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Subclassification of Children with Autism and Pervasive Developmental Disorder: A Questionnaire Based on Wing's Subgrouping Scheme[1]

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A questionnaire (the Wing Subgroups Questionnaire, or WSQ) for subclassifying children with autism into one of Wing's three hypothesized subgroups was developed, and the validity of this measure was assessed. Forty parents of children with autism or pervasive developmental disorder not otherwise specified (PDDNOS) completed the questionnaire. Results indicated that the questionnaire has adequate external criterion-referenced validity with similar subgroup ratings made by clinicians, and good internal consistency. Furthermore, results revealed three distinct and separate subgroups corresponding to Wing's subclassification scheme. Other analyses suggested that Wing assignment based on the WSQ was independent of chronological age and age equivalents for social and daily living skills, but not independent of diagnosis of autism vs. PDDNOS, IQ, severity of autism, sex, receptive language mental age, and age equivalents for communication skills. Finally, a discriminant analysis indicated that, of all the dependent variables examined in the present study, the clinicians' Wing assignment was the best predictor of Wing assignment based on the parent-completed WSQ. These findings provide support for Wing's classification system, and suggest that the WSQ is a valid and useful tool for subclassifying individuals with autism.

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Autism is a heterogeneous disorder characterized by a wide range of abnormalities of behavior and impairments in functioning. As a result, researchers and clinicians repeatedly have attempted to identify meaningful subgroups of autism and related disorders. Clinicians initially focused on specific syndromes of behavioral abnormalities in children who were thought to be "psychotic" (e.g., Asperger, 1944; Kanner, 1943; Mahler, 1952). These syndromes, however, overlapped greatly, such that it was difficult to discriminate among them. More recent attempts at subclassification have focused upon the possibility of subtypes based on neurological findings (Coleman, 1987) and pre-, peri-, and neonatal factors related to autism (Tsai, 1987). Other methods for subclassification have included the use of factor-analytic techniques (Sherman, Shapiro, & Glassman, 1983; Siegel, Anders, Ciaranello, Bienenstock, & Kraemer, 1986) and cognitive measures, such as IQ (Bartak & Rutter, 1976; Rutter & Garmezy, 1983).

A subclassification scheme proposed by Wing and colleagues (Wing & Attwood, 1987; Wing & Gould, 1979) is noteworthy for its rich clinical description of children. Subgroups of children with autism and related disorders are differentiated on the basis of several behavioral domains including social interaction, cognitive functioning, communication skills, as well as other behaviors.

Wing's subclassification scheme outlines three subgroups of persons with autism and related disorders. One key distinguishing feature of the three subgroups pertains to the quality of social interaction. The *aloof* subgroup is characterized by rare spontaneous social approaches to others (except to obtain wants or needs) and by the tendency to reject unsolicited social or physical contact. The *passive* subgroup also is characterized by a lack of spontaneous social approaches to others; but passive individuals, unlike aloof individuals, typically engage another person when approached as long as the other person structures the interaction. The *active-but-odd* subgroup is characterized by a willingness to make social approaches to others; these social approaches, however, are made in a peculiar, naive, or one-sided fashion.

Several other behavioral domains are addressed in Wing's subclassification system, including symbolic play, motor imitation, nonverbal and verbal communication, daily routines, odd or stereotyped behavior, motor coordination, among others. Wing has proposed that individuals show subgroup-specific patterns of behaviors across these different domains. For instance, if a person shows a pattern of social interaction that fits Wing's description of the aloof subgroup, Wing has hypothesized that he or she will also display specific patterns of behavior in the domains of symbolic play, imitation, routines, and so on.

Wing's subclassification system has been embraced by clinicians and researchers in the field as a sensitive way to subclassify individuals with autism and related disorders. It has been seen as a tool for developing individualized educational plans and treatments for the different types of persons diagnosed as autistic. Wing's system, however, is based in large part on clinical experience. Since Wing originally published her subclassification system (Wing & Gould, 1979), only one study has attempted to empirically validate the system.

