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The abilities of autistic and schizophrenic children to recognize the meanings of concrete nouns, nonemotional (neutral) adjectives, and emotional adjectives were compared to a normal control (NC) group using a picture-matching task. Autistic children performed significantly worse than chronological-age-matched normal and schizophrenic children on emotional adjectives but did not differ in their abilities to recognize the meanings of nouns and neutral adjectives. Schizophrenic children did not differ from normal children in any of the three tasks. When matched on mental age, autistic and normal groups did not differ significantly. In a descriptive analysis of definitions, verbal responses from autistic children were found to be more like those of younger normal children. Considered together, these results suggest that abnormal
performance on adjectives can be attributed to language delay rather than to specific autistic features. When parents, autism experts, and speech/language pathologists evaluated definitions of emotional adjectives produced by autistic and normal children, all three rater groups were able to distinguish between responses from the two groups.

In recent years, the emotional life of adults (Buck, 1984; Hellman & Satz, 1983; Tucker, 1981) and children (Cicchetti & Schneider-Rosen, 1984; Izard, Kagan, & Zajonc, 1984; Lewis & Michelson, 1983; Murphy, 1983; Yarrow, 1980) has become the object of serious scientific inquiry. In adults, there is considerable evidence that the right hemisphere of the brain plays a role in the production and comprehension of emotional meanings of speech (Ross, 1981), whereas mood appears to be the product of basal limbic structures (Benson, 1984). In children, although the primary focus of inquiry has been cognition, it is recognized that the emotional and social domains are significant in development and well being (Izard, Kagan, & Zajonc, 1984). Specifically, knowledge of how a child acquires and uses adjectives that refer to affective meanings may be important in understanding the structure of a child's emotional experience.

The study of emotional language is confounded by the fact that its acquisition is associated with general intellectual and social development. The experience (feelings) and expression (behavior) of a particular emotion is dependent on variables such as linguistic abilities, age, and cognitive maturity. For example, the ability to differentiate among contrasting emotions may be contingent on the child's knowledge of cause and effect. Lewis and Michelson (1983) and Yarrow (1980) suggested that some emotions (e.g., shame and guilt) are likely to be experienced only after the child is able to compare his or her behavior to a standard. Thus, the individual must cognitively evaluate a situation prior to the experience of an emotion. To understand an emotion is to know: (a) the situations where it occurs; (b) the states, events, and actions that relate to it; (c) what actions and expressions follow as a consequence from it; and (d) what uses an emotion can apply to (Schwartz & Trabasso, 1984). Yarrow suggested that emotions can be discriminated on a symbolic level. Symbolic perception requires the individual to relate the stimuli to past experiences and to integrate memories of remote and recent events. Therefore, the child's perception of a stimulus may influence his or her interpretation of the meaning of that stimulus. According to Izard, Kagan, and Zajonc (1984), cognitive factors can lead to an emotion but are not always sufficient; cognition is necessary in the symbolization and labeling of emotion. Thus, the acquisition of affective terms reflects the overlap between language acquisition and cognitive capacity. Even though the child may be experienced an emotion, he or she may be unable to use the appropriate lexical terms (Lewis & Michelson, 1983). In this arti-

cle, we investigate normal acquisition of emotional adjectives and determine how factors such as psychosis affect the understanding and use of emotional words.

Much research on labeling emotions has focused on children's understanding of the antecedents and consequences of emotions and their use of emotional terms in describing their feelings (Izard, 1971). A child's ability to discriminate and recognize emotions in speech, for example, apparently develops earlier than his or her ability to label them (Van Lancker, Cornelius, & Kreiman, 1989), and the number and type of response increases with age, with older children producing more specific and qualified statements. This suggests that cognitive maturity is a factor in the interpretation of emotions; however, although it has been shown that children do use emotional words as early as 2 years old (Zane-Waxler, Radke-Yarrow, & King, 1979), it is not known if they understand these words and if they use them with the correct connotations.

