Journal of Autism and Developmental Disorders, Vol. 31, No. 5, 2001

Analysis of Social Interactions as Goal-Directed Behaviors in Children With Autism

Lisa A. Ruble[1]

An ecological psychology framework that considers the intentions of the child within the child's own social context was used to study the complexity of social interactions of 16 children with autism or Down syndrome. Children were observed in their homes and behaviors were recorded. Records were then analyzed by dividing behavior based on the children's own goals. Goal-directed behaviors were then categorized. Statistical analyses revealed similar social contexts and opportunities to receive bids from others for both groups. Differences in the frequencies and complexities of children's behaviors depended on behavioral intent. Socially intended behaviors were less frequent, less self-initiated, and less complex in children with autism. These findings are discussed as problems of attention and executive function, because social behaviors were more likely to occur secondarily, within the context of another ongoing behavior.

KEY WORDS: naturalistic social interactions; autism; ecological psychology; executive function.

Many researchers maintain that social impairments in autism are the core problem (Volkmar & Klin, 1993; Walters, Barrett, & Feinstein, 1990; Waterhouse; 1994; Wing & Gould, 1979). Social behaviors are used primarily for syndrome definition and are considered as qualitatively and quantitatively different from those observed in other childhood disorders (Volkmar & Klin, 1993). Adult outcomes such as community inclusion and mental health status are related to social skills and positive peer friendships (McEvoy & Odom, 1987; Mesibov, 1984; Ruble & Dalrymple, 1996; Smith, 1990; Wing & Gould, 1979).

The nature of the social impairments has been characterized as poor social understanding and skill, rather than a lack of interest (Njardvik, Matson, & Cherry, 1999). Work by Sigman and colleagues demonstrated that children with autism experience social interest and emotional attachment (Kasari *et al.*, 1993; Sigman & Mundy, 1989; Sigman & Ungerer, 1984). Problems learning social interactions without structure (Ferrara & Hill, 1980; Lord, 1984); initiating, responding, and sustaining reciprocal social interactions (Lord, 1984; Smith, 1990; Walters *et al.,* 1990); differentiating and classifying emotions (Hobson, 1986); communicating accurately and competently with others (Wetherby, 1986); and considering their own and others' viewpoints (Baron-Cohen *et al.*, 1985; Howlin, 1986) document the social impairments.

Researchers debate whether the social impairments in autism result from a *social* or *cognitive* deficit because of the complex cognitive processing required (Waterhouse & Fein, 1991). Interactions require ability to attend to a multitude of cues and to interpret and respond to these cues appropriately for the social context (Howlin, 1986). Social behaviors have been linked to attentional functioning (Courchesne, 1994; Dawson *et al.,* 1998) and executive function (Rogers, 1998) abilities that mediate rapid shifting of attention, processing of complex stimuli, and maintenance of goal-directed behaviors.

Social interaction studies that occur in children's own environments have been advocated (Hauck *et al.*, 1995; Prizant, 1995; Stone & Caro-Martinez, 1990; Volkmar & Klin, 1993; Wetherby, 1986). Such studies

[1] Correspondence regarding this article should be addressed to Lisa Ruble, Treatment and Research Institute of Autism Spectrum Disorders, Child Development Center, Vanderbilt University, Department of Pediatrics, Medical Center South, Room 415, Nashville, TN 37232; e-mail: lisa.ruble@mcmail.vanderbilt.edu

0162-3257/01/1000-0471$19.50/0

have identified differences in the frequency and quality of social behaviors. McGee and colleagues (1997) examined naturally occurring social behaviors in order to establish benchmarks for goal setting. Children with autism were less likely to be in close proximity to other children, receive social bids from other children, be focused on another child, use verbalizations, focus on adults, and show more typical behavior.

Some of the behaviors described by McGee and colleagues (1997) appear amenable to change, however, because researchers have found that as proximity between children with autism and peers decreased, time spent in interactive play increased, number of interactions increased, and responding to other children's initiations increased when children were observed together over time (Lord, 1984; Lord & Hopkins, 1986; McHale, 1983). Initiations from children with autism, however, remained low (Lord, 1984; Lord & Hopkins, 1986; Hauck *et al.,* 1995). Hauck and coworkers (1995) also found that the frequency of interactions with adults was similar to comparison children but qualitatively different.

Assessing children's own intentions during interactions has also expanded our view of social behavior by delineating specific social communicative impairments. Once characterized as noncommunicative and noninteractive, children with autism are now described as more purposeful (Wetherby, 1986). For example, Wetherby (1986) and Prizant and others (Prizant & Duchan, 1981; Prizant & Rydell, 1984) found that stereotyped utterances from children with autism, such as echolalia, had functional meaning in purpose (e.g., requesting, protesting, affirming, declaring, calling, rehearsing, self-regulating) when the behavior was examined from the child's viewpoint. Researchers also identified distinct patterns of communicative strengths (such as regulating others' behaviors) and weaknesses (such as communicating for social reasons) by analyzing children's communicative intentions (Wetherby, Prizant, & Hutchinson, 1998). Mundy and others (Mundy & Sheinkopf, 1998; Mundy *et al.,* 1986) analyzed children's intentions and revealed pronounced differences in specific nonverbal social communication behaviors such as joint attention, the ability to coordinate attention between people and objects. Nonverbal requesting behaviors, however, were less disordered.

In order to extend naturalistic observation methods to allow for assessment of more complex aspects of behavior, an ecological psychology framework was applied. First described in the 1950s by Barker and Wright (1955/1971) and later adapted by Scott (1980), ecological psychology methods consider the intentions of the child within the child's own social context. Audiotaped records of behavior were made and analyzed. Rather than dividing behavior based on units of time (e.g., every 15 seconds), as is most commonly done in studies of social interaction, an original unit for analysis was used—one that was created by the child, rather than the researcher (Barker & Wright, 1955/1971; Carlson, Scott, & Eklund, 1980; Wright, 1967). The child's intentions, while participating in everyday activities at home, were partitioned and served as the analytical unit.

