SOCIAL SUBTYPES IN AUTISM: AN EXAMINATION OF THEIR VALIDITY
AND RELATIONS TO MEASURES OF SOCIAL COGNITION

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Social Subtypes in Autism: An Examination of Their Validity and Relations to Measures of Social Cognition

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(ABSTRACT)

The present study examined the validity of Wing's (Wing & Attwood, 1987; Wing & Gould, 1979) subtypes of social impairment in a sample of autistic individuals and the relations between social deficits and role-taking ability. Specifically, fifty-three autistic persons were assigned by clinical raters to one of a) socially aloof, b) passive interaction, or c) active, but odd interaction subtypes (Wing & Attwood, 1987; Wing & Gould, 1979). Clinical charts were reviewed for diagnostic information as well as chronological ages and, where available, estimates of intellectual functioning (IQ). Teachers or direct care staff completed specific measures of social behavioral characteristics, adaptive functioning, and level of autism with regard to each subject. Children were individually
administered an adapted version of the Autism Diagnostic Observation Schedule (ADOS) (Lord et al., 1989) and measures of three specific aspects of role taking ability by the principle examiner, who was blind to subtype assignment. The general findings support the validity of at least aloof and active-but-odd subtypes as predictors of behavior across language/communication, reciprocal social interaction, and stereotyped behavior/restricted interest domains and suggest that individuals assigned to these respective groups differ in a number of important ways (e.g., level of autism, IQ, adaptive behavior). Partial support for an intermediate, passive subtype was garnered, though clear discrimination of this group was limited by a small sample size. Planned comparisons of role-taking ability to subtypes of social impairment were precluded by the small number of subjects, particularly those in the aloof group, for whom such measures were attainable. The utility of social subtypes for promoting enhanced communication among professionals, research on homogeneous samples of autistic individuals, and planning educational and treatment interventions were discussed as important implications of this work.
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Introduction

Conceptualization of autistic disturbance has eluded researchers and clinicians since Kanner's (1943) original case studies. Numerous reorganizations in theoretical and diagnostic foci have characterized the disorder's brief history. Early etiological models targeted parents as the source of their autistic children's disorder (e.g., Bettelheim, 1967). However, Rimland's (1964) oft-cited review of the scant empirical support for "refrigerator parent" causality allayed further serious consideration of that hypothesis. Moreover, conceptualization was realigned with increased emphasis on biological and intra-individual processes. Recent reviews of genetic (Folstein & Rutter, 1988), neurochemical (e.g., Anderson & Hoshino, 1987), neurophysiological (e.g., Ornitz, 1983; 1987), neurological (e.g., James & Barry, 1980; Golden, 1987), and obstetrical (e.g., Konstantareas, 1986) research indicate support for many biological correlates in autism, likely pursuant to charges of the syndrome's innateness (cf., Kanner, 1943). In fact, many contemporary formulations afford a primary etiologic role to nonspecific physical damage to the central nervous system (DeMyer, 1987; Schopler & Mesibov, 1987, both cited in Bryson, Smith, & Eastwood, 1988). However, as Rutter and Schopler (1988) suggest, the preponderance of available information does not support any one causal
mechanism, but indicates etiologic as well as phenotypic heterogeneity. Accordingly, the current perspective will emphasize individual differences, particularly as they apply to behavioral expression of autistic disturbance.

In step with the noted reorganizations in etiological thought, significant growth in the data base has been reflected in several content areas. Specifically, social behavior (e.g., Mundy & Sigman, 1989; Schopler & Mesibov, 1986; Volkmar, 1987), cognition (e.g., Sigman, Ungerer, Mundy, & Sherman, 1987; Rutter, 1983), perception (e.g., Frith & Baron-Cohen, 1987), and communication (e.g., Paul, 1987; Prizant & Schuler, 1987) have been given considerable research attention, as each of the cited reviews illustrate. Particularly noteworthy among these developments is the conceptual division of several authors on the issue of primary or defining features of autistic disorder. For example, Rutter (1983) and Dawson (1983) have concluded that a basic cognitive deficit involving impaired language, sequencing, abstraction, and coding functions exists in most cases. Others (e.g., Fein, Pennington, Markowitz, Braverman, & Waterhouse, 1986) have argued that social symptoms might more fruitfully be viewed as primary. In this vein, reciprocity of social interchange may be regarded as a central deficiency (e.g., Rutter, 1983; Rutter & Garmezy, 1983). Strictly speaking, however, cognitive and
social as well as affective function and process should be viewed as interdependent, consistent with many theories of human development (e.g., Cairns, 1986; Sroufe, 1979 cited in Dawson & Galpert, 1986). The importance of a developmental perspective notwithstanding, the current author places greater emphasis on autistic social dysfunction, largely out of pragmatic concern. Namely, social behavior is more readily observable and, consequently, more reliably measured than is cognitive process. In fact, social behaviors such as eye gaze, motor activity, facial expression, and vocalization (see Dawson & Galpert, 1986 for a selective review) may be observed and measured reliably within weeks after birth, allowing the potential for addressing important questions of early development. Several such questions were the focus of our recent integrative review (Borden & Ollendick, in press). Herein (i.e., social impairment), variability between autistic individuals is particularly marked and arguably demands further attention. Accordingly, the discussion will now turn to individual differences in autistic social behavior.

In an epidemiological study of children with autism and autistic-like conditions, Wing and Gould (1979) identified three distinct subtypes based on the quality of impairments in social interaction: (1) social aloofness, (2) passive interaction, and (3) active, but odd interaction. The
authors concluded that subclassification of individuals based on the severity of social impairment yielded closer association to behavioral, psychological, and medical variables than did a system based on the history of autism or lack thereof (Wing & Gould, 1979). Moreover, the two classification schemes were found to share variance; individuals with and without a history of autism were found in each of the subtypes of social impairment. The aloof group contained the largest number of autistic subjects, though the difference between the number of individuals in this group and those in either passive or active-but-odd groups was not statistically significant (Wing & Gould, 1979).

In the present study, predictive validity with regard to Wing’s (Wing & Attwood, 1987; Wing & Gould, 1979) social subtypes was examined. The behavioral characteristics of individuals who typify each of these impaired social interaction "styles" are detailed below.

The Aloof Subtype

• The first group, described as "socially aloof", show general indifference to others and represent those most severely impaired in social interaction. As Wing (1983) notes, social aloofness is frequently associated with severe deficits in or complete absence of verbal and nonverbal communication. Further, aloof autistic individuals tend
toward severe or profound impairment, with better visuo-spatial than verbal skills as measured on standardized psychological tests (Wing & Attwood, 1987). Recently, Volkmar, Cohen, Bregman, Hooks, & Stevenson (1989) provided corroborative empirical evidence for the low IQ and mental age of those in the aloof group relative to passive and active-but-odd persons. Some aloof individuals will make spontaneous "social" approaches, though these tend only to occur in the interest of gratifying immediate, personal needs (Wing & Gould, 1979). Moreover, aloof persons may participate in rough-and-tumble activities (e.g., tickling or chasing) with adults, but show no interest in the purely social aspects of contact with others (Wing & Gould, 1979; Wing & Attwood, 1987). Rather, autistic persons of low intellectual functioning (i.e., the aloof group) spend much of their time engaged in simple stereotyped activities (Wing & Attwood, 1987) that are generally self-directed (e.g., finger flicking, arm flapping, or body rocking) (Rutter & Lockyer, 1967; Shah, Holmes, & Wing, 1982). A detailed description of the behavioral features of the "socially aloof" subtype is presented in Table 1.

__________________________

Insert Table 1 about here

__________________________
The Passive Subtype

Similar to socially aloof persons, passive children and adults make social approaches only to meet their immediate needs; however, passive individuals readily accept the social overtures made by others and may even show some appearance of enjoyment in doing so (Wing & Attwood, 1987). Speech is generally better developed in passive than in aloof persons, though the characteristic abnormalities (i.e., immediate and delayed echolalia, pronoun reversal) are present and there is a lack of interpersonal communication for pleasure (Wing & Attwood, 1987). Further, there is evidence that passive individuals have higher levels of intellectual ability than those in the aloof group (Volkmar et al., 1989), though, they too show better visuospatial than verbal skills (Wing & Attwood, 1987). The behavioral features of passive autistic persons are summarized in Table 2.

____________________
Insert Table 2 about here
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In short, passive autistic individuals tend to be the most amiable and easily managed of the three subtypes (Wing & Attwood, 1987). They show less marked features of autism (e.g., less resistance to change, less stereotyped movement) and higher levels of intellectual and adaptive functioning
than those in the aloof group.

The Active-But-Odd Subtype

The third subtype, "active, but odd interaction", describes those individuals who make spontaneous approaches in the interest of indulging their own repetitive, idiosyncratic preoccupations (Wing & Gould, 1979). Accordingly, their social behavior has been described as one-sided (Wing, 1981; Wing & Attwood, 1987) and takes the form of talking at or repeatedly questioning another person (Wing & Attwood, 1987). Speech tends to be better developed than that in either of the other groups, though characterized by odd intonation and poor breath and volume control (Wing & Attwood, 1987). Moreover, active-but-odd persons show the highest level of intellectual functioning of the three subtypes (Volkmar et al., 1989). They differ from aloof and passive individuals in that some show verbal abilities that are equal to or higher than their performance scores on the Wechsler scales; however the verbal subtests on which they tend to excel require facility in rote memory rather than reasoning ability (Wing & Attwood, 1987).

Finally, behavior problems appear to be common in active-but-odd persons, presumably due in part to their socially imposing manner and accompanying sensitivity to criticism (Wing & Attwood, 1987). The behavioral characteristics of Wing's active-but-odd subtype are summarized in Table 3.
As Wing and Attwood (1987) indicate, the classification of autistic individuals by social impairment should not be taken as rigid. Rather, children can move from one group to another with age. Specifically, aloof children may become passive or active-but-odd as they grow older, but rarely is there movement in the other direction (Wing & Attwood, 1987). Lord (1984), in fact, has suggested that a progression from aloof to passive to active-but-odd interaction often characterizes the social development of autistic children. Volkmar et al. (1989) provide some support for this notion of developmental progression (i.e., aloof --> passive --> active-but-odd) with their cross-sectional findings. Further, Rutter's (1970) follow-up study of autistic children into adulthood showed improvement in interpersonal relationships despite continued lack of "social know-how". In contrast, Gillberg and Steffenburg (1987) found that about half of the autistic subjects in their population-based study maintained an aloof social style through adolescence and into the early adult years. Additionally, Mesibov, Schopler, Schaffer, and Michal (1989) failed to find any improvement in autistic children's relationships with others, using the Child Autism Rating
Scale (CARS) (Schopler, Reichler, & Renner, 1986) as a pre-post measure, before age 10 and after age 13. Thus, the results are conflicting with regard to age-related improvement in the social relatedness of autistic persons. Clearly, caution should be exercised in interpreting the reported cross-sectional findings. Moreover, Rutter’s (1970) work bears replication in an elaborated longitudinal design before any firm conclusions may be drawn regarding the suggested directional movement in social development.

In recent years, autistic social cognition has been granted due attention in research and conceptualization. Baron-Cohen (1988) summarizes the current state of the field as follows: "The studies of autistic children’s social understanding have shown a number of unimpaired areas, such as face recognition, mirror self-recognition, and perceptual role-taking, but severe impairments have been found in intermodal matching of emotional expressions, in conceptual role-taking, specifically in attributing beliefs to others, and in imitation of symbolic gestures" [Emphasis in original] (p. 384). In the interest of brevity, only a few of the relevant studies will be discussed here, with emphasis on deficient matching of emotional expressions and attribution of beliefs to others (See Baron-Cohen, 1988 for a comprehensive and insightful review of the social cognitive research). These areas are of particular interest
because recent attempts have been made to relate performance deficits in each respective realm to impairment in social behavior. Thus, attention will be drawn to the interrelatedness among social, cognitive, and affective processes (cf., Cairns, 1986; Sroufe, 1979, cited in Dawson and Galpert, 1986) consistent with the developmental view that questions of primacy are fundamentally in error.

Hobson (1989) has mirrored the sentiments of Kanner (1943) in suggesting that autistic children are innately lacking in the ability to respond emotionally to others and that this is the primary feature of the disorder. His thoughtful research has emphasized and supported autistic children's inability to make differentiations of age and gender (Hobson, 1983) and their impairment in the discrimination of emotional cues (Hobson, 1986a, 1986b). For example, autistic children were decidedly deficient in their ability to match pictures of faces depicting emotions to videotaped samples of actors conveying emotions by gestures, vocalizations, or the context.

Recently, Braverman, Fein, Lucci, & Waterhouse (1989) have demonstrated a significant relationship between performance on respective face- and affect-matching tasks and mental age, social behavior, and play in a sample of pervasive developmental disorder (PDD) children. Interestingly, facial recognition was listed as one of those
areas in which autistic children are unimpaired (Baron-Cohen, 1988). Moreover, the Braverman et al. (1989) study differs importantly from Hobson's (1986a, 1986b) paradigm in that matching of emotional expressions takes place within a single modality. In contrast, Baron-Cohen (1988) suggests that autistic children have greater difficulty matching intermodal indices of emotion than recognizing emotions in one mode. Clearly, several issues remain to be resolved in this area, though Braverman et al.'s (1989) emphasis on relationship between social behavior and social cognition offers promise for future research. In fact, the present study was conceived with this and other developmental questions (e.g., Cairns, 1986; Sroufe, 1979, cited in Dawson & Galpert, 1986) in mind.

Using Wimmer and Perner's (1983) puppet play paradigm, Baron-Cohen, Leslie, & Frith (1985, 1986) showed that autistic children are significantly impaired in their ability to impute beliefs to others relative to normal and Down's syndrome children. Specifically, one of two puppets was "out of the room" while the other one moved a hidden object; the critical question was whether the subject reported that the first puppet would look for the object where it was last seen or where it had been moved (Baron-Cohen et al., 1985, 1986). Autistic subjects differed from controls in that they were more likely to conclude that the
object would be looked for in its present location. The authors interpreted their findings as indicating that autistic children lack a "theory of mind" (Baron-Cohen et al., 1985, 1986). More recently, Baron-Cohen (1988) has suggested that the autistic child's "theory of mind" represents a case of specific developmental delay.

Oswald and Ollendick (1989) have extended the work of Baron-Cohen and others (1988; Baron-Cohen, Leslie, & Frith, 1985, 1986) in demonstrating a significant relationship between deficiencies with regard to the Interrelating Multiple Elements dimension of role taking and measures of social competence. However, they failed to replicate the findings of Baron-Cohen et al. (1985, 1986). In the present study, identical role-taking tasks/measures were employed in the interest of further exploring the relationships among social deficits and specific aspects of role taking ability. Moreover, the division of autistic subjects into qualitatively (and arguably in quantity also) differing patterns of social impairment was well suited to examining the link between autistic social behavior and social cognition. In short, social cognition offers promise as an area for future research. Nonetheless, the thrust of the experimental movement in this area (i.e., autistic social cognition) seems largely to be toward argument for the primacy of social cognitive deficits. In contrast, Cairns
(1986) summarizes the developmental psychobiological vantage point, consonant with the present framework: "...the general point is that it is the combination of properties -- no single or salient "deviant" characteristic -- that defines the adaptive unit" (p. 23). A reasonable application/extension of this perspective might hold that variation between individuals on each of these content "themes" (e.g., social, cognitive, affective) may provide critical information on the broader issue of behavioral development and adaptive functioning in autistic persons. Accordingly, the social behavior of autistic subjects was examined with attention to individuals differences which might be predicted by social subtype assignment (i.e., aloof, passive, active-but-odd). Further, measures of social cognition were employed such that the relationship between level of social impairment and social cognitive ability could be explored.

Summary and Rationale

As the foregoing review of the literature attests, autism refers to a broad range or class of disturbances characterized by specific developmental delays and deviances across several dimensions of behavioral and adaptive functioning (e.g., social, cognitive, affective). Within the current perspective, social deficiencies are worthy of particular emphasis because, (1) relevant behavioral aspects
(e.g., eye gaze, vocalization, motor activity, facial expression) may be observed and measured readily from an early age, and (2) "...it is they that give rise to the name of the syndrome, autism" (Rutter, 1983, p. 524) and which constitute, perhaps, its most characteristic attribute. Moreover, qualitative differences in social style or tendency (i.e., Wing's social subtypes) may be meaningfully (Wing & Gould, 1979) and reliably (Volkmar et al., 1989) delineated among groups of individuals labelled autistic. Specifically, Volkmar et al. (1989), in an empirical examination of the utility and validity of social typologies, found that clinical raters could reliably assign individuals from a broad range of developmental disorders to one of the three subtypes (overall kappa coefficient = 0.68) (see Cicchetti & Sparrow, 1981). In fact, agreement was best for the subsample of autistic cases (K = 0.73) (Volkmar et al., 1989). Not surprisingly, disagreements were most common for assignment of individuals to the passive subtype, where measures of age and developmental delay, for example, were intermediate between aloof and active-but-odd extremes.