Previous studies of autism focused principally on deficits in language and cognition (Ornitz, Guthrie, & Farley, 1977; Prior, 1979; Wing, 1969), but some researchers have also investigated the social and feeling life of the autistic child. Deficits in social interactions in persons with autism, especially in attention-sharing behaviors such as pointing to and showing objects, have been reported by Sigman, Mundy, Sherman, & Ungerer (1986). Wolff and Barlow (1980) found that autistic children were deficient in their ability to report how people felt when asked to describe differences between people in two pictures. A series of studies by Hobson (1986a, 1986b) probing the abilities of autistic children to recognize and match natural emotional expressions in videotaped scenes reported deficits in such matching abilities. Analyzing language samples of seven autistic children 14 to 21 years old, Simmons and Baltaxe (1975) found instances of nonypical semantic features in words of emotional connotation. Finally, our clinical experience with autistic children suggested that terms for emotions were used aberrantly and that even when a correct identification was made for an affective term on a picture pointing task, for example, the Peabody Picture Vocabulary Test; PPVT (Dunn, 1959) when asked why that (correct) picture was chosen, these children often verbalized a bizarre reason. Our notion was that autistic children may have unusual mental representations for words describing inner feeling states.

This study was conducted to further investigate whether children diagnosed as autistic or schizophrenic are impaired in cognitive understanding of words with affective meanings. We were interested in (a) whether schizophrenic or autistic children, many of whom have abnormal affective and social behaviors, acquire and understand adjectives describing inner feeling states differently from other kinds of adjectives; and (b) whether, in autistic children, despite correct recognition of emotional adjectives, abnormal semantic representations could be detected in their verbal productions, when
compared to NC children. Our hypotheses were that autistic children would perform significantly worse on recognition of emotional than nonemotional adjectives and significantly worse on emotional adjectives than NC or schizophrenic subjects. Furthermore, we predicted that verbal descriptions of their correct identifications would be identifiable as abnormal.

METHOD

Subjects

A total of 35 NC children (20 girls, 15 boys) ranging in age from 2 years, 10 months to 12 years, 1 month (mean chronological age [CA] = 6.24 years; SD = 2.92), were tested. This group was used to determine normal performance on the three tasks (described next). A subset from this group was formed to provide mean CA and mean mental age (MA) matches to the clinical groups; this subgroup included 16 children (7 girls, 9 boys; mean CA = 8 years, 9 months; SD = 2 years, 2 months; range = 6 years, 2 months to 12 years, 1 month).

Clinical subjects were 20 autistic children (17 boys, 3 girls; mean CA = 8 years, 8 months; SD = 1 year, 8 months, range = 7 years, 0 months to 12 years, 10 months) and 11 schizophrenic children (8 boys, 3 girls; mean CA = 8.86 years; SD = 2.0, range = 7 years, 0 months to 12 years, 0 months). The clinical subjects were diagnosed by the Child Psychiatry Clinical Research Center at the University of California, Los Angeles 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 neurologic 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 pediatrian—all expert in dealing with psychotic children (Tanguay, 1986). A diagnosis of early infantile autism or childhood schizophrenia was reached only if all members of the team or all but one agreed that the child's condition met all of the criteria listed in the Diagnostic and Statistical Manual of Mental Disorders (3rd ed., American Psychiatric Association, 1987). Children whose developmental quotient or IQ was less than 40 on a standardized psychologic assessment were rejected (Tanguay, Edwards, Buchwald, Schwafel, & Allen, 1982).

Stimuli and Procedure

Three sets of 15 words were chosen. The first is a set of 15 object nouns (table, chair); the second is a set of nonemotional or neutral adjectives, which describe external appearances (round, furry); the third is a set of emotional adjectives (happy, sad) which label an inner feeling state (see Appendix). The words in each list were obtained from text-frequency ratings calculated from corpora of written (Kucera & Francis, 1967) and spoken (Dahl, 1979) American English. Words were chosen that children could be expected to know, and no word had a rating of less than 9 per million in the text-frequency counts. Four line drawings were selected for each target word from the PPVT and the Auditory Familiar Sounds Test (Developmental Learning Materials, Allen, TX; examples given in Figures 1–3). The child was presented with a word spoken by the examiner, who then instructed the subject to point to one of four pictures on a response card to match the word. The examiner took care not to direct the child’s response by eye gaze, commentary, or other means. Subjects' choices are tabulated on a separate sheet. In addition, for the emotional adjectives children were asked why
they chose the answer they did and were then asked to define the word. These responses were recorded for later transcription and analysis.

