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Learning language and social interaction skills seem to be relatively easy and effortless accomplishments as a child develops, however, for a child with autism, these skills may be delayed, effortful, or even nonexistent. Autism is a pervasive developmental disorder, meaning that it affects every aspect of an individual's life and causes many obstacles in everyday functioning. The *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition* (DSM-IV), which is used by the American Psychiatric Association (1994), provides specific criteria for the diagnosis of autism. One of the criteria includes qualitative impairments in communication. Although all aspects of communication can be affected by autism, pragmatic deficits are often considered hallmarks of this clinical condition (Rollins & Snow, 1998).

Pragmatic skills, also referred to as dyadic/discourse skills, are those that allow individuals to use their communication appropriately and effectively when interacting with others (McLean, 1990). Children's development of intentionality and their development of different types of communicative functions are two areas that are frequently studied by researchers who are interested in the pragmatic deficits of children with autism. In these studies, children's development of intentionality and communicative functions are often analyzed along with vocabulary and grammar to examine how these different skill areas are related. Findings from some studies suggest that deficits in intentional development and its communicative function skills, especially joint attention, serve as obstacles to the acquisition of vocabulary and grammar (Rollins & Snow, 1998). Other studies suggest a relationship between these variables, but they also find other

factors to be important precursors to a child's development of language, such as verbal imitation, pretend play, (Smith, Mirenda, and Zaidman-Zait, 2007) and diversity of object play (Yoder, 2006). Still others have shown that children with autism can demonstrate an increase in their production of words and grammar without demonstrating an increase in joint attention or intentionality (Wetherby et al., 1998). This latter type of finding suggests that the developmental trajectories of these two aspects of language can be unrelated, in at least some children.

The focus of the current project is to analyze one child's development of intentionality, vocabulary, and grammar by completing a longitudinal case study. There are three sections of the literature review. In the first, I define the term intentionality and discuss the communicative functions of different intentional acts. In the next section, I review studies that have examined the development of intentionality, vocabulary, and grammar in children who are developing typically. The final section includes a review of studies that have examined the development of intentionality, vocabulary, and grammar in children diagnosed with autism.

Intentionality and Communicative Function

Intentionality. All typically developing children are born with the ability to react to internal and external stimuli. These reactions become the infant's first form of communication. Though the infant is unaware of the effect of these early behaviors, they are considered communicative in nature because responsive caregivers assign communicative significance to them. Infants' communication at this point is pre-intentional, yet it still has a communicative effect. Responses of caregivers facilitate infants' learning about communication by helping them become aware of their effects on

others. Infants' behaviors become less reflexive and more proactive between the ages of three to eight months. However, the infants' behaviors continue to lack awareness or anticipation of communicative effects, and thus are still considered to be lacking in intentionality.

Around eight or nine months, most infants show evidence that they can use objects and people to achieve desired outcomes. This achievement, along with the child's increasing ability to coordinate attention between a referent and person, marks the beginning of intentional/illocutionary communication. The intentional behaviors at this point in a child's development are generally non-verbal in nature but they can be accompanied by vocalizations. Around the age of one year, linguistic communication in the form of words and protowords begin to emerge within the child's repertoire of intentional behaviors (McLean, 1990). Word production marks the beginning of the locutionary stage of communication development (Wetherby & Prizant, 1989).

Deciding whether an infant's behavior is intentionally communicative is a difficult endeavor. Not all communicative behaviors are intentional, and any behavior can serve a communicative function regardless of whether the function was intended by the child. This is exemplified in the perlocutionary stage of intentional development when the caregiver assigns communicative significance to behaviors regardless of the child's intent (McLean, 1990). Because intentionality cannot be directly measured, it is often inferred from observable behaviors displayed by the child during interactions (Wetherby & Prizant, 1989). These behaviors include: (1) alternating eye gaze between goal and listener; (2) persistent signaling until the goal is accomplished or failure is indicated; (3) changing the signal quality until the goal has been met; (4) ritualizing or

conventionalizing the form of a signal within specific communicative contexts; (5) awaiting a response from the listener; (6) terminating the signal when the goal is met; and (7) displaying satisfaction when the goal is attained or dissatisfaction when it is not.