With regard to the validity of Wing's social subtypes, the findings of Volkmar et al. (1989) were rather discouraging. Namely, independent measures of deviant social interaction (Autism Behavior Checklist [ABC] relating
score; Krug, Arick, & Almond, 1980, cited in Volkmar et al., 1989) and development (the ratio of Vineland Interpersonal Score to Mental Age; Volkmar et al., 1987) showed only a weak relationship to subtype assignment (Volkmar et al., 1989). The authors speculated that their failure to demonstrate a strong relationship may reflect the specific nature of social deviance under investigation or complex interactions among deviant and normal developmental patterns. Whereas these observations are likely correct, it could be more succinctly argued that the specific measures in that study lacked the sensitivity necessary to distinguish behavioral differences between groups. A third validity index employed by Volkmar and his colleagues (1989) proved more supportive, though lacking in level of interobserver agreement. Briefly, a subtyping questionnaire was designed based on descriptive criteria elaborated in recent works (Prizant & Schuler, 1987; Wing & Attwood, 1987). Caregiver/clinician responses to the 23 yes/no item questionnaire, yielded kappa values of 0.30 or better for 17 items which were then subjected to further statistical analyses. These items discriminated individuals across the three subtypes in a manner generally consistent with the predictions of Wing and others (e.g., Wing & Attwood, 1987; Prizant & Schuler, 1987). The low levels of interrater reliability observed for individual questionnaire items were
quite appropriately attributed to areas of overlap among descriptive criteria (e.g., Wing & Attwood, 1987) for each subtype (Volkmar et al., 1989). In short, some support for the validity of social typologies has been garnered (Volkmar et al., 1989), though further work is clearly needed in this area.

As Wing and Attwood (1987) have indicated, the assignment of persons to social subtypes may have its greatest utility in the clinical arena, where it might aid in the planning and delivery of treatment services. While the potential for such usefulness is acknowledged, it would seem that the value of social subtypes rests on their ability to predict behavior. Several investigators (e.g., Rutter & Garmezy, 1983) have noted the prepotency of IQ as a predictor of outcome, verbal communication, and likelihood of seizures. In fact, the present state of research would likely favor IQ or mental age over social typologies in terms of broad-based (i.e., distal) prediction of outcome. The strong relationship between subtype assignment and level of intellectual functioning (e.g., Volkmar et al., 1989; Wing & Attwood, 1987; Wing & Gould, 1979) has already been noted. Where social subtypes might significantly advance IQ as a predictor and, consequently, achieve their goal of clinical utility, is in the proximate anticipation of behavior. In this vein, the present study seeks to validate
Wing's subtypes as they relate to specific measures of observed social interaction and behavioral functioning.

Recently, Lord et al. (1989) have developed a standardized observation schedule (Autism Diagnostic Observation Schedule - ADOS) for making diagnostic distinctions between autism and related conditions. As these authors state, "One of the underlying purposes of the ADOS was to facilitate observation of social communicative features specific to autism rather than those accounted for or exacerbated by severe mental retardation" (p. 187). Clearly, mental retardation may be distinguished from autism, though the two conditions co-occur in approximately three-quarters of all autistic cases (Rutter, 1979, cited in Rutter & Schopler, 1988). Specifically, Rutter and Schopler (1988) review several marked differences between pervasive developmental disorders (PDD, autism inclusive) and mental retardation including: (1) age of onset, (2) medical correlates, (3) sex distribution, (4) patterns of cognitive disability, and (5) discrimination of socioemotional cues. However, few attempts have been made to discriminate empirically the differences in social behavior which are presumed to exist among persons with autism. The Autism Diagnostic Observation Schedule, which consists of a series of structured and semistructured presses for interaction (Lord et al., 1989) is particularly suited to this
objective. Specifically, the coding of relevant indices of social and communicative behavior with regard to their quality, made both live and upon review of videotaped protocols, affords the discrimination of subtle differences between subtypes. In fact, preliminary analyses performed on a group of 20 autistic and 20 mentally handicapped/lower IQ children matched individually for chronological age, verbal IQ, and sex yielded differential ratings for autistic-nonautistic comparisons and for comparisons between autistic individuals of varying levels of intellectual functioning (Lord et al., 1989). As the conceptual focus of the present investigation is on heterogeneity within the syndrome of autism, the nonautistic control group was omitted and a larger sample of autistic subjects was employed. However, IQ or mental age varied freely across subjects and was examined as a predictor variable with regard to social subtype assignment.

Finally, the social cognitive measures employed by Oswald and Ollendick (1989) were included in the interest of replicating and extending their work. Specifically, the division of autistic subjects by social impairment (i.e., social subtypes) provided an opportunity to investigate the relationship between differences in social behavior and performance in the social cognitive domain. In short, the rich behavior sample attained through administration of a
structured set of tasks to groups of autistic individuals defined by Wing's (Wing & Attwood, 1987; Wing & Gould, 1979) social subtypes facilitated validational studies as well as exploration of the link(s) between levels of social impairment and role-taking ability (Baron-Cohen et al., 1985, 1986; DeVries, 1970; Gratch, 1964). In turn, the findings were expected to have implications for understanding the interrelationships among social, cognitive, and affective functioning in development (e.g., Cairns, 1986; Sroufe, 1979, cited in Dawson & Galpert, 1986), particularly with regard to autism.

Hypotheses

The proposition that there exist qualitative differences in the social behavior of persons with autism leaves essentially no room for dispute. That these differences cluster to yield subtypes raises questions as to reliability and validity. The typology proposed by Wing (Wing & Attwood, 1987; Wing & Gould, 1979) has received most attention in the clinical domain, where individual autistic children are often characterized in a heuristic sense. More recently, the reliability with which such characterizations may be applied has been demonstrated (Volkmar et al., 1989). However, concurrent empirical examination of the validity of these social subtypes yielded somewhat discouraging results (Volkmar et al., 1989), as noted earlier. Nonetheless,
clinical experiences, both first-hand and evidenced through frequent reference to "Wing's subtypes" in the research literature over some ten years, suggests that the proposed social behavioral differences are meaningful. Accordingly, observable and reliably measurable differences in behavior were expected among autistic children clinically assigned to one of aloof, passive, or active-but-odd groups. Moreover, it was anticipated that subjects would behave and perform in a manner roughly consistent with the descriptions Wing and others (e.g., Prizant & Schuler, 1987; Wing & Attwood, 1987) have provided for each subtype (see Tables 1-3). With regard to the specific hypotheses to follow, acceptable reliability of assignment to subtype (cf. Volkmar et al., 1989) and inter-observer agreement for behavioral measures (cf. Lord et al., 1989) were assumed. However, difficulties in subtype assignment were predicted to occur most often in discrimination of passive from aloof and active-but-odd groups (cf. Volkmar et al., 1989), due to conceptual (and descriptive) overlap among the categories.

First, differences in level of mental retardation were expected, with active-but-odd subjects showing significantly higher levels of measured intellectual functioning (IQ) and adaptive behavior (Vineland Adaptive Behavior Composite, Communication, Daily Living Skills, and Socialization age equivalent scores) than those in the passive and aloof
groups (cf. Volkmar et al., 1989). In turn, passive individuals were expected to demonstrate significantly higher IQ and adaptive behavior than aloof subjects (cf. Volkmar et al., 1989). Whereas age related differences in social subtype have been suggested in the literature (e.g., Lord, 1984), with some support from cross-sectional work (Rutter, 1970; Volkmar et al., 1989), the chronological ages of subjects were expected to be approximately equal across groups (cf. Gillberg & Steffenburg, 1987; Mesibov et al., 1989). Moreover, sex differences in assignment to subtype were not anticipated.

Second, on-task behavior and, consequently, task performance was expected to be higher for subjects in the active-but-odd group than for those in the other groups. This prediction related not only to the proposed differences in intellectual and adaptive functioning, but to the expected relative strength of active-but-odd subjects in verbal expressive ability (Wing & Attwood, 1987). Passive and aloof groups were not expected to differ significantly on task performance measures, excepting for reciprocal play, where passive children were predicted to show more willingness and ability to engage than aloof subjects.

Third, global differences in reciprocal social interaction, language/communication, and stereotyped behavior/restricted interests were expected as a function of
subtype. Specifically, aloof subjects were expected to show limited social engagement, lower levels of verbal and nonverbal communication, and more stereotyped behaviors/restricted interests relative to passive and active-but-odd children. Moreover, individuals in the active-but-odd group were expected to show significantly advanced social behavior, language/communication, and less stereotyped behaviors/restricted interests when compared to passive children. In turn, it was anticipated that these global differences in observed behavior between groups would be reflected in overall ratings of autism. Thus, aloof children were expected to be rated as showing the highest level of autism, followed by passive, and active-but-odd groups, with each of these differences achieving statistical significance. Although abnormal behaviors and disturbances of mood were expected in all groups of children, significant global differences were not anticipated.

Within the area of reciprocal social interaction, the number and quality of social overtures were expected to be particularly discrepant between groups, as these items, in a sense, define the subtypes. Moreover, measures of relatedness to the examiner such as shared enjoyment in interaction and quality of rapport were expected to reveal significant differences between groups, with active-but-odd children scoring highest, followed by passive, and aloof
subjects. Measures of specific social behaviors (i.e., eye contact, social distance, facial expressions, smiles) were believed to lack the sensitivity to discriminate significant differences between groups, as all subjects were expected to show high levels of deviance. However, differences in social disinhibition were expected, with aloof subjects demonstrating significantly more behaviors in this domain than either passive or active-but-odd groups; the latter two groups were expected to show no difference on this measure. This prediction followed the expectation that aloof subjects would evidence a greater tendency to disregard the examiner’s presence, whereas the other groups would show some ability to modulate their behavior in the given context.

In the area of language/communication, significant differences, particularly between aloof and active-but-odd groups, were expected for all measures. This prediction related to proposed differences in expressive language ability, with aloof children frequently lacking verbal capacities and active-but-odd children showing high levels of verbal expression (Wing & Attwood, 1987). Thus, measures of usual mode of communication, overall level of nonechoed language, conversation, nonverbal communication, report of interests/activities, intelligibility, intonation/rhythm/rate of language, amount of pronoun reversal, amount
of immediate echolalia, and use of stereotyped phrases and neologisms were expected to reveal significant differences between aloof and active-but-odd subjects, with aloof children rated as more deficient on each of these indices. However, active-but-odd children were expected to ask more inappropriate questions than aloof and passive subjects, given their tendency to indulge their own idiosyncratic preoccupations in conversation (Wing & Attwood, 1987). It should be noted that additional differences between aloof/passive and passive/active-but-odd groups were anticipated for measures of intelligibility, intonation/rhythm/rate, pronoun reversal, and immediate echolalia as a reflection of overall differences in level of autism.

With regard to stereotyped behaviors/restricted interests, excesses on each of the relevant measures were predicted in the aloof group, when compared to passive and active-but-odd children (cf. Wing & Attwood, 1987). Specifically, aloof subjects were expected to show more unusual preoccupations, sensory interests, compulsions/rituals, stereotyped movements, tics (motor and vocal) and self-injury than passive and active-but-odd children. Whereas differences between passive and active-but-odd subjects were expected, it was not believed that these would achieve statistical significance.

As noted above, global differences between groups on
indices of abnormal behavior and mood were not expected. However, differences were predicted between aloof and the other two groups on the single measure of negativism, in accordance with the defining features of the subtypes. Specifically, aloof subjects were expected to resist engagement in tasks and in interaction to a significantly greater degree than passive and active-but-odd children.

Fourth, significant differences in role-taking ability were anticipated as a function of social subtype. Given support in the literature for the relative deficiency of at least some aspect of role-taking among autistic children (e.g., Baron-Cohen et al., 1985; Oswald & Ollendick, 1989), it was expected that subjects would have difficulty completing the assessment as a whole or in part. Nonetheless, it was believed that differences would emerge, with the more socially (and cognitively) competent active-but-odd subjects achieving higher levels of performance than aloof and passive children on the interrelating multiple elements (penny hiding) and controlling the self (puppet scene) measures; however, differences between passive and aloof subjects were expected to be nonsignificant. These predictions were consistent with the findings of Oswald and Ollendick (1989), who observed significant correlations between these measures and independent assessments of social interaction competence. Moreover, it was expected that no
differences would exist between groups on the measure of inference (picture sequencing). This prediction followed the anticipation that all autistic subjects would perform poorly on this measure (cf. Oswald & Ollendick, 1989). Within groups, it was expected that subjects would perform best on the interrelating multiple elements task, followed by the controlling the self, and inference tasks, respectively.

Finally, differences between measures/variables were expected with regard to their ability to discriminate between groups. Briefly, the global measure of reciprocal social interaction was expected to serve as the best predictor of subtype assignment, followed, in order of importance, by IQ, language/communication, and stereotyped behaviors/restricted interests. Moreover, these four variables, in combination, were expected to yield the best discriminant function for assigning individuals to social subtypes.
Method

Subjects

The sample was comprised of 53 children (43 male, 10 female), each of whom had previously received a diagnosis of autism or pervasive developmental disorder using DSM-III (American Psychiatric Association, 1980) or DSM-III-R (American Psychiatric Association, 1986) criteria. Clinical charts were reviewed for the purpose of attaining diagnostic information as well as birthdates and, where available, estimates of intellectual functioning. IQ scores, obtained from the case records of thirty-seven subjects, reflected administrations of a variety of measures, including the Stanford-Binet Intelligence Scale (Terman & Merrill, 1960), Wechsler Intelligence Scale for Children—Revised (Wechsler, 1974), Leiter International Performance Scale (Leiter, 1948), McCarthy Scales of Children’s Abilities (McCarthy, 1972), Extended Merrill-Palmer Scale (Ball, Merrifield, & Stott, 1978), Hiskey-Nebraska Test of Learning Aptitude (Hiscoe, 1966), and Bayley Scales of Infant Development (Bayley, 1969). The Childhood Autism Rating Scale (CARS, see Appendix A; Schopler et al., 1986) was administered to a teacher or treatment worker familiar with each child; a cut-off score of 30 was required for inclusion in the study with a few exceptions. For three subjects, CARS scores approached the cut-off (28.5, 27, and 26.5
respectively), though a diagnosis of autism had been documented in treatment records. In two additional cases, CARS scores were unavailable, although a clinical diagnosis of autism had been rendered. Subjects were recruited, with their parents' consent, from residential treatment facilities in rural Virginia (N = 34) and Cape Cod, Massachusetts (N = 9), and from day treatment programs in rural Virginia (N = 10). The chronological ages of subjects ranged from 6 years, 0 months to 19 years, 5 months with a mean age of 13 years, 3 months (SD = 3 years, 6 months).

Assessment Procedures

Assignment to social subtype. Each subject was independently assigned to one of the three social subtypes (aloof, passive, active-but-odd) by a teacher or treatment worker familiar with the individual. Descriptive behavioral criteria for designation of subtype (Prizant & Schuler, 1987) (Tables 1-3) were furnished to facilitate this process. Raters were instructed to assign subjects based upon the best "fit" with the available descriptions, emphasizing the qualitative nature of the task. Moreover, raters were asked to consider the subject's "characteristic" behavior across multiple settings. This procedure yielded a preponderance of aloof (n = 22) and active-but-odd (n = 22) ratings with 9 cases assigned to the intermediate, passive category. For thirty-two of the subjects, a second rater
was employed to attain an assessment of reliability with regard to subtype assignment. As noted earlier, Volkmar et al. (1989) found high levels of agreement between raters (K = 0.73) using a similar procedure. In cases where there were disagreements, a third rater was independently employed; all discrepancies were resolved through this strategy.

**Social typologies questionnaire.** An initial assessment of the validity of social subtype assignment was obtained through the responses of independent raters to the Social Typologies Questionnaire (Volkmar et al., 1989) (see Appendix B). Specifically, a teacher or direct-care staff person, blind to the subtype assignment of each subject, completed the 23 yes/no item instrument developed by Volkmar and colleagues (1989). In their preliminary work, Volkmar et al. (1989) found that six of the original twenty-three questionnaire items showed unacceptable levels of interobserver agreement (K < 0.30). However, several of these items were judged to be particularly discriminating between groups (e.g., actively rejects social interaction except for meeting specific needs, passively accepts social interaction but doesn't seek it, isn't aware when other's are bored by conversation) and, therefore, were retained in the interest of replicating the original work of Volkmar et al. (1989). For the purpose of statistical analysis, only
those items which met or exceeded a kappa criterion of 0.30 were retained, however.

**Vineland adaptive behavior scales.** Ratings of adaptive functioning were obtained through clinician or teacher responses to the Vineland Adaptive Behavior Scales (Sparrow, Balla, & Cicchetti, 1984). Age equivalent scores for the Adaptive Behavior Composite and across Communication, Daily Living Skills, and Socialization domains were recorded for statistical analysis.

**Role-taking measures.** The measures of social cognition employed by Oswald and Ollendick (1989) were administered in the interest of replicating and extending their work. Moreover, the division of subjects into subtypes of social impairment provided the opportunity for comparison of role-taking ability to social behavioral attainment. As Oswald and Ollendick (1989) noted, the specific measures were chosen to reflect each of the three dimensions of role-taking proposed by Higgins (1981, cited in Oswald & Ollendick, 1989). Moreover, performance of these tasks involved largely nonverbal response modes, such that subjects would not be hampered by possible linguistic deficiencies (Oswald & Ollendick, 1989). The general nature of these tasks is described below. See Appendix C for the specific instructions which were given to subjects and/or consult the primary sources for additional details.
Inference (the picture sequence task). This task was originally introduced by Baron-Cohen et al. (1986) and requires the subject to place cartoon pictures in the proper sequence to tell a story. As Oswald and Ollendick (1989) note, the underlying skill measured involves level of inference and reasoning about the psychological characteristics or mental states of another.

Controlling the self (the puppet scene). As described previously, Baron-Cohen et al. (1985) used this conceptual role-taking task to assess an autistic individual’s ability to attribute a false belief to others, in this case, a puppet. Successful performance is dependent upon the subject’s ability to prevent his/her own viewpoint from interfering with his/her judgement about the viewpoint of another (Oswald & Ollendick, 1989).

