

Interpretation of Facial Expressions of Affect in Children with Learning Disabilities with Verbal or Nonverbal Deficits

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Abstract

The ability to identify facial expressions of happiness, sadness, anger, surprise, fear, and disgust was studied in 48 nondisabled children and 76 children with learning disabilities aged 9 through 12. On the basis of their performance on the Rey Auditory-Verbal Learning Test and the Benton Visual Retention Test, the LD group was divided into three subgroups: those with verbal deficits (VD), nonverbal deficits (NVD), and both verbal and nonverbal (BD) deficits. The measure of ability to interpret facial expressions of affect was a shortened version of Ekman and Friesen's Pictures of Facial Affect. Overall, the nondisabled group had better interpretive ability than the three learning disabled groups and the VD group had better ability than the NVD and BD groups. Although the identification level of the nondisabled group differed from that of the VD group only for surprise, it was superior to that of the NVD and BD groups for four of the six emotions. Happiness was the easiest to identify, and the remaining emotions in ascending order of difficulty were anger, surprise, sadness, fear, and disgust. Older subjects did better than younger ones only for fear and disgust, and boys and girls did not differ in interpretive ability. These findings are discussed in terms of the need to take note of the heterogeneity of the learning disabled population and the particular vulnerability to social imperception of children with nonverbal deficits.

Studies comparing children with learning disabilities with their normally achieving peers indicate that, as a group, the former also experience more from social-emotional and behavioral difficulties (Bryan, Donohue, & Pearl, 1981; Bursuck, 1989; Kronick, 1980; McNutt, 1978; Spreen, 1988). These difficulties have often been seen as secondary to the cognitive problems of the learning disability and have been attributed to the impact of negative experiences common to most children with LD, such as the frustration of repeated school failure (Bruck, 1986; Coleman, 1983; Swayze, 1980). However, research findings indicate that the central processing deficiencies underlying the cognitive, linguistic, and academic aspects of learning disorders may also underlie their social and emotional features (Pearl, 1987).

The results of research suggest that children with LD tend to have diffi-

culty in understanding those subtle cues inherent in nonverbal communication that play so important a role in social interaction (Axelrod, 1982; Bachara, 1976; Bruno, 1981; Sisterhen & Gerber, 1989). One critical aspect of nonverbal communication is the interpretation of facial expressions of emotion, and children with LD have been found to be less accurate than nondisabled children in making such interpretations (Holder & Kirkpatrick, 1991). As Bandura (1986) has pointed out, the ability to read the signs of emotions in social interaction has important adaptive value in guiding actions toward others. Presumably, deficits in this area play a significant role in the social difficulties experienced by children with LD.

Three decades ago Johnson and Myklebust (1967), on the basis of clinical observations, suggested the distinction between verbal and nonverbal learning disabilities, asserting that the

latter may be more personally debilitating than the former, for they interfere with the ability to interpret the emotions of others. However, most studies of deficits in social perception and skills in children with LD have not focused on defining subgroups at particular risk for such difficulties (Axelrod, 1982; Bachara, 1976; Bruno, 1981; Bryan, 1977; Holder & Kirkpatrick, 1991; Sisterhen & Gerber, 1989; Stone & La Greca, 1990).

In recent years, a rise in interest in differentiating the subtypes of learning disability has led to descriptions of a nonverbal, presumably right-hemisphere disorder in children with LD as well as frankly neurologically impaired children characterized by a core set of symptoms consisting of emotional and interpersonal disturbance, poor visuospatial and nonverbal problem-solving ability, and low arithmetic achievement (Bender & Golden, 1990; Gross-Tsur, Shalev, Manor, &

Amir, 1995; Korhonen, 1991; Van der Vlugt, 1991; Voeller, 1986).

