I sound just like I feel.” In instructing the child to listen to her and point to the right picture to indicate how she is feeling, the child had an opportunity to become accustomed to the speaker’s voice, while hearing the instructions. For the linguistic condition, the instructions, given on tape by the same speaker, were to point to the picture that shows what the sentence means.

Both linguistic and emotional conditions were preceded by four practice items, which were repeated until it was clear that the child understood the task. Thus each child heard 4 practice items and 16 test items for each condition, linguistic and emotional. For each tape-recorded test utterance, the child was encouraged to point to one of four drawings. The examiner was careful not to look at any one of the four response items. When a clear pointing response from the child was observed, the examiner then entered the child’s responses onto a separate answer sheet. The order of tasks (linguistic/emotional) was alternated with each child.

These stimuli were pretested on 45 normal adults, 16 men and 29 women, ages 21 to 65 ($M = 31.4$ years, $SD = 12.0$ years), who scored an average of 100% on the linguistic task and 97.4% ($SD = 5.24$ points) on the emotional task. The normal adults tested were all native speakers of English without psychiatric history and with education ranging from high-school-graduate to postgraduate levels.

Listen to me talk now, and point to the picture that shows how I feel.”
As mentioned earlier, the stimuli were prepared such that normal adults would perform nearly perfectly on both tasks. Our interest was in comparing developmental schedules of normal and clinical participants on emotional versus linguistic stimuli. Preliminary data analysis indicated that normal children fell into two disjunctive groups with respect to their performance on the affective task: younger and older, with a clean break between ages 7 and 8 years. Therefore, the autistic and normal-control groups were each divided into two subgroups: (a) children age 8 or older and (b) children under 8. The schizophrenic group included mainly older children, because children under 7 seldom receive this diagnosis (e.g., only one schizophrenic child under 7 was tested (see Figure 9).

Mean scores (percentage correct) for all three groups are shown in Table 2. Older normal children performed well on both tasks: They made virtually no errors on the linguistic task, and only 8% errors in the emotional condition. Younger normal children also performed well on the linguistic task (7% errors). Scores on the linguistic task are plotted against age in Figure 3. Scores on the emotional task are plotted against age in Figure 4, which shows that younger normal children were relatively unable to do the task, whereas older normals performed at a mean of 92% correct. A shift in performance occurred at about age 8. The difference between the older and younger groups in performance on the emotional task was significant, \( t(32) = -5.79, p < .001 \). Additionally, performance is significantly correlated with age \( r = .66, p < .001 \). Because nearly all normal children scored perfectly on the linguistic task, no correlation was calculated.

Most younger and older autistic children performed relatively well on the linguistic task, although individual scores varied far more than did scores for the normal group: The younger autistic group averaged 72% correct, whereas the older autistic group averaged 89% correct, a significant difference, \( t(26) = -2.06, p < .05 \). Older autistic children also performed better than younger ones on the emotional task, \( t(26) = 2.07, p < .05 \).

We wished to determine whether information on MA in the autistic population would reveal a pattern in performance on the two tasks, such that mental retardation in the children would be related to linguistic or affective recognition abilities. To this end, individual scores on each task were plotted versus CA and versus MA for autistic children (Figures 5 to 8). For the autistic children, CA was a poor predictor of performance on both tasks (linguistic task, \( r = .21, p > .2 \); emotional task, \( r = .08, p > .7 \)). As might be expected, performance does vary slightly more regularly, although not significantly, with a child’s MA (linguistic task, \( r = .47, p < .03 \); emotional task, \( r = .40, p < .06 \)). However, these correlation values are small relative to those observed for the normal control group, and even children with the highest MAs continue to have difficulty with the emotional task. Autistic children did not show the same acquisition pattern for understanding the labeling of verbal expressions of emotion that normal children do (i.e., abrupt changes in performance at about age 8). The younger autistic children were poor at the affective judgment, and the older autistic children varied greatly in their ability to make

| Table 2 |
|________|
| Means and Standard Deviations of Performance on Linguistic and Emotional Tasks for Normal and Autistic Groups Over 8 Years (Older) and Under 8 Years (Younger) and for the (Older) Schizophrenic Group |

<table>
<thead>
<tr>
<th>Group</th>
<th>( n )</th>
<th>Mean Percentage Correct</th>
<th>SD</th>
<th>Mean Percentage Correct</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Younger normal</td>
<td>16</td>
<td>92.3</td>
<td>16.6</td>
<td>47.8</td>
<td>29.8</td>
</tr>
<tr>
<td>Older normal</td>
<td>17</td>
<td>100</td>
<td>0</td>
<td>91.8</td>
<td>7.8</td>
</tr>
<tr>
<td>Younger autistic</td>
<td>10</td>
<td>71.9</td>
<td>24.2</td>
<td>38.8</td>
<td>18.8</td>
</tr>
<tr>
<td>Older autistic</td>
<td>18</td>
<td>88.5</td>
<td>18.2</td>
<td>61.1</td>
<td>31.0</td>
</tr>
<tr>
<td>Schizophrenic (older)</td>
<td>19</td>
<td>99.0</td>
<td>3.1</td>
<td>82.4</td>
<td>15.4</td>
</tr>
</tbody>
</table>