Interrelating multiple elements (the penny-hiding game). Briefly, this task involves a social game in which the examiner hides a penny in one of his hands and asks the subject to guess its location. Subsequent trials involve reversal of respective roles, with the subject hiding the penny and the examiner attempting to find it. As Oswald and Ollendick (1989) indicate, "...the investigator examines and rates the subject’s ability to think recursively (i.e., ‘to think about what another is thinking about what I am thinking’)" (p. 121). Consistent with the
procedures of Oswald and Ollendick (1989), scoring for this task was derived from DeVries' (1970) adaptation, which was first described by Gratch (1964) (See Appendix C for scoring sheet). Development along this dimension of role-taking involves an increase in the number and relation of multiple elements involved in a judgment (Oswald & Ollendick, 1989).

**Adaptation of the autism diagnostic observation schedule (ADOS).** Recently introduced by Lord et al. (1989) and given brief mention earlier, the ADOS is an interactive instrument which involves an examiner's presentation of a series of structured and semistructured presses for social interaction; ratings of specified target behaviors are made, both live and from videotape. It is important to note that the examiner was not formally trained in the administration of the ADOS and that the procedures utilized in the present study reflect an adaptation based on printed information. Brief descriptions of the adapted ADOS task items and target behaviors are presented in Table 4.

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Insert Table 4 about here

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The first task, construction, involves the presentation of a picture puzzle or, when seemingly appropriate to the subject's level of functioning, shape sorter and an insufficient number of pieces to complete the activity; the
remaining pieces are placed out of the subjects immediate grasp, but in clear view. Ratings are made of the manner and extent to which the subject asks for assistance in acquiring the pieces necessary for task completion. The "unstructured presentation of toys" task is relatively self-explanatory and involves a set of both familiar and unusual miniatures which provide an opportunity for spontaneous imaginative play. The examiner then attempts to join in the subject's play and to assess his/her capacity for reciprocal play and whether or not he/she seeks to extend the interaction. Specific codings are made on the quality of spontaneous, imaginative play and on the subject's ability to engage in, and quality of reciprocal play. In addition, the individual's response to verbal and gestural prompts for assistance in cleaning up are made. The third task involves a structured drawing game and seeks to determine whether the subject can take turns and use objects jointly (i.e., toward a common goal). The fourth task, demonstration, requires the subject to illustrate through mime, gesture, and language, how to carry out a series of familiar actions (e.g., brushing one's teeth). Next, the subject is asked to describe a colorful poster which features many objects, persons, and inferred activities. Measurements, contingent upon the degree to which the examiner must provide prompts and model responses, are made on the subject's level of
description (e.g., describing objects or isolated components of the picture vs. describing activities or themes). The sixth task requires the subject to examine a book containing only pictures and to describe sequential events in the story. The next portion of the interview involves examiner-prompted conversation about topics that have arisen earlier in the session; ratings of reciprocal communication are made. Finally, the interviewer asks a series of specific questions designed to assess the subject’s ability to describe social and emotional situations and concepts (Wolff & Barlow, 1979, cited in Lord et al., 1989). Specific ratings are made on the subject’s ability to describe emotions, qualities of persons, and the concept of friendship.

In keeping with the procedures of Lord et al. (1989), each of the target behaviors described above and in Table 4 were coded on-task. For reliability purposes, a second examiner was present for twenty of the interviews and unobtrusively rated each of the specified target behaviors. More general ratings were made immediately after the interview in each of five areas: (a) language/communication, (b) reciprocal social interaction, (c) stereotyped behaviors/restricted interests, (d) mood, and (e) other abnormal behaviors. Individual descriptive items which fall under these five categories are detailed in
Again, interobserver agreement was assessed for the general ratings made in twenty of the interviews. Finally, the examiners made an overall rating of autism based on their observations during the interview session. Importantly, all raters were blind to the subtype assignment of individual subjects.

In most instances, general ratings were made on a 3-point ordinal scale, from 0 = within normal limits, to 1 = infrequent or possible abnormality, to 2 = definite abnormality (Lord et al., 1989). However, some measures employed a 4-point ordinal scale. Further, items which required categorical scoring were designated a rating of 7, including behaviors in a given category which were abnormal in way not captured by other codings (e.g., pronoun errors other than those involving first-person references, such as "they" for "it") (Lord et al., 1989). Finally, responses which were not scorables received a coding of 8, including those tasks in which a subject refused or was unable (due to verbal limitations, for example) to participate. Ratings on the adapted ADOS were described in terms of principles with supportive examples, consistent with the original work.
(e.g., Quality of social overtures: 0 = integrates appropriate facial expression, gesture, and vocalization to communicate intentions; 1 = slightly odd quality of social overtures. Overtures may often be for personal demands or related to own interests, but there is an attempt to involve the examiner in that interest; 2 = inappropriate overtures that lack social quality and integration of own and other’s behavior. Includes subject bringing up preoccupations with no attempt to involve the examiner in them; 8 = negligible social overtures of any kind) (Lord et al., 1989).

As the authors of the original work noted, the videotaping of protocols allows the potential for creating a standardized data base for the analysis of specific social and communicative behaviors in addition to those ratings made in the ADOS (Lord et al., 1989). In the current study, examiners independently reviewed videotapes as a self-check in cases of uncertain on-task scoring.

General Procedures

All subjects were tested individually. The examiner escorted each child from his/her classroom to a separate room where the formal assessment took place. In all cases, the session began with the administration of the adapted ADOS (Lord et al., 1989). This allowed for observation of social behavior uncontaminated by familiarity with the examiner and facilitated the building of rapport necessary
for the more structured role-taking assessments. These followed the completion of the adapted ADOS (Lord et al., 1989) and the opportunity for a short break (5 min.). In contrast to the Oswald and Ollendick (1989) protocol of counterbalancing task presentation order, the social cognitive (i.e., role-taking) tasks were administered in a consistent sequence across subjects. As noted earlier, a second examiner was present for twenty of the assessments such that measures of reliability were obtained. In addition, all testing was videotaped for the independent review of examiners in cases of uncertain on-task scoring. Edibles were used as reinforcers for participation in the assessments.
Results

Reliability Analyses

Assignment to subtype. As indicated above, the clinical rating of subtype yielded an uneven distribution of cases in aloof (n=22) and active-but-odd (n=22) groups, with the remaining nine subjects assigned to the intermediate, passive category. Reliability of subtype assignment was calculated, for thirty-two cases, using kappa statistics, which correct for chance levels of agreement (Fleiss, 1981, cited in Volkmar et al., 1989). Perfect agreement was observed for 72% of the cases (23 of 32), with a corresponding kappa value of .56. Not surprisingly, six of the nine cases in which there were disagreements involved distinction of passive groupings from aloof (n=3) or active-but-odd (n=3) categories. In each of the nine cases of discrepant assignment, the employment of a third independent rater yielded agreement with one of the original codings.

Social typologies questionnaire. Levels of agreement were calculated for each of the 23 yes/no items of the social typologies questionnaire based upon the responses of two independent raters with regard to 19 cases. Consistent with the Volkmar et al. (1989) study, a kappa value of .30 was designated as the cutoff for retaining individual items for further analysis. Thirteen of the original items met or exceeded this criterion. These items and their
corresponding kappa values are presented in Table 6.

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Insert Table 6 about here

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Adapted ADOS. Estimates of interobserver agreement for the adapted ADOS were obtained, using the randomly-selected subsample of 20 cases for whom a second rater had been present during assessment. Kappa values were computed for each of the on-task and global rating measures. In general, the agreement among raters was quite good, with an overall (average) kappa value of .83 observed for the on-task measures. Individual kappas, ranging from .69 for the "Reciprocity in play" measure to 1.00 for the "Asking for help" coding are reported in Table 7.

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Insert Table 7 about here

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Similarly, the overall (average) kappa value of .82 for the global measures reflected very high agreement between raters. Kappas for individual items in the Language and Communication area ranged from .81 for "Usual mode of communication" to .93 for "Stereotyped phrases" and "Inappropriate questions and statements", with an overall (average) kappa of .86. In the area of Reciprocal Social Interaction, the overall (average) kappa was estimated at
.85, with values ranging from .66 for "Shared enjoyment" and "Smiling" to 1.00 for "Facial expressions", "Unusual eye contact" and "Social distance/posture". Reliability estimates for individual items in each of these areas, together with the single rating for Play are presented in Table 8.

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Insert Table 8 about here

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The remaining items of the adapted ADOS, across Stereotyped Behavior and Restricted Interests, Other Abnormal Behavior, and Mood areas attained similar levels of interobserver agreement. Kappa values for the Stereotyped Behavior and Restricted Interests domain ranged from .69 for "Vocal tics" to 1.00 for "Compulsions or rituals", "Tics", and "Self-injury" measures; the overall (average) kappa was .91 for this area. With regard to Other Abnormal Behavior, reliability was somewhat lower than that attained in other areas, though well within acceptable limits. Individual kappas ranged from .68 for ratings of "Attention" to .89 for codings of "Tantrums or aggression", with an overall (average) value of .76. Finally, interrater agreement for the Mood area varied from .71 for inferred "Misery" to .91 for "Overall distress" and "Inappropriate cheerfulness"; the overall (average) kappa was estimated at .81. Individual
kappas across each of these areas as well as for the overall rating of autism (.70) are presented in Table 9.

Insert Table 9 about here

Validity Analyses

Differences between groups

In an overall examination of social subtypes, a multivariate analysis of variance (MANOVA) was conducted on the 9 global dependent variables (5 composite scores from the Adapted ADOS, Vineland Adaptive Behavior Composite age equivalent score, CARS total score, chronological age, and IQ). The composite scores from the adapted ADOS were derived by summing the ordinal dependent variable scores in each of Language/Communication, Reciprocal Social Interaction, Stereotyped Behavior/Restricted Interests, Other Abnormal Behavior, and Mood areas. Categorical ratings of 7, indicating "abnormal in a way not captured by the other codings", were transformed to reflect the ordinal nature of the scales. Thus, the absolute level of abnormality for each behavior was coded, from 0 = within normal limits, to 1 = infrequent or possible abnormality, to 2 = definite abnormality (cf., Lord et al., 1989). It should be noted that the occurrence of such categorical ratings, and consequent need for transformation of 7's to
2's, was quite rare across measures and unrelated to the subtype of individual subjects. Due to the limited number of cases for which IQ data was available (N=37) and the relatively small number of subjects assigned to the passive group (n=9), cell sizes were unequal and statistical power was likely compromised. In fact, the resultant MANOVA reflected only 28 of the 53 cases due to additionally missing pieces of Vineland data (n=11). Nonetheless, the effect of subtype was significant, $F(18,36) = 2.04, p < .04$. When IQ was omitted and a MANOVA was conducted on the remaining seven dependent variables (i.e., 5 composite scores from the Adapted ADOS, CARS total score, and chronological age), the effect of subtype was increased, $F(14,86) = 2.49, p < .006$. Accordingly, univariate analyses followed on each of the global dependent variables (including IQ and Vineland Adaptive Behavior Composite age equivalent), with social subtype as the independent variable in a series of one way ANOVA's. The effect of subtype was significant for six of these variables, including Reciprocal Social Interaction, $F(2,50) = 12.98, p < .0001$, Vineland Adaptive Behavior Composite age equivalent, $F(2,39) = 10.73, p < .0003$, Language and Communication, $F(2,50) = 9.43, p < .0004$, IQ, $F(2,34) = 6.83, p < .004$, CARS total score, $F(2,48) = 6.40, p < .004$, and Restricted Interests, $F(2,50) = 4.04, p < .03$. Multiple comparison tests were performed on
each of these variables using the Tukey/Kramer method (Hinkle, Wiersma, & Jurs, 1988), which controls for differences in group sizes. Significant differences between aloof and active-but-odd groups were revealed for all variables, with Language and Communication, and IQ measures showing additional differences between aloof and passive groups. Summary statistics for each of the global dependent variables, including IQ, are reported in Table 10.

Insert Table 10 about here

Inspection of means across subtypes indicates that aloof subjects were rated as more abnormal on indices of reciprocal social interaction, adaptive behavior, language/communication, IQ, and showed more stereotyped behavior/restricted interests and higher levels of autism than active-but-odd individuals. Further, aloof children were rated as significantly lower in language/communication, and intellectual functioning than passive subjects; these findings are particularly noteworthy given the relatively low proportion of cases assigned to the passive group. Interestingly, there were no differences in the chronological ages of subjects as a function of subtype. This finding contrasts that of Volkmar et al. (1989), whose cross-sectional work suggested an age-related progression in
social behavior (i.e., aloof --> passive --> active-but-odd) 

It should be noted that the role-taking indices were 
 omitted from the overall analysis due to the low number of 
 subjects for whom these abilities were measurable. 
 Specifically, eighteen of the fifty-three subjects exhibited 
 scorable responses on some or all of the role-taking 
 measures, with an uneven distribution of these individuals 
 across aloof (n=2), passive (n=5) and active-but-odd (n=11) 
 subtypes, X^2 = 10.46, df = 2, p < .01. Analysis of 
 standardized residuals indicated that the relatively small 
 number of aloof subjects who completed any of the measures 
 was a major contributor to the significant chi-square. 
 Whereas, one might expect that this disparity in measurable 
 indices of social cognition was accounted for, in part, by 
 the distribution of nonverbal (vs. verbal) subjects across 
 subtypes, these differences failed to reach statistical 
 significance, X^2 = 4.61, df = 2, p < .10. Moreover, 
 performance on the tasks was not dependent on linguistic 
 facility, as noted earlier. Thus, discussion with regard to 
 differences in role-taking ability as a function of social 
 subtype (i.e., qualitative differences in social impairment) 
 will be, necessarily, limited to statements of whether or 
 not measurable skills were observed.
Social typologies questionnaire. The relationship of the thirteen questionnaire items, for which acceptable levels of interobserver agreement had been attained, to social subtype assignment was examined through a series of $X^2$ analyses. Seven of these items reached significance at a minimum level of .05. The chi-square values and tests of significance for each of the 13 items, together with percentages of responses across the three subtypes of social impairment are presented in Table 6. A summary score, based on the seven questionnaire items which achieved statistical significance, was derived. Kruskal-Wallis oneway analysis of variance (Hinkle, Wiersma, & Jurs, 1988) on the mean ranks revealed a significant effect for subtype, Kruskal-Wallis $X^2 = 7.13$, df = 2, $p < .03$. Multiple comparison tests, using an analogue of the Bonferroni pairwise comparison procedure (Neter, Wasserman, & Kutner, 1985) indicated that the mean rank for the active-but-odd group was significantly greater than that for the passive group; all other comparisons were nonsignificant. Nonetheless, when this summary score was entered as a single predictor variable in a discriminant analysis, only 41.2% of cases were correctly classified.

Vineland adaptive behavior scales. In an examination of differences in adaptive behavior across subtypes, a multivariate analysis of variance (MANOVA) was planned for
Vineland age equivalent scores across communication, daily living skills, and socialization domains. However, tests for homogeneity of dispersion (variance-covariance) matrices indicated significant violation of the MANOVA assumption. When the effect of large differences in group sizes was reduced by omitting passive subjects from the analysis, significant differences between variance-covariance matrices remained. Therefore, multivariate analysis was not pursued.

Huberty and Morris (1989) have recently argued that multiple analyses of variance (ANOVA's) needn't be preceded by multivariate analysis of variance (MANOVA) in the interest of controlling for Type I error because the alpha value for each ANOVA would be less than or equal to the alpha employed for the MANOVA only when the null hypothesis is true. Moreover, the multivariate method and the univariate method address different research questions (Huberty & Morris, 1989). In the present context, an overall difference in adaptive behavior was documented through univariate analysis of the Adaptive Behavior Composite age equivalent (see Table 10). The interest of subsequent analysis is not to determine the significance of the effect of subtype for a linear combination of domain age equivalent scores, but rather to ascertain which areas of adaptive functioning (Communication, Daily Living Skills, and Socialization) differ among aloof, passive, and active-
but-odd groups. Accordingly, one-way ANOVA's were performed on each of the three domain age equivalent measures; a probability level of .01 was adopted for these analyses. As expected, the effect of subtype was significant for communication, $F(2,39) = 8.54, p < .0009$, and daily living skills, $F(2,39) = 9.88, p < .0004$. Tukey/Kramer multiple comparison tests revealed differences between aloof and active-but-odd groups for both variables and between aloof and passive groups for the daily living skills measure. Surprisingly, the effect of subtype was nonsignificant for the socialization age equivalent variable, $F(2,39) = 2.23, p < .13$. This finding appears to have been accounted for by the large deviation of scores about their respective group means in addition to the pervasive limitations of unequal cell sizes. Nonetheless, there appear to be differences in adaptive behavior as a function of subtype, with active-but-odd individuals showing higher levels of communication and daily living skills than aloof subjects. In addition, passive subjects demonstrate more advanced abilities with regard to daily living skills than those in the aloof group.

In keeping with the findings of Volkmar et al. (1989), one might expect that the observed differences in adaptive functioning across subtypes reflected differences in IQ or mental age (MA) between groups. Specifically, these authors found that, employing a ratio of Vineland score to MA or
entering IQ as a covariate, differences in adaptive behavior between subtypes were either marginally significant or absent (Volkmar et al., 1989). Whereas this methodology could be applied to only a subset of the present population, due to the disparity of cases for which IQ and Vineland data was available (N = 29), the results were consistent with those reported (i.e., Volkmar et al., 1989). Specifically, independent oneway analyses (ANOVA's) on Vineland domain scores with, 1) IQ as a covariate, and 2) domain score to MA ratios yielded no differences between aloof (n=9), passive (n =7), and active-but-odd (n=13) groups across Communication, Daily Living Skills, and Socialization domains.