RESULTS

Figure 4 presents results for the NC group (n = 35). Because a broad age range (2 years, 10 months to 12 years, 1 month) was represented in this population, we were interested in presenting scores plotted against CA. Children of all ages performed almost perfectly in identifying nouns (99.6% correct), and there was no effect of age on performance ($R^2 = .062$, ns). Performance scores for the neutral adjectives averaged 89.7% correct for this group, and a small but significant correlation between age and performance in comprehension of neutral adjectives ($R^2 = .285$, $p < .001$) was observed. On emotional adjectives the group mean was 78.7% correct because of the errors made by the younger children in this population, and a larger effect of age on performance ($R^2 = .421$, $p < .0001$) was observed. Emotional adjectives were more difficult than neutral adjectives for the NC group overall which was confirmed by a paired $t$ test, which indicated a significant difference between scores on neutral adjectives and emotional adjectives ($t = 4.298$, $p < .0001$). Thus, normal children recognized meanings of nouns quite easily, as was expected; in general, adjectives were somewhat more difficult, and meanings of neutral adjectives were recognized better than meanings of emotional adjectives.

Although age was correlated with performance on both kinds of adjectives, performance on emotional adjectives was somewhat more affected by age than performance on neutral adjectives. Examination of the age/performance scatterplot (Figure 4) for recognition scores on neutral adjectives...
suggests that children of about 5 years old and older recognize these terms considerably better than children under 4 years old. The same shift from poor to good performance is suggested for emotional adjectives.

Group comparisons were made using CA-matched groups. Table 1 gives means and standard deviations for the mean age-matched group (n = 16), the autistic group (n = 20), and the schizophrenic group (n = 11) performance on nouns and on neutral and emotional adjectives. A two-factor analysis of variance (ANOVA) with repeated measures on task was performed on the three groups, resulting in a significant main effect of group, F(2, 44) = 10.528, p < .001, a significant main effect of task, F(2, 44) = 40.27, p < .0001, and a significant Group × Task interaction, F(2, 44) = 7.928, p < .0001. Thus, the groups differed in performance, and their performance differed as a function of task. One-way ANOVAs performed on each task indicated that the groups did not differ in their performance on nouns, F(2, 44) = 3.473, p = .04, but significant group differences were found for neutral adjectives, F(2, 44) = 8.036, and emotional adjectives, F(2, 44) = 12.08, p < .0001. Post hoc Scheffé analyses comparing NC, autistic, and schizophrenic children revealed significant (p < .05) differences between NC and autistic groups and between autistic and schizophrenic groups on neutral and emotional adjectives, but NC and schizophrenic children did not differ significantly on any of the three tasks.

To investigate whether sex of the subject in the comparison groups was a contributing factor, data from boys only were analyzed separately. One-factor ANOVAs on 16 NC, 8 schizophrenic, and 17 autistic children revealed no group differences in performance on nouns, F(2, 38) = 2.853, ns, a significant effect of group for neutral adjectives, F(2, 38) = 6.369, p < .01, and a significant effect of group for emotional adjectives, F(2, 38) = 8.867, p < .001. Again, NC and autistic, and schizophrenic and autistic groups differed significantly (p < .05) on both neutral and emotional adjectives but not on nouns.