This study explores children's goal-directed behaviors of *social* intent and specifically compares features of nonsocially directed behaviors to those of socially directed behaviors. Each analytic unit, called an activity unit (AU), was partitioned, labeled according to the child's intention, and coded. The codes were borrowed from previous ecological research: intention of AU, sociality of AU, initiation of AU, amount of AU overlap, and type of AU overlap (Wright, 1967; Scott, 1980). The goal of behavior (which represents the child's intention) is the defining feature of the AU. Each AU was given a label describing what the AU was about, what was happening, or what the child was trying to do. Sociality of AU refers to the potential for and complexity of social interaction as each AU was coded for the number of interactive partners. Initiation of AU described who or what initiated the behavior. The number of overlapping AUs refers to the simultaneity or co-occurrence of multiple AUs. The ability to initiate, engage, and disengage in one activity that is consistent across some time period demonstrates the ability to organize behavior. Thus, ability to perform multiple behaviors that reflect varying intentions is assessed by number of overlapping AUs and represents developmental maturity (Wright, 1967). The type of AU overlap reflects the complexity of the structure of the behavior as children engaged in one or more different AUs simultaneously. When an AU is nonoverlapping (see Appendix C), the child's intention was to accomplish one goal; however, when an AU overlapped with another AU, the child's intentions were to perform two different actions simultaneously. AUs that encompass one entire other AU are called enclosing. The AU, however, that is entirely within another AU, is called enclosed. Wright found that most units of behavior are enclosed. Thus, people more often produced short goal-directed behaviors within the context of longer goal-directed activities. As children age, Wright (1967) summarized, "the behavior of the older children occurred in fewer but longer segments (featured by enclosing units), which means that older children managed to maintain goal-directed actions with greater

persistence in the face of potentially interrupting action units" featured by enclosed AUs (p. 120).

Analysis of the patterns and complexity of the goal-directed behaviors of these children is reported elsewhere (Ruble, 1997, 1998; Ruble & Scott, 2001). Findings revealed that children with autism exhibited strikingly delayed patterns of goal-directed behaviors, even considering their mental age. Their goal-directed behaviors were more sequential. They tended to engage in one activity at a time, shift frequently from activity to activity, and persist in activities for a shorter length of time. Wright (1967) noted that the ability to engage in multiple goal-directed behaviors simultaneously and to exhibit longer goal-directed behaviors are developmental skills that directly correlate with age.

Questions asked in this study were: (a) How does the potential for interaction compare for children with autism and children with Down syndrome at home; and (b) How do initiation, number, and complexity category codes of nonsocial versus social goal-directed behaviors compare?

METHODS

Participants

A total of 8 boys with autism and 8 with Down syndrome and their families participated in the study. Both groups of children were between the ages of 6 and 10 years and were served primarily in educational programs for students with mild to moderate mental impairments. The children were recruited from local school districts. Special education directors were contacted and asked to identify teachers of children with autism or Down syndrome who were served primarily in programs for students with moderate to severe disabilities. Teachers were sent an explanation letter of the study and letter of informed consent. They were asked to send these letters to parents. Parents willing to participate contacted the researcher directly or gave permission for the teacher to give their phone number to the researcher. Parents received a small stipend of $25 for participation.

Other professionals (physicians and psychologists), not connected to this study, had diagnosed children with autism prior to this research. All children met DSM-IV criteria for autistic disorder (American Psychiatric Association, 1994). Only boys with autism and Down syndrome who were served in public school programs for students with moderate and severe disabilities were recruited.

The Vineland Adaptive Behavior Scales: Interview Edition (VABS) (Sparrow, Balla, Cicchetti, 1984) was administered to the child's parent or caregiver during the first home visit. *T*-test analysis of domain standard scores are reported in Table I. No differences in communication ($t = -.54$, ns) or daily living skills ($t = -1.8$, ns) were found. Socialization skills were significantly lower for boys with autism ($t = 2.3$, $p < .05$). Two items in the socialization domain appeared to differentiate the groups. Less than 25% of the children with autism were reported to show interest in activities of others and engage in elaborate make-believe activities, compared with more than 75% of the children with Down syndrome.

VABS standard scores were significantly below average and consistent with reported cognitive levels for both groups of children. School personnel, with parents' permission, released previous psychological assessments of cognitive levels. Measures included the Bayley Scales of Infant Development, the Stanford-Binet (4th Ed. and Form L-M), the Slosson Intelligence Tests, the Kaufman Brief Intelligence Test, the Differential Abil-

Table I. Characteristics of Participants

	Autism			Down syndrome			
Measure	M	SD	Range	M	SD	Range	*t*
Age (years)	8.5	1.6	6.2–10.7	8.7	1.1	6.8–9.9	.28
Cognitive Level	2.1	1.1	1–3	2.3	0.5	2–3	−.57
		Moderate[1]			Moderate		
VABS							
Communication SS[2]	39.0	15.2	21–71	42.8	12.4	24–57	−.54
Socialization SS	48.4	9.6	32–63	66.4	20.1	42–99	−2.3*
Daily Living SS	32.9	17.0	19–59	49.4	19.1	19–74	−1.8

[1] Overall level of retardation
[2] Standard score
* $p < .05$

ities Scale, and the Wechsler Intelligence Scale for children. A procedure described by Baranek (1999) was used to compare groups. The level of mental retardation (MR) was coded as: 0 = Borderline (70–84); 1 = Mild MR (55–69); 2 = Moderate MR (40–54); 3 = Severe/Profound MR (< 39). No difference in level of MR was found ($t = -.57$, ns).