Adapted ADOS. Differences in observed behavior as a function of social subtype were explored through multivariate analysis of variance using the 5 composite scores from the adapted ADOS (Language/Communication, Reciprocal Social Interaction, Stereotyped Behavior/Restricted Interests, Other Abnormal Behavior, and Mood). As anticipated, the effect of subtype was significant, $F(10,94) = 3.31, p < .002$. Univariate analyses, as reported earlier (See Table 10), showed differences between subtypes for Language/Communication, Reciprocal Social Interaction, and Stereotyped Behavior/Restricted Interests. Interestingly, these three areas comprise what Wing (1981;
Wing & Gould, 1979) has referred to as "the triad of social and language impairment" in her review of common or diagnostic features of autism. Thus, most significant behavioral differences between subtypes were observed with regard to the principal defining features of the autistic population from which they were derived. Kruskal-Wallis ANOVA’s (Hinkle, Wiersma, & Jurs, 1988) were conducted on each of the ordinal dependent variables which were used in the derivation of the five composite scores. Probability levels were set at $p < .01$ because of the number of separate analyses. Multiple comparison tests were performed, on those items reaching the criterion level of significance, using an analogue of the Bonferroni pairwise comparison procedure (Neter, Wasserman, & Kutner, 1985). Results for each of the separate Kruskal-Wallis ANOVA’s and post hoc comparisons of variables in the Language/Communication, Reciprocal Social Interaction, and Play areas are presented in Table 11.

Insert Table 11 about here

As shown in Table 11, seven of the Language and Communication items showed differences between the aloof and active-but-odd groups, with four of these measures revealing additional differences between aloof and passive subjects.
Aloof subjects were rated as lower in overall level of nonechoed language, conversation level and intelligibility, and showed more specific language abnormalities (i.e., deficient intonation/rhythm/rate, pronoun reversal, immediate echolalia, and stereotyped phrases) than individuals in the active-but-odd group. Moreover, aloof subjects displayed less intelligible speech and more pronoun reversal, immediate echolalia, and stereotyped phrases than those in the passive group.

In the area of Reciprocal Social Interaction, differences between subtypes were observed for four of the variables, including quality of social overtures, shared enjoyment in interaction, quality of rapport, and social disinhibition. Post hoc comparisons indicated that the social overtures of aloof subjects were reduced in quality relative to active-but-odd individuals. Further, children in the aloof group displayed more socially disinhibited behavior, appeared to enjoy interaction less, and showed decreased rapport with the examiner when compared to active-but-odd subjects. The effect of subtype was also significant for the single measure of Play, with pairwise contrasts indicating that aloof subjects were rated as less imaginative/creative in play interaction than active-but-odd children.

Across respective areas of Stereotyped Behavior/
Restricted Interests, Other Abnormal Behavior, and Mood only one of the dependent measures showed differences between subtypes. Specifically, vocal tics were observed more frequently for subjects in the aloof group than for those in the active-but-odd group. Nonetheless, several of the items in the Stereotyped Behavior/Restricted Interests domain approached the level of significance, thus, contributing to a significant effect of subtype in the oneway analysis of the composite score. Results of the Kruskal-Wallis tests and post hoc comparisons for individual measures across Stereotyped Behavior/Restricted Interests, Other Abnormal Behavior, and Mood areas are presented in Table 12, together with the analysis of the Overall Rating of Autism.

Insert Table 12 about here

Consistent with the observed differences between subtypes on composite measures constituting "the triad of social and language impairment" (Language/Communication, Reciprocal Social Interaction, and Stereotyped Behavior/Restricted Interests), the effect of subtype was very significant for the Overall Rating of Autism, Kruskal Wallis $X^2 = 17.66$, df = 2, $p < .0002$. Post hoc comparisons indicated that aloof subjects were rated as exhibiting higher levels of autism than those in both passive and active-but-odd
groups.

In an examination of the convergent validity of ratings with regard to level of autism, the codings for Overall Rating of Autism were correlated with total scores obtained on the CARS (Schopler et al., 1986) across subjects (N = 51). For the purpose of this analysis, the metric total scores were converted to ranks of 0 = not autistic, 1 = mild/moderate autism, and 2 = severe autism using the guidelines specified in the Childhood Autism Rating Scale (CARS) (Schopler et al., 1986). A Spearman rank order correlation of rho = .46, p < .01 was obtained, indicating a significant relationship between the two measures.

On-task measures. The relationship of social subtype to on-task measures from the Adapted ADOS was examined through a series of Kruskal-Wallis oneway ANOVA's (Hinkle, Wiersma, & Jurs, 1988) on the ordered ranks. A significance level of .01 was adopted due to the number of independent analyses. Unfortunately, many subjects received codings of "8" for these measures, indicating that their responses were not scorable. This was frequently the case when subjects were nonverbal or showed limited engagement in the tasks (e.g., scorable responses to "describing a poster", "telling a sequential story", "describing qualities of persons, the concept of friendship, and emotions" were dependent on verbal abilities to a large degree). Therefore, cell sizes
were drastically reduced for several of these variables with resulting impact on tests of significance. In short, the effect of subtype was nonsignificant for each of the on-task measures, though the ordering of means was consistent with that expected (i.e., aloof < passive < active-but-odd) for 9 of the 11 variables. Lord et al. (1989), similarly, found that the general ratings of the ADOS were more useful in discriminating between groups than the on-task measures and, thus, highlighted the importance of noting the quality of interactions (Pettit, McClaskey, Brown, & Dodge, 1987, cited in Lord et al., 1989).

**Sex differences.** The overall distribution of male (N = 43) to female (N = 10) subjects in the present sample was roughly consistent with that reported for the autistic population as a whole. Specifically, Rutter and Schopler (1988) indicate that autism is 3-4 times more common in boys than in girls. Moreover, several authors have noted that autistic girls are more likely to be severely mentally retarded and to have a family history of cognitive problems (e.g., Lord & Schopler, 1985; Lord, Schopler, & Revick, 1982; Tsai, Stewart & August, 1981; Wing, 1981). Given the noted association between low IQ and social aloofness (Wing & Attwood, 1987; Volkmar et al., 1989), systematic bias toward assignment of females to the aloof group might be expected. However, the distribution of male and female
subjects across subtypes was approximately equal, $X^2 = 2.83$, df = 2, $p < .30$. Moreover, sex differences in IQ were not present in the current sample, $F(1,35) = 0.75$, $p < .40$.

**Discriminant Function Analyses**

In the interest of clarifying the extent to which the variables singly, and in combination, differentiated the three subtypes of social impairment, multiple discriminant function analyses were conducted. Specifically, a stepwise discriminant analysis was performed to determine which of the nine global dependent variables (5 composite scores from the Adapted ADOS, Vineland Adaptive Behavior Composite age equivalent score, CARS total score, chronological age, and IQ) discriminated significantly among the three clinician-assigned social subtypes. The variables found to contribute significantly to the discriminant function were IQ, $F(2,25) = 6.78$, $p < .005$, Vineland Adaptive Behavior Composite age equivalent, $F(4,48) = 4.03$, $p < .007$, Mood, $F(6,46) = 3.88$, $p < .003$, and Reciprocal Social Interaction, $F(8,44) = 3.82$, $p < .002$. However, when Vineland Adaptive Behavior Composite age equivalent was removed, the remaining three variables combined to yield the "best" discriminant function, $F(6,46) = 5.06$, $p < .0006$; 75.7% of the analyzed cases (N=37) were correctly classified, including 81.8% of the aloof group (n=11), 85.7% of the passive group (n=7), and 68.4% of the active-but-odd group (n=19). This result was somewhat
misleading given the number of cases which were omitted from the analysis (N=25) due to missing IQ and Vineland data. Accordingly, a second stepwise discriminant-function analysis was conducted excluding IQ and Adaptive Behavior Composite age equivalent as predictor variables. The resultant procedure revealed significant contributions of Reciprocal Social Interaction, $F(2,48) = 12.34, p < .0001$, Mood, $F(4,94) = 6.98, p < .0002$, Language and Communication, $F(6,92) = 5.11, p < .0002$, and Stereotyped Behavior and Restricted Interests, $F(8,90) = 4.12, p < .0004$ to the discriminant function. Of the 53 cases analyzed through this procedure, 69.8% were correctly classified, including 77.3% in the aloof group, 66.7% in the passive group, and 63.6% in the active-but-odd group.

In an examination of the efficacy of observed behavior for classifying autistic individuals to subtypes of social impairment and identification of those areas of behavior which contribute most significantly to such an endeavor, a discriminant function analysis was conducted on the 5 composite variables from the adapted ADOS (Language and Communication, Reciprocal Social Interaction, Stereotyped Behavior and Restricted Interests, Other Abnormal Behavior, and Mood). Not surprisingly, The "best" discriminant function was derived through combination of Reciprocal Social Interaction, $F(2,50) = 12.98, p < .0001$, Language and
Communication, \( F(4, 98) = 6.63, p < .0002 \), and Stereotyped Behavior and Restricted Interests, \( F(6, 96) = 5.12, p < .0002 \), the "triad of social and language impairment" (Wing, 1981; Wing & Gould, 1979). Of the 53 cases analyzed, 73.6% were correctly classified, including 81.8% of the aloof subjects, 66.7% of the passive subjects, and 68.2% of the active-but-odd subjects.

Finally, each of the global dependent variables were entered into separate discriminant-function analyses to explore their relative accuracies, as single predictors, in classifying individuals to social subtypes. The percent accuracy of subtype assignment for each of these discriminant-function analyses is presented in Table 13.

As can be seen in Table 13, Language/Communication and Reciprocal Social Interaction were the best single predictors of subtype assignment, correctly classifying 66.0% and 60.4% of cases, respectively. However, there was considerable variability, within individual measures, in classification accuracy across subtypes. For example, the accuracy of the Language and Communication measure ranged from 77.3% for the aloof group to 33.3% for the passive group. Clearly, difficulties exist with regard to
classification of passive individuals (cf. Volkmar et al., 1989) due, at least partly, to overlap with aloof and active-but-odd groups.
Discussion

The results of the present study suggest that the syndrome of autism may be divided reliably and meaningfully into at least two subtypes based upon qualitative differences in social impairment. Specifically, autistic individuals assigned, with acceptable levels of interobserver agreement, to Wing's (Wing & Gould, 1979; Wing & Attwood, 1987) aloof and active-but-odd subtypes showed differences on a variety of constitutional, other-report, and behavioral indices. In addition, the overall findings provided partial support for distinction of passive from aloof autistic children, despite difficulties inherent in the small sample size. However, no convincing evidence was garnered for differentiation of passive subjects from those in the active-but-odd group. Again, the limitation of sample size must be acknowledged. With regard to planned studies of role-taking aspects and their relationship to subtypes of social impairment, the findings were disappointing. Namely, few subjects (N = 18) exhibited measurable responses to some or all of the role-taking tasks, with their uneven distribution across subtypes precluding the proposed analyses. Possible explanations for the observed findings, divided among reliability, validity, and role-taking studies, will be elaborated below.
Reliability Studies

Assignment to subtype. Assignments to subtype by independent clinical raters yielded an acceptable level of agreement (\( K = .56 \)), albeit lower than that expected given the findings of Volkmar et al. (1989). Specifically, these authors found an overall kappa coefficient of .68 in their study of 149 children and adults, with best agreement attained for a subsample of autistic cases (\( N = 78, K = .73 \)). The relatively low agreement in the present study may be best explained by discrepancies with the Volkmar et al. (1989) study in assignment procedure. Specifically, the present investigation sought clinical assignments to subtype through treatment workers or teachers who had little or no previous knowledge of Wing's typologies and made their ratings based on experience with the subjects together with brief descriptions of the target groups (Tables 1-3). Moreover, the relatively small number of cases from which reliability statistics were calculated (\( N = 32 \)) undoubtedly amplified the effect of disagreements when compared to the Volkmar et al. (1989) study. In contrast, Volkmar et al. (1989) employed four child psychiatrists, who made their ratings on the basis of detailed records available for each case in addition to, in many cases, personal experience with the individuals being rated. Nonetheless, the present results with regard to subtype assignment were consistent
with Volkmar et al.'s (1989) observation that disagreements were most common while determining the passive subtype. This discrepancy will be given fuller attention in the discussion of subtype validity. In short, the level of interobserver agreement obtained in the present work, using untrained raters, suggests that there are clearly observable differences between autistic individuals that may be described reliably by assignment to subtypes of social impairment (i.e., Wing's subtypes).

Social typologies questionnaire. The administration of the social typologies questionnaire to teachers and direct-care staff yielded relatively poor interobserver agreement, consistent with the pilot work (Volkmar et al., 1989). Specifically, the independent responses of paired raters, with regard to 19 cases, produced acceptable levels of agreement (K > .30) for only 13 of the original 23 yes/no items. Whereas, Volkmar et al. (1989) obtained reliability ratings for a greater number of cases (N = 62), they, similarly, found that only 17 of the items were agreed upon at or above the criterion level. Interestingly, there were differences between the present and earlier studies in terms of the particular items which attained acceptable reliability. In the present investigation, "Passively accepts social interaction, but doesn't seek it" and "Is happiest when left alone" ratings were retained for further
analysis, though they were omitted, due to poor reliability, in the Volkmar et al. (1989) work. In contrast, several items, including "Prefers nonsocial activities", "Doesn't attend to social stimuli", "Feels/smells/tastes objects", and "Doesn't communicate word or sign" were reliable in Volkmar et al.'s (1989) study, but unreliable presently. Obviously, the poor levels of agreement, within and across studies, suggest extreme caution in interpreting the questionnaire data (cf. Volkmar et al., 1989). Moreover, it is agreed that the development of a more metrified approach may be useful, with additional attention to the issue of reliability (Volkmar et al., 1989).

Adapted ADOS. It should be recalled with necessary emphasis that the principal investigator and reliability raters were not formally trained in the administration of the ADOS (Lord et al., 1989) and that the instrument used in this study was an adaptation based on printed material. Nonetheless, the overall findings with regard to interobserver agreement were largely consistent with those reported in Lord et al.'s (1989) groundbreaking work. Specifically, despite the use of less sophisticated procedures for the purpose of reliability assessment, the present study's observed agreement was comparable to that reported in the Lord et al. (1989) study. Namely, overall (average) kappas across respective on-task and global
measures were .83 and .82, reflecting good agreement between the current raters, with regard to the twenty cases for which these assessments were made. Whereas Lord et al. (1989) employed weighted kappas for the reliability assessment of 20 autistic and 20 mentally handicapped/ lower IQ children and adolescents, their interrater agreement was of similar magnitude. Further, the kappas observed for individual items in the present study were roughly consistent with those reported for the ADOS (Lord et al., 1989) across global and on-task ratings. Thus, interrater agreement was quite good for the behavioral measures utilized in the present study, allowing confident interpretation of the results with regard to predictive validity.

Validity Studies

Overall differences between subtypes. As expected, global differences between subtypes were revealed through multivariate analysis of variance (MANOVA) on the major dependent variables employed in the present study. These variables included chronological age in months, IQ score, Vineland Adaptive Behavior Scale Composite age equivalent (Sparrow et al., 1984), Childhood Autism Rating Scale (CARS) total score (Schopler et al., 1986), and five composite scores based upon observed behavior during the administration of the adapted ADOS (Language and
Communication, Reciprocal Social Interaction, Stereotyped Behavior and Restricted Interests, Mood, and Other Abnormal Behavior) (cf. Lord et al., 1989). In turn, univariate analyses of variance (ANOVA's) revealed significant differences between groups on respective measures of reciprocal social interaction, adaptive behavior, language and communication, IQ, CARS total score, and stereotyped behavior and restricted interests. Post-hoc comparisons indicated that aloof subjects scored lower on global measures of reciprocal social interaction, adaptive behavior, language and communication, intellectual functioning, and were rated as evincing higher levels of autism (CARS total score) and stereotyped behaviors/restricted interests than individuals in the active-but-odd group. Further, passive subjects were higher in IQ and were rated as less autistic than those in the aloof group. Whereas the pattern of findings supported the hypotheses with regard to differences between passive and the other groups, across each of these measures except stereotyped behaviors/restricted interests, these additional differences were of insufficient magnitude to attain statistical significance. The relatively small sample size with regard to the passive group likely accounted, at least partly, for this outcome. Nonetheless, it appears that the passive subjects in the present study overlap, to a great extent,
with the active-but-odd group, while sharing relatively less variance with aloof individuals. In the sections to follow, observed differences between subtypes will be detailed for each of the specific behavioral measures from which the adapted ADOS composite scores were derived as well as for the Vineland domain age equivalents and social typologies questionnaire.

**Behavioral differences between subtypes.** As expected, significant differences between aloof and active-but-odd subjects were observed for many behavioral ratings made on the adapted ADOS. However, discriminations of aloof from passive individuals were infrequent and confined to the areas of language/communication and overall rating of autism. Moreover, no evidence for differences between passive and active-but-odd groups was obtained in the behavioral assessment. The findings across areas of the adapted ADOS will be considered in turn.

In the area of language and communication, aloof subjects were rated as lower in level of nonechoed language and in their ability to engage in conversation when compared to active-but-odd individuals. Further, aloof children and adolescents produced less-intelligible speech and showed a greater tendency toward pronoun reversal, immediate echolalia and use of stereotyped phrases than subjects in both passive and active-but-odd groups; however, the latter
two groups did not differ significantly on any of these measures. In addition, aloof persons exhibited more abnormality in the intonation/rhythm/rate of their speech than subjects in the active-but-odd group. Whereas predicted differences between groups for several of the language/communication measures were not born out in the data, it should be noted that several items, including "usual mode of communication", "reports of interests/activities", "neologisms", and "inappropriate questions and statements" attained marginal levels of significance (p < .05). Thus, individuals assigned to Wing's subtypes, particularly those in aloof and active-but-odd groups, appear to differ along the dimension of language/communication in a number of important ways.