Volkmar, Cohen, Bregman, Hooks, and Stevenson (1989) created a questionnaire aimed at addressing the validity of Wing's system, but the results from this study were mixed. While Volkmar et al. (1989) found that clinicians could reliably assign autistic, atypical, and nonautistic developmentally delayed children into one of Wing's three subgroups, the data from the questionnaire they developed (which was filled out by teachers, parents, and caregivers) were inconclusive. In fact, Volkmar et al. (1989) found that IQ was actually a slightly better predictor of Wing subgroup assignment (based on clinicians' ratings) than the summary score from the questionnaire they developed.

The purpose of the present research was to empirically validate a questionnaire based on Wing's subtyping scheme, the Wing Subgroups Questionnaire (WSQ). Specifically, we attempted to address several questions. First, are trained clinicians' assignments of autistic children into one of Wing's three subgroups based on direct behavioral observation, consistent with parents' subgroup assignments based on their responses to a questionnaire? Second, do parents' responses to the WSQ indicate that certain patterns of symptoms across different domains (social, communication, cognition, and other behaviors) exist as predicted by Wing and her colleagues? Third, are Wing's three subgroups distinct and separate, or do they overlap? And fourth, how do the subgroup assignments based on the WSQ relate to chronological age, IQ, severity of autism, receptive language mental age, and subdomain scores from the Vineland Adaptive Behavior scales? Finally, we viewed the present study as the first part of a larger study designed to explore whether subgroups of autism are associated with distinct patterns of brain activity, as measured by electroencephalographic recordings.

METHODS

Subjects

The sample consisted of 40 children, 36 with autistic disorder and 4 with pervasive developmental disorder not otherwise specified (PDDNOS),

and their parents. All participants in this study were diagnosed using the Childhood Autism Rating Scale (CARS; Schopler, Reichler, & Renner, 1986). In addition, 36 of the participants were diagnosed using DSM-III-R criteria (American Psychiatric Association, 1987). Both the CARS diagnoses and the DSM-III-R diagnoses were based on a 30-minute structured play session and interview with parents. Thirty participants were male; 10 were female. Mean chronological age was 11.29 years (range = 4.75 to 20.08; SD = 4.36). Recent IQ scores (WPPSI, WISC-R, WAIS-R, or Leiter International Performance Scale) were available for 36 children (mean IQ = 58.5; SD = 22.47) For the Wechsler scales, a prorated Full-scale IQ was calculated according to Sattler (1990). This prorated IQ was based on scores from five subtests (Arithmetic, Vocabulary, Comprehension, Block Design, and Object Assembly on the WISC-R and Information, Vocabulary, Comprehension, Block Design, and Geometric Design on the WPPSI). Scores from the Revised Vineland Adaptive Behavior Scales (VABS; Sparrow, Balla, & Cicchetti, 1984) and the Peabody Picture Vocabulary Test-Revised (PPVT; Dunn & Dunn, 1981) were available for 24 children.

Materials and Procedures

For a subsample of the children (n = 36), clinicians (the authors and 2 clinical child psychology graduate students) classified each child with regard to Wing's three subgroups based on observations of the child's behavior in the 30-minute structured play session. The videotape of each child was viewed independently by two raters for the purpose of calculating interrater reliability; disagreements between raters were settled by consensus.

