Verbal Expression and Comprehension Deficits in Young Children With Autism

Agnes S. Chan, Jasmine Cheung, Winnie W. M. Leung, Rebecca Cheung, and Mei-chun Cheung

Language impairment is a primary characteristic of children with autism; however, findings on the language deficits of these children have been inconclusive, and even less is known about the language profiles of Chinese-speaking children with autism. The present study examined the verbal expression–comprehension abilities of 46 Chinese children at ages 5 to 6. The children with autism were further classified into high- or low-functioning groups based on their nonverbal intelligence. Results showed that 63% of the children with autism demonstrated language impairment. Specifically, 42% were impaired in both verbal expression and comprehension abilities, and 21% demonstrated impaired expression skills. General intelligence did not seem to explain this heterogeneity, as variability was also observed among the high-functioning children with autism. The results also suggested that a test of expressive language is more sensitive than a test of comprehension in differentiating Chinese children with autism from their age-matched counterparts at early childhood.

Autism is characterized by deficits in social interaction, delayed and deviant communication, and restricted and repetitive patterns of interests and behaviors, with the onset occurring before the age of 3 years (American Psychiatric Association, 2000). Among these defining characteristics, the problem in communication is often regarded as central to our understanding of autism (Kjelgaard & Tager-Flusberg, 2001) because the majority of children with autism have a significant delay or a total lack in the development of communicative language. Earlier estimates have indicated that almost 50% of individuals with autism do not develop functional and communicative language during their lifetimes (Rutter, 1978; Volkmar et al., 1994). Although the figure is now estimated at 35% to 40%, the number is still substantial (Mesibov, Adams, & Klinger, 1997). Among those children with autism who have some verbal abilities, their communicative skills are often characterized by idiosyncratic features, such as echolalia (Schuler & Prizant, 1985), telegraphic speech (Wing, 1969), difficulty in making inferences (Minshew, Goldstein, Muenz, & Payton, 1992), failure to recognize connotations of words (Happé, 1991), infrequent use of mental state verbs (Tager-Flusberg, 1992), and inflexible and ritualistic language (Tager-Flusberg, 1981). This line of research has led to a common consensus that unusual language functioning is a clinical characteristic of autism (Tager-Flusberg, 1981) and that the unique characteristic of communicative deficits are quite different from the language problems found in other clinical populations (Kjelgaard & Tager-Flusberg, 2001).

Although there is general consensus that unusual language characteristics are an essential and major clinical feature of autism, the nature of the general communicative abilities of individuals with autism is relatively less understood. One study compared the language production and comprehension abilities of children with autism and children with severe receptive language disorder (Bartak, Rutter, & Cox, 1975, 1977). Results showed that children with autism, even after their nonverbal general intelligence was matched with children having severe receptive language disorder, had significantly lower scores on language comprehension than language production. This result suggested that verbal comprehension ability might be more impaired than verbal expression in children with autism. However, inconsistent results were reported by Jarrold, Boucher, and Russell (1997), who examined the language functioning of 120 participants, including children with diagnoses of autism, Asperger syndrome, and severe language disorders, and found no significant difference in the language production and comprehension of children with autism. These inconsistent results may suggest that the language impairments among autistic children are quite heterogeneous. This notion is further supported by a study that examined a broad range of language measures in 89 children with autism, including phonological and vocabulary production, lexical comprehension, semantics, and grammar (Kjelgaard & Tager-Flusberg, 2001). Results showed significant heterogeneity in their performance across the expressive and receptive language tests, in

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which some children with autism had quite normal language functioning and others were significantly below their age expectations. Hence, a primary goal of the present study was to examine the different aspects of language functioning of a group of young children with autism ages 5 to 6. We were particularly interested in understanding the language profile of children with autism at a younger age because some evidence has suggested that children with autism usually acquire speech and language by the age of 5 years (Aarons & Gittens, 1999), and early intervention is important for later language development (Prior & Ozonoff, 1998; Ventner, Lord, & Schopler, 1992). Understanding the nature of language impairment of children with autism at a young age will provide a better foundation to develop more effective language interventions at an early stage.

A second purpose of the present study was to examine the possibility of cultural difference in the manifestation of language deficits associated with autism. To date, the majority of empirical studies on the language deficits of children with autism are conducted with children whose first language is English. Research conducted with children with autism from non–English-speaking countries appears to be very scarce. Given that there is evidence to suggest that alphabetic languages, such as English, are processed differently in the brain from logographic languages, such as Chinese (Chan et al., 2002; Cheung, Chan & Cheung, 2003; Tan et al., 2000), the present study aimed to shed light on the language profiles of children with autism whose native language was Chinese.