Procedures

Participants were observed at home during structured (dinner) and unstructured activities (free time). Each child was observed for about 2 hours. When possible, observations were started at the beginning of an activity and terminated at the end of an activity. These natural start points and endpoints were previously determined during the processes of orientation and adaptation.

Before observations ensued, participants completed a two-step process. First, families were *oriented* to the purpose of the study, the methods of the observations, the data to be collected, and the equipment to be used in their homes. The VABS and a semi-structured interview were conducted at that time. Next, families were *adapted* to the observer's presence. During adaptation, the experimenter followed the child, spoke into the stenomask (described in the apparatus section), and recorded the behavior until the child and all other people in the environment adapted to the equipment and the presence of the observer. Scott's (1980) criteria for adaptation were applied. Essentially, adaptation occurred when the child and the people in the environment stopped noticing the observer, and more behaviors, wider ranges of behaviors, and more uneven behaviors were observed (e.g., head scratching, yawning). About two consecutive, 2 to 3-hour observations were needed to obtain adaptation. Once the family was adapted, the data were collected.

Data were collected via the chronolog, described in detail by Scott (1980). Chronologs provide ongoing narrative records of the stream of behavior at the molar level. The chronolog summarizes the ongoing behavior, recording only directly observable behavior from the everyday perspective of a layperson. The behavior of the people around the child and ongoing events are described and provided in the chronolog descriptions as context. In the margin of the chronolog, time notations are made. A 2-hour chronolog translated into approximately 50 pages of data for each child. Chronolog excerpts are provided in Appendices A and B.

Apparatus

A stenomask was used to collect the chronologs (Schoggen, 1964). The stenomask is a recording device that covers the lower half of the face, quieting the observer's comments and allowing the observer to unobtrusively record all ongoing events in the environment onto an audiotape. The stenomask is connected to a portable tape recorder and has a switch which allows the recorder to be turned on and off unobtrusively. A stopwatch was used for time notations. This procedure, rather than videotaping, was used because a stenomask allows more flexibility in the natural environment. The observer is able to easily follow the child going upstairs, going outside to play, and running from room to room. Also, stenomask recording is less invasive than videotape recording.

Observer Training

The experimenter and five graduate students collected the chronolog records. The graduate students, who collected 80% of the chronolog records, were blinded to the details of the study (e.g., purpose of the study, how the data would be unitized and coded). A colleague with extensive experience in the collection and analysis of narrative records provided primary training (M. M. Scott). Following training, successive practice records from each observer were critiqued until criteria established by Barker and Wright (1955/1971) were met (see Ruble, 1998, for details).

Data Reduction Procedures

Unitization and Categorization

Data reduction techniques for ecological research methods are different from those derived from traditional laboratory experimental methods (Scott & Hatfield, 1985). First, each chronolog was unitized into its naturally occurring structural units (Scott, 1980) via the AU. AUs provide the units of analysis and represent goal-directed behaviors that occur along a constant psychological direction from the perspective of the child (Scott, 1980). Detailed parameters for unitizing AUs are available from Wright (1967) and Scott (1980). After unitization, a descriptive label of the content of the AU was made. Examples of molar behavioral labels were "watching TV," "eating dinner," "asking for a drink," and "asking a question." Using transcripts from different children, two reliability analyses for unitization of about 90 minutes of data were conducted, after one-third and after two-thirds of the data had been analyzed. The Scott and Hatfield (1985) procedure for reliability analysis was applied. This formula takes into account the duration of behavior as part of the analysis, thus increasing the ecological validity. The number of units marked by both independent analysts were multiplied by minutes or

fractions of minutes. The percentage of agreements was then divided by the total number of agreements and disagreements; results were 95% and 89% reliable.

Each AU was then categorized using a category code manual. The codes used were intention of AU, sociality of AUs, initiator of AU, number of overlapping AUs, and type of AU overlap. The definitions of these codes are provided in their respective tables. Two independent raters coded the AUs, and two separate reliability analyses of 120 minutes of data were obtained from two different transcripts, after one-third and after two-thirds of the data had been analyzed. Using a percent agreement formula, the reliabilities ranged from 81% to 100% agreement.

Data Transformation

Another variation from traditional experimental studies is that data from ecological records are transformed. Depending on the nature of the data generated, one of two types of transformations were applied, a time-weighted or a frequency-based formula (Scott & Hatfield, 1985). Time-weighted percentages are proportions of total AU time, whereas frequency percentages are proportions of the total number of AUs for each child. Both formulas create proportional or percentage scores but differ in the larger whole to which they refer. When deciding a priori which formula to apply to a category, the question "How are these data best described?" was asked. For example, the category Sociality of AU was judged to represent a variable that occurred throughout an entire AU, whereas another category, Initiator of the AU, was judged to portray a behavior that occurred only at one point in the AU. Thus, the question "How much time did the child engage with other people?" can be answered using the time-weighted formula, but "How often did the child initiate?" requires the frequency-based conversion. Both transformations can be used for the same category code, depending on the question asked. The transformation applied is noted with the respective table.

RESULTS

Both the potential for social interaction and the complexity of social interaction were assessed (see Table II). Most of the AUs (68%) were rated as simple social (one person was involved with the child); only 8% were nonsocial. No differences in sociality of AUs were revealed between the groups.

Of the total number of AUs coded ($N = 1182$), 66% of the AUs of both groups were initiated by the child (see Table III). A *t*-test of proportional frequency scores revealed that children with autism were just as likely to initiate their AUs as the children with Down syndrome ($t = 72$, ns). No differences were observed in who initiated the AUs or the number of AUs initiated to the child ($t = -.74$, ns).