Because normal children performed at ceiling on nouns and near ceiling on neutral adjectives, measures of performance by clinical groups may reveal differences not seen in measures including all three groups. Therefore, further tests comparing the two clinical groups were performed. Comparisons were made using performance data on the three tasks by the autistic (n = 20) and schizophrenic (n = 11) groups. A 2 × 3 ANOVA with repeated measures on task revealed a significant main effect of group, F(2, 58) = 22.69, p < .01, and a significant Group × Task interaction, F(2, 58) = 5.23, p < .01. Post hoc analysis indicated no difference between groups on nouns and neutral adjectives, F(1, 29) = 4.24, p = .05. However, when average values of scores on nouns and neutral adjectives were compared to emotional adjectives, the groups differed significantly, F(1, 29) = 5.23, p < .01. Matched pair t tests of scores on neutral and emotional adjectives showed a significant difference between tasks in the autistic group (df = 19, t = 4.274, p < .0001), whereas the schizophrenic group did not show a significant difference in performance on the two tasks (df = 10, t = 1.985, ns). Thus, the autistic children performed significantly worse in identifying emotional adjectives than either nouns or neutral adjectives, whereas the schizophrenic children's performance did not differ significantly on these tasks.

We analyzed performance of autistic children using both CA and MA as classificatory parameters, to determine the role of intelligence, or mental retardation, as tested by standard assessment instruments. As just mentioned, significant correlations between CA and performance on neutral and emotional adjectives but not for nouns were observed for normal children. For autistic children, significant (p < .05) but relatively low correlations with CA were also observed on neutral and emotional adjectives but not for nouns (for nouns, R² = .129, ns; for neutral adjectives, R² = .264; for emotional adjectives, R² = .36; both adjective correlations were significant at p = .05). The shift in performance seen for neutral adjectives in the larger normal group at about 5 years old was also observed in the autistic group, although less clearly and at a later age—about 7 years old (see Figure 5). No such pattern was apparent for autistic performance on emotional adjectives, who showed greater variability overall.

MA scores were not available for the schizophrenic group. The question of MA is more crucial for autistic children, who vary greatly on this measure. Therefore we next investigated the role of MA in performance of autistic children. MAs were measured using the Merril-Palmer Test and the Wechsler Pre-school and Primary Scale of Intelligence (WPPSI) within 6 months of testing on these protocols. Autistic children were matched with NC children, yielding 13 children in each group (autistic and NC). Table 2 shows mean performance scores of these two groups on nouns, neutral, and emotional adjectives. A two-factor repeated measures ANOVA revealed no significant main effect of group, F(1, 24) = 1.76, ns, a significant main effect of task, F(2, 24) = 18.829, p < .0001, and no Group × Task interaction, F(2, 24) = .253, ns. Thus, when NC and autistic children were matched for MA and their performance on these three tasks compared,
TABLE 2
Means for MA-Matched Groups on Three Tasks

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Nouns</th>
<th>Neutral Adjectives</th>
<th>Emotional Adjectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>100</td>
<td>86.2</td>
<td>77.1</td>
</tr>
<tr>
<td>Autistic</td>
<td>93.3</td>
<td>75.4</td>
<td>64.6</td>
</tr>
</tbody>
</table>

*1n = 13.

Both groups differed overall in their abilities to recognize nouns, neutral adjectives, and emotional adjectives, but the groups did not differ significantly from each other. This suggests that deficits observed in autistic children on these tasks may be related to language delay or mental retardation in these subjects.

Descriptive Study

The previous study assessed comprehension of nouns and adjectives using a word–picture matching task. This gives little indication of what children think about the meanings of these words. A correct pointing response may not reflect a normal mental representation of the word meaning. To observe how children might understand these meanings, we analyzed verbal responses elicited from normal and autistic children. For each correct pointing response, children were encouraged to answer three questions: (a) Why did you choose that picture?, (b) How would you define the word _____?, and (c) How would you use that word in a sentence? Verbal responses were tape recorded and transcribed. First, we evaluated and categorized verbal responses; second, we investigated whether verbal definitions given by autistic subjects were distinguishable from definitions of the same words given by age-matched normal control children.

The 15 emotional adjectives were rank ordered by percentage correct and the five highest ranking adjectives were selected: hurt, sad, happy, mean, surprised. For these adjectives, transcribed responses to the question “What do you think _____ means?” were analyzed. Responses were evaluated and categorized.