Of particular note in this context is the work of Rourke and his co-investigators (for summaries see, e.g., Rourke, 1988, 1989; Rourke & Fuerst, 1991), who have studied the link between patterns of central processing abilities and disabilities and subtypes of both learning disabilities and socio-emotional functioning. Their results indicate that children with impaired reading and spelling and significantly better arithmetic achievement tend to score poorly on measures of abilities subserved by the left hemisphere and satisfactorily on those subserved by the right. By way of contrast, children with nonverbal learning disabilities whose spelling and reading are above average and arithmetic is in the deficit range tend to perform adequately on measures of abilities subserved by the left hemisphere and poorly on those subserved by the right. On the basis of data from a series of studies, Rourke has concluded that although socioemotional disturbance seems to be more common among individuals with LD than among their normally achieving peers, no single pattern of disturbance is characteristic, and many children with LD show no such difficulties. However, children suffering from the nonverbal learning disability pattern are at particular risk for serious psychopathology that tends to be progressive. These findings have led Rourke to underline the importance of taking adequate note of the heterogeneity of the learning disabled population in studies that attempt to clarify the relation between learning disabilities and socioemotional disturbance.

The present research studied the ability to interpret facial expressions of affect (one very important aspect of nonverbal social perception) in differentiated subgroups of children with LD and their nondisabled peers. Specifically, it compared the ability to identify six basic emotions from facial expressions among children with LD with nonverbal deficits (NVD), verbal

deficits (VD), and both verbal and non-verbal deficits (BD), and nondisabled children. It was hypothesized that nondisabled children would have better interpretive ability than children with LD, but that children with LD with VD would do better than those with NVD or BD. It was also hypothesized that older children would be more accurate than younger children on this task.

Method

Participants

The participants were students in Grades 3 through 6 in five schools in middle class neighborhoods with LD and general education classes. Criteria for the selection of participants with LD were as follows: (a) diagnosis as learning disabled by the school district psychological services, based on (1) testing on a Hebrew version of the WISC-R (Wechsler, 1976), Bender-Gestalt Test (Koppitz, 1975), Figure Drawings (Koppitz, 1968) and achievement tests, as well as additional tests where necessary, and (2) achievement test scores at least 2 years below grade level; (b) absence of extreme behavioral or attentional difficulties; (c) absence of frank neurological problems; and (d) residence in Israel for at least the past 4 years (this to exclude immigrants with inadequate knowledge of Hebrew). Of the 109 children in Grade 3 through 6 LD classes in these schools, 76 (54 boys and 22 girls) met these criteria and participated in the study.

The nondisabled comparison group consisted of 48 students (29 boys and 19 girls) chosen from one representative general education class at each grade level. These classes included more girls than boys; therefore, in order to match the male-female balance of the LD group as far as possible, all boys in these classes whose parents had consented to their participation and 19 girls selected at random were included. Recent immigrants were excluded.

The participants ranged in age from 9 to 12 years. They were divided into two age categories: 9 to 10 years of age, and 11 to 12. The mean age of the students with LD was 10.70 ($SD = 1.10$) and of the nondisabled participants was 10.67 ($SD = 1.07$). All participants were members of middle class families, and all were Caucasian. Informed parental consent was obtained for all students.

Instruments

Sensitivity to Facial Expressions of Emotion. Ekman and Friesen's (1976) Pictures of Facial Affect (PFA) was the measure of sensitivity to facial expressions of emotion. The PFA consists of 110 35-mm black-and-white slides of faces of men and women expressing happiness, sadness, anger, surprise, fear, and disgust, as well as a set of neutral faces. Ekman and Friesen reported interjudge agreement ranging from 70% to 100% for the emotions expressed on these photographs. According to them, a subset of 36 slides maintains the validity of the instrument. In previous research with children with LD (Holder & Kirkpatrick, 1991), a subset of 36 slides without the neutral stimuli was used in order to accommodate the anticipated limited attention span of some of the participants with LD. The present study used a somewhat larger subset of 48 slides, four male and four female faces for each of the six emotions. The items chosen were those within each category for which Ekman and Friesen reported the highest interjudge agreement. The reported mean agreement for this subset was 94.9%. In order not to confound the ability to interpret facial expressions with poor reading and test-taking skills, the participants' responses were recorded by the examiner, and the PFA multiple-choice answer sheets were not used.

Verbal and Nonverbal Functioning. The measures of verbal and nonver-

bal learning and memory were the following:

1. The Rey Auditory Verbal Learning Test (AVLT; Rey, 1964). A Hebrew version (Vakil & Blachstein, 1993) of this test of verbal learning and memory was used.
2. The Benton Visual Retention Test (BVRT; Benton, 1974). This test of visual perception and memory consists of three parallel sets of 10 cards with geometric designs. Of the four possible BVRT procedures, participants were tested on Administration A, in which each design is exposed for 10 seconds and the student then draws it from memory, and Administration D, in which each design is exposed for 10 seconds and the participant reproduces it from memory after a 15-second delay.