FIGURE 2 Response sheet for the affective condition of affective/prosodic protocol.
distinctions. Furthermore, the low correlation between MA and performance on the emotional task suggests that the poor performance of autistic (relative to normal) children on this task was not due to mental retardation, "developmental delay," or low MA: Some children with low MAs were proficient on the emotional task, whereas others with higher MAs were relatively unable to do the task. MA is thus not a good predictor of performance on the emotional task.

Student-Newman-Keuls tests examined the relative performance of the autistic and normal groups on both tasks. On the linguistic task, autistic children under 8 produced significantly more errors than all other groups on the linguistic task, but no other groups differed significantly in performance (MSE = 204.58, df = 58, alpha = .05). On the emotional task, normal children under 8 did not differ in performance from either autistic group, but nor-
mals over 8 made significantly fewer errors than did other children ($MSE = 542.322, df = 58, alpha = .05$). Thus the older autistic children performed significantly worse than older normals on the emotional task, whereas the two younger groups did not differ significantly on that task.

Mean scores for the schizophrenic group are included in Table 2; scores on the linguistic and emotional tasks are plotted against CA in Figures 9 and 10. As the figures show, all these children performed nearly perfectly on linguistic testing. In contrast to observations in older (and younger) autistic children, in the schizophrenic group, performance on the emotional tasks was significantly correlated with the child's age ($r = .47, p < .04$), suggesting that (older) schizophrenics did not differ from (older) normals in developmental schedule on this task. This finding contrasts with results obtained for the
autistic group, in which scores on the emotional task did not correlate significantly with CA or MA. A Student–Newman–Keuls test comparing the five groups on the linguistic task indicated that only the younger autistic group differed significantly from the others ($MSE = 204.58, df = 76$, alpha = .05). That is, the schizophrenic group did not differ in performance from either older normal or older autistic children. On the emotional task, the older normal and schizophrenic groups, again, did not differ in performance ($MSE = 524.32, df = 76$, alpha = .05), although these two groups differed significantly from the older and younger autistic and the younger normal groups.

**DISCUSSION**

This study compared performance in normal and clinical groups on a linguistic and an emotional task, using bidimensional, tape-recorded verbal stimuli that communicated both an emotional and a linguistic meaning. First, this study revealed that normal children under 8 were poor in a task that required them to match emotional prosody in speech expressing four basic emotions (sad, happy, angry, or surprised) to a line-drawn face and a word referring to that emotion, despite good performance on a test with superficially similar task demands (listening to a tape-recorded stimulus and matching it to one of four pictures). In contrast, normal children above age 8 were able to match the emotional sentence to the face/word response nearly as well as adults. The differences between performance on the two tasks may be attributable to conceptual differences between the tasks. We speculate that the linguistic meaning is foregrounded and salient, whereas the emotional meaning is backgrounded and covert. Line drawings corresponding to the linguistic meaning may be conceptually more “obvious” than line drawings requiring a labeling of emotional meanings carried in the intonation. Further research is required to uncover the reasons for the disparate performance.

The rather abrupt shift from poor performance at the younger ages to good performance at older ages may correspond to a general shift in cognitive development reflected in other functions documented for children between ages 5 and 7 (Shapiro & Perry, 1976; Tanguay, 1985; White, 1965). In contrast, Dimitrovsky (1964) reported a gradual increase in correct identifications of vocal emotion using a matching task. In that study, stick-figure drawings with captions were used as responses, whereas faces and captions were used in our study.

It cannot be inferred from these findings that younger children are unable to perceive and recognize the four emotions in speech. In fact, studies reviewed above have indicated clearly that children perceive and comprehend various aspects of prosodic information in speech from early infancy. However, we may conclude that the ability to label or categorize acoustic cues in speech for four common emotions is not acquired in normal children until about age 8. Our findings agree with those of W. C. Lewis et al. (1971), who reported that children ages 5 to 7 were less able to talk about their emotions than older children. To determine normal children's competence for emotional comprehension, further research is needed; for example, a discrimination task would eliminate the need for overt categorization and cross-modal matching, and would assess children’s abilities to recognize acoustic differences between emotional stimuli.