The WSQ was administered to parents for the entire sample of children. Two copies of the WSQ were sent to two-parent families; the parents were asked to complete the questionnaires independently. The WSQ consists of 13 groups of four different descriptions of behavior; each of these four descriptions characterizes either the aloof, passive, active-but-odd, or normally developing subgroups. A sample group of descriptions is provided (see Appendix). These 13 groups cover several behavioral domains. Three social groups of descriptions pertained to the individuals' pattern of social approach and responses to others' approaches. Three communication groups of descriptions covered the individuals' overall level of communication skills, response to communication by others, and purpose of communication. Three cognitive groups pertained to imitation and play skills. Four groups of descriptions covered other behaviors, specifically unusual motor behavior, resistance to change, physical coordination, and challenging behaviors, such as tantrums. For each group, parents were asked to rate each of the four descriptions with respect to how frequently their child's behavior fit that description (0 = never; 6 = always). Parents also chose the description (aloof, passive, active-but-odd, or normal) that *best* described their child. Note that the descriptions were not labeled with respect to subgroups in the questionnaire. Furthermore, order of descriptions with respect to subgroup was counterbalanced across the 13 groups of descriptions.

RESULTS

Interrater Reliability of Clinicians' Wing Assignments

Based on a Spearman rank correlation, interrater reliability for the clinicians' subgroup assignment based on direct observation of the child was acceptable, $r(35) = .71$, $p < .0001$.

Comparison of Clinical Wing Assignments and Assignments Based on Parents' WSQ

Wing assignment based on the WSQ was determined by calculating separate summary scores for each of the four subgroups (aloof, passive, active-but-odd, and normal) added across the 13 groups of descriptions. Each child was assigned to the subgroup for which he or she received the highest summary score.

Based on a Spearman rank correlation, the clinicians' assignments and the assignments based on the parent-completed WSQ showed good concordance, $r(35) = .73$, $p < .0001$.

Consistency of Ratings Across the WSQ

Chronbach's alpha was used to estimate the consistency of parents' ratings within a subgroup across the 13 groups of descriptions which addressed different domains (e.g., social, communicative, cognitive, and other). For example, if a mother ranked her child as very frequently failing to initiate and withdrawing from social interaction, Wing has hypothesized that this mother would rank her child as very frequently showing no communicative initiations, very poor imitation ability, and perseverative, nonfunctional play (all of which are characteristics of the aloof subgroup). Chronbach's alpha for the descriptions addressing the aloof subgroup was .77; for the passive subgroup, .63; and for the active-but-odd subgroup, .85.

Thus, parents ranked the descriptions for behaviors addressing all three subgroups in a way that is coherent with Wing's system.

Separateness of the Three Subgroups

Low or negative correlations for summary scores between descriptions on the WSQ suggests that Wing's three subgroups are distinct and separate. The correlation between summary scores for aloof and passive subgroups was –.02, between summary scores for passive and active-but-odd subgroups was .17, and between summary scores for aloof and active-but-odd subgroups was –.70. The negative correlation between scores for the aloof versus active-but-odd subgroups offers support for the idea that these subgroups fall at two ends of a continuum.

Subgroup Differences

Table I displays the distribution of subjects based on diagnosis (PDDNOS vs. autistic disorder) and Wing subgroup assignment. WSQ subgroup classification and diagnosis were related, $\chi^2(4, n = 40) = 8.62, p < .08$, but this relation was not quite statistically significant. It is interesting to note that there were three times the number of severely autistic children in the aloof subgroup ($n = 10$) as compared to mildly autistic children ($n = 3$). Moreover, no children with PDDNOS were classified as aloof.

Differences among WSQ subgroups, in terms of IQ, chronological age, CARS score, and PPVT mental age, were explored via a series of one-way analyses of variance. As shown in Table II, significant subgroup differences were found for PPVT mental age, $F(2, 31) = 6.87, p < .01$, and for CARS score, $F(2, 37) = 3.48, p < .05$; analysis of subgroup differences in terms of IQ revealed a nonsignificant trend, $F(2, 32) = 2.73, p < .09$. These results indicate that children classified as aloof were characterized by poorer receptive language skills, more severe autistic symptomatology, and more severe cognitive impairments, as compared to passive and active-but-odd children. The three subgroups did not differ significantly in terms of chronological age, however.