The administration and scoring for both of these tests was standard, as described by Lezak (1995).

Procedure

The children were tested individually in a room designated for this purpose. Each child was seen once for between 75 and 90 minutes.

Testing on the PFA was prefaced by a brief discussion about feelings, followed by practice in interpreting emotions from facial expressions. To this end, six slides not included in the testing subset were used. Correct responses were confirmed, and further explanation was offered for incorrect responses. Once it was clear that the child understood what was required, the 48 slides of the testing subset were presented individually in random order, each slide exposed for 10 seconds. Answers were recorded verbatim. When more than one response was given for a slide, all of the answers were recorded and the child was asked to select one. Substitute labels such as "mad" for "angry" were evaluated by three judges not otherwise involved in the study,

and responses were scored correct only when all three agreed. The number of correct responses for each of the six emotions and for the entire 48-item subset was calculated for each participant.

Following completion of the PFA, and after a 2-minute break, students were administered the Rey AVLT. In the 20-minute interval during this test called for by standard procedure, the participants left the testing room for refreshments and so forth. After this intermission, they completed the Rey AVLT. The following scores used by Vakil and Blachstein (1993) in their structure analysis of this test were calculated for each participant: (a) immediate memory, (b) best learning, (c) proactive interference, (d) retroactive interference; (e) delayed recall, (f) recognition, and (g) temporal order.

The Rey AVLT was followed by the BVRT. Half of the participants were tested on Administration A first and Administration D second, and for the other half the order of presentation was reversed. The number of errors and the number of designs correctly reproduced from memory for both administrations were calculated for each student.

Research Design

Categorization of the children with LD into the three subgroups was based on a model for the classification of left- and right-hemisphere dysfunction described by Hellige (1990). This involved the use of two measures attributed to different functions, the scores on which were orthogonal to each other. Participants with LD were classified as VD, NVD, or BD on the basis of their performance on the Rey AVLT and the BVRT. According to Lezak (1995), the Rey AVLT has been widely used as a measure of verbal memory and learning, and the BVRT as a measure of visual perception and memory. Although critics have noted that verbal cues may aid in performance on the BVRT, research findings indicate

that primarily visual coding is used on this test (Vakil, Blachstein, Shellef, & Grossman, 1989). The process by which the specific AVLT and BVRT scores were selected follows.

The seven AVLT scores of the combined sample (ND plus LD, $N = 124$) were transformed to standard scores and subjected to the factor-analytic procedure used by Vakil and Blachstein (1993). A principal-component analysis was performed to determine the number of factors retained by Kaiser's eigenvalue greater than 1.0 rule, and the emerged factors were rotated orthogonally using Equamax procedure. This yielded three major factors that together explained 77.5% of the variance: (a) *Storage* (35% explained variance) included temporal order, best learning, and recognition; (b) *retention*, despite interference by time or stimulus (25.8% explained variance), included delayed recall and retroactive interference; and (c) *short-term verbal memory* (16.7% explained variance) included proactive interference and immediate memory. The children with LD 7 same procedure for the LD ($n = 76$) and nondisabled ($n = 48$) groups separately yielded the same three factors in differing order, with these factors explaining a similar proportion of the variance (70.7% for the nondisabled group and 76.2% for the LD group).

Four considerations determined the selection of retention despite the interference of time or stimuli as the measure of verbal learning and memory: (a) Unlike the other two factors, it was either first or second in all three analyses; (b) the structural model for the combined sample was most similar to that found previously (Vakil & Blachstein, 1993); (c) conceptually, this factor more clearly reflected consistency of verbal learning and perception (Anderson, 1985) than did the other two; (d) virtually no relationship existed between the BVRT scores and this factor (r 's ranged from .01 to .06).