Older autistic children were not significantly worse than older normal children on the linguistic task. However, in the emotional condition, neither older nor younger autistic children differed significantly from younger normal children. That is, the linguistic task did not distinguish the older normal from the older autistic children, but the emotional task did. As correlations comparing performance both to MA and to CA were not significant for the autistic groups, it was concluded that the poor performance cannot be explained by developmental delay or by lower MA. The observation that autistic children were poor at identifying vocalized emotional meanings from speech agrees with findings reported by Hobson (1986a, 1986b), who used videotaped emotional scenes in a similar paradigm. His stimuli included facial and vocal emotion, as well as situational context. Our study indicated that one of the channels, vocalized emotion, is not well recognized by autistic children.

From these results, we cannot tell whether autistic children do not have any competence for four emotions expressed in speech prosody, or whether they are merely unable to make the cross-modal matching required by the task. That is, it cannot be said whether or not autistic children recognize emotional meanings expressed in the prosody of speech. It can only be said that they cannot match these emotions given categories to choose from. As suggested earlier for normals, testing using a discrimination paradigm is indicated to address these questions.

The schizophrenic group did not differ from older normal children on either the linguistic or the emotional tasks. This finding suggests that despite the social/emotional disturbances in this population, an ability to recognize and to match basic emotions expressed in the prosody of speech is intact. Thus the inappropriate behaviors observed in conversational interaction in these children cannot be obviously attributed to a deficit in comprehending and categorizing basic emotional meanings in the speech of their interlocutors.

This study represents a preliminary attempt to investigate emotional abilities of normal and developmentally disabled children. The study uses an experimental paradigm very similar to that originally used by Heilman, Scholes, and Watson (1975) on left- and right-brain-damaged patients. In that study, patients listened to an emotionally intoned sentence, and pointed to a pictured response. Left-brain-damaged patients, all aphasics, were found not to differ from normals, but right-brain-damaged patients were significantly impaired in this task; that is, recognizing and matching basic emotional pros-
ody in speech was possible for the aphasic group but not for the right-hemisphere-damaged group.

In this study, a preliminary attempt was made to measure the abilities of three groups (normal, autistic, and schizophrenic) to match prosodic cues for four common emotions in speech with labels for those emotions, in comparison with their abilities to make comparable linguistic judgments. Our tentative hypothesis, that autistic but not schizophrenic children would be impaired in the emotional judgment compared to the linguistic judgment, both as compared to normal-control children, was essentially supported. The surprising finding was that younger normal children were not successful at the emotional task. The reasons why the younger normal group and both autistic groups could not successfully perform the emotional-prosody task remain to be probed. For the younger autistic group, no implications regarding hemispheric specialization can be drawn, as this group did not differ significantly from CA-matched normals; Both performed poorly. However, results from the older autistic children, in comparison with older normal-control children, are not incompatible with the notion that autistic children have bilateral hemispheric impairment (Prior & Bradshaw, 1979). This supposition is based on findings already reviewed here that recognition of emotional meanings in speech in normal children is lateralized to the right hemisphere, whereas linguistic comprehension is processed in the left hemisphere (see Bryden, 1982). In this study, autistic children were impaired in both the linguistic and the emotional tasks. However, whether the impairment occurs at stages of perceiving, comprehending, and/or categorizing the stimuli cannot be determined from our results. Further research, for example, using a discrimination paradigm, and possibly complementing that paradigm with an electrophysiological measure of auditory evoked responses, may reveal whether the emotional contrasts signaled in speech prosody are processed perceptually in younger normal and in autistic children.

REFERENCES


EMOTIONAL-PROSODIC MEANINGS IN SPEECH
A Comparison of Cognitive and Behavioral Patterns in Learning-Disabled Children: Subtype and Sex Differences

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A sample of 83 learning-disabled (LD) females were individually matched to 83 LD males by age and Full Scale IQ and were compared on several cognitive and behavioral measures. Factor- and cluster- analytic techniques were applied to the cognitive and behavioral data, and similar factor and profile structures were found for male and female LD children. The clusters and factors identified in the analyses demonstrated several significant relationships to performance on certain cognitive and behavioral measures, reading, and an attention- impulsivity task for the combined male and female sample. Although statistically significant sex differences were found on measures suggesting that females were less impulsive and were better at reading comprehension than males, the study identified more similarities than differences among LD males and females.

There has been considerable controversy regarding the presence or absence of sex-related differences in cognitive functions, academic achievement, and behavior in the developing child (Bakker & Moerland, 1981; Fairweather, 1976; Hyde, 1981; Maccoby & Jacklin, 1974; Satz & Zaiden, 1983). Although Maccoby and Jacklin's (1974) classic review has been cited as providing evidence of "normal sex differences" in aggression, mathematics, spatial visualization, and verbal language skills, other authors have raised questions regarding these generalizations and suggest that if sex differences do exist, they account for only a small proportion of the variance in these traits (Fairweather, 1976; Hyde, 1981; Satz & Zaiden, 1983).

One consistent finding in the literature is that more males than females are identified as learning disabled (LD). The ratio of males to females has been reported to range from 2:1 to 5:1 (Critchley, 1970; Finuccii & Childs, 1981).