The present study examined the language profile of Chinese children with autism following a neuropsychological model, namely, the expression–comprehension model that has been widely used in studying patients with language impairments (e.g., aphasia). This model has significant clinical implications for language training because it is well documented that verbal expression and comprehension are different component processes in language functioning (Kertesz, 1993; Lezak, 1995; Zillmer & Spiers, 2001) and that verbal expression and comprehension are not mutually exclusive (Cummings & Trimble, 1995; Zillmer & Spiers, 2001). That is, some patients who demonstrate impairments in verbal production skills still have intact verbal comprehension ability (e.g., Broca's aphasia; Berker, Bester, & Smith, 1986), whereas others show the opposite pattern (Wernicke's aphasia; Wernicke, 1874; see also Bear, Connors, & Paradiso, 2001; Beeson & Bayles, 1997; Bradshaw & Mattingley, 1995; Ferro & Crespo, 1988; Gardner, 1974; Martin, 1998; Zillmer & Spiers, 2001). Because the existing evidence on the language profile of children with autism is quite inconsistent, it is conceivable that different degrees of impairment on verbal expression and comprehension abilities can be observed in children with autism. Thus, to examine the expression–comprehension language functions of these children, two language tests that are commonly used for assessing verbal expression (*Expressive Language Scale [Content]* of the *Reynell Developmental Language Scales-Second Revision* [RDLS]; Reynell & Huntley, 1985) and comprehension abilities (*Token Test in Multilingual Aphasia Examination* [Token Test]; Benton, Hamsher, & Sivan, 1994), were employed.

It is well understood that the general intelligence of children with autism may vary, in which some may have mental retardation and others may have IQ scores in the typical range. It may therefore be possible to explain the heterogeneity in language abilities in relation to different levels of general intelligence (Kjelgaard & Tager-Flusberg, 2001). Consequently, the present study also examined the verbal expression and comprehension abilities of children with autism with varying levels of intellectual functioning.

Method

Participants

Participants of this study included 46 children between the ages of 5 and 6, among which 27 were typically developing (15 boys, 12 girls) and 19 had autism (16 boys, 3 girls). The study was conducted in Hong Kong, in a special administrative region in the southern part of the People's Republic of China. All children were native Chinese speakers living in Hong Kong, with the Cantonese dialect as their first language. The children with autism were recruited by posting advertisements in various children's centers. All of them were diagnosed at government child assessment centers or hospitals by psychiatrists and clinical psychologists, and all met the diagnostic criteria based on the *Diagnostic and Statistical Manual of Mental Disorders, 4th edition* (*DSM-IV*; American Psychiatric Association, 2000). Children in the control group were recruited from a mainstream kindergarten on a voluntary basis, and none had any history of psychiatric or neurological disorder, and their academic performance in school was within the typical range. The two groups of children were matched by age, but the children with autism had fewer years of education (see Table 1).

Materials

Test for Intelligence. The *Test of Nonverbal Intelligence–III* (TONI-III; Brown, Sherbenou, & Johnson, 1997), which assesses abstract reasoning and nonverbal problem-solving abilities, was used to test the nonverbal intelligence of the children. The test consists of 45 items, with each item carrying 1 point. The raw score was converted into nonverbal IQ based on the conversion scale provided in the TONI-III manual.

Test for Verbal Expression. The Expressive Language Scale (Content) of the Chinese version of the RDLS (Department of Health and Education Department, Hong Kong, 1987) was used to test the verbal production ability of the children. The test was translated into Cantonese from the original scale (Reynell & Huntley, 1985) and standardized on children in Hong Kong. The test was individually administered

TABLE 1
Demographic Characteristics of Children in the Control and Autistic Groups and Their Performance on the Cognitive Tests

Variable	Typical children (n = 27)			Children with autism (n = 19)				
	M	*SD*	Range	*M*	*SD*	Range	*t*	*p*
Chronological age (years)	5.74	.37	5.08–6.33	5.77	.59	5.00–6.92	.375	= .71
Years of education[a]	2.70	.72	1–3	2.16	.76	0–3	2.46	= .02
Nonverbal intelligence								
TONI-III								
Raw score	11.56	5.12	4–22	4.79	4.63	0–16	4.59	< .001
Deviation quotient	109.85	12.31	87–131	87.42	14.98	69–121	5.56	< .001
Verbal expression								
RDLS	12.41	3.02	3–16	4.95	4.36	0–12	6.45	< .001
Verbal comprehension								
Token test	83.44	18.60	63–105	49.42	34.76	0–102	3.89	< .001