Mean number-correct and error scores on Administrations A and D of

TABLE 1
Distribution of Participants by Age and Group

Age	Group				Total
	Nondisabled	VD	NVD	BD	
9–10	22	4	9	15	50
11–12	26	15	14	10	65
Total	48	19	23	25	115

Note. VD = verbal deficits; NVD = nonverbal deficits; BD = both verbal and nonverbal deficits.

the BVRT were calculated for the combined group ($N = 124$). The number-correct scores for the two administrations were highly correlated, as were the error scores, $r = .69$, $p < .001$, for the former, and $r = .80$, $p < .001$, for the latter. High correlations were also obtained between the number-correct and error scores ($-.92$ and $-.88$), indicating that the two types of scores measured largely the same aspect of performance. The number-correct score for Administration A was selected as the measure of nonverbal learning and memory because of the slightly higher correlation between the number-correct and error scores for this administration and the more balanced variance in relation to the mean. Participants' number-correct scores on Administration A were transformed to standard scores.

Categorization of Participants. Participants with LD were categorized on the basis of their standard scores on the Rey AVLT and BVRT scores described above. Those with standard scores below 0 on the former and above 0 on the latter were classified as VD, those with standard scores above 0 on the former and below 0 on the latter as NVD, those scoring below 0 on both as BD, and those scoring above 0 on both as ND (no dysfunction). The nine ND students who gave no evidence of either verbal or nonverbal dysfunction as defined by this study were removed from the sample.

The distribution of participants in the three LD subgroups (VD, NVD, and BD) as well as in the nondisabled comparison group is presented in Table 1 for the younger students (ages 9 and 10), the older subjects (ages 11 and 12), and the total group.

Results

Table 2 presents the mean number of correct PFA responses for each emotion and the overall mean for emotion for the nondisabled, VD, NVD, and BD groups, and for the younger and older participants in these groups.

As far as the overall mean for emotion is concerned, a two-way ANOVA (Group \times Age) yielded a significant main effect for group, $F(3, 107) = 19.35$, $p < .001$, and a main effect bordering on significance for age, $F(1, 102) = 3.56$, $p < .07$. The interaction between group and age was not significant. A post hoc comparison of means by the Duncan test at the .05 level revealed that, as hypothesized, the nondisabled and VD groups were significantly more accurate in identifying facial expressions of emotions than were the NVD and BD groups, and the nondisabled group was significantly more accurate than the VD group.

As to the specific emotions, a three-way MANOVA (Group \times Age \times Emotion—with Emotion as repeated measure) yielded a main effect for group, $F(3, 107) = 19.35$, $p < .001$, and

for emotion, $F(5, 535) = 68.25$, $p < .001$. In addition, significant interactions were found between group and emotion, $F(15, 535) = 2.60$, $p < .001$, and between age and emotion, $F(5, 535) = 2.19$, $p = .05$.

Post hoc comparisons of means were made by the Duncan test at the .05 level for the four groups for each of the six emotions. These findings are presented in Table 3. As indicated, the nondisabled group gave significantly more correct responses than the BD group on all emotions except happiness and disgust, and more correct responses than the NVD group on all emotions except happiness and sadness. The VD group did significantly better than the NVD group in identifying expressions of disgust, and the normal group did better than the VD group in identifying surprise.

The Duncan test also revealed significant differences between the emotions in the ease with which they were identified. Happiness was the easiest to identify, in fact showing a ceiling effect. The remaining emotions in ascending order of difficulty of identification were anger, surprise, sadness, fear, and disgust. Significant differences in recognition rate were found between happiness and anger, between anger and both fear and disgust, and between sadness and disgust.

As far as the influence of age was concerned, a t -test analysis revealed a significant difference in favor of the older group only for fear and disgust, $t(113) = 2.01$ or more, $p < .05$.

Finally, a three-way MANOVA (Group \times Gender of participant \times Emotion—with Emotion as repeated measure) yielded no evidence of a main effect for gender, or of a significant interaction between gender and either group or emotion.