Table II. Percentages of Activity Units (AUs) in Sociality Categories by Diagnosis*

	Autism		Down Syndrome		
Sociality	M	SD	M	SD	*t*
Complex social: more than one person involved with child	.36	.23	.38	.27	−.17
Simple social: one person involved with child	.43	.18	.57	.28	−1.19
Potentially social: people present but not involved with child	.16	.22	.03	.03	1.62
Nonsocial: no one present	.06	.08	.03	.06	.69

*Values are calculated as a percentage of each child's total AU time.

Of particular interest, however, are features of social AUs. Description of social AUs are provided in Table IV. Analysis of these AUs indicated that boys with Down syndrome were about twice as likely to respond to someone ($t = -4.0$, $p < .001$) and three times more likely to attract attention to themselves for social reasons ($t = -2.7$, $p < .01$). No difference in frequency of asking others for help was revealed ($t = .21$, ns). Another separate AU, failing to respond, indicated that children with autism were more than twice as likely to not respond to someone ($t = 3.5$, $p < .01$).

Table V shows the comparisons between social and nonsocial AUs. Both groups of children initiated a similar number of AUs ($t = .72$, ns). No differences were revealed in features of child-initiated *nonsocial* AUs; that is, both groups of children produced and initiated a similar number of nonsocial AUs with similar overlap. In contrast, a comparison of *social* AUs revealed that boys with Down syndrome exhibited a significantly larger number of social AUs ($t = -3.4$, $p < .01$), more child-initiated social AUs ($t = -2.1$, $p < .05$), and more overlapping AUs ($t = -2.6$, $p < .05$).

To examine further the complexity of social interaction and perhaps understand why children with autism exhibited fewer social interactions overall, analysis of the features of social versus nonsocial AUs was performed. On the whole, aggregate analysis of the types of overlap for nonsocial and social AUs were notably different (see Table VI). Social AUs were more likely to be isolated (the AU occurred singly without any overlap) or enclosed (the AU itself was completely contained within an entire other AU). The majority of social AUs (65%)

Table III. Raw Data and Proportional Percentages of Activity Units (AUs) in Initiation Categories by Diagnosis

	Autism					Down syndrome					
	Raw data			Proportional data		Raw data			Proportional data		
Category code	M	SD	Range	M	SD	M	SD	Range	M	SD	*t*
Initiator of AU											
Child	60	32	25–108	.66	.10	37	10	26–55	.62	.12	.72
Mom	16	12	0–35	.18	.10	17	8	2–26	.28	.12	−1.78
Dad	4	4	0–12	.05	.05	1	2	0–5	.02	.03	1.61
Sibling	3	3	0–6	.04	.05	3	2	0–7	.05	.04	−.44
Grandparent	5	11	0–31	.03	.08	0	0	0–1	.00	.01	1.16
Other Child	1	4	0–10	.02	.07	1	2	0–4	.02	.03	.12

*Proportional values are calculated as a percentage of each child's total *N* of AUs. *T*-test based on proportional data.

were entirely within another AU. In contrast, most of the nonsocial AUs (40%) were enclosing (the AU contained at least one entire other AU within it) and interlinking (the AU occurred at least partially during the course of another AU). Types of AU overlap are in Appendix C.

DISCUSSION

In this study, the everyday social lives of children with autism and Down syndrome were strikingly similar. Both groups of children had equal and high potential for interaction with family members, to respond to family members, and to interact with specific family members. These findings are consistent with Wright's (1967) earlier report that most of (typical) children's activities involved other people.

Despite living within similar social contexts, differences in the frequency and complexity of socially intended behaviors were found. Children with autism initiated fewer behaviors for the purposes of *attracting attention* to themselves and *responding to others*, impairments which have previously been reported (Dawson *et al.*, 1998; McHale, 1983; Lord, 1984; Van Engeland, Bodnor, & Bolhuis, 1985; Wetherby, 1986). They showed equal likelihood, however, to ask for help as found by others (Mundy *et al.*, 1986; Wetherby, Prizant, & Schuler, 2000).

Analysis of the features of social versus nonsocial behaviors reflected clear differences as well. Children with autism exhibited fewer social interactive behaviors overall, fewer self-initiated interactions, and less complex interactive behaviors. Meanwhile, behaviors of nonsocial intent revealed no differences between children. Thus, the frequency and quality of social behaviors distinguished children with autism from children with Down syndrome.

Explanations for these findings may come from two particular qualitative features of the AUs. Analysis of the patterns and complexity of behaviors revealed that social behaviors are inherently more complex as measured by the type of AU overlap and the amount of AU overlap. Analysis of the type of AU overlap indicated that the majority (65%) of the social interactive

Table IV. Percentages of Social Activity Units (AUs) by Diagnosis

		Autism		Down syndrome		
Intention of AU	Percentage*	M	SD	M	SD	*t*
Responding to someone	14.2	.11	.03	.20	.05	−4.0***
Attracting attention to self	5.9	.03	.03	.11	.08	−2.7**
Asking for help	5.2	.05	.04	.05	.03	.21
Failing to respond to someone	9.0	.12	.04	.05	.04	3.5**

*Values are calculated as a percentage of each child's total *N* of AUs.
**$p < .01$
***$p < .001$

Table V. Percentages of Features of Child-Initiated Nonsocial and Social Activity Units (AUs)[a]

	Autism		Down syndrome		
Category	M	SD	M	SD	*t*
Percentages of child-initiated AUs	.66	.10	.62	.12	.72
Nonsocial AUs					
Percentages of AUs	.61	.11	.51	.12	1.6
Percentages of child-initiated AUs	.51	14	.38	.13	1.75
Percentages of overlapping child-initiated AUs	.78	.27	1.11	.48	−.33
Social AUs					
Percentages of AUs	.25	.09	.43	.12	−3.4**
Percentages of child-initiated AUs	.13	.07	.23	.11	−2.1*
Percentages of AUs overlapping child-initiated AUs	.12	.06	.32	.20	−2.6*

[a]Values are calculated as a percentage of child's total *N* of AUs.
*$p < .05$
**$p < .01$

behaviors for both groups of children were enclosed within the context of another ongoing activity, emphasizing the need for rapid shifting of attention. Imagine, for example, a child eating dinner, watching TV, and getting mom's attention. While eating dinner, he is able to initiate, maintain, and respond simultaneously. Children with Down syndrome were better able to engage in multiple goal-directed behaviors simultaneously.