As mentioned earlier, intentionality can be expressed through gestural, vocal, or verbal communicative means. By definition, a gesture is an action that is produced with the intent to communicate and is typically expressed using the fingers, hands, and arms. In determining the function of an individual's actions, it is important to recognize the difference between "behaviors" (e.g., reaching to get something) and "gestures used to communicate" (e.g., the use of reaching to communicate to another that the child wants the object; Crais, Douglas, & Campbell, 2004). Capone and McGregor (2004) list multiple gestures that emerge between infancy and toddlerhood. For example, deictic gestures, such as showing a toy frog to a caregiver, giving a book to a peer, and pointing, establish a point of reference by calling attention to an object or event. Representational gestures carry meaning in their form to symbolize a referent, such as flapping one’s arms to represent a bird’s flight or holding a finger to the lips to represent being quiet.

Vocal and verbal communication can also take various forms in order to express intentions. Vocal communicative means are defined as transcribable vowels or vowel plus consonant combinations. Verbal communicative means are defined as words or word approximations used to refer to a specific object, action, or attribute (Wetherby & Prizant, 1993). As children get older, they increase their use of verbal communicative means. This increase in means is seen in their expanded use of words and utterances to express communicative intent (Wetherby, Cain, Yonclas, & Walker, 1988). Additionally, as

children engage in more verbal discourse, the range of intentions that they can express through verbal means increases (Wetherby & Prizant, 1989).

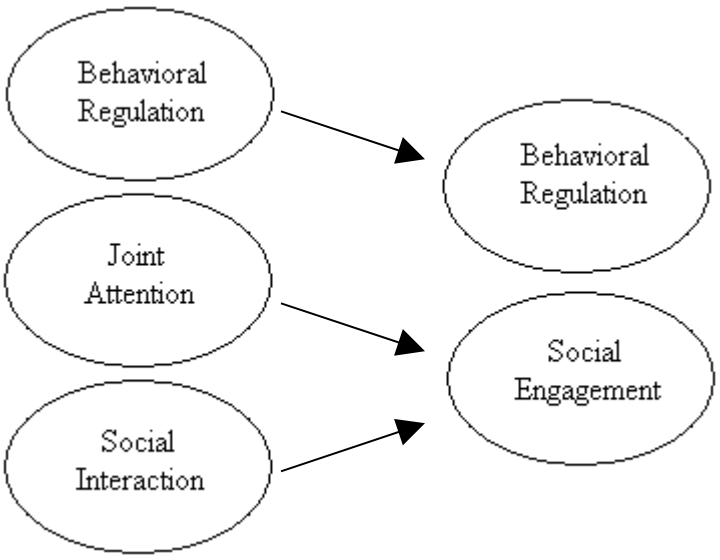
Communicative Function. Gestural, vocal, and verbal means of intentional communication can serve different communicative functions. For example, imperative functions are acts that are used to regulate another's behavior for the purpose of obtaining or restricting a goal. Given this, imperative functions are sometimes referred to as acts of behavioral regulation. These include actions, vocalizations, or verbalizations that serve to request an object, refuse an undesired object, or command another to stop an undesired action.

Declarative acts serve a different function. These are acts that are used to direct another's attention for the purpose of sharing the focus of an entity or event. Given this, these are sometimes referred to as acts of joint attention. Examples of this communicative function include actions, vocalizations, or verbalizations that serve to comment on an object, request information about an object, or clarify a previous statement.

A third type of communicative function described in the literature involves social interaction functions. These acts include actions, vocalizations, or verbalizations that serve to attract and maintain another’s attention to oneself for affiliative purposes (Wetherby et al., 1988). These include showing off, greeting an individual, or acknowledging another’s previous statement or action. In the current project, acts of joint attention and social interaction are combined into one category of social engagement (see Figure 1).