With regard to reciprocal social interaction, aloof subjects displayed social overtures of lesser quality than active-but-odd individuals, though, surprisingly, of equal frequency. Moreover, predicted differences on ratings of "shared enjoyment in interaction" and "quality of rapport with the examiner" were observed, with both reduced in the aloof group relative to active-but-odd subjects. Further, aloof individuals displayed more socially disinhibited behavior than those in the active-but-odd group, consistent with that expected. Anticipated differences with regard to the other measures of reciprocal social interaction were not
supported. However, ratings for "quality of social response", and "social distance" measures revealed marginally significant differences between groups (p < .05). Of particular note, were the failures of "amount of social overtures" and "amount of reciprocal social communication" measures to reveal any differences between subtypes. A possible explanation for the unsupported hypotheses with regard to these measures relates to difficulties in quantifying relevant behaviors in ratings (i.e., frequent vs. some).

Contrary to expectations, specific ratings in the area of stereotyped behaviors and restricted interests yielded differences between groups for only one measure. Specifically, aloof subjects displayed more vocal tics than individuals in the active-but-odd group. Moreover, only one additional measure, namely "stereotyped movements", revealed marginally significant differences (p < .05) between subtypes. Although it was anticipated that the subtypes would be clearly differentiated across all measures of stereotyped behaviors and restricted interests, it is believed that the low frequency with which some of the target behaviors (e.g., self-injury) were observed during the assessment sessions precluded statistically significant findings. This argument may be equally applied to the nonsignificant results across measures of mood and abnormal
behavior, though differences were not predicted, save for the "negativism" index. Further, it was anticipated that the specific measures across areas of mood and abnormal behavior would lack the sensitivity to detect differences between groups. It seems likely that one or both of the noted limitations were operative, at some level, for many of the behavioral measures.

On the single measure of play behavior, aloof subjects were rated as significantly less imaginative/creative than active-but-odd children and adolescents; however, expected differences between passive and aloof groups were unsupported. Finally, the overall rating of autism corroborated evidence attained through the CARS total score ratings of teachers/staff in documenting significant differences between subtypes. Specifically, aloof individuals were rated as higher in overall level of autism than subjects in both passive and active-but-odd groups.

**Vineland adaptive behavior scales.** Univariate analyses of variance (ANOVA's) conducted on age equivalent scores for Communication and Daily Living Skills domains of the Vineland Adaptive Behavior Scales (Sparrow et al., 1984) revealed differences between the subtypes of social impairment. Specifically, aloof subjects were rated as significantly delayed in adaptive communication and daily living skills when compared to active-but-odd children and
adolescents. Moreover, passive individuals attained higher levels of daily living skills than aloof subjects, though they did not differ significantly from active-but-odd individuals on this measure. Surprisingly, there were no differences, as a function of subtype, on the age equivalent measure of Socialization. As noted earlier, the relatively high deviation of scores about their respective group means may have accounted for this finding.

Social typologies questionnaire. Consistent with the analytical procedures of Volkmar et al. (1989), chi-squares were calculated, across subtypes, for each of the questionnaire items which attained an acceptable level of interobserver agreement (K > .30). Of the 13 items which met or exceeded the kappa criterion, 7 revealed significant differences between groups (p < .05) (See Table 6). However, these data were difficult to interpret given the disparity of cases assigned to the passive group. Nonetheless, differences between aloof and active-but-odd groups were evident for five of the items. Specifically, aloof subjects were more frequently described by "stereotyped behaviors common", "passively accepts social interaction, but doesn’t seek it", and "is happiest when left alone" items than active-but-odd individuals. In contrast, active-but-odd children and adolescents were characterized more often by "incessantly talks about 1 topic" and "uses verbal routines
in interaction" items than those in the aloof group. Finally, passive subjects appeared to be more frequently ascribed characteristics of "echolalia is common" and "no reaction to new people" items relative to the other groups. On the face, each of the above items seem to reflect the subtypes as would be predicted. All of the questionnaire items which attained a significant chi-square were combined to yield a summary score. Group differences with regard to the summary score were observed through Kruskal-Wallis ANOVA, with active-but-odd subjects scoring significantly higher than passive subjects; all other comparisons were nonsignificant. However, the meaning of the difference between groups is unclear. In short, the social typologies questionnaire, in its present form, appears to be of little use in differentiating subtypes of social impairment. As noted earlier, the development of a more metrified questionnaire would seem to be indicated, though the issue of interrater reliability will require continued attention (cf. Volkmar et al., 1989).

**Discriminant function analyses.** As expected, the variables which, in combination, yielded the "best" discriminant function or that which was most predictive of subtype assignment were those which comprise the "triad of social and language impairment" (Wing, 1981; Wing & Gould, 1979): Language and communication, reciprocal social
interaction, and stereotyped behaviors and restricted interests. These areas of behavioral functioning have appeared consistently in American Psychiatric Association’s Diagnostic and Statistical Manual of Mental Disorders since the syndrome’s formal recognition in 1980 (i.e., DSM-III and DSM-III-R; American Psychiatric Association, 1980, 1986) and were prominent among the descriptors in Kanner’s (1943) original case work. Thus, as suggested earlier, the most significant predictors of subtype assignment were ratings in those areas of behavioral functioning which define the autistic population from which the typology was derived. It should be noted that IQ would likely have served as a significant contributor to the discriminant function had data been available for a greater number of subjects.

However, it is argued that the behavioral measures account for unique variance in the prediction of subtype assignment and offer more precision in this endeavor. Whereas this suggestion could not be tested fully given the disparity of subjects for whom IQ data were obtained, the analysis of dependent variables as independent predictors allowed a partial examination of this issue.

As anticipated, behavioral measures in the areas of language and communication and reciprocal social interaction served as the best single predictors to subtype assignment, correctly classifying 66.0% and 60.4% percent of subjects
(N = 53), respectively. CARS total score (i.e., level of autism, N = 51), Vineland Composite age equivalent (i.e., level of adaptive behavior, N = 42), and IQ (N = 37) followed in relative predictive strength, with respective accuracies of 58.8%, 54.8%, and 54.1%. It is important to note, however, that the relative accuracies of single predictors across subtypes were quite variable. For example, the accuracy of the language and communication measure ranged from 77.3% for assignments of aloof to 33.3% for the passive category. In fact, each of the best four single predictors, noted above, yielded least precision for classification of passive subjects. The implications of this finding together with the reported information on subtype reliability and validity will be summarized in the concluding section.

Role-taking

Contrary to expectations, an insufficient number of subjects completed the role-taking assessment to allow for the planned analyses of differences between subtypes. Specifically, eighteen subjects, including 2 aloof, 5 passive, and 11 active-but-odd individuals, offered some level of measurable response to the structured measures. As noted earlier, the small number of aloof subjects accounted for, to a large extent, the significance of the observed chi-square. This result is not surprising given the
anticipated relationship between level of social competence (Oswald & Ollendick, 1989), intellectual functioning, and role-taking ability. The relatively high degree of social impairment in the present study’s aloof group has already been noted, with considerable weight of supportive evidence. Moreover, the observed IQ scores available for aloof subjects (N = 11) were generally in the severe range of mental retardation ($\overline{X} = 29.5$, SD = 10.3), explaining further their inability to perform the role-taking tasks. In fact, the present subject population, as a whole, appeared lower in measured level of intellectual functioning (N = 37, $\overline{X} = 45.4$, SD = 19.8) than the autistic sample that Oswald and Ollendick (1989) studied (N = 10, $\overline{X} = 61$, SD = 15.2). Thus, the paucity of cases for which role-taking was measurable may be attributed, at least partly, to cognitive limitation. Moreover, the possible effect of fatigue, given that the Adapted ADOS preceded role-taking assessment, must be acknowledged.

Summary and Implications

The present study lends considerable support to the validity of aloof and active-but-odd subtypes. In fact, the frequency with which hypotheses were supported across measures of the adapted ADOS suggests that assignment of individuals to these respective subtypes allows confident prediction of behavioral differences (i.e., predictive
validity). Nonetheless, the observation of differences between aloof and active-but-odd subjects is not surprising inasmuch as they lie conceptually at extreme ends of a continuum with regard to social impairment. In this vein, the relatively high number of disagreements between raters when determining the passive subtype (cf. Volkmar et al., 1989) reflects continuity in social impairment between the noted "anchors" and the autistic spectrum to which Wing and Attwood (1987) make reference. It is likely, given the available descriptions of Wing's subtypes (e.g., Prizant & Schuler, 1987; Wing & Attwood, 1987)(See Tables 1-3), that the passive group in any given sample would show some overlap with either aloof or active-but-odd groups, and possibly with both in various respects. In the current study, the passive group was found to share considerably more variance with the active-but-odd than with the aloof group. In fact, the argument could be made, statistically speaking, that the present study's passive group was no different than the active-but-odd group. In contrast, the relatively consistent pattern of findings (i.e., ordering of means with respect to subtype) across measures argues in favor of differences in the passive group when compared to the aloof and active-but-odd groups. Accordingly, the failure to find significant differences between the passive and other groups for most measures may have been accounted
for by the small number of subjects assigned to that subtype. In turn, the relative few passive individuals identified in this investigation may reflect bias in the population studied. Specifically, residential treatment programs, from which over three-quarters of the sample was drawn, service those autistic individuals whose behavior is most severely disturbed and/or disturbing to others. As Wing and Attwood (1987) have indicated, children in the passive group are the most amiable and easily managed of the three subtypes. Accordingly, sampling of predominantly residential facilities may have biased selection toward aloof and active-but-odd children, while omitting passive subjects who are managed at less restrictive levels of care (i.e., parental care, outpatient treatment, day programs).

It is noteworthy that, consistent with expectations and despite reported evidence to the contrary (viz. Rutter, 1970; Volkmar et al., 1989), the age of subjects in the present study did not differ as a function of subtype. As indicated earlier, several authors (e.g., Lord, 1984; Rutter, 1970; Volkmar et al., 1989) have suggested that autistic individuals show improved social relatedness with age. However, in the absence of longitudinal data supporting a progression from aloof to passive to active-but-odd and in the presence of contradictory findings (e.g., Gillberg & Steffenburg, 1987; Mesibov et al., 1989) no age
related differences in subtype were anticipated. Whereas the present lack of support for age related differences between subtypes brings no more conclusive evidence to bear on the issue than other cross-sectional studies, it does lend a measure of support for the emergent perspective of autism as a spectrum of disorders (cf. Allen, 1988). Specifically, level of social impairment may be taken as a functional (primary) limitation that reflects various neurological abnormalities and interacts synergistically with other functional (e.g., cognitive level) and underlying neurological impairments to yield a unique phenotype (cf. Goodman, 1989). As such, subtypes of social impairment needn't be age-related or maturational, and, in fact may be relatively stable. It is not disputed that some or even many autistic persons show measurable changes in social behavior with age. However, these behavioral changes, ostensibly reflecting improved social relatedness, may not involve marked shifts in social interaction "style" (i.e., aloofness --> passivity --> active social initiation). Rather, a socially aloof autistic child, for example, may show less active avoidance and disruptive behavior in response to the initiations of others as he/she grows older, while maintaining a preference for solitary activity and social isolation. Thus, behavioral differences within autistic individuals over time, and between persons
with autism at any given time, may be viewed along a continuum of social impairment. Nonetheless, the present study has shown that Wing's subtypes (Wing & Attwood, 1987; Wing & Gould, 1979) differentiate autistic children and adolescents with relatively distinct clusters of behavioral, constitutional, and other-reported characteristics. The implications of this finding, beyond the value of heuristic description and derivation of more homogeneous research samples, relate to the planning of educational and treatment services (cf. Wing & Attwood, 1987). Accordingly, variable education and treatment approaches may be indicated depending on the subtype assignment of a given individual.

In a recent summary of the state of the art with regard to diagnosis and treatment of autism, twenty-one prominent researchers in the field offered the following conclusions:

Any treatment plan must include educational and behavioural approaches. Some children are given medication because of extreme behaviour problems. There can be no "30 minutes a day exclusively" treatment for children with autism. A multidisciplinary integration of approaches in which parents and siblings are actively involved is called for in most cases. A high degree of structure, a calm environment and continuity as regards time, place and persons are all essential elements in the habilitation
programme (Andersson et al., 1989, p. 442).

This statement is important because it highlights the intensity and multiple levels of intervention necessary to addressing the problems of autism as well as those treatment approaches (i.e., educational, behavioral, pharmacological) which have demonstrated effectiveness. The behavioral approach to treatment, with its first application to autism in Ferster's (1961) work, rests on the assessment and understanding of individual behaviors (cf. Schreibman, 1988). Within the current framework, a specific set or range of behaviors may be predicted by subtype assignment. Thus, knowledge of the subtype of a given autistic individual may foretell those areas of behavioral excess and deficit for which specific treatments should be applied. Given strongest support for differences between aloof and active-but-odd groups, the following discussion will focus on contrasting treatments for individuals in these categories.

First, it should be noted that social impairments have been the most challenging of targets in the treatment of autistic persons (Schreibman, 1988). As Schreibman (1988) aptly states, "It is perhaps prophetic that the behavior characteristic which most uniquely defines autism is also the one that has proven the most difficult to understand and treat" (p. 118). Nonetheless, some successes have been
reported in the application of behavioral and pharmacological treatments. Whereas early behavioral approaches to the social skills training of autistic individuals were typically dyadic (i.e., adult therapist and patient) and focused on antecedents and consequences of individual behaviors, more recent methods emphasize pragmatic instruction or analysis of social behavior within naturally occurring contexts (see Frankel, Leary, & Kilman [1987] for a review). This strategy avoids the pitfalls of the earlier approach by promoting wider generalization of learning (Stokes & Baer, 1977) while ensuring the functionality of the skills being taught (Halle, 1982, cited in Frankel et al., 1987). Although both aloof and active-but-odd groups of individuals may benefit from social skills training, the goals of treatment and, consequently, the process of teaching will differ widely between persons in each respective group. Specifically, the establishment of social intent or initiation of interaction will be the primary focus with regard to aloof children, whereas modification of pre-existing intent will serve as an important goal for the treatment of active-but-odd individuals (see Lord and MaGill [1989] for a detailed discussion of methodological and theoretical issues in studying the peer directed behavior of autistic persons). Moreover, the inextricably bound issue of communication/
language will dictate the use of different educational approaches and goals depending on the subtype of the learner. This proposition will be given fuller attention below.

In their recent discussion of strategies for facilitating the communication of autistic individuals, Prizant and Schuler (1987) present an adaptation of Wing and Gould's (1979) typologies (see Tables 1-3) in illustrating the range of social/communicative "styles" within the disorder. Moreover, they suggest that the frequency and various aspects of the quality of social initiations and responses may naturally determine priorities in communication programming (Prizant & Schuler, 1987). Clearly, the socially aloof child, who rarely initiates interaction, will require a different teaching strategy than one whose social approaches may cause problems due to their frequency and inappropriateness (i.e., an active-but-odd person). "In other words, the communicative needs of a more passive person may be very different from the communicative needs of a very active person who frequently takes the initiative in communicating" (Prizant & Schuler, 1987, p. 325). With regard to socially aloof children, who show decreased language development and infrequent language use relative to their active-but-odd counterparts, the "natural language-teaching paradigm" (e.g., Koegel & Johnson, 1989)
is most appropriate. Briefly, this model of instruction emphasizes motivation enhancement within the context of naturally occurring or naturalistic planned activities (Koegel & Johnson, 1989). For example, reinforcing stimuli (e.g., food, a preferred toy) may be arranged in such a way that the child must request assistance to gain access to them; Koegel and Johnson (1989) refer to this as a "communicative temptation". In contrast, the teaching of active-but-odd children, as regards communication, will be more heavily weighted toward pragmatics and learning social/communicative conventions. Specifically, proper initiation of interactions, maintaining a conversational topic (or shifting when such is called for), and terminating interactions (cf. Prizant & Schuler, 1987) will be prominent goals in the communication training of active-but-odd persons.

With regard to pharmacological treatment of autism, several medications have been prescribed, with noted impact on the behavior of some autistic children. In general, these interventions have proven most applicable to severely impaired children and have served to ameliorate a variety of behavioral deficits. Thus, individuals in the aloof group are more likely candidates for pharmacotherapy than are active-but-odd persons. A few of the most widely and effectively used medications will be given brief mention
here. In a recent study, Campbell, Green, and Deutsch (1985, cited in Schreibman, 1988) showed that trifluoperazine (Stelazine), a low potency neuroleptic with less sedative effects than other phenothiazines (e.g., Thorazine), produced a decrease in the social withdrawal of low-functioning autistic children, while increasing their alertness and verbal production. However, as Schreibman (1988) indicates, the use of this medication may be limited, in some cases, by the potential for negative side effects (e.g., lowered seizure threshold, tardive dyskinesia). The results of treatment with haloperidol (Haldol), a high potency neuroleptic, have offered similar promise, although the potential for side-effects are of equal order. For example, Campbell et al. (1978) showed that administration of this medication resulted in decreased hyperactivity, temper tantrums, irritability, stereotypies, and withdrawal in a large sample of autistic cases. The findings of other studies employing haloperidol, most of which were conducted in the same laboratory, have been similarly positive (see Campbell, 1989 for a review). In recent years, Fenfluramine, an anorectic drug that has been used in the treatment of obesity, has received considerable attention as a treatment for autism. Holm and Varley (1989) provide a comprehensive review of the research, which indicates positive impact on social behavior, language, motor
activity, and intellectual functioning in many autistic subjects. The authors note, however, that their own experiences with Fenfluramine suggest that patients habituate to the drug, showing a diminution in the beneficial effects after a few months of treatment (Holm & Varley, 1989). Finally, Naltrexone, a potent and long-acting opiate antagonist, has been suggested as a potentially useful treatment for some symptoms of autism. In what Holm & Varley (1989) note as the only carefully designed study to date, Campbell, Adams, Small, McVeigh, Tesch, and Curren (1988, cited in Holm & Varley, 1989) observed significant reductions in stereotyped behaviors and markedly increased social relatedness in eight moderate to profoundly retarded autistic boys when Naltrexone was administered at high dose (2.0 mg/kg per day). In short, there is evidence to suggest that pharmacological treatment may be useful for some of the more severely impaired of autistic children (i.e., the aloof group). In fact, the reported findings would seem to constitute a significant breakthrough in the treatment of autism. However, the potential for untoward side effects (e.g., sedation, agitation, dyskinesias) and the methodological flaws in many, if not most, of these studies indicate that caution should be exercised in the administration of these medications and in drawing firm conclusions regarding their
treatment efficacy (cf. Schreibman, 1988). Moreover, as Holm and Varley (1989) correctly assert, "pharmacological treatment should always be used in conjunction with behavioral therapies...never as a substitute for them" (p. 401).