Note. TONI-III = *Test of Nonverbal Intelligence–III* (Brown, Sherbenou, & Johnson, 1997); RDLS = *Reynell Developmental Language Scales* (Reynell & Huntley, 1985).
[a]Years of education is counted from the first year of Kindergarten (which is a 2-year program in Hong Kong), followed by Grade 1 and so on.

orally by psychologists or trained research assistants and required the children to describe the contents of pictures. A total of three pictures with different main themes was presented to the children, in which one picture (cleaning theme) was used for demonstration, with a model answer given to the children. The other two pictures (meal and park themes) were used for formal testing. The presentation order of the pictures was standardized, and the children were asked to describe the content of the pictures without time limit. Each picture carries 8 points, with a maximum score of 16. Performance on the test was assessed in terms of the degree of correctness of the main theme and sentence complexity, which were reflected in three subscores: (a) Basal Score, (b) Connective Ideas, and (c) Additional Sentences. Scoring was done by a trained research assistant who was also one of the administrators of the test.

Test for Verbal Comprehension. The 22-item version of the Token Test was used to assess the verbal comprehension ability of the children by asking them to follow various commands. Similar to the Expressive Language Scale–RDLS, the Token Test was also orally administered. The original instructions were in English, and were translated into Cantonese by a Chinese–English bilingual clinical psychologist whose native language was Cantonese. The translated test was individually administered orally by psychologists or trained research assistants.

The Token Test consists of 10 circle and 10 square tokens in two different sizes and five colors (red, green, yellow, black, and white). The tokens were presented in front of the children in a fixed order, and the children were asked to carry out commands that involved different numbers of conceptual information at different levels of difficulties.

The original Token Test is scored in an all-or-none manner, where each item carries 1 point. The child gets a full mark if the response is correct or zero if the response is not entirely correct, regardless of the number of semantic concepts involved in the command. The data were scored with the original method, but many lower functioning children obtained a zero score, although they demonstrated the ability to fulfill parts of the task (e.g., able to identify the shape but not the color). Given that there was a floor effect on the original score, a modified scoring method was developed to increase the sensitivity of the score. The modified scoring method was based on the commands of the Token Test, in which the children were asked to perform some actions on different numbers of tokens that differed in size, shape, and color. On a few items, the spatial relation between tokens was also involved. Hence, in the modified scoring method, scores were given based on these six types of semantic concepts: size, shape, color, number, action, and spatial relation, where one point was given for each concept successfully carried out by the child. The total test score was the sum of the item scores. Because the number of semantic concepts ranged from two to seven in different items, the scores for each of the items were different. For example, in the item "pick up a white square and a green circle," there were five semantic concepts: "pick up" (action), "white" (color), "square" (shape), "green" (color), and "circle" (shape). For the more difficult items that included the "spatial relation" concept, such as "put the yellow square 'on' (spatial relation) the white circle," an additional point would be given, and the maximum score for these items was 6. In addition, there was a penalty for carrying out irrelevant actions such as taking an extra token, and one point would be deducted from the score of the item. The number of items for

this test was 22, and the maximum score was 105. Scoring was done by the same trained research assistant who scored the Expressive Language Scale–RDLS and who was also one of the administrators of the test.

Procedure

The parents' or guardians' consents for the children's participation in the study were obtained prior to testing. All children were tested individually in a quiet room at their respective schools, and all assessments were conducted by trained examiners. The session began with a short conversation, during which time the examiner asked the children some demographic information involving their name, age, and home address, and the name of their school. The conversation was followed by the Expressive Language Scale–RDLS, the TONI-III, and the Token Test, respectively.

Results

Nonverbal Intelligence

To compare the nonverbal intelligence of control and children with autism, an independent-sample *t* test was conducted. Results indicated a significant difference between the typical children and the children with autism with respect to the raw scores, $t(44) = 4.59$, $p < .001$, and nonverbal IQ, $t(44) = 5.56$, $p < .001$, as determined by the TONI-III (see Table 1); the effect size was large (eta squared = .32; Cohen, 1988). Typical children generally achieved significantly higher scores on nonverbal IQ than did the children with autism.