Discussion

The finding that all three LD groups were less accurate than the nondisabled group in identifying facial ex-

TABLE 2
Mean Number of Correct PFA Responses for Each Emotion for the Nondisabled, VD, NVD, and BD Groups
and for Younger and Older Participants in These Groups

Group	\bar{X}	Emotion						Overall \bar{X} for emotion
		Happiness	Sadness	Fear	Anger	Surprise	Disgust	
Y Nondisabled (<i>n</i> = 22)	<i>SD</i>	7.95 .21	6.04 1.39	4.90 2.34	7.09 1.15	7.00 1.02	3.00 2.07	6.00 .63
Y VD (<i>n</i> = 4)	<i>SD</i>	8.00 0	4.25 2.21	3.50 2.38	6.00 2.16	7.00 .81	3.75 2.63	5.41 1.16
Y NVD (<i>n</i> = 9)	<i>SD</i>	7.66 .70	5.00 1.65	3.77 3.07	6.11 1.90	4.00 2.59	1.11 1.69	4.61 .82
Y BD (<i>n</i> = 15)	<i>SD</i>	7.93 .25	3.66 2.28	2.86 2.53	5.73 1.94	4.80 2.78	2.80 2.75	4.63 1.14
O Nondisabled (<i>n</i> = 26)	<i>SD</i>	8.00 0	5.42 1.55	5.53 1.83	7.23 .81	7.30 1.01	3.69 2.66	6.19 .71
O VD (<i>n</i> = 5)	<i>SD</i>	8.00 0	5.20 1.97	5.06 2.60	7.06 1.16	4.66 2.82	4.40 1.91	5.73 .68
O NVD (<i>n</i> = 14)	<i>SD</i>	8.00 0	4.64 2.20	4.00 2.74	5.78 1.96	4.50 2.71	2.78 2.35	4.95 .76
O BD (<i>n</i> = 10)	<i>SD</i>	7.80 .42	4.40 2.01	4.40 2.63	6.70 1.25	3.80 3.19	3.50 2.12	5.10 .85
Nondisabled (<i>n</i> = 48)	<i>SD</i>	7.97 .14	5.70 1.50	5.25 2.08	7.16 .97	7.16 1.01	3.37 2.41	6.10 .68
VD (<i>n</i> = 19)	<i>SD</i>	8.00 0	5.00 2.00	4.73 2.57	6.84 1.42	5.15 2.69	4.26 2.02	5.66 .78
NVD (<i>n</i> = 23)	<i>SD</i>	7.86 .45	4.78 1.97	3.91 2.81	5.91 1.90	4.30 2.61	2.13 2.24	4.81 .79
BD (<i>n</i> = 25)	<i>SD</i>	7.88 .33	3.96 2.16	3.48 2.63	6.12 1.73	4.40 2.92	3.08 2.49	4.82 1.04
Total (<i>N</i> = 115)	<i>SD</i>	7.93 .27	5.02 1.93	4.51 2.52	6.63 1.52	5.66 2.53	3.20 2.40	5.49 .99

Note. Y = younger group; O = older group; VD = verbal deficits; NVD = nonverbal deficits; BD = both verbal and nonverbal deficits.

TABLE 3
Results of Post Hoc Comparison of Means (Duncan, α = .05) of
Correct Responses of Nondisabled, VD, NVD, and BD Participants for
Each of the Six Emotions

Emotions						
Happiness	Sadness	Fear	Anger	Surprise	Disgust	Overall
4 = 3 = 2 = 1	4 < 1	3 = 4 < 1	4 = 3 < 1	2 = 4 = 3 < 1	3 < 1 = 2	4 = 3 < 2 < 1
	4 = 3 = 2	2 = 1	2 = 1		4 = 2 = 1	
	3 = 2 = 1	4 = 3 = 2	4 = 3 = 2		4 = 3	

Note. VD = verbal deficits; NVD = nonverbal deficits; BD = both verbal and nonverbal deficits.

< Mean significantly lower. p = .05.

= No significant difference between means. 1 = Nondisabled; 2 = VD; 3 = NVD; 4 = BD.

pressions of emotion is in line with evidence from previous research pointing to a lack of proficiency in understanding the subtleties of nonverbal communication in general (Axelrod, 1982; Bachara, 1976; Bruno, 1981; Sisterhen & Gerber, 1989; Thomas, 1979) and in interpreting facial expressions of affect in particular (Holder & Kirkpatrick, 1991) in individuals with learning disabilities.