Seven types of responses were found:

1. Perseverations on the target word.
2. Description of local detail from line-drawings in the response cards.
3. Concrete response, usually a physiological reference.
4. Self-referential response: The emotion is related to specific personal experience of the child.
5. Generalized situational or experiential example.
6. True synonym.
7. Wrong definitions.
Definitional features tended to change with age in normal children. Younger children (<7 years old) often gave definitions that included the target word or perseverations. For example, for surprised, a child of 5 years, 6 months (CA) said “means like when a surprise comes”; for hurt, a child of 4 years, 6 months said “means that you got hurt.” Younger children were also more likely to give a concrete definition, either referring to details in the picture, as in mean is “when somebody ties you up in a rope” (3 years) or invoking a physical event, as in hurt is “like you scratch yourself” (5 years, 4 months). Younger children also gave more wrong answers. The following verbal response illustrates the concrete and wrong-definition features: sad is “like a little kid gets mad if somebody-spans you.”

Older children (>7 years old) tended to give fewer perseverations, concrete pictured or physical details, or wrong definitions. Instead, they more frequently gave true synonyms, such as sad as “unhappy,” (12 years, 1 month; 9 years, 0 months) or “not happy” (11 years, 7 months), or “it means sort of like disappointed. It’s the opposite of happy”; (10 years, 5 months) and mean was defined as “not nice,” (10 years, 4 months and 9 years, 1 month). Rather than idiosyncratic concrete details, they gave generalized situational or experiential examples. For example, hurt was defined as “somebody got an accident” (8 years, 8 months); mean was defined as “like you’re real tough and you kill people and stuff. Just not a nice person.” (10 years, 5 months). Older children also used fewer self-referential definitions.

The responses of the autistic children, all over 7 years old, were more like responses of normal children under 7 years old. Responses contained more perseverations, allusions to the line-drawing and other idiosyncratic concrete detail, and self-reference. A higher proportion were classed as “wrong.” For example, for mean, the response of an autistic child (10 years, 5 months) “because if you’re being mean to someone and they don’t like you when you do mean things to them” is both perseverative and wrong. Another (8 years, 6 months) described details in the picture: “If they hurt you, and you get wrapped up in the tree.” The verbal responses of the autistic children included fewer synonyms and generalized examples (34%) than normal children of the same age (81%). The MA of the autistic children was a better predictor of their definitions than their CA. Synonyms and generalized examples were provided only by one autistic child (10 years, 7 months) whose MA was 11 years, 10 months; hurt was defined as “wounded,” sad was defined as “unhappy.”

The next analysis addressed the question of whether autistic verbal definitions could be discriminated from normal responses. Seven autistic boys with a mean CA of 9.70 years (range = 7 years, 11 months to 11 years, 10 months) and a mean MA of 8.02 years (range = 5 years, 5 months to 11 years, 7 months), and seven normal boys with a mean CA of 7.92 years were selected for the descriptive study. The control subjects were matched to the autistic subjects by MA within 6 months. For the normal and the experimental groups, responses from the 7 children were sorted into four age groups: those from 5- (n = 2), 7- (n = 2), 8- (n = 3), and 11- (n = 2) year-old children. Responses from the 11 years olds (n = 2) were used as a practice trial.

The definitions obtained from clinical and normal subjects were combined and randomized within 5-, 7-, 8-, and 11-year-old age groups. These responses were then given to three sets of raters, so that nine raters made 90 judgments of verbal definitions taken from four groups of autistic children matched in MA to four groups of normal children. The first group of raters included three parents. The second group of raters, the autism expert group, included a psychiatrist and two psychologists specializing in infantile autism. The third rater group consisted of three speech pathologists and was called the speech/language expert group. These raters were asked to rate each individual definition as normal (typical or average, appropriate or expected for a child of that age) or bizarre (odd or weird, deviating from a typical or expected response for a child of that age).