In conclusion, social subtypes, owing to their demonstrated predictive validity, support more efficient planning of treatment and education services than do traditional diagnostic categories (i.e., Autistic Disorder, Pervasive Developmental Disorder Not Otherwise Specified [PDD-NOS]; American Psychiatric Association, 1986). A comparatively large amount of information about an autistic individual is gained through the simple and reliable procedure of assignment to subtype. In the present study, relatively untrained raters achieved acceptable levels of observed agreement when making subtype assignments, each of which required less than 15 minutes. Thus, assignment of autistic individuals to subtypes of social impairment is a cost-effective means of acquiring valuable assessment information. Wing and Attwood (1987) suggest that assignment of children to one of the categories is usually possible by school age based on their most characteristic behavior in reaction to strange adults and to age peers during unstructured play activity. As behavioral observation is critical to the functional analysis of target
behaviors for treatment, such as those noted in the pragmatic analysis of social skills (Frankel et al., 1987), it would seem justified that clinicians routinely make subtype assignments through their normal process of assessment. Doing so would facilitate the development of education and treatment plans, while also promoting research on more homogeneous samples of individuals within the autistic spectrum and enhancing communication among professionals.
References


Dawson, G. (1983). Lateralized brain function in autism:

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North America, 9, 671-688.


Table 1: Behavioral description of Wing and Gould’s (1979) "Socially aloof" subtype

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Aloof and indifferent in most situations (exceptions: having specific needs met)</td>
<td></td>
</tr>
<tr>
<td>b. Any interaction is primarily with adults through physical means (tickling, physical exploration)</td>
<td></td>
</tr>
<tr>
<td>c. Little apparent interest in social aspects of contact</td>
<td></td>
</tr>
<tr>
<td>d. Little evidence of verbal or nonverbal turn-taking</td>
<td></td>
</tr>
<tr>
<td>e. Little evidence of joint activity or mutual attention</td>
<td></td>
</tr>
<tr>
<td>f. Poor eye contact, active gaze aversion</td>
<td></td>
</tr>
<tr>
<td>g. Repetitive, stereotypic behaviors may be present</td>
<td></td>
</tr>
<tr>
<td>h. May be oblivious to environmental changes (e.g., person entering room)</td>
<td></td>
</tr>
<tr>
<td>i. Moderate-to-severe cognitive deficiency</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Behavioral description of Wing and Gould's (1979) "passive interaction" subtype

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Limited spontaneous social approaches</td>
</tr>
<tr>
<td>b. Accepting of others' approaches</td>
</tr>
<tr>
<td>- adult initiations</td>
</tr>
<tr>
<td>- child initiations</td>
</tr>
<tr>
<td>c. Passivity may encourage interaction from other children</td>
</tr>
<tr>
<td>d. Little pleasure derived from social contact, but active rejection is infrequent</td>
</tr>
<tr>
<td>e. Child may be verbal or nonverbal</td>
</tr>
<tr>
<td>f. Immediate echolalia more common than delayed echolalia</td>
</tr>
<tr>
<td>g. Varying degrees of cognitive deficiency</td>
</tr>
</tbody>
</table>

Table 3: Behavioral description of Wing and Gould's (1979) "Active-but-odd interaction" subtype

<table>
<thead>
<tr>
<th>a. Spontaneous social approaches are apparent</th>
</tr>
</thead>
<tbody>
<tr>
<td>- most frequently with adults</td>
</tr>
<tr>
<td>- less with other children</td>
</tr>
<tr>
<td>b. Interaction may involve repetitive, idiosyncratic preoccupation</td>
</tr>
<tr>
<td>- incessant questioning</td>
</tr>
<tr>
<td>- verbal routines</td>
</tr>
<tr>
<td>c. Interaction may be communicative or noncommunicative (if verbal), delayed and immediate echolalia</td>
</tr>
<tr>
<td>d. Poor or deficient role-taking skills</td>
</tr>
<tr>
<td>- poor perception of listener needs</td>
</tr>
<tr>
<td>- no modification of language complexity or style</td>
</tr>
<tr>
<td>- problems in shifting topics</td>
</tr>
<tr>
<td>e. Interest in routine of interaction rather than content</td>
</tr>
<tr>
<td>f. May be very aware of other's reactions (especially extreme reactions)</td>
</tr>
<tr>
<td>g. Less socially acceptable than passive group (active violation of culturally-determined social conventions)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Task</th>
<th>Target behavior(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction task</td>
<td>--Asking for help</td>
</tr>
<tr>
<td>Unstructured presentation of toys</td>
<td>--Symbolic play</td>
</tr>
<tr>
<td></td>
<td>--Reciprocal play</td>
</tr>
<tr>
<td>Drawing game</td>
<td>--Turn taking in a structured task</td>
</tr>
<tr>
<td>Demonstration task</td>
<td>--Descriptive gesture and mime</td>
</tr>
<tr>
<td>Poster task</td>
<td>--Description of agents and actions</td>
</tr>
<tr>
<td>Book task</td>
<td>--Telling a sequential story</td>
</tr>
<tr>
<td>Conversation</td>
<td>--Reciprocal communication</td>
</tr>
<tr>
<td>Socioemotional questions</td>
<td>--Ability to use language to discuss</td>
</tr>
<tr>
<td></td>
<td>socioemotional topics</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Language/Communication</strong></th>
<th><strong>Reciprocal Social Interaction</strong></th>
<th><strong>Stereotyped Behaviors/Restricted Interests</strong></th>
<th><strong>Mood</strong></th>
<th><strong>Other Abnormal Behaviors</strong></th>
<th><strong>Overall clinical rating of autism</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>--Level of nonechoed language</td>
<td><strong>--Conversational</strong></td>
<td><strong>--Amount of social overtures</strong></td>
<td><strong>--Unusual preoccupations</strong></td>
<td><strong>--Overall distress</strong></td>
<td><strong>--Overactivity</strong></td>
</tr>
<tr>
<td>--Reports</td>
<td><strong>--Intelligibility</strong></td>
<td><strong>--Amount of reciprocal social communication</strong></td>
<td><strong>--Unusual sensory interests</strong></td>
<td><strong>--Misery</strong></td>
<td><strong>--Overactivity</strong></td>
</tr>
<tr>
<td>--Intonation/rhythm/rate</td>
<td><strong>--Immediate echolalia</strong></td>
<td><strong>--Facial expression</strong></td>
<td><strong>--Autistic mannerisms and stereotyped movements</strong></td>
<td><strong>--Anxiety</strong></td>
<td><strong>--Tantrums and aggression</strong></td>
</tr>
<tr>
<td>--Idiosyncratic language</td>
<td><strong>--Inappropriate questions, statements</strong></td>
<td><strong>--Shared enjoyment</strong></td>
<td><strong>--Speech abnormalities associated with autism</strong></td>
<td><strong>--Inappropriate cheerfulness</strong></td>
<td><strong>--Negativism</strong></td>
</tr>
<tr>
<td>--Imagination and creativity</td>
<td><strong>--Pronoun reversal</strong></td>
<td><strong>--Unusual eye contact</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--Nonverbal communication linked with language</td>
<td><strong>--Speech abnormalities associated with autism</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6: Responses to Social Typologies Questionnaire by subtype

<table>
<thead>
<tr>
<th>Item</th>
<th>A (n=21)</th>
<th>P (n=9)</th>
<th>A/O (n=21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 1. Echolalia is common</td>
<td>0.58</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Item 2. No reaction to new people</td>
<td>0.42</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Item 3. Stereotyped behaviors common</td>
<td>0.37</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>Item 4. Primarily interacts physically</td>
<td>0.48</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>Item 5. Passively accepts social interaction</td>
<td>0.45</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>Item 6. Incessantly talks about 1 topic</td>
<td>0.41</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Item 7. Spontaneously approaches others</td>
<td>0.62</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>Item 8. Uses verbal routines in interaction</td>
<td>0.55</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Item 9. Has bizarre preoccupations</td>
<td>0.62</td>
<td>17</td>
<td>7</td>
</tr>
<tr>
<td>Item 10. Easily approached by others</td>
<td>0.38</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>Item 11. Is happiest when left alone</td>
<td>0.41</td>
<td>18</td>
<td>7</td>
</tr>
<tr>
<td>Item 12. Is not aware when others are bored by conversation</td>
<td>0.38</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td>Item 13. Special abilities present</td>
<td>0.38</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

A = aloof, P = passive, A/O = active-but-odd  
\#_y_ = number of "yes" responses  
X² df=2

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Table 7: Estimates of interrater reliability for individual task items of the Adapted ADOS.

<table>
<thead>
<tr>
<th>Item</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Asking for help</td>
<td>1.00</td>
</tr>
<tr>
<td>2. a. Symbolic play</td>
<td>.91</td>
</tr>
<tr>
<td>b. Reciprocity in play</td>
<td>.69</td>
</tr>
<tr>
<td>c. Giving help to the interviewer</td>
<td>.85</td>
</tr>
<tr>
<td>3. Turntaking in drawing</td>
<td>.87</td>
</tr>
<tr>
<td>4. Demonstration/mime</td>
<td>.86</td>
</tr>
<tr>
<td>5. Description of a poster</td>
<td>.88</td>
</tr>
<tr>
<td>6. Telling a sequential story</td>
<td>.81</td>
</tr>
<tr>
<td>7. a. Questions about emotions</td>
<td>.86</td>
</tr>
<tr>
<td>b. Qualities of persons</td>
<td>.71</td>
</tr>
<tr>
<td>c. Concept of friendship</td>
<td>.70</td>
</tr>
</tbody>
</table>

Overall (Average) K = .83
Table 8: Estimates of interrater reliability for overall ratings of communication, social behavior, and play from the Adapted ADOS.

A. Language and Communication: Overall (Average) $K = .86$

<table>
<thead>
<tr>
<th>Item</th>
<th>$K$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Usual mode of communication</td>
<td>.81</td>
</tr>
<tr>
<td>2. Overall level of non-echoed language</td>
<td>.86</td>
</tr>
<tr>
<td>3. Conversation</td>
<td>.86</td>
</tr>
<tr>
<td>4. Language production and linked nonverbal communication</td>
<td>.86</td>
</tr>
<tr>
<td>5. Report of interests</td>
<td>.85</td>
</tr>
<tr>
<td>6. Intelligibility</td>
<td>.91</td>
</tr>
<tr>
<td>7. Speech abnormalities associated with autism</td>
<td>.86</td>
</tr>
<tr>
<td>8. Pronoun reversal</td>
<td>.84</td>
</tr>
<tr>
<td>9. Immediate echolalia</td>
<td>.79</td>
</tr>
<tr>
<td>10. Stereotyped phrases</td>
<td>.93</td>
</tr>
<tr>
<td>11. Neologisms</td>
<td>.85</td>
</tr>
<tr>
<td>12. Inappropriate questions and statements</td>
<td>.93</td>
</tr>
</tbody>
</table>

B. Reciprocal Social Interaction: Overall (Average) $K = .85$

<table>
<thead>
<tr>
<th>Item</th>
<th>$K$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Amount of social overtures</td>
<td>.86</td>
</tr>
<tr>
<td>2. Quality of social overtures</td>
<td>.71</td>
</tr>
<tr>
<td>3. Quality of social response</td>
<td>.84</td>
</tr>
<tr>
<td>4. Amount of reciprocal social communication</td>
<td>.76</td>
</tr>
<tr>
<td>5. Shared enjoyment</td>
<td>.66</td>
</tr>
<tr>
<td>6. Overall quality of rapport</td>
<td>.92</td>
</tr>
<tr>
<td>7. Social distance/ posture</td>
<td>1.00</td>
</tr>
<tr>
<td>8. Social disinhibition</td>
<td>.92</td>
</tr>
<tr>
<td>9. Unusual eye contact</td>
<td>1.00</td>
</tr>
<tr>
<td>10. Facial expression</td>
<td>1.00</td>
</tr>
<tr>
<td>11. Smiling</td>
<td>.66</td>
</tr>
</tbody>
</table>

C. Play: Imagination/creativity                               

| K = .74 |
Table 9: Estimates of interrater reliability for overall ratings of restricted interests, other abnormal behavior, mood, and level of autism from the Adapted ADOS.

### D. Stereotyped Behavior and Restricted Interests:

<table>
<thead>
<tr>
<th>Item</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Unusual preoccupation with special interests or activities</td>
<td>.86</td>
</tr>
<tr>
<td>2. Unusual sensory interest in play material/person</td>
<td>.92</td>
</tr>
<tr>
<td>3. Compulsions or rituals</td>
<td>1.00</td>
</tr>
<tr>
<td>4. Mannerisms and stereotyped movements</td>
<td>.92</td>
</tr>
<tr>
<td>5. Other mannerisms and stereotyped movements</td>
<td>.85</td>
</tr>
<tr>
<td>6. Tics</td>
<td>1.00</td>
</tr>
<tr>
<td>7. Vocal tics</td>
<td>.69</td>
</tr>
<tr>
<td>8. Self-injury</td>
<td>1.00</td>
</tr>
</tbody>
</table>

### E. Other Abnormal Behavior:

<table>
<thead>
<tr>
<th>Item</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Overall appearance</td>
<td>.72</td>
</tr>
<tr>
<td>2. Overactivity</td>
<td>.74</td>
</tr>
<tr>
<td>3. Attention</td>
<td>.68</td>
</tr>
<tr>
<td>4. Tantrums or aggression</td>
<td>.89</td>
</tr>
<tr>
<td>5. Disruptive behavior</td>
<td>.77</td>
</tr>
<tr>
<td>6. Negativism</td>
<td>.78</td>
</tr>
</tbody>
</table>

### F. Mood:

<table>
<thead>
<tr>
<th>Item</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Overall distress</td>
<td>.91</td>
</tr>
<tr>
<td>2. Anxiety</td>
<td>.72</td>
</tr>
<tr>
<td>3. Misery</td>
<td>.71</td>
</tr>
<tr>
<td>4. Inappropriate cheerfulness</td>
<td>.91</td>
</tr>
</tbody>
</table>

### G. Overall Rating of Autism:

<table>
<thead>
<tr>
<th>Item</th>
<th>K</th>
</tr>
</thead>
</table>

K = .70
Table 10: One-way ANOVA's on overall and composite (*) dependent variables.

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reciprocal Social (n=22)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction * (n=9)</td>
<td>12.36</td>
<td></td>
<td></td>
<td>(2,50) 12.98</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Tukey/Kramer Multiple</td>
<td>6.83</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comparisons (p &lt; .05):</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Aloof &gt; Active/Odd</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Vineland Composite (n=18)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Age Equivalent (n=8)</td>
<td>48.25</td>
<td></td>
<td></td>
<td>(2,39) 10.73</td>
<td>&lt;.0003</td>
</tr>
<tr>
<td>Tukey/Kramer Multiple</td>
<td>25.86</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Comparisons (p &lt; .05):</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Aloof &lt; Active/Odd</td>
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<tr>
<td>Language and</td>
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<td></td>
</tr>
<tr>
<td>Communication * (n=22)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>IQ (n=11)</td>
<td>53.00</td>
<td></td>
<td></td>
<td>(2,34) 6.83</td>
<td>&lt;.004</td>
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<tr>
<td>Tukey/Kramer Multiple</td>
<td>19.99</td>
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<td>Comparisons (p &lt; .05):</td>
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<tr>
<td>Aloof &gt; Active/Odd</td>
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<tr>
<td>CARS Total Score (n=21)</td>
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<tr>
<td>Restricted (n=9)</td>
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<td>Interests * (n=22)</td>
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<tr>
<td>Mood * (n=22)</td>
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<tr>
<td>Abnormal Behavior * (n=22)</td>
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<tr>
<td>Chronological Age in Months</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>(n=22)</td>
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<tr>
<td>SD</td>
<td></td>
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<tr>
<td>MANOVA (All variables above</td>
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<td></td>
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<tr>
<td>except IQ</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>and Vineland Composite age)</td>
<td></td>
<td></td>
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<tr>
<td>$\bar{X}_1$ = Mean aloof,</td>
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<td>$\bar{X}_2$ = Mean passive,</td>
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<td>$\bar{X}_3$ = Mean active/odd</td>
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108
Table 12: Kruskal-Wallis oneway ANOVA’s on dependent variables from the adapted ADOS - stereotyped behavior/ restricted interests, other abnormal behavior, mood, and overall rating of autism.