The amount of overlap reflects AU complexity. Wright (1967) explained that the amount of overlap demonstrates ability to engage in multiple goal-directed behaviors simultaneously. Wright found that older children consistently showed a higher degree of connectedness among their behavioral units, thus reflecting developmental maturity. Older children were better able to keep more than one goal-directed behavior going at a particular time and to begin a new activity while completing a previous one. If they were interrupted, they were better able to attend to the disruption without losing track of their originally intended behavior. These skills, as originally described by Wright (1967), resemble molar level descriptions of executive function and attention shifting abilities found to be especially impaired in autism (Courchesne, 1994; Rogers, 1998). Moreover, when one considers social behavior, executive function and attentional skills appear critical. One must be able to shift attention easily and disengage and re-engage attention smoothly (Pierce, Glad, & Schreibman, 1997). Because social behaviors were more likely to be within the context of other longer goal-directed behaviors, social behaviors appear to be strongly mediated by executive function and attentional skills.

The complexity of social behaviors may also help explain the differences in the frequency of observed

Table VI. Percentages of Type of Overlap Categories by Social and Nonsocial Activity Units (AUs)*

	Social		Nonsocial		
Type of overlap	M	SD	M	SD	*t*
Isolated: the AU occurred without any overlap	.16	.14	.003	.003	4.7***
Enclosing: the AU contains at least one entire other AU within it	.06	.10	.40	.17	−7.1***
Enclosed: The AU is itself completely contained by another AU	.65	.24	.17	.08	7.2***
Interlinking: the AU occurred at least partially during the course of another AU	.06	.08	.18	.11	−3.7**

*Values are calculated as a percentage of total *N* of AUs.
**$p <$ .01
***$p < .001$

social intentions of the children. Attentional requirements during interactions, such as when someone was trying to elicit the child's attention while the child was involved in another activity, may explain the lack of responding. Family members put forth much effort trying to gain the child's attention. Problems responding to social stimuli have been reported by Dawson and colleagues (1998), who found that children with autism were much less likely to respond to their name. Mundy, Sigman, and Kasari (1990) explain that problems of responsivity hinder development of joint attention, a primary aspect of the disability which depends on the effort required to process social stimuli by incorporating a sharing of attention with another person. The finding that children with autism were less likely to attract attention to themselves for social reasons, may be a result in a delay in joint attention (Mundy & Sheinkopf, 1998).

In conclusion, social development in autism is crucial for adult outcomes and quality of life (Ruble & Dalrymple, 1996). These findings emphasize the need for alternative methods of assessment in order to understand the complexity of social behavior. Clinically, these findings stress the importance of children with autism to learn to *initiate* social behaviors, not just to respond as Koegal *et al*. (1999) found initiation as a predictor of outcome. Parents need training on ways to encourage initiation and responsiveness and accommodate problems of shifting of attention (e.g., allow more processing time). Intervention research that targets these skills in the natural environment is needed. Another question arising from this study is the effect of communicative competence. Language development is inextricably linked to cognitive development and attention (Dawson & Lewy, 1989). Pragmatic skills may help children engage in social behaviors of more complexity or vice versa. Children with Down syndrome have better developed pragmatic communication than do children of similar levels of syntactic development (Beeghly, Weiss-Perry, Cicchetti, 1995). Children with autism, on the other hand, have a relative weakness in pragmatic skills, compared with syntactic skills (Schopler & Mesibov, 1985). This impact of this reverse development in skill needs more study. Analysis of the communicative mechanisms used in AUs by the children and their partners is underway.

A limitation of this study is a lack of comparison data from a larger group of children with autism and higher functioning children. Thus, the specificity of these results is unknown and results should be interpreted with caution. Such information will help inform the questions of specificity and delay verses deviance. Another word of caution: even though the potential for social interaction was similar for both groups of children, these findings do not suggest that the quality of interactions was equal. This question is currently being addressed.

ACKNOWLEDGMENT

This research was supported by the US Department of Education: Research in Education of Individuals with Disabilities Program, Student Initiated Research Projects H023B50008. Gratitude is extended to Shannon Lazar, Myrtle Scott, and the families and staff of the Monroe, Marion, and Franklin County School Districts in Indiana.

Appendix A. Excerpt of a Chronolog of a Child with Autism

Preparing Food[29]

51'58" Freddie takes the plate out of the microwave and carries it to the couch in the living, room looking at the plate.

Holding his plate of food, Freddie sits on the couch, facing the television, which is not on.

[Observer Comment (OC): Mom told me earlier that Freddie doesn't usually have much interest in the TV]

Freddie begins to eat one of the rolls delicately, taking tiny bites from the corners.

52'38" Freddie taps the roll with his finger in between bites.

Asking a Question[31]

"Mommy's not going to work?" Freddie asks loud enough to be heard in the kitchen while looking at his food. [OC: Mom has the evening off.]

"I'm not working tonight. I'm going to hear some music tonight," Mom replies from the kitchen.

Eating Dinner[30]

Freddie continues to eat, expressionless.

53'26" Mom and Tim continue to talk about the evening.

Freddie begins to eat his second roll.

Freddie sits with his left foot up on the table in front of the couch.

Freddie continues to eat slowly.

54'03" Mom walks across the living room and sits on the table, which is placed against the wall next to the couch.