Percentage of correct normal response (hit rate) and incorrect normal response (false alarm rate) obtained from parents, autism experts, and speech/language experts for the three subject groups are shown in Table 3. A signal detection measure, probability of an accurate response P(A), using correct responses (both hits and correct abnormal responses) and incorrect responses (false alarms and incorrect rejections) was tabulated for all raters’ judgments of the three age groups (McNicol, 1972). The values for all raters combined for each age group reveal that the highest percentage correct was obtained for the oldest group, the 8 year-olds (87% correct). Table 3 also gives hit and false alarm rate for each age by each rater group. The lowest hit rates are seen for the 7-year-old group across all three groups of raters; the highest probability of a correct identification was obtained from the parent group.

These studies used children’s verbal responses to questions about emotional adjectives that were correctly judged in the comprehension task. Whether evaluating those responses or subjecting them to judgments by “blind” raters, a similar conclusion emerges. Autistic and normal children appear to differ with respect to mental representations of meanings for these emotional adjectives, even when they produce correct recognition responses on a matching task.

DISCUSSION

Normal, autistic, and schizophrenic children were tested in their abilities to comprehend meanings of nouns and of neutral (nonemotional) and emotional adjectives. Normal children know more nouns than neutral adjectives.
This study shows that autistic children are more impaired than schizophrenic or normal children in comprehension of emotional adjectival meanings, suggesting a developmental deficit in that population for establishing emotional meanings, related to the presence of mental retardation in that group. These findings add information to recent interest in social/emotional development of autistic children. On the other hand, that schizophrenic children performed as well as normal children on both tasks suggests that their language disturbance, usually attributed to an underlying thought disorder, does not extend to comprehension of emotional adjectives. Categorization of common human emotions in schizophrenic children was not markedly abnormal when compared to CA-matched NC children.

The descriptive studies indicated that autistic and NC children have different notions of how to define emotional adjectives. This was true even of adjectives that had a correct score on the comprehension task. Evaluations of verbal responses elicited from each child revealed that autistic children retain definitional features of younger NC children, using fewer synonyms and generalized examples and more concrete and wrong responses. The blind rating study, in which parents and experts classified the responses of autistic and normal children with a high probability of accuracy, indicates that elicited verbal definitions of emotional adjectives from autistic children are readily recognizable as abnormal. Compared to autism experts and speech/language pathologists, parents showed the best classification accuracy.

Results from comprehension scores and verbal responses obtained for emotional adjectives indicated that deficits in verbal understanding are present in autistic children and are related to mental retardation in these subjects. Schizophrenic children were not deficient in comprehension of emotional adjectives. However, verbal responses were not obtained for these children. Further investigation may uncover similar aberrant mental representations for verbal material in these and other clinical populations. The findings suggest that results of formal testing may be insufficient to characterize language deficits in developmentally disordered children.

**ACKNOWLEDGMENTS**

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**REFERENCES**


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**TABLE 3**
Percentage Correct Normal Responses (Hits), Percentage Incorrect Normal Responses (False Alarms; FA), and Probability Values (P/A); Chance = 0.5 for the Three Groups of Raters Rating the Three Age Groups of Children

<table>
<thead>
<tr>
<th></th>
<th>Hits</th>
<th>FAs</th>
<th>P/A</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All ages</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parents</td>
<td>81.0%</td>
<td>37.5%</td>
<td>0.81</td>
</tr>
<tr>
<td>Autism experts</td>
<td>81.6%</td>
<td>46.3%</td>
<td>0.77</td>
</tr>
<tr>
<td>S/L experts</td>
<td>73.3%</td>
<td>47.3%</td>
<td>0.71</td>
</tr>
<tr>
<td><strong>All raters</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age 8</td>
<td>87.0%</td>
<td>33.3%</td>
<td>0.86</td>
</tr>
<tr>
<td>Age 7</td>
<td>71.5%</td>
<td>60.6%</td>
<td>0.60</td>
</tr>
<tr>
<td>Age 5</td>
<td>79.8%</td>
<td>28.7%</td>
<td>0.84</td>
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<td><strong>Parents</strong></td>
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<tr>
<td>Age 8</td>
<td>88.9%</td>
<td>28.1%</td>
<td>0.88</td>
</tr>
<tr>
<td>Age 7</td>
<td>70.8%</td>
<td>50.0%</td>
<td>0.68</td>
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<td>Age 5</td>
<td>87.5%</td>
<td>28.1%</td>
<td>0.88</td>
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<td><strong>Autism experts</strong></td>
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<td>Age 8</td>
<td>83.3%</td>
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<td>Age 5</td>
<td>86.7%</td>
<td>26.7%</td>
<td>0.88</td>
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</tr>
<tr>
<td>Age 8</td>
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<td>Age 5</td>
<td>65.6%</td>
<td>31.3%</td>
<td>0.76</td>
</tr>
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</table>