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>Kruskal-Wallis $X^2(df=2)$</th>
<th>p</th>
<th>Post hoc comparisons</th>
<th>A &lt; AO</th>
<th>A &lt; P</th>
<th>P &lt; AO</th>
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</thead>
<tbody>
<tr>
<td><strong>Stereotyped Behavior and Restricted Interests</strong></td>
<td></td>
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<td></td>
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<tr>
<td>Unusual preoccupations</td>
<td>2.70</td>
<td>&lt; .26</td>
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<tr>
<td>Unusual sensory interests</td>
<td>4.70</td>
<td>&lt; .10</td>
<td></td>
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<tr>
<td>Compulsions/rituals</td>
<td>0.88</td>
<td>&lt; .65</td>
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<tr>
<td>Stereotyped movements</td>
<td>7.09</td>
<td>&lt; .03</td>
<td></td>
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<tr>
<td>Other stereotypies</td>
<td>3.54</td>
<td>&lt; .18</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Tics</td>
<td>2.70</td>
<td>&lt; .26</td>
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<tr>
<td>Vocal tics</td>
<td>14.04</td>
<td>&lt; .001</td>
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<tr>
<td>Self-injury</td>
<td>0.33</td>
<td>&lt; .85</td>
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<td><strong>Other Abnormal Behavior</strong></td>
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<tr>
<td>Overall appearance</td>
<td>2.30</td>
<td>&lt; .32</td>
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<tr>
<td>Overactivity</td>
<td>3.24</td>
<td>&lt; .20</td>
<td></td>
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<tr>
<td>Attention</td>
<td>8.13</td>
<td>&lt; .02</td>
<td></td>
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<tr>
<td>Tantrums and aggression</td>
<td>2.37</td>
<td>&lt; .31</td>
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<tr>
<td>Disruptive behavior</td>
<td>0.97</td>
<td>&lt; .62</td>
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<tr>
<td>Negativism</td>
<td>2.17</td>
<td>&lt; .34</td>
<td></td>
<td></td>
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<tr>
<td><strong>Mood</strong></td>
<td></td>
<td></td>
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<tr>
<td>Overall distress</td>
<td>4.04</td>
<td>&lt; .14</td>
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<tr>
<td>Anxiety</td>
<td>2.82</td>
<td>&lt; .25</td>
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<tr>
<td>Misery</td>
<td>1.35</td>
<td>&lt; .51</td>
<td></td>
<td></td>
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<tr>
<td>Inappropriate cheerfulness</td>
<td>3.22</td>
<td>&lt; .20</td>
<td></td>
<td></td>
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<tr>
<td><strong>Overall Rating of Autism</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Level of autism</td>
<td>17.66</td>
<td>&lt; .0002</td>
<td>**</td>
<td></td>
<td>*</td>
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</table>

--Post hoc comparisons were performed using an analogue of the Bonferroni pairwise comparison procedure (Neter, Wasserman, & Kutner, 1985).

A = aloof, P = passive, AO = active-but-odd
* $p < .05$
** $p < .01$
Table 13: Percent accuracy of subtype assignment based on discriminant-function analyses.

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Aloof</th>
<th>Passive</th>
<th>Active/Odd</th>
<th>Within Measure</th>
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<tbody>
<tr>
<td>Language and Communication</td>
<td>77.3</td>
<td>33.3</td>
<td>68.2</td>
<td>66.0</td>
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<td>(N = 53)</td>
<td>(n=22)</td>
<td>(n=9)</td>
<td>(n=22)</td>
<td></td>
</tr>
<tr>
<td>Reciprocal Social Interaction</td>
<td>72.7</td>
<td>33.3</td>
<td>59.1</td>
<td>60.4</td>
</tr>
<tr>
<td>(N = 53)</td>
<td>(n=22)</td>
<td>(n=9)</td>
<td>(n=22)</td>
<td></td>
</tr>
<tr>
<td>CARS total Score</td>
<td>66.7</td>
<td>33.3</td>
<td>61.9</td>
<td>58.8</td>
</tr>
<tr>
<td>(N = 51)</td>
<td>(n=21)</td>
<td>(n=9)</td>
<td>(n=21)</td>
<td></td>
</tr>
<tr>
<td>Vineland Composite Age Equivalent</td>
<td>83.3</td>
<td>0</td>
<td>50.0</td>
<td>54.8</td>
</tr>
<tr>
<td>(N = 42)</td>
<td>(n=18)</td>
<td>(n=8)</td>
<td>(n=16)</td>
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</tr>
<tr>
<td>IQ</td>
<td>81.8</td>
<td>42.9</td>
<td>42.1</td>
<td>54.1</td>
</tr>
<tr>
<td>(N = 37)</td>
<td>(n=11)</td>
<td>(n=7)</td>
<td>(n=19)</td>
<td></td>
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<tr>
<td>Mood</td>
<td>63.6</td>
<td>100.0</td>
<td>0</td>
<td>43.4</td>
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<tr>
<td>(N = 53)</td>
<td>(n=22)</td>
<td>(n=9)</td>
<td>(n=22)</td>
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</tr>
<tr>
<td>Chronological Age in Months</td>
<td>50.0</td>
<td>0</td>
<td>45.5</td>
<td>39.6</td>
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<tr>
<td>(N = 53)</td>
<td>(n=22)</td>
<td>(n=9)</td>
<td>(n=22)</td>
<td></td>
</tr>
<tr>
<td>Abnormal Behavior</td>
<td>63.6</td>
<td>44.4</td>
<td>9.1</td>
<td>37.7</td>
</tr>
<tr>
<td>(N = 53)</td>
<td>(n=22)</td>
<td>(n=9)</td>
<td>(n=22)</td>
<td></td>
</tr>
<tr>
<td>Restricted Interests</td>
<td>63.6</td>
<td>55.6</td>
<td>0</td>
<td>35.9</td>
</tr>
<tr>
<td>(N = 53)</td>
<td>(n=22)</td>
<td>(n=9)</td>
<td>(n=22)</td>
<td></td>
</tr>
</tbody>
</table>

Discriminant Functions

(IQ, Vineland Composite age, Mood, Social Interaction) \(N = 28\) (81.8% aloof, 85.7% passive, 68.4% active/odd)

(Social Int., Mood, Language/Comm., Restricted Interests) \(N = 53\) (81.8% aloof, 66.7% passive, 68.2% active/odd)

(Language/Comm., Social Interaction, Restricted Interests) \(N = 53\) (81.8% aloof, 66.7% passive, 68.2% active/odd)
APPENDIX A

Childhood autism rating scale (CARS; Schopler et al., 1986)
CHILDHOOD AUTISM RATING SCALE

The following fifteen-item scale was developed and adapted for the pre-school age range from the nine points for childhood psychosis set forth by the Creak Working Party in 1961. (The original nine points are not in a rating scale form.) The behavior and reactions of the child during the diagnostic evaluation session are observed and rated in each of the fifteen areas. The rating scale can be used with different types of diagnostic evaluations if the child is given the opportunity to demonstrate his functioning in all the areas which are rated. At Division TEACCH we have developed a structured diagnostic evaluation procedure which provides an adequate basis for judging the child's behavior and yields a Psychoeducational Profile of the child's functioning. If this particular diagnostic procedure is not used, it will be necessary to incorporate into the evaluation certain activities which are intended to elicit the child's reactions to certain situations. For each area of functioning which has to be rated, an appropriate situation or activity will be described. The ratings may be made by the examiner or by someone who is observing the evaluation.

A score of (1) indicates that the child's behavior is within normal limits for his age; (2) indicates his behavior is mildly abnormal; (3) indicates his behavior is moderately abnormal; and (4) indicates his behavior is severely abnormal. The midpoints should be used when the child's behavior falls between the four ratings which are described. As much as possible, treat the categories as being equal intervals on a continuum from normal behavior (1) to severely abnormal behavior (4). The child's age must be considered in making these judgments. For example, a normal two year old's attention to a distant adult tends to be shorter and less sustained than a normal five year old's. Such an age appropriate developmental difference should not be construed as an impairment in relatedness for the two year old.

Interpretation of scores. The diagnostic category is determined on the basis of the child's total score and the number of scales in which he obtains a score of (3) or higher. Children who obtain a total score of less than 30 are designated Not Autistic; children who obtain a total score of 37 or higher, and who are rated (3) or higher on any 5 scales are designated Severely Autistic; children who obtain a total score of 30 or higher, but who are not rated (3) or higher on at least 5 scales are designated Mild-Moderately Autistic.

The purpose of the scale is to rate behavior without recourse to causal explanations. Since some of the behaviors resulting from childhood autism are similar to behaviors caused by other childhood disorders, it is important in making the ratings to simply rate the degree to which the child's behavior deviates from normal without making judgments about whether the behavior may be explained away as being caused by brain damage, mental retardation, etc. The total score and the pattern of the impairments will distinguish an autistic child from other developmentally disordered children. For example, a non-autistic but retarded child may show unusual affect (flat, inhibited, or a continuously silly expression), which might be rated as a (2) under Affect. However, this rating, even with mildly abnormal behavior in other areas, would not be sufficient to classify him as autistic. Item fifteen
is a global rating of psychosis which should be based on your subjective impression of the degree of autism as it is defined by the other fourteen points. The rating in each area must take into consideration the peculiarity, frequency and intensity of the abnormal behavior. Since an impairment in any area may assume many forms depending on its peculiarity, frequency, and intensity, it is difficult to specify how each rating should be made. The following examples are to be used as guidelines only.

I. RELATIONSHIPS WITH PEOPLE

Provide the child with a variety of interaction situations; attempt to have the child play with toys, to carry out simple activities, to interact with the examiner. The amount of direction from examiner should range from persistent, intensive intrusion (as much as is necessary to get a response from the child) to complete non-intrusion (the child is completely free to do as he wishes). Do some physical activities with the child to determine his reaction to physical contact and physical demonstrations of affection. Offer both positive and negative feedback.

Deviations from normal relatedness may range from milder forms such as being overly shy, some negativism, avoidance of eye contact, to the more severe forms such as intense aloofness, avoidance, obliviousness. In making the rating it is helpful to consider the amount and intensity of intrusion which is required by the adult, as well as how much interaction the child initiates, particularly during the non-intrusion period. Also note the child's reaction to physical affection.

(1) No evidence of impairment in relatedness. Age appropriate degrees of shyness, guardedness, negativeness, or direct responsiveness may be present.

(2) Mildly abnormal relatedness. Some lack of eye contact, some negativism or avoidance, excess shyness, or some lack of responsiveness to the examiner.

(3) Moderately abnormal relatedness. Considerable aloofness (may at times seem unaware of the adult), intensive intrusion may be necessary at times to get a response. Minimal contact initiated by the child (contact often has empty impersonal quality).

(4) Severe abnormal relatedness. Intense aloofness, avoidance, obliviousness. Child seldom responds to the examiner. Child rarely, if ever, initiates any interaction. Only the most intensive intervention will produce a response.

II. Imitation (Verbal and Motoric)

Have the child imitate both verbal and motoric tasks, making sure that the child understands that he is to copy what the adult is doing or saying. Vary from simple to complex tasks so that the distinction can be made between: unwillingness to imitate, lack of understanding of the task or directions, or inability to complete the task. Verbal imitation might range from repeating simple babbling sounds to repeating long, complicated sentences. Motor imitation should involve both gross motor imitation such as physical exercises and fine motor imitation such as copying shapes.
cutting with scissors, or playing with small objects.

In this area, when the imitation task seems too difficult, rate his willingness to imitate and his attempts to copy the adult—ignore his actual inability to do the task. This scale is of particular significance in assessing preverbal functions. Accordingly, the willingness to follow verbal direction is treated as verbal imitation. Deviations range from milder forms such as imitating only part of the time and delayed imitation, to the more severe forms such as complete refusal to imitate. There are several items in the diagnostic section which are designed to evaluate imitation. Use these tasks as well as any which may occur spontaneously during the session. When making the rating, consideration should be given to the amount of effort required to elicit imitation. Generally, motoric imitation is better than verbal imitation.

1. *Age appropriate imitation, both verbally and motorically.*

2. *Mildly abnormal imitation.* Imitates most of the time, may require occasional prodding or imitation delayed.

3. *Moderately abnormal imitation.* Imitates only part of the time or requires great persistence from the examiner.

4. *Severely abnormal imitation.* Seldom, if ever, imitates, either verbally or motorically.

III. AFFECT

The general evaluation hopefully will be pleasant for the child, but provide some situations where the child's frustration or anger might be aroused such as by removing a toy he likes or insisting he do something which seems to be difficult for him. Provide enough different kinds of toys and materials and activities that are appropriate to his functioning level to test for pleasure and interest. There are several items designed to elicit pleasurable responses such as blowing bubbles, physical play and puppet play.

Note when the type of response is appropriate but the degree is too extreme (excessive or inhibited) as well as when the type is inappropriate. Look for inappropriate and inexplicable extremes of affective responses, rigidity of responses, and the sometimes less obvious, constricted, bland responses.

1. *Age and situation appropriate affective responses* (pleasure, displeasure, and interest) as indicated by change in facial expression, posture, and manner.

2. *Mildly abnormal affective responses.* Some lack of appropriate responsiveness to changes in affective stimuli. Affect may be somewhat inhibited or excessive. May smile occasionally for no apparent reason, or may be somewhat fearful or materials or activities which do not generally elicit fear.

3. *Moderately abnormal affective responses.* Definite signs of inappropriate affect. Reactions quite inhibited or excessive or often unrelated to the stimulus, grimacing, rigidity.
(4) **Severely abnormal affective responses.** Responses seldom appropriate to the situation, extremely rigid perseveration of affect, extremely resistant to modification by the examiner.

**IV. USE OF BODY**

Provide for both fine and gross motor tasks to evaluate coordination. Attempt in varying degree to prohibit bizarre body use to determine its persistence.

Deviations range from the milder forms such as clumsiness, lack of coordination or stereotyped movements (such as repeatedly touching face) to the more severe forms such as peculiar posturing, examination of body, self-directed aggression, rocking, spinning, and toe-walking. The pencil and paper table tasks and the physical activity can be used to make a judgment regarding coordination. The more bizarre body uses will occur at any time and will not need to be intentionally elicited by the examiner.

(1) **Age appropriate use and awareness of body.**

(2) **Mildly abnormal use and awareness of body.** Minimal peculiarities in body use and awareness (stereotyped movements, clumsiness, lack of coordination or very infrequent occurrence of deviations listed in (3) below.

(3) **Moderately abnormal use and awareness of body.** Moderate signs of clear dysfunction (peculiar finger or body posturing, examination of body, self-directed aggression, rocking, spinning, finger-wiggling, toe-walking).

(4) **Severely abnormal use and awareness of body.** Extreme or pervasive occurrence of functions listed in (3) above.

**V. RELATION TO NON-HUMAN OBJECTS**

Provide a wide variety of toys and materials which are suitable to the child's level of functioning, as well as some which will encourage bizarre use only if the child is so inclined (eg., items which will spin, dangle, or items which have small parts). Allow the child to play with the materials as he wishes, then show him the appropriate use to determine if he will adopt it.

Deviations range from the milder forms such as mild disinterest in materials or infantile use of them to the more severe forms where the objects generally are used inappropriately: repetitive, mechanical, preoccupation with materials such as spinning the wheels on a truck instead of rolling it, dangling a string or straw, twirling objects, staring at the edges of puzzle parts instead of the surfaces, etc. Note how materials are used as well as the child's general interest in the toys. Note how the child plays during the unstructured, non-intrusion period to help make this rating.

(1) **Age appropriate interest, use, and exploration of objects.**

(2) **Mildly inappropriate interest, use, and exploration of objects.** Mild disinterest or mildly inappropriate use of materials, or inappropriate age use. (Infantile mouthing of objects, banging
materials, fascination with materials which squeak, turning lights on and off).

(3) Moderately inappropriate interest, use and exploration of objects. Significant lack of interest in most objects or some peculiar and obvious preoccupation with repetitive use of objects (not consistent with function, possibly mechanical or bizarre and avoidance of other objects, eg, dangling string or straw, picking at objects with fingernails, spinning wheels, fascination with one small part, holding object to light for reflection, fascination with movement per se, pushing hinges, etc.)

(4) Severely inappropriate interest, use, and exploration of objects. Extremes of the above, and very difficult to distract.

VI. ADAPTATION TO ENVIRONMENTAL CHANGE

This area is difficult to validly assess because the evaluation situation may not interfere with specific established routines except that, the entire situation is not routine. However, switching materials and changing the procedures which are minimally established should provide some information.

The child's adaptability to change should be evaluated by looking at his willingness to switch from one material to another and to change set within a given activity. Deviations may take the form of some unwillingness to give up a material or activity to a more extreme, severe resistance and irritability to a change in materials or activities.

(1) Age appropriate response to change.

(2) Mild resistance to change. Some evidence of resisting environmental changes, staying with an object or activity or persisting in the same response pattern; can be distracted.

(3) Moderate resistance to change. Active resistance to change in activities with signs of irritability, frustration; difficult to distract when intervention is attempted.

(4) Severe resistance to change. Severe reactions to change that are extremely resistant to modification. May tantrum if change is insisted upon.

VII. VISUAL RESPONSIVENESS

Provide tasks which require visual attention. If human eye contact is avoided, force contact by turning the child's head toward you to test for the strength of the avoidance.

Rate the child's use and interest in visual cues (not his ability to see specific objects). Deviations include avoidance of visual cues as well as bizarre visual behavior. Milder deviations include some avoidance of looking at the materials or the adult when asked to, or excessive looking at himself in the mirror, to the more severe forms of pervasive avoidance of looking, grimacing repeatedly in the mirror, staring at the lights. In making this rating it is helpful to notice how frequently the examiner must tell the child to "look" and how often the examiner must physically turn the child's head toward him or the materials.
(1) Age appropriate visual responses, used in an integrated way with other sensory systems.

(2) Mildly abnormal visual responses. Child must be reminded occasionally to look at materials, some preoccuaption with mirror image, some avoidance of eye contact, some staring off into space, some fascination with lights.

(3) Moderately abnormal visual responses. Child must be reminded frequently to look at what he is doing, likes to look at shiny objects, little eye contact even when forced, looks "through" people, frequently stares into space, looks at materials from an unusual angle, often holds materials very close to eyes.