By way of contrast with most previous research in this area, the comparisons made in the present study were between differentiated rather than undifferentiated groups of children with LD and their normally achieving peers. As hypothesized, children with NVD (either without or in conjunction with VD) were less successful in interpreting emotions from facial expressions than those with VD only. To respond to others in an affectively appropriate manner, one must be able to discern their emotional states; given the critical significance of facial cues in social interaction, the results suggest that children with NVD are at a particular disadvantage in their relationships with others. More than those with VD, who themselves seem more vulnerable to such difficulties than nondisabled children, children with NVD seem to be at risk for what Myklebust (1975) termed "social imperception" (p. 86) and, consequently, for the development of social and emotional problems. This evidence of their greater deficiency in one important aspect of nonverbal social perception lends further support to the assertions of Rourke (1989) and others (Gross-Tsur et al., 1995; Myklebust, 1975; Voeller, 1986) concerning the especially debilitating effects of nonverbal learning disabilities.

As noted, there were marked differences in the accuracy with which the specific emotions were identified. Most participants, with or without LD, achieved a perfect score in identifying expressions of happiness, and the progression of accurate identification for the remaining emotions in descending order was anger, surprise, sadness,

fear, and disgust. These results are generally similar to those of Gates (1923) and Izard (1971) and identical to those of Holder and Kirkpatrick (1991).

The findings lend only partial support to the hypothesis that the ability to interpret expressions of affect increases with age. As indicated, significant differences in favor of the older group were found only for fear and disgust. The general research consensus on this subject has been that interpretive ability increases with age (De Paulo & Rosenthal, 1978; Dimitrovsky, 1964; Gates, 1923; Izard, 1971), although findings in this respect have not always been consistent (Holder & Kirkpatrick, 1991; Thomas, 1979). No doubt the age range of participants in the various studies as well as the complexity of the emotions to be identified are important factors in this context. It is not surprising that in the present study there were significant differences in accuracy of interpretation between older and younger participants for the two emotions most difficult to identify. It seems likely that a stronger age effect might have emerged had the age range of the students been wider.

As reported, boys and girls did not differ in accuracy of interpretation. This finding is in line with those from a number of studies (Gitter, Mostofsky, & Quincy, 1971; Holder & Kirkpatrick, 1991; Thomas, 1979) but in disagreement with the results of other research pointing to the superior interpretive ability of girls (De Paulo & Rosenthal, 1978; Hall, 1978).

In this study, interpretive ability was defined as accuracy of verbal labeling of the emotions expressed. To some extent this may have confounded labeling ability with interpretive proficiency. However, it seems likely that, if this was the case, it worked more to the detriment of the VD and BD groups than to that of the NVD group. It is possible even that a dependent measure that played down verbal mediation might have suggested that the VD group was as adept at identifying ex-

pressions of affect as the nondisabled children. Thus, although designs eliminating the requirement of verbal labeling might be appropriate for further research in this area, the findings concerning the deficit in interpretive proficiency associated with NVD seem not to have been contaminated by this limitation of the present design.

In conclusion, the results further underline the importance of differentiating subgroups among individuals with LD and clearly suggest that children with nonverbal dysfunction tend to have particular difficulty with an important aspect of social perception. This, among other things, may render them at greater risk for the development of social and personal problems than other children with LD. Unfortunately, it seems likely that more often than not their deficits go unrecognized or misunderstood. The usual diagnostic battery includes no measure of social perception. Evaluations in the school setting are usually based largely on verbal ability, and the intact verbal ability of these children is misleading, particularly at the younger age levels, where conceptual difficulties may not yet be evident. Understandably, the emphasis in the schools is on the remediation of academic problems. Given the centrality of reading and verbal knowledge in curricula, children with verbal dysfunction are more likely to be extended remedial help (with its attendant individual attention). As children with nonverbal learning disabilities grow older and their social and emotional difficulties become apparent, they may be referred for psychotherapy, but it is highly questionable whether traditional psychotherapy is the intervention of choice for them. Rourke (1995), in outlining an integrated treatment program involving the parents, teachers, and therapists of these children, emphasized the need to focus on promoting social and adaptive life skills. As Voeller (1986) pointed out, these children must learn to understand the cues of social interaction, and, for this, focused teaching of how to express

one's own feelings appropriately and interpret others' expressions of emotions may be required. All of this points to the importance of developing diagnostic procedures and intervention strategies that address not only the academic problems of students with LD but also the range of their difficulties, including social imperception.

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