Freddie does not look at Mom or say anything to her.

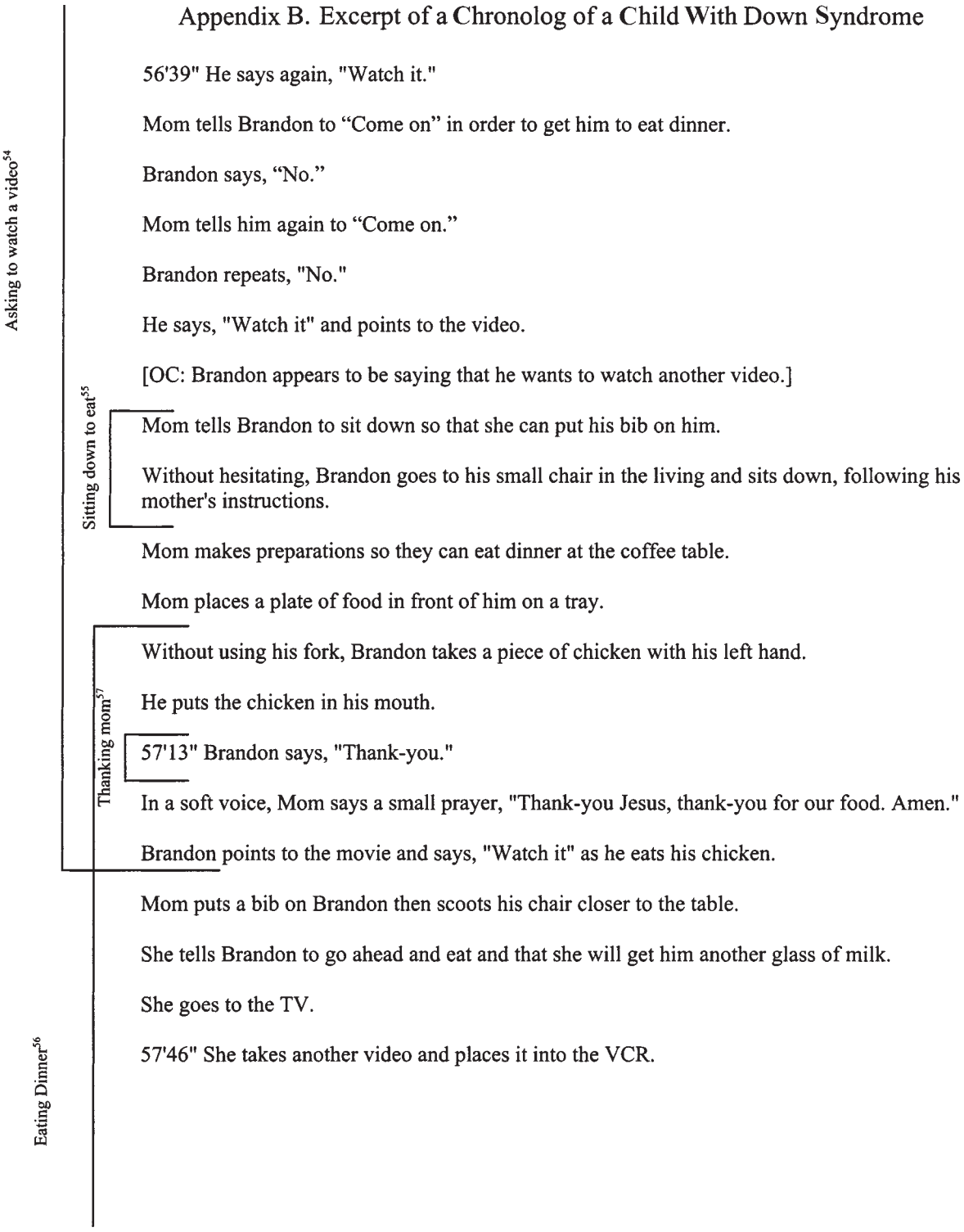
Freddie continues to eat calmly, paying attention to his food.

Tim walks to the living room door.

Tim stands in the doorway and talks to Mom from across the living room.

Tim leaves without saying anything to Freddie, and Freddie does not appear to notice his departure.

Appendix B. Excerpt of a Chronolog of a Child With Down Syndrome



56'39" He says again, "Watch it."

Mom tells Brandon to "Come on" in order to get him to eat dinner.

Brandon says, "No."

Mom tells him again to "Come on."

Brandon repeats, "No."

He says, "Watch it" and points to the video.

[OC: Brandon appears to be saying that he wants to watch another video.]

Mom tells Brandon to sit down so that she can put his bib on him.

Without hesitating, Brandon goes to his small chair in the living and sits down, following his mother's instructions.

Mom makes preparations so they can eat dinner at the coffee table.

Mom places a plate of food in front of him on a tray.

Without using his fork, Brandon takes a piece of chicken with his left hand.

He puts the chicken in his mouth.

57'13" Brandon says, "Thank-you."

In a soft voice, Mom says a small prayer, "Thank-you Jesus, thank-you for our food. Amen."

Brandon points to the movie and says, "Watch it" as he eats his chicken.

Mom puts a bib on Brandon then scoots his chair closer to the table.