(4) Severeley abnormal visual responses. Pervasive visual avoidance of objects and people, bizarre use of visual cues.

VIII. AUDITORY RESPONSIVENESS

In addition to talking to the child, provide other types of auditory stimuli (mechanical) to evaluate the child's responsiveness to them.

Rate the consistency of the child's use of and interest in auditory cues, not his ability to hear specific sounds. Look for avoidance or inattention to sounds and speech as well as hypersensitivity to sounds and speech. Note his responses to the examiner's voice, noisemakers, and extraneous sounds from within and outside the testing room. Administer the auditory stimuli when the child is not looking, being certain that the child's response is to the auditory stimuli and not to the visual stimuli.

(1) Age appropriate auditory responses, used in an integrated way with other sensory systems.

(2) Mildly abnormal auditory responses. Some lack of response to auditory stimuli or to particular sounds (speech as opposed to mechanical sounds). Responses may be delayed. Stimuli may occasionally have to be repeated. Child may be hypersensitive or at times distracted by extraneous noises.

(3) Moderately abnormal auditory responses. Responses may be inconsistent, stimuli may have to be repeated several times before the child responds. May be very hypersensitive to certain sounds (eg, very startled, covers ears).

(4) Severeley abnormal auditory responses. Pervasive auditory avoidance, regardless of type of stimulus, or extremely hypersensitive.

IX. NEAR RECEPTOR RESPONSIVENESS

Provide a variety of different textured materials and objects. To evaluate the child's response to pain, observe his reaction to any accidental falling or bumping himself; in none occurs accidentally, it may be necessary to pinch the child.

This item covers touch, taste, smell and response to pain. The tactile blocks and a pinch are included to determine any possible abnormality.
Smelling, tasting, rubbing or touching for apparent sensory rather than functional experience may occur at any time. Try to distinguish between the milder infantile-like mouthing of materials and the more severe abnormality of licking and tasting materials.

(1) Normal response to pain--appropriate to intensity; normal tactual and olfactory exploration, but not to the exclusion of other forms of exploration.

(2) Mildly abnormal use of near receptors. Some lack of appropriate response to pain or evidence of mild preoccupation with tactual exploration (smelling, tasting, etc.). May do some infantile mouthing of objects.

(3) Moderately abnormal use of near receptors. Moderate lack of appropriate response to pain, or evidence of moderate preoccupation with tactual exploration, tasting, etc. The exploration may be of objects, self, or other people.

(4) Severely abnormal use of near receptors. Excessive preoccupation with tactual exploration (mouthing, licking, feeling, or rubbing) for sensory rather than functional experience. Pain may be either ignored completely or grossly overacted to. Excessive preoccupation with exploratory smelling.

X. ANXIETY REACTION

Observe possible anxiety to separation from parents. Engage the child in physical play including lifting him off the floor to determine his reaction to physical closeness and anti-gravity play.

Anxiety may assume many forms which might include crying, screaming, giggling, withdrawal, fearfulness, etc. Consider the frequency, severity and duration when making the rating. The initial separation from the parents, and the anti-gravity play, or possibly the puppets may elicit anxious responses.

(1) No excessive anxiety reaction. The reactions are appropriate to the age of the child and the situation--they are not prolonged.

(2) Mild anxiety reactions.

(3) Moderate anxiety reactions.

(4) Severe anxiety reaction. The child may not settle down during the entire session. He may be obviously fearful, withdrawn, etc.

XI. VERBAL COMMUNICATION

Encourage the child to verbalize. If little occurs spontaneously, ask simple to complex questions and attempt to have the child imitate sounds and words.

Abnormalities in verbal communication range from simple retarded speech development to the more severe, almost exclusive use of peculiar, bizarre
speech such as jargon and echolalia.

(1) **Speech is age appropriate.**

(2) **Speech is mildly abnormal.** Speech shows overall retardation. Most of the speech is meaningful, but it may include remnants of echolalia.

(3) **Speech is moderately abnormal.** Speech is absent or is a mixture of some meaningful speech combined with some inappropriate speech (eg, echolalia, jargon).

(4) **Speech is severely abnormal.** Noises sufficiently complex to be roughly equivalent to speech, but virtual absence of intelligible words, or peculiar and bizarre use of more recognizable language.

XII. NON-VERBAL COMMUNICATION

Use gestures when giving instructions (sometimes). Note the child's attempts to obtain what he wants. Encourage nonverbal communication by removing something the child wants and notice his means of retrieving it.

This covers the child's communication of needs and demands which are expressed nonverbally (use of facial expressions, gestures, posture). Include also the child's response to nonverbal requests by the examiner. If the child has reasonably normal verbal communication, there may be little nonverbal communication. However, those with language impairments may or may not have developed a nonverbal means of communication. In the diagnostic session, look for the child's responses to the examiner's nonverbal instructions, whether or not he reaches for the adult for more physical play, whether or not he attempts to let the examiner know he wants more candy, how he indicates a possible need to go to the bathroom.

(1) **Nonverbal communication is age appropriate.**

(2) **Nonverbal communication is mildly abnormal.** Nonverbal communication shows overall retardation (limited, like that of a younger child). The communication may consist of simple, vague, pointing to or reaching for what he wants.

(3) **Nonverbal communication is moderately abnormal.** Nonverbal communication is absent, child does not use or respond to nonverbal communication.

(4) **Nonverbal communication is peculiar, bizarre, and generally incomprehensible.**

XIII. ACTIVITY LEVEL (motility Patterns)

Allow some opportunity for free movement for the child. Also evaluate the degree of controllability by insisting that the child be still.

The age of the child, the length of the session, and the distance traveled to the center should be considered when making this rating.
(1) **Activity level is normal**—neither hyperactive nor hypoactive.

(2) **Activity level is mildly abnormal.** Child may be mildly restless, moving about or somewhat slow to move about. Generally can be controlled and the level interferes only slightly with performance.

(3) **Activity level is moderately abnormal.** Quite active and hard to restrain. May have a driven quality to the activity. Requires frequent control by the examiner; or, quite inactive, moves slowly and requires effort to get a response.

(4) **Activity level is severely abnormal.** Extremes in the activity level (driven or apathetic). Very difficult to manage and/or get the child to respond to anything. Almost constant control by the adult is required.

**XIV. INTELLECTUAL FUNCTIONING**

Provide some cognitive tasks for the child to assess his overall intellectual functioning.

Hints of potential refers to a skill(s) which are at or near age level but is combined with retarded skills. Obvious discrepancies refer to a skill(s) which is higher than age level or particularly unusual (i.e., musical ability).

(1) **Intellectual functioning is normal**—no evidence of retardation.

(2) **Intellectual functioning is mildly abnormal.** Skills appear fairly evenly retarded across all assessed areas.

(3) **Intellectual functioning is moderately abnormal.** Some skills appear retarded combined with some skills at or very near age level—hints of potential.

(4) **Intellectual functioning is severely abnormal.** Some skills appear retarded combined with some which are higher than age level or are particularly unusual.

**XV. GENERAL IMPRESSIONS**

(1) **No psychosis.**

(2) **Minimal or mild psychosis.**

(3) **Moderate signs of psychosis.**

(4) **Maximum or extreme signs of psychosis.**
CHILDHOOD AUTISM RATING SCALE

Scoring Sheet

Name ____________________________

Date ____________________________

C.A. ____________________________

Rater ____________________________

(circle one)

I. Relationship with People
   1 1/2 2 2 3 3 1/2 4

IX. Near Receptor Responsiveness
   1 1/2 2 2 3 3 1/2 4

II. Imitation—verbal and motoric
   1 1/2 2 2 3 3 1/2 4

X. Anxiety Reaction
   1 1/2 2 2 3 3 1/2 4

III. Affect
    1 1/2 2 2 3 3 1/2 4

XI. Verbal Communication
    1 1/2 2 2 3 3 1/2 4

IV. Body Awareness
   1 1/2 2 2 3 3 1/2 4

XII. Nonverbal Communication
    1 1/2 2 2 3 3 1/2 4

V. Relation to Nonhuman Objects
   1 1/2 2 2 3 3 1/2 4

XIII. Activity Level
    1 1/2 2 2 3 3 1/2 4

VI. Adaptation to Change
    1 1/2 2 2 3 3 1/2 4

XIV. Intellectual Functioning
    1 1/2 2 2 3 3 1/2 4

VII. Visual Responsiveness
     1 1/2 2 2 3 3 1/2 4

XV. General Impressions
     1 1/2 2 2 3 3 1/2 4

VIII. Auditory Responsiveness
      1 1/2 2 2 3 3 1/2 4

TOTAL SCORE ____________

Number of items scored 3 or higher

Diagnostic Category—
   Not autistic
   Mild-moderately autistic
   Severely autistic

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Appendix B

Social typologies questionnaire (Volkmar et al., 1989)
Social Typologies Questionnaire

Name: ___________________________  Age: ______  Sex: Male  Female __

Rater's Name: ___________________________  Date: ______

Directions: Please respond to each question as it applies to this individual by checking either yes or no. If you are unsure please check the one best response.

YES  NO

1. Doesn't attend to social stimuli
2. Underresponsive to stimuli
3. Echolalia is common
4. Prefers nonsocial activities
5. Feels/smells/tastes objects
6. No reaction to new people
7. Doesn't communicate word or sign
8. Little interest in social interaction
9. Stereotyped behaviors common
10. Immediate echolalia greater than delayed
11. Primarily interacts physically
12. Passively accepts social interaction but doesn't seek it
13. Actively rejects social interaction except for meeting specific needs
14. Incessantly talks about 1 topic
15. Spontaneously approaches others
16. Uses verbal routines in interaction
17. Has bizarre preoccupations
18. Easily approached by others
Reminder: Please check yes or no in response to each question as it relates to this child. If you are unsure please check the one best response.

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>19. Is happiest when left alone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Trouble with topic shifts in conversations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. Isn’t aware when other’s are bored by conversation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Special abilities are present</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Tolerates social interaction but doesn’t mind when it ends</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PLEASE USE THIS SPACE FOR ANY COMMENTS ABOUT THE INDIVIDUAL. THANK YOU FOR YOUR COOPERATION.

COMMENTS:
Appendix C

Task instructions for role-taking measures
Puppet Scene -- Instructions

1. Place two puppets, two cups, and one marble on the table.

2. Put puppets on hands: "I want you to meet two friends of mine. This is Sally and this is Bill".

3. Have puppets shake hands with the child saying, "Hi, my name is _______".

4. Ask the child: "Now what is this one’s name? Good. And what is this one’s name? Very good." (Naming Question: Correct on first try = C; incorrect on first try = I)
   If the child gets the names wrong, correct him/her and then ask him/her again until he/she has the names correct.

5. Have Sally take the marble and put it under her cup. Then, have Sally disappear under the table.

6. Have Bill remove the marble from Sally’s cup and put it under his own cup.

7. Bring Sally back and ask the child: "Where will Sally look for her marble?" (Belief Question: Sally’s cup = C; Bill’s cup = I)

8. Conclude with final questions: "Where is the marble really?" (Reality Question: Bill’s cup = C; Sally’s cup = I) "Where was the marble in the beginning?" (Memory Question: Sally’s cup = C; Bill’s cup = I)

Figure 1. *Experimental scenario.*
Picture Sequence -- Instructions

1. Place the frame in front of the subject with the numbers facing him/her.

2. Arrange the picture set above the frame, with the numbers on the backs of the cards in order (1 to 4) from the subject’s left to right. The letters will be scrambled.

3. Take the first picture from the set (corresponding to the first letter of the word for that set) and place it in position ‘1’ in the frame.

4. Say to the subject: "This is the first picture. Look at the other pictures and see if you can make a story with them". If the subject does not respond immediately, name all of the objects in the first picture and then say, "Which is the next picture?" Allow the subject to order the pictures in the frame and make any corrections he/she chooses.

5. When the child is obviously finished, say, "Tell me the story". If the subject does not proceed, begin with the card on the left and say, "What’s happening here?" Point to each card in turn with same prompt, if necessary. Finally, record the sequence of letters on the back of the card’s from the subject’s left to right.

6. Continue with the other sets of cards in order until finished.
Penny Hiding Game -- Instructions

1. For the first six trials, hide a penny in each hand and tell the subject: "Guess which hand the penny is in".

2. For the next four trials, hide a penny in neither hand. For the last trial, hide a penny in each hand. Use the same direction each time.

3. Tell the subject: "Now it's your turn; you hide the penny". Each time, for six trials, try to guess the wrong hand.

4. Score the subject pass/fail on each of the ten items on the score sheet.
ROLE TAKING MEASURES

Subject name: ____________________
I.D. number: _____
Order of Presentation: _____ _____ _____

I. Baron-Cohen Cartoon Sequences
   Sequencing Score: _____

II. Penny-hiding Game
   Guessing/hiding Stage Score: _____

III. Puppet Scene
   Naming Question: _____
   Belief Question: _____
   Reality Question: _____
   Memory Question: _____
   Score: _____
PUPPET SCENE -- DATA SHEET

Subject name: ________________
Subject number: ________________

Score the following pass/fail:

Naming Question  _____
Belief Question  _____
Reality Question  _____
Memory Question  _____
Score  _____

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<table>
<thead>
<tr>
<th>Picture Set</th>
<th>Time to Complete (secs)</th>
<th>Order of Letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. DOWN</td>
<td></td>
<td>D</td>
</tr>
<tr>
<td>2. DISH</td>
<td></td>
<td>D</td>
</tr>
<tr>
<td>3. BLOW</td>
<td></td>
<td>B</td>
</tr>
<tr>
<td>4. TRIP</td>
<td></td>
<td>T</td>
</tr>
<tr>
<td>5. HITS</td>
<td></td>
<td>H</td>
</tr>
<tr>
<td>6. ROCK</td>
<td></td>
<td>R</td>
</tr>
<tr>
<td>7. BUYS</td>
<td></td>
<td>B</td>
</tr>
<tr>
<td>8. MAKE</td>
<td></td>
<td>M</td>
</tr>
<tr>
<td>9. TAKE</td>
<td></td>
<td>T</td>
</tr>
<tr>
<td>10. DROP</td>
<td></td>
<td>D</td>
</tr>
<tr>
<td>11. BEAR</td>
<td></td>
<td>B</td>
</tr>
<tr>
<td>12. GONE</td>
<td></td>
<td>G</td>
</tr>
<tr>
<td>13. WASH</td>
<td></td>
<td>W</td>
</tr>
<tr>
<td>14. GIRL</td>
<td></td>
<td>G</td>
</tr>
<tr>
<td>15. DIGS</td>
<td></td>
<td>D</td>
</tr>
</tbody>
</table>
**PENNY-HIDING GAME -- DATA SHEET**

Subject name:  
I.D. number:  

Guessing Trials (Which hand did child choose?)

<table>
<thead>
<tr>
<th>Positive</th>
<th>Negative</th>
<th>Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td></td>
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<tr>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Number of changes from L to R  

Hiding Trials (In which hand was it hidden?)

| 1  | 4  |
| 2  | 5  |
| 3  | 6  |

Number of changes from L to R  

Score subject pass/fail for each of the following:

1. Attempts to play when asked to hide.  
2. Does not always hide in same hand.  
3. Changes penny hand more than once during hiding.  
4. Hides correctly on at least one trial, that is, imitates mechanics of procedure.  
5. Does not always guess the same hand.  
6. Changes hand guessed more than once during guessing.  
7. Almost always hides correctly.  
8. Has competitive attitude in hiding, for example, indicates chagrin or disappointment when E guesses correctly, indicates pleasure when E is wrong, tells E to pick hand without penny or extends hand suggestively, says E is wrong when E guesses correctly (tries to cheat), irregularly shifts penny's location, presents two empty fists when hiding, says didn't want E to find penny or is trying to fool E, inadvertently lets E see penny and then rehides or indicates chagrin.  
10. Uses shifting strategy in guessing.  

Guessing/Hiding Score  

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Curriculum Vitae

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PERSONAL INFORMATION

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EDUCATION

Ph.D. October, 1991
Virginia Polytechnic Institute
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Blacksburg, Virginia
Clinical Psychology

Dissertation: Social subtypes in autism:
An examination of their
validity and relations to
measures of social cognition

M.S. December, 1987
Virginia Polytechnic Institute
and State University
Blacksburg, Virginia
Developmental Psychology

Thesis: Reconstructive and reproductive
processes in children's recall
for prose structure and content

B.S. May 1985
University of Connecticut
Storrs, Connecticut
Psychology
Biology
PROFESSIONAL ORGANIZATIONS

American Psychological Association
Association for Advancement of Behavior Therapy

PROFESSIONAL HONORS

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American Psychological Association
April, 1990

NIMH Training Fellowship
Severe Emotional Disorders in Children
January, 1990

CLINICAL EXPERIENCE

10/91 to present  Post-Doctoral Fellow in
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Supervisor: Stephen C. Luce, Ph.D.  
6/86 to 9/86  Behavior Research Institute  
6/85 to 9/85  Providence, RI  

TEACHING EXPERIENCE  
Department of Psychology  Virginia Tech  Blacksburg, VA  
8/89 to 5/90  Instructor: Psychology of Learning  
Supervisor: J. J. Franchina, Ph.D.  
3/87 to 6/87  Instructor: Laboratory in Motivation  
Supervisor: J. J. Franchina, Ph.D.  

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12/87 to 3/87  
Instructor: Laboratory in Conditioning
Supervisor: J. J. Franchina, Ph.D.

9/85 to 12/87  
Graduate teaching assistant for undergraduate classes including:  
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Psychology of Personality  
Psychology of Learning  
Introductory Psychology

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J. Germana, Ph.D.  
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PUBLICATIONS


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