The children with autism were classified into high-functioning (IQ > 70) and low-functioning groups (IQ ≤ 70) according to their performance on the TONI-III. Because the nonverbal IQ of the 5-year-old children with autism was obtained by using the conversion scale of 6 to 6.5 years old, there was a possibility of underestimating their nonverbal IQ. However, results showed that all 5-year-old children were classified into the high-functioning group. As a result, a sample of 4 children (mean age: 6 years) in the low-functioning group (IQ: 69–70) and 15 children (mean age: 5 years 1 month) in the high-functioning group (IQ: 75–121) was classified (see Table 2).

Language Abilities

Verbal production of the typical children and the children with autism was compared using an independent-sample *t* test. Results showed that there was a significant difference, $t = 6.45$, $p < .001$, on the Expressive Language Scale–RDLS between the groups, with a large effect size (eta squared = .49). The same analysis was performed on the verbal comprehension ability of the two groups. Results indicated a similar significant difference, $t = 3.89$, $p < .01$, on the Token Test between the two groups, with an effect size of .26 (see Table 1).

Language Performance

Whereas the typical children and the children with autism demonstrated significantly different performance in both verbal production and comprehension tests, it was uncertain whether the significant difference in language abilities was due to their discrepancy in intelligence. Therefore, the language abilities of a subgroup of children with autism whose TONI

TABLE 2
Demographic Characteristics of High- and Low-functioning Autistic Children and Their Performance on the Cognitive Tests

	High (*n* = 15)			Low (*n* = 4)				
Variable	*M*	*SD*	Range	*M*	*SD*	Range	*t*	*p*
Chronological age (years)	5.58	.52	5.00–6.92	6.46	.15	6.33–6.67	–4.82	< .001
Years of education[a]	1.93	.70	0–3	3.00	.00	3–3	–2.97	= .01
Nonverbal intelligence								
TONI-III								
Raw score	6.07	4.38	1–16	.00	.00	0–0	5.36	< .001
Deviation quotient	92.13	13.25	75–121	69.75	.50	69–70	6.53	< .001
Verbal expression								
RDLS	6.13	4.14	0–12	.50	1.00	0–2	2.65	= .02
Verbal comprehension								
Token test	61.13	29.05	3–102	5.50	7.19	0–16	3.73	< .001

Note. TONI-III = *Test of Nonverbal Intelligence–III* (Brown, Sherbenou, & Johnson, 1997); RDLS = *Reynell Developmental Language Scales* (Reynell & Huntley, 1985).
[a]Years of education is counted from the first year of kindergarten (which is a two-year program in Hong Kong), followed by Grade 1 and so on.

raw score was matched with that of typical children were compared. As a result, a sample of 22 typical children and 10 children with autism was selected, with TONI raw scores ranging between 4 and 16. Independent sample *t* tests suggested that the selected subgroups were not significantly different in terms of age, $t(30) = .43$, $p > .05$, and TONI raw scores, $t(30) = 1.17$, $p > .05$.

Results indicated that even when the two groups were matched on nonverbal intelligence, there was still a significant difference, $t(30) = 3.59$, $p < .01$, in the verbal production ability between the typical children ($M = 12.41$, $SD = 3.23$) and the children with autism ($M = 7.90$, $SD = 3.45$, eta squared = .30). But for verbal comprehension skills, the scores for the typical group ($M = 82.32$, $SD = 18.76$) and the group of children with autism ($M = 73.10$, $SD = 19.54$) were not significantly different, $t(30) = 1.27$, $p > .05$. Nevertheless, it should be noted that the power of the test was low (.23), which suggests that the nonsignificant result can be related to the relatively small sample size (69 children in each group would have been needed to achieve a power of .80).

The Expressive Language Scale and Token Test

To investigate the abilities of the Expressive Language Scale–RDLS and the Token Test in discriminating between children with and without autism, discriminant analyses were performed for each test. When the Expressive Language Scale–RDLS was used as the predictor of membership of the two groups, the canonical correlation was .719, $\chi^2(1, N = 46) = 31.67$, $p < .001$, showing a large association between the discrimination function and group membership. With this discriminant function, the overall classification rate was 84.8%. The correctly classified cases consisted of 92.6% of typical children and 73.7% of children with autism. When the Token Test was used as the predictor of membership of the two groups, the canonical correlation was .544, $\chi^2(1, N = 46) = 15.25$, $p < .001$, showing a moderate association between the discrimination function and group membership. With this discriminant function, the overall classification rate was 58.7%. The correctly classified cases consisted of 59.3% of typical children and 57.9% of children with autism. It seemed that the performance on the Expressive Language Scale–RDLS tended to be more effective in discriminating between children with autism and typical children than did the Token Test.