Figure 1

Schema of communicative functions.



Typical Development of Intentionality, Vocabulary, and Grammar

In a study by Wetherby et al. (1988), 15 typically developing children were studied longitudinally to evaluate their use of intentional communication at the prelinguistic, one-word, and multiword stages. The data came from 30-minute language samples collected at each stage of development. Results were that the children's linguistic abilities as measured by number of word types and MLU, as well as their number of intentional communicative acts increased at each stage of development. For example, the mean number of word types at the prelinguistic stage was 1.07 (2.46) and at the multiword stage, it was 67.47 (32.70). By definition, the average MLU at the prelinguistic stage could not be calculated, but the average MLU did increase from .74 (.47) at the one-word stage to 2.20 (.64) at the multiword stage. Finally, the number of intentional communicative acts was 39.1 (25.34) at the prelinguistic stage and 152.1 (57.23) at the multiword stage. This study also found that the use of communicative acts

containing gestural means only, vocal means only, and coordinated gestures and vocalizations decreased from the prelinguistic to the multiword stage. In contrast, acts consisting of verbalizations only increased (see Table 1).

Table 1

Communicative means at the prelinguistic and multiword stage.

	Prelinguistic stage	Multiword stage
Gestures only	34.86 (18.56)	10.18 (9.52)
Vocalizations only	22.70 (16.59)	5.60 (4.21)
Coordinated gestures and vocalizations	40.12 (14.30)	10.20 (8.74)
Verbal only	1.02 (3.39)	30.82 (10.39)

In another study, Crais et al. (2004) examined the emergence of behavior regulation and joint attention gestures in 12 typically developing infants from six months until their second birthday. To be considered a gesture, the behavior had to be directed toward an adult and serve a communicative function. Though most gestures had some eye contact between the child and the adult, this was not required for the act to be considered a gesture.

The results of this study showed that for the majority of the children, behavior regulation acts emerged before joint attention acts (behavior regulation: 5.75 months; joint attention: 7.17 months). In this study, the ages at which the acts emerged are younger than the 8 or 9 month mark for intentionality development commonly cited in the literature. One possible reason for this difference relates to the criteria these authors used to define a gesture. Specifically, they did not require the children to make eye contact in order for a gesture to be considered intentional.

As part of this study, the author also examined communicative functions of the children's early word productions. The study examined eight functional ways that words could be used and found the mean age of appearance for each. These included: (1) using words to comment (11.42 months); (2) using words to seek attention (11.92 months); (3) requesting objects (12.58 months); (4) requesting actions (13.17 months); (5) rising intonation at the end of a word to request information (14.00 months); (6) protests (14.42 months); (7) initiation of social games (15.25 months); (8) acknowledging the question produced by another (15.92 months). These findings show that children use their earliest word productions to both regulate behaviors and engage others in social interaction.

Intentionality, Vocabulary, and Grammar Development in Children with Autism

For many children (those with and without autism), the ability to establish and maintain joint attention is strongly related to the development of expressive language. Rollins and Snow's (1998) study of the relationship between pragmatic skills and grammatical development in six children with autism and in thirty typically developing children supports this statement. Furthermore, their findings imply that deficits in joint attention may have numerous negative consequences on the development of children's language systems. For example, the study showed how children who are typically developing and whose mothers often follow their lead had more fully developed syntactic skills 20 months after the start of the project than children whose mothers were directive. This result was not found in the children with autism. Even if the mother's style was child-centered, there was no positive effect on the grammatical growth of the children with autism. The authors speculated that because of the joint attention deficits found in

children with autism, they could not benefit from a facilitative child-centered maternal style.