Table I. Relation Between Diagnosis and Wing Subgroup Assignment

	Subgroup					
	Aloof		Passive		Active-but-odd	
Diagnosis	*n*	%	*n*	%	*n*	%
PDDNOS	0	0	3	25.0	1	6.7
Autistic disorder						
Mild-moderate (CARS)	3	23.1	5	41.7	8	53.3
Severe (CARS)	10	76.9	4	33.3	6	40.0

Table II. Characteristics of Children Classified According to Wing Subgroups

Wing subgroup	IQ	Chronological age (years)	CARS score[a]	PPVT MA[b]
Aloof				
M	47.25	9.87	40.00	30.91
SD	25.30	2.73	6.60	14.59
n	12	13	13	11
Passive				
M	61.27	10.90	35.17	47.63
SD	16.24	5.48	6.41	25.49
n	11	12	12	11
Active-but-odd				
M	67.17	12.85	34.60	84.42
SD	21.28	4.29	4.42	52.67
n	12	15	15	12
F	2.73	1.76	3.48	6.87
P <	.09	ns	.05	.01

[a]Childhood Autism Rating Scale.
[b]Peabody Picture Vocabulary Test-Revised mental age.

Post hoc *t* tests indicated that the differences between the CARS scores and IQ for the aloof and active-but-odd groups were significant, CARS: $t(22) = 2.50, p < .05$; IQ: $t(22) = -2.09, p < .05$. Analysis of the difference between the means for the aloof and passive subgroups revealed a nonsignificant trend, CARS: $t(23) = 1.86, p < .08$; IQ: $t(21) = -1.59, p < .13$. The differences between the passive and active-but-odd subgroups, however, were not significant, CARS: $t(25) = 0.26$, ns; IQ: $t(25) = 0.27$, ns.

Table III presents data related to WSQ Wing subclassification and sex. Chi-square analysis indicated Wing classification and sex were significantly related, $\chi^2(2, n = 40) = 6.03, p < .05$. There were girls in the aloof ($n = 4$) and active-but-odd subgroups ($n = 6$), whereas there were no girls in the passive subgroup.

WSQ assignment and age-equivalent scores from the Socialization, Communication, and Daily Living subdomains on the VABS were entered into a one-way multivariate analysis of variance using WSQ subgroup as the independent variable. Significant differences among subgroups were found for all three Vineland variables, Socialization: $F(2, 31) = 4.48, p <$

Table III. Sex Differences Among Children Classified According to Wing Subgroups

Wing subgroup	Sex: Female *n*	Sex: Male *n*	Total *n*	Total %
Aloof	4	9	13	32.5
Passive	0	12	12	30.0
Active-but-odd	6	9	15	37.5
Total				
n	10	30		
%	25	75		

.05; Communication: $F(2, 31) = 6.96$, $p < .01$; Daily Living: $F(2, 31) = 4.65$, $p < .05$. As Volkmar et al. (1989) have noted, however, these results are influenced by the differences in developmental level among the three subgroups. As Table II illustrates, the primary area in which the three subgroups differed developmentally is in terms of PPVT mental age. This difference was controlled for statistically by creating a ratio of Vineland subdomain age-equivalent scores to PPVT mental age, following Volkmar et al. (1986). A one-way multivariate analysis of variance was then carried out on these ratio scores. In this analysis, a significant subgroup difference was found only for the Vineland Communication score, $F(2, 30) = 5.57$, $p < .01$.

Discriminant Analysis

A stepwise discriminant analysis was carried out using the WSQ assignments as the independent variable. As Table IV illustrates, the stepwise selection method found one discriminant function (discriminant Function 1) with an eigenvalue above 1. Discriminant Function 1 from this analysis correctly classified 75.76% of the autistic individuals in this study into one of the three WSQ Wing subgroups.