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tives, and they know more neutral than emotional adjectives. When compared with CA-matched NC children, autistic children were found to be worse in matching neutral and emotional adjectives to pictures depicting their meanings. The schizophrenic group did not differ from normals on any of the three tasks. In a comparison of the clinical groups, autistic and schizophrenic children were significantly different in recognizing emotional but not neutral adjectives or nouns. Both autistic and NC children showed a positive correlation between age and performance on neutral and emotional adjectives. Both groups shift from poor to good performance on neutral adjectives at about 5 years old for normal children and about 7 years old for autistic children. A similar shift in performance observed for emotional adjectives in normal children was not apparent for the autistic group, probably due to greater variability. When autistic children were compared with a group of NC children matched for MA, both groups differed in their abilities to recognize nouns, neutral adjectives, and emotional adjectives, but the groups did not differ significantly from each other. This finding suggests that the deficits observed in autistic children in comprehending neutral and emotional adjectives may be related to mental retardation in these children.

**APPENDIX**

List 1. Object nouns

1. wagon
2. bicycle
3. flower
4. picture
5. carrot
6. glass
7. bed
8. eye
9. drum
10. bus
11. camera
12. brush
13. piano
14. book
15. hand

List 2. Neutral adjectives

1. hot
2. round
3. messy
4. big
5. old
6. furry
7. heavy
8. gentle
9. thirsty
10. clean
11. square
12. broken
13. dirty
Task Effects in the Development of Hand Preference in 9-, 13-, and 20-Month-Old Infant Girls

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Hand preference for reaching for objects was assessed in 63 female infants (twenty-two 9-month-olds, eighteen 13-month-olds, and twenty-three 20-month-olds). Unimanual reaching was elicited for five different kinds of objects after demonstrations of their use: putting pegs in a pegboard, drawing with a crayon, building a tower of cubes, stirring a spoon in a cup, and putting cubes in a cup. Bimanual manipulation was elicited for four different toys after demonstrations of their use: nut-and-bolt, car-in-a-jar, ball-in-a-box, and pinwheel. For unimanual reaching, there was a significant increase with age in the percentage of infants showing a right-hand preference as well as an increase in strength of preference. Further analyses also revealed that of the different tasks, the crayon task was the most reliable predictor of hand preference, whereas the spoon-in-the-cup task was the least reliable. For bimanual manipulation, frequency of right-hand manipulation increased with age, although there were age-related changes in hand-preference patterns. Younger infants tended to approach all tasks as unimanual reaching tasks, whereas older infants used more task-specific approaches. We conclude that previous reports of discontinuities in the development of handedness reflect, at least to some extent, the changing functional significance of the handedness tasks themselves.

Research on the development of handedness has suggested that the process is marked by major discontinuities, with hand preference fluctuating over time from one hand to the other and with periods of unilateral reaching alternating with periods of bilateral reaching (Carlson & Harris, 1985; Gesell & Ames, 1947; Hawn & Harris, 1983). To explain these fluctuations, a variety of models have been proposed reflecting differing views about the underlying cerebral mechanisms involved. According to Gesell (1965), fluctuations in hand use are the normal expression of the self-regulatory...