Rollins and Snow (1998) also used the Index of Productive Syntax (IPSyn; Scarborough, 1990) to assess morphosyntactic skill achieved by each child in a 20-minute language sample. The IPSyn score is a composite score which reflects the child's use of 56 syntactic and morphological forms, such as negations, questions and other sentence structures. The authors looked at the frequency with which the children used behavior regulation acts and joint attention acts in relation to their IPSyn scores. The data revealed that there was a high positive correlation between change in IPSyn and the frequency of communicative acts in joint attention. This correlation was not found between IPSyn and behavior regulatory acts, suggesting that the use of acts for behavior regulation is not strongly related to the acquisition of expressive language. Together these findings suggest that the establishment and manipulation of joint attention may be a prerequisite to the development of productive syntax, and because this skill is deficient in children with autism, their expressive language skills may be negatively affected.

In another study conducted by Rollins (1999), the pragmatic and vocabulary development of five children with autism were followed from the prelinguistic to early one-word stage. Of the five children (mean age at onset 2;7), three children (aged 3;1, 2;8, and 2;2) showed an increase in vocabulary development, one (aged 2;5) showed a decrease, and one (aged 2;6) showed no statistically significant change. The author found that the children who showed an increase in vocabulary development presented four similar features. First, they had less than 40% of their communicative activity comprised of behavior regulatory acts. Second, they had less than 30% of their communicative

activity comprised of unconventional means, such as throwing objects. Third, more than 40% of their communicative activity was comprised of joint attention acts. Finally, across the length of the study, all three of these children showed an increase in the total number of communicative functions they produced.

From these results, the author speculated that an increase in the diversity of conventional means, such as gestures and words, coupled with an increase in joint attention skills was associated with the children's increase in the rate of their vocabulary acquisition. The author also speculated that joint attention skills may need to reach a certain point (comprising more than 40% of a child's communicative activity) before vocabulary growth can accelerate.

For children with autism, the results further showed that words can be used for behavior regulatory acts with a near exclusion of words used for joint attention acts. This was shown by four of the five children at the start of the project. During the 20-minute sample at the initial meeting, the ratios of these four children's percent use of behavior regulation acts to joint attention acts ranged from 100:0, 67:0, 33:5, and 84:16. In a review of Tomasello and Chall (1997), Rollins noted that behavioral regulation requires the child to understand that another person can cause something to happen, but joint attention requires a child to understand that the other individual in the conversation makes behavioral and perceptual choices.

In a study conducted by Wetherby et al. (1998), the developmental profiles of 22 children with autism were compared with 22 children without autism but who presented with delayed language. The data were collected through the administration of seven subtests of the *Communication and Symbolic Behavior Scales* (*CSBS*; Wetherby et al.,

1993). These subtests were: communicative functions (i.e. protest, request a social routine, comment on object), gestural communicative means (i.e. giving, reaching, manipulating adult's hand), vocal communicative means (i.e. number of consonants used and multisyllablic utterances), verbal communicative means (i.e. inventory of words and word combinations), reciprocity (i.e. ability to persist and perhaps modify communication when goal is not obtained, number of acts in response to adult's behavior), social/affective signaling (i.e. gaze shifts, shared positive affect), and symbolic behavior (i.e. constructive/combinatorial play, different action schemes). Two sets of findings from this study are relevant to the current work. First, and as shown in Table 2, the authors found that the two groups differed in communicative functions (i.e. behavior regulation, joint attention) and gestural communicative means, but they displayed comparable scores in vocal and verbal communicative means.

Table 2

CSBS cluster scores for participants with autism and language delay.

	Autism	Language delay
Communicative functions	3.36 (1.00)	7.09* (2.45)
Gestural communicative means	3.50 (1.14)	6.27* (3.48)
Vocal communicative means	4.18 (2.11)	4.45 (1.87)
Verbal communicative means	5.14 (1.49)	5.55 (1.10)

Secondly, these authors compared results for older and younger participants with autism and found that the 3- and 4-year-olds with autism showed similar profiles to the 2-year-olds with autism in all areas tested except for vocal and verbal communicative means. Data to support this finding are presented in Table 3. These results showed that growth curves for vocal and verbal communicative means were very different from and more accelerated than the growth curves of the other areas examined by the *CSBS*.

Table 3

CSBS cluster scores for older and younger participants with autism.