The greatest weights for variables in Function 1 are the clinicians' Wing assignments, followed by the Communication age-equivalent score on the VABS. Thus, the clinicians' Wing assignment was the most powerful predictor of WSQ assignment based on parent ratings, a finding that supports the external validity of the WSQ.

Table IV. Results of Discriminant Analysis of Variables Related to WSQ Wing Subclassification[a]

Predictor variable	Standardized discriminant function coefficient: Func. 1	Standardized discriminant function coefficient: Func. 2	Wilks's lambda	$F(2, 30)$
Sex	−.30	0.46	.889	1.88
Raw score on CARS	—	—	.729	5.57[b]
Clinical Wing assignment	0.91	−0.01	.557	11.92[c]
IQ score	—	—	.837	2.93
Socialization subdomain on Vineland	—	—	.781	4.20
Communication subdomain on Vineland	0.49	1.84	.705	6.28[b]
Daily Living subdomain on Vineland	—	—	.776	4.33
Age	0.22	−0.61	.832	3.03
Mental age on PPVT	−0.15	−1.22	.755	4.87

[a]In interpreting the direction of the weights, it may be noted that subclassification into the aloof subgroup was coded 0, passive was coded 1, and active-but-odd was coded 2. For sex, female was coded 1, male was coded 2. The clinical Wing assignments were coded like the WSQ-based assignments (aloof = 0; passive = 1; active-but-odd = 2). For the first function, Wilks's lambda = .28, distributed as a chi-square statistic with 10 degrees of freedom and equal to 35.72 ($p < .001$), and the eigenvalue = 1.20. For the second function, Wilks's lambda = .61, distributed as a chi-square statistic with 4 degrees of freedom and equal to 13.7 ($p < .01$), and the eigenvalue = 0.63.
[b]$p < .01$.
[c]$p < .001$.

DISCUSSION

The results of this study indicate that subclassification based on the parent-completed Wing Subgroups Questionnaire (WSQ) shows good concordance with the clinicians' independent classification based on direct observations of children's behavior. Also, in a discriminant analysis, the clinicians' classification was found to have the greatest weight in a discriminative function, correctly predicting 76% of the WSQ assignments. These two findings provide support for the external validity of the WSQ. Furthermore, parents ranked descriptions of their child's behavior in a way that is consistent with Wing's subclassification system. That is, parent rankings of behavioral descriptions characteristic of a given subgroup showed adequate internal consistency across behavioral domains. Furthermore, correlational analyses between parent rankings of behavioral descriptions pertaining to different subgroups were low or negative, indicating that the WSQ subgroups were separate and distinct.

Several differences were found among children classified by the WSQ into one of Wing's subgroups. Some of these findings paralleled those from the Volkmar et al. (1989) study. Volkmar et al. found that subgroup classification was related to severity of autism (Autism Behavior Checklist; Krug, Arick, & Almond, 1980) and to IQ. In the present study, CARS scores were significantly higher for aloof than active-but-odd children, with passive children in the middle. Also, aloof children were found to have lower IQ scores than both passive and active-but-odd children, although this difference did not quite reach statistical significance.

Interestingly, post hoc *t*-test comparisons of CARS and IQ data obtained from each of the subgroups suggested that the aloof children were more distinct from the other two subgroups in terms of severity of autism and IQ. The differentiation between passive and active-but-odd children in terms of these two domains, on the other hand, was less clear. This is in contrast to Volkmar et al. (1989), who found that active-but-odd children constituted the subgroup that appeared to be noticeably distinct in terms of IQ and severity of autism; active-but-odd children were less cognitively delayed and less severely autistic than both passive and aloof children, who were harder to differentiate in terms of these variables. These differences in results may simply reflect the particular samples studied.