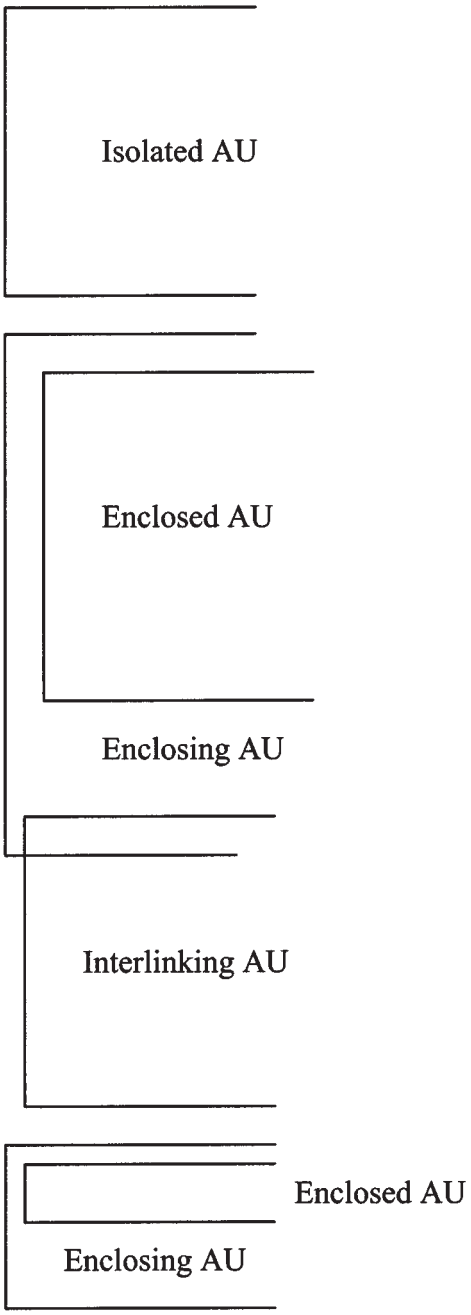
She tells Brandon to go ahead and eat and that she will get him another glass of milk.

She goes to the TV.

57'46" She takes another video and places it into the VCR.

Appendix C.

Examples of types of AU overlap



REFERENCES

American Psychiatric Association. (1994). *Diagnostic and statistical manual (4th ed.)*. Washington, DC: American Psychiatric Association.

Baranek, G. (1999). Autism during infancy: A retrospective video analysis of sensory-motor and social behaviors at 9–12 months of age. *Journal of Autism and Developmental Disorders, 28,* 213–224.

Barker, R., & Wright, H. (1955/1971). *Midwest and its children.* Hamden, CT: Archon Books. (Original work published 1955).

Baron-Cohen, S., Leslie, A., & Frith, U. (1985). Does the autistic child have a "theory of mind"? *Cognition, 21,* 37–46.

Beeghly, M., Weiss-Perry, B., Chicchetti, D. (1995). Beyond sensorimotor functioning: Early communicative play development of children with Down syndrome: In D. Cicchetti & M. Beeghly (Eds.), *Children with Down syndrome: A developmental perspective* (pp. 329–368). Cambridge: Cambridge University.

Carlson, C., Scott, M., & Eklund, S. (1980). Ecological theory and method for behavioral assessment. *School Psychology Review, 9,* 75–82.

Courchesne, E. (1994). A new finding: Impairment in shifting attention in autistic and cerebellar patients. In S. H. Broman & J. Grafman (Eds.), *Atypical cognitive deficits in developmental disorders: Implications for brain function* (pp. 101–137). Hillsdale, NJ: Erlbaum.

Dawson, G., & Lewy, A. (1989). Arousal, attention, and the socioemotional impairments of individuals with autism. In G. Dawson (Ed.), *Autism: Nature, diagnosis, and treatment* (pp. 49–74). New York: Guilford.

Dawson, G., Meltzoff, A., Osterling, J., Rinaldi, J., & Brown, E. (1998). Children with autism fail to orient to naturally occurring social stimuli. *Journal of Autism and Developmental Disorders, 28,* 479–485.

Ferrara, C., & Hill, S. (1980). The responsiveness of autistic children to the predictability of social and nonsocial toys. *Journal of Autism and Developmental Disorders, 10,* 51–57.

Hauck, M., Fein, D., Waterhouse, L., & Feinstein, C. (1995). Social initiations by autistic children to adults and other children. *Journal of Autism and Developmental Disorders, 25,* 579–593.

Hobson, R. P. (1986). The autistic child's appraisal of expressions of emotion: A further study. *Journal of Child Psychology and Psychiatry, 27,* 671–680.

Howlin, P. (1986). An overview of social behavior in autism. In E. Schopler & G. Mesibov (Eds.), *Social behavior in autism* (pp. 103–132). New York: Plenum.

Kasari, C., Sigman, M., Yirmiya, N., & Mundy, P. (1993). Affective development and communication in young children with autism. In A. P. Kaiser & D. B. Ceray (Eds.), *Enhancing children's communication and language intervention series* (Vol. 2, pp. 201–222). New York: Brookes.

Koegel, L., Koegel., Shoshan, Y., & McNerney, E. (1999). Pivotal response intervention II: Preliminary long-term outcome data. *The Journal of the Association for Persons with Severe Handicaps, 24,* 186–198.

Lord, C. (1984). The development of peer relations in children with autism. In F. J. Morrison, C. Lord, & D. Keating (Eds.), *Applied developmental psychology* (Vol. 1, pp. 165–230). Orlando: Academic Press.

Lord, C. & Hopkins, J. M. (1986). The social behavior of autistic children with younger and same-age nonhandicapped peers. *Journal of Autism and Developmental Disorders, 16,* 249–262.

McEvoy, M., & Odom, S. (1987). Social interaction training for preschool children with behavioral disorders. *Behavioral Disorders, 12,* 242–251.

McGee, G., Feldman, R., & Morrier, M. (1997). Benchmarks of social treatment for children with autism. *Journal of Autism and Developmental Disorders, 27,* 353–364.

McHale, S. (1983). Social interactions of autistic and nonhandicapped children during free play. *American Journal of Orthopsychiatry, 53,* 81–91.

Mesibov, G. (1984). Social skills training with verbal autistic adolescents and adults: A program model. *Journal of Autism and Developmental Disorders, 14,* 395–404.