	2 year olds	3 & 4 year olds
Communicative functions	3.18 (0.60)	3.55 (1.29)
Gestural communicative means	3.45 (1.04)	3.55 (1.29)
Reciprocity	4.45 (2.66)	4.64 (2.69)
Social/Affective signaling	8.09 (2.77)	8.00 (1.84)
Symbolic behavior	3.36 (1.12)	3.55 (0.93)
Vocal communicative means	3.09 (0.30)	5.27* (2.57)
Verbal communicative means	4.55 (0.82)	5.73* (1.79)

Finally, in a recent exploratory study based on parent questionnaires, 35 children with autism (initial ages between 20 and 71 months) were assessed four times over the course of two years by Smith et al. (2007). This study examined the development of

expressive vocabulary by using eight subtests of the *MacArthur-Bates Communicative Development Inventory* (*MCDI*; Fenson, Dale, Reznick, Thal, Bates, Hartung, Pethick, & Reilly, 1993). The subtests were: expressive vocabulary, verbal imitation, use of objects to pretend, gestures to initiate joint attention, gestures for games/routines, actions with objects, pretending to be a parent, and imitating adult actions.

Based on the results, the authors categorized the 35 children into four clusters. Cluster 1, with 15 participants, was characterized by flat growth with a slight incline. Vocabulary increased at an average rate of 9.74 words over the course of the study with a total of 0-56 words at the end of the two years. Cluster 2, with eight participants, was characterized by a slow incline with a noticeable change between 12 and 24 months. For this cluster, vocabulary increased at an average rate of 200.25 words over the two years and totaled between 139 and 314 words at the end of the study. Cluster 3, with seven participants, produced few words at the start of the study but exhibited a high, steady increase in vocabulary development. Vocabulary increased at an average rate of 453.43 words and totaled 399-620 words after the two years. Finally, Cluster 4, with five participants, was characterized by a steep rate of vocabulary growth. Vocabulary increased at a rate of 638 words and totaled 646-697 words at the end of the study.

After establishing these profiles, the authors analyzed the parents' responses to the initial *MCDI* subtests in order to examine potential predictors of these four clusters of children. The study found that verbal imitation was significantly different at the start of the study between the clusters, with Cluster 1 having significantly lower verbal imitation scores than any of the other clusters. Additionally, using objects to pretend was significantly lower in Cluster 1 as compared to Cluster 2 and Cluster 4. Initiation of joint

attention was also found to be significantly higher in Cluster 4 than in Clusters 1 and 2. From these results, the authors speculated that verbal imitation, using objects to pretend, and initiation of joint attention were good predictors of expressive vocabulary development. Behaviors that were not good predictors of expressive vocabulary development included gestures for games/routines, actions with objects, pretending to be a parent, and imitating adult actions.

The reviewed literature reveals that intentionality and its communicative functions are important in language development and that these skills are often deficient in children with autism. Nevertheless, there are differing opinions about the role of intentionality in the development of vocabulary and grammar in these children. It appears that certain types of intentional behaviors (i.e., joint attention) may be more important than others (i.e. behavior regulation) for language learning. Additionally, the relationship between intentionality, vocabulary, and grammar may vary across children and may be dependent on the developmental growth trajectory of each child.

Given the literature review, the goal of the current work was to examine the developmental progression of intentionality, vocabulary, and grammar in one child who presented with a diagnosis of autism. These skills were also analyzed in order to evaluate the relationship among these variables across time. Time was operationally defined as a fourteen month period with seven testing sessions. For each testing session, the questions asked were: (1) Did the child display intentional behaviors? If yes, were they verbal or nonverbal in nature, and were they produced for the purpose of behavior regulation or social engagement? (2) Did the child produce words and grammar? If yes, what was his level of vocabulary and grammar? Across testing sessions, two additional questions were

asked. These were: (1) Did the amount or type of the child's intentionality, vocabulary, and grammar behaviors change over time? (2) Did the child's use of intentional acts relate to his development of vocabulary and grammar?

Methods

Participant