Volkmar et al. (1989) noted a difference between the results from their study and Wing and Attwood's (1987) clinical descriptions of the three subgroups. Wing and Attwood suggested that the three subgroups they outlined may correspond to traditional DSM-III (or DSM-III-R) diagnostic categories; for example, the aloof group may correspond to classical autism while individuals in the passive group may correspond more to atypical PDD as defined in DSM-III. Volkmar et al. (1989) noted that this was not the case in their study. Data from the present study suggest that, while subgroup classification was marginally related to diagnosis, the relation was not consistent with Wing and Attwood's (1987) prediction. Thus, the findings of Volkmar and his colleagues were replicated.

An area in which results from the present study differed from those of Volkmar et al. (1989) concerns the relation between subgroup classification and chronological age. In the present study, as was the case in the study by Wing and Gould (1979), Wing subgroup classification was not related to chronological age. In contrast, Volkmar et al. (1989) found that aloof children were significantly younger than passive or active-but-odd children. Differences among subgroup means for chronological age in the present study appear quite large; however, the standard deviations (especially for the passive and active-but-odd groups) were so large that these differences were not significant. The range of ages of passive children in particular was very large in this sample.

Findings from the present study parallel findings from Wing and Gould (1979) in other ways. For example, in the present research, analyses of data from the Peabody Picture Vocabulary Test suggest that the Wing subgroups do seem to reflect three different levels of receptive language ability. Similarly, Wing and Gould (1979) found that most of the aloof children in their sample had language comprehension ages below 20 months whereas most of the active-but-odd children had language comprehension ages above 20 months.

Wing and Gould (1979) also found that fewer aloof children had speech while more active-but-odd children had speech. The present study found differences among aloof, passive, and active-but-odd children on the Communication subdomain on the Vineland even after receptive language mental age (from the PPVT) was controlled for statistically. Thus, the differences among the three subgroups in communication skills, both in the present study and in the Wing and Gould (1979) study, appear to be more pervasive than a deficit in receptive vocabulary.

One area in which the findings from the present study differ from those of both Volkmar et al. (1989) and Wing and Gould (1979) is in the distribution of sex across Wing's three subgroups. Neither of the previous studies found any differences in sex distribution; however, as Table III illustrates, sex and Wing subclassification were related in the present study. It is not clear why this was the case. Studies of sex differences in autistic individuals have consistently found that females with autism have slightly lower IQs as a group than males (see Lord & Schopler, 1987, for a review). Based on these findings, one might predict more females in the aloof subgroup, since these children typically had lower IQs than both the passive and active-but-odd subgroups. However, 6 of 15 (40%) active-but-odd children were female, whereas 4 of 13 (31%) aloof children were female.

In summary, results from this study suggest that the Wing Subgroups Questionnaire is a valid tool for classifying children with autism and related disorders into subgroups based on Wing's subclassification system. Empirical support for the conceptual basis of Wing's subgrouping scheme also was found.

APPENDIX

An Example of One Group of Descriptions on the Wing Subgroups Questionnaire

My child shows this behavior:

Never	Very rarely	Rarely	Sometimes	Frequently	Very frequently	Always
0	1	2	3	4	5	6

Group #1.
Please rate each item according to the scale above. Then, at the end of the group of items, please choose the one item that best describes your child.

Rating:

1. ____ When my child is with unfamiliar adults or children he does not start interactions, but he will interact with others if they pull him into activities. He will play with others as long as others direct the play but will wander off at the end of a game unless redirected by the other people.

2. _____When my child is with unfamiliar adults or children he readily approaches others to interact and responds easily to others. His manner of interacting is generally appropriate (not awkward or unusual).

3. _____When my child is with unfamiliar adults or children he either fails to respond when others approach *or* turns or walks away from others. He only approaches other people to obtain something that he needs or to play physical games (for example, roughhousing or tickling); otherwise, he does not approach others to interact.

4. _____When my child is with unfamiliar adults or children he does approach others to interact but is awkward or unusual in his manner of doing so. He is not able to change his speech or behavior to adapt to others and continues to pursue his own topics or favorite activities, even in the face of active discouragement.

_____Which of the items in the group above best describes your child?

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