Mundy, P., & Sheinkopf, S. (1998). Early communication skill acquisition and developmental disorders. In J. Burack (Ed.), *Handbook of mental retardation and development, volume xviii* (pp. 183–207). New York: Cambridge.

Mundy, P., Sigman, M., & Kasari, C. (1990). A longitudinal study of joint attention and language development in autistic children. *Journal of Autism and Developmental Disorders, 20,* 115–128.

Mundy, P., Sigman, M., Ungerer, J., & Sherman, T. (1986). Defining the social deficits of autism: The contribution of nonverbal communication measures. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 27,* 657–669.

Njardvik, U., Matson, J., & Cherry, K. (1999). A comparison of social skills in adults with autistic disorder, pervasive developmental disorder not otherwise specified, and mental retardation. *Journal of Autism and Developmental Disorders, 29,* 287–295.

Pierce, K., Glad, K., & Schreibman, L. (1997). Social perception in children with autism: An attentional deficit? *Journal of Autism and Developmental Disorders, 27,* 265–282.

Prizant, B. (1995). *Preliminary report of the autism working group to the National Institutes of Health.* Washington, DC: Government Printing Office.

Prizant, B., & Duchan, J. (1981). Analysis of the functions of delayed echolalia in autistic children. *Journal of Speech and Hearing Disorders, 46,* 241–249.

Prizant, B., & Rydell, P. (1984). Analysis of the functions of delayed echolalia in autistic children. *Journal of Speech and Hearing Research, 27,* 183–192.

Rogers, S. (1998). Neuropsychology of autism in young children and its implications for early intervention. *Mental Retardation and Developmental Disabilities, 4,* 104–112.

Ruble, L. (1997, August). *A Comparative Study of Natural Habitat Behaviors of Children with Autism and Children with Down syndrome: An Ecological Approach.* Poster session presented at the annual meeting of the American Psychological Association, Chicago.

Ruble, L. (1998). Comparative study of the natural habitat behaviors of children with autism and children with Down syndrome: An ecological approach. *Dissertation Abstracts International, 59* (5-B): 2459. (University Microfilms No. AAM98-34558).

Ruble, L., & Dalrymple, N. (1996). An alternative view of outcome in autism. *Focus on Autism and Other Developmental Disabilities, 1,* 3–14.

Ruble, L., & Scott, M. (in press). *Executive functions and natural habitat behaviors of children with autism.* Manuscript submitted for publication.

Schoggen, P. (1964). Mechanical aids for making specimen records of behavior. *Child Development, 35,* 195–198.

Schopler, E., & Mesibov, G. (Eds.). (1985). *Communication problems in autism.* New York: Plenum.

Scott, M. (1980). Ecological theory and methods for research in special education. *Journal of Special Education, 14,* 279–294.

Scott, M., & Hatfield, S. (1985). Problems of analyst and observer agreement in naturalistic narrative data. *Journal of Educational Measurement, 22,* 207–218.

Sigman, M., & Mundy, P. (1989). Social attachments in autistic children. *Journal of the American Academy of Child and Adolescent Psychiatry, 28,* 74–81.

Sigman, M., & Ungerer, J. (1984). Attachment behaviors in autistic children. *Journal of Autism and Developmental Disorders, 14,* 231–244.

Smith, M. D. (1990). *Autism and life in the community: Successful interventions for behavioral challenges.* Baltimore: Brookes.

Sparrow, S., Balla, D., & Cicchetti, D. (1984). *Vineland Adaptive Behavior Scales (survey form).* Circle Pines, MN: American Guidance Service.

Stone, W., & Caro-Martinez, L. (1990). Naturalistic observations of spontaneous communications in autistic children. *Journal of Autism and Developmental Disorders, 20,* 437–453.

Van Engeland, H., Bodnor, F., & Bolhuis, G. (1985). Some qualitative aspects of the social behavior of autistic children: An ethological approach. *Journal of Child Psychology and Psychiatry, 26,* 879–893.

Volkmar, F. R., & Klin, A. (1993). Social development in autism: Historical and clinical perspectives. In S. Baron-Cohen, H. Tager-Flusberg, & D. J. Cohen (Eds.), *Understanding other minds: Perspectives from autism* (pp. 41–55). Oxford: Oxford University Press.

Walters, A. S., Barrett, R. P., & Feinstein, C. (1990). Social relatedness and autism: Current research, issues, directions. *Research in Developmental Disabilities, 11,* 303–326.

Waterhouse, L. (1994). Severity of impairment in autism. In S. Broman & J. Grafman (Eds.), *Atypical cognitive deficits in developmental disorders: Implications for brain function* (pp. 159–179). New Jersey: Erlbaum.

Waterhouse, L., & Fein, D. (1991). Social or cognitive or both? Crucial dysfunctions in autism. In C. Gillberg (Ed.), *Diagnosis and treatment of autism* (pp. 53–61). New York: Plenum.

Wetherby, A. (1986). Ontogeny of communicative functions in autism. *Journal of Autism and Developmental Disorders, 16,* 295–316.

Wetherby, A., Prizant, B., & Hutchinson, T. (1998). Communicative, social-affective, and symbolic profiles of young children with autism and pervasive developmental disorder. *American Journal of Speech-Language Pathology, 7,* 19–91.

Wetherby, A., Prizant, B., & Schuler, A. (2000). Understanding the nature of communication and language impairment. In A. Wetherby & B. Prizant (Eds.), *Autism spectrum disorders: A transactional developmental perspective.* (pp. 109–141). Baltimore: Brookes.

Wing, L., & Gould, J. (1979). Severe impairments of social interaction and associated abnormalities in children: epidemiology and classification. *Journal of Autism and Childhood Schizophrenia, 9,* 11–29.

Wright, H. (1967). *Recording and analyzing child behavior with ecological data from an American town.* New York: Harper & Row.