To further verify whether addition of the score on the Token Test could improve the power of overall classification, the scores from both language tests were used as the predictors of group membership. The results showed that the canonical correlation was .719, $\chi^2(2, N = 46) = 31.31$, $p < .001$, and the overall classification rate (84.8%) was the same as that of the Expressive Language Scale–RDLS alone. Therefore, the Expressive Language Scale–RDLS alone was sensitive enough in discriminating between children with and without autism, achieving an overall classification exceeding 80%.

Variation of Expression and Comprehension Abilities among the Children With Autism

The level of language abilities of the children with autism was defined by comparing their individual scores in the language tests to the group means of the typical children on an age-equivalent measure. The cutoff point for classifying the children with autism as "normal" or "impaired" in their language functioning was set at 2 standard deviations below the mean for the typical group of children.

For verbal expression ability, the performance on the Expressive Language Scale–RDLS was examined. The group mean (and standard deviation) of typical children was 12.41 (3.02). The cutoff point with 2 standard deviations below the mean was set at 6.37. In the group having autism, 7 children (all were high-functioning) scored above the cutoff point and 12 children (8 were high-functioning and 4 were low-functioning) scored below. The group mean (and standard deviation) of the verbal comprehension ability for the typical children, as measured by the Token Test, was 83.44 (18.60). With 2 standard deviations below the mean, the cutoff point was set at 46.24. Eleven children with autism (all were high-functioning) scored above the cutoff point and 8 of them (4 were high-functioning and 4 were low-functioning) scored below.

As shown in Figure 1a, among the 19 children with autism, 7 were "normal" in both verbal expression and comprehension abilities (37%). Eight children were "impaired" in both verbal expression and comprehension (42%), 4 showed normal comprehension but impaired verbal expression skills (21%), and no child was found with impaired comprehension but normal verbal expression. A chi-square analysis suggested that the number of children falling in each category was not random, $\chi^2(1, N = 19) = 5.56$, $p < .05$, which suggested the presence of heterogeneity of language functioning among the children with autism.

Expression and Comprehension Abilities of High- and Low-Functioning Children With Autism

Because the scores on the two language tests showed wide variability among the children with autism (i.e., the children with different intellectual functioning seemed to have different patterns of language performance), the effect of intelligence on the levels of language abilities was investigated.

To explore the relationship between nonverbal intelligence and verbal expression ability, an independent sample *t* test was conducted on the scores of the Expressive Language Scale–RDLS of the high- and low-functioning groups. Results indicated that there was significant difference, $t(17) = 2.65$, $p < .05$, between the high-functioning group and the low-functioning group (see Table 2), with an effect size of .29.

The same analysis was performed on verbal comprehension ability. Results showed that performance on the Token Test for

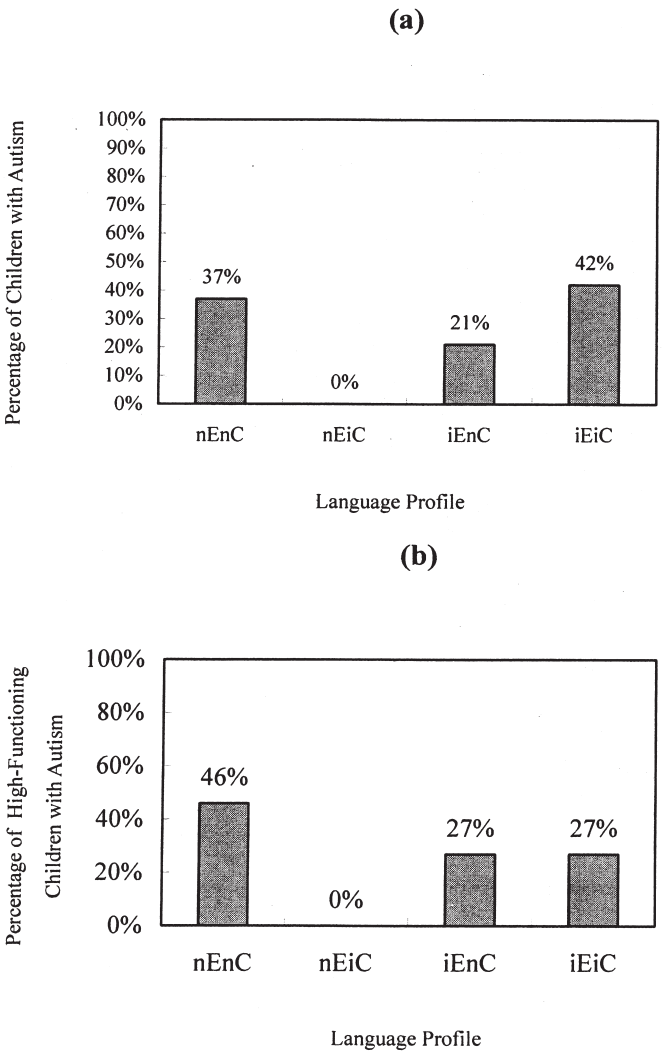

FIGURE 1. Language profiles of children with autism. (a) Percentage of children with autism (n = 19) with normal expression and normal comprehension (nEnC), normal expression and impaired comprehension (nEiC), impaired expression and normal comprehension (iEnC), and impaired expression and impaired comprehension (iEiC); (b) Percentage of high-functioning children with autism (n = 15) with normal expression and normal comprehension (nEnC), normal expression and impaired comprehension (nEiC), impaired expression and normal comprehension (iEnC), and impaired expression and impaired comprehension (iEiC).

the high-functioning group and the low-functioning group was again significantly different, $t(17) = 3.73$, $p < .05$ (see Table 2). The effect size was large (eta squared = .45).

As the high-functioning group consisted of children with autism who had a range of IQ scores (75–121), the relation between nonverbal intelligence and language abilities was further investigated within the high-functioning children with autism by using the Pearson product-moment correlation coefficient. Results showed a positive correlation between nonverbal intelligence and verbal expressive ability (as measured by Expressive Language Scale–RDLS), $r = .83$, $p = .00$, and between verbal comprehension ability (as measured by Token Test), $r = .71$, $p < .05$. Further investigation revealed that 7 children were "normal" in both verbal expression and comprehension abilities (46%), and 4 children were "impaired" in both (27%). Four children showed normal comprehension but impaired verbal expression skills (27%), and no child was found with impaired comprehension but normal verbal expression skills (see Figure 1b). The pattern observed in the high-functioning children with autism again showed significant heterogeneity in their language abilities, although the proportion of children who demonstrated impairment in both verbal expression and comprehension abilities was slightly lower than the proportion found with the entire group of children with autism.

Discussion

One purpose of the present study was to examine the language profile of children with autism observed at early childhood. The results of the present study, consistent with some previous findings (Charman, Drew, Baird, & Baird, 2003), showed that children with autism as young as 5 to 6 years old have already demonstrated language deficits when compared to their age-matched counterparts. Understanding the early expression of language deficits of children with autism may be clinically significant, given that some empirical evidence has suggested the beneficial effects of early intervention to this group of children. For instance, it has been reported that children with autism who participated in an early intervention program (with the mean age of 2 years 8 months) showed great improvement in their intellectual and educational functioning through an intensive one-to-one training program (Lovaas, 1987). Similar results were reported by Harris, Handleman, Gordon, Kristoff, and Fuentes (1991), in which the language abilities of 16 young children with autism between the ages of 2 years 9 months and 4 years 4 months improved significantly after treatment.

Early diagnosis of language impairments in autism would seem to be clinically significant. The present findings demonstrated the clinical sensitivity of the Expressive Language Scale-RDLS in discriminating children with autism from typical children. Specifically, the Expressive Language Scale–RDLS correctly classified 93% of typical children and 74% of children with autism. Compared with the Token Test (classification rate: 59%), the Expressive Language Scale–RDLS was found to be significant in discriminating between typical children and children with autism, with an overall classification rate of around 85%. This discrepancy cannot be attributed to a less sensitive scoring system of the Token Test, given that the original scoring system was modified to depict more detailed information on the performance of the children. However, it should be noted that the different discriminating ability of the Expressive Language Scale–RDLS and Token Test might also be attributed to different difficulty levels of test items; that is,

the Expressive Language Scale may be more difficult than the Token Test. In addition, although the translation of the simple instructions of the Token Test were straightforward and therefore should not pose any problem on the validity and reliability of the test, the fact that it was not standardized on Chinese-speaking children warrants further caution in interpreting the data. Further research using other tests to assess the expressive and comprehension abilities on Chinese children with autism may help to clarify this issue.

Another finding from the present study was the language heterogeneity of children with autism. The expression–comprehension dichotomy of neuropsychological assessment for examining language impairments was adopted to study language functioning associated with autism. Consistent with the findings that have been noted in previous research (Kjelgaard & Tager-Flusberg, 2001), the present results indicated that there was significant heterogeneity in the language abilities of children with autism. Among the children with autism, 21% demonstrated normal comprehension but significant impairment in expressive ability, and 42% had difficulties with both verbal expression and comprehension. The remaining 37% showed quite typical functioning on these two verbal dimensions. These results suggested that children with autism as a group may have different degrees of impairment on verbal expression and comprehension abilities.

The heterogeneous pattern of language functioning found in children with autism as a group was also observed in a subgroup of high-functioning children with autism. Among the 15 high-functioning children with autism, who had estimated nonverbal IQ scores of over 70, 46% showed verbal production and comprehension abilities within the normal range, 27% were impaired in both, and the remaining 27% had typical verbal comprehension but impaired expressive ability. Thus, though the language abilities among children with autism were quite heterogeneous, that variability cannot simply be attributed to difference in general intelligence. Specifically, language impairment was not confined only to children who were low-functioning.

However, inconsistent with the findings of previous research (Bartak et al., 1975, 1977), which suggest that the expressive language is relatively more spared among children with autism than receptive language, the children with autism in the present study showed the opposite pattern. Although 11 children with autism were comparable to typical children in the performance of language comprehension, only 7 children with autism were comparable to typical controls in expressive language. In addition, though 21% of the children with autism demonstrated impairment in verbal expression but spared comprehension, none of the children with autism demonstrated impaired verbal comprehension but spared verbal expression. These inconsistent results between the present and previous studies might be related to the various theoretical models and tests being employed by the different studies. Specifically, the present study followed the neuropsychological model of expression–comprehension, but others (Baltaxe, 1977; Lord & Paul, 1997) have employed a more linguistically or psycholinguistically oriented model with emphasis on, for example, phonology, semantics, grammar, vocabulary, and pragmatic skills. In addition, different tests in assessing verbal expression and comprehension have been employed (Kjelgaard & Tager-Flusberg, 2001; Jarrold et al., 1997) and might have introduced the issue of test comparability and sensitivity, as previously mentioned. Furthermore, the fact that the children in the present study were all native Chinese speakers may also be related to the inconsistent findings with previous studies that have involved English-speaking children. As has previously been pointed out, there is evidence to suggest that Chinese and English are processed differently in the brain (Chan et al., 2002; Cheung et al., 2003; Tan et al., 2000), and the different language profiles found in Chinese- and English-speaking children with autism may have important theoretical and clinical implications. It will be theoretically and clinically significant to test this conjecture by cross-cultural comparison of children with autism for whom English or Chinese is their first language.

ABOUT THE AUTHORS

Agnes S. Chan, *PhD, is a professor in the Department of Psychology at The Chinese University of Hong Kong. Her research is in the area of neuropsychology, with special interest in cognitive impairments associated with brain disorders and in investigating effective interventions for cognitive dysfunctions.* ***Jasmine Cheung,*** *BSSc, is a postgraduate student of clinical psychology at The Chinese University of Hong Kong.* ***Winnie W. M. Leung,*** *MPhil, currently does research and assessment in neuropsychology at The Chinese University of Hong Kong.* ***Rebecca Cheung,*** *MSSc, is a clinical psychologist and a doctoral candidate in clinical psychology at The Chinese University of Hong Kong. Her research interests include cognitive functions of patients with brain disorders and neuropsychological test development.* ***Mei-chun Cheung,*** *PhD, is a clinical psychologist and in charge of the Centre for Neurocogntive Function Enhancement at The Chinese University of Hong Kong. Her research interests include cognitive functions in patients with brain damage and brain imaging on patients with cognitive dysfunctions. Address: Agnes S. Chan, Neuropsychology Laboratory, Department of Psychology, The Chinese University of Hong Kong, Shatin, N. T., Hong Kong.*

AUTHORS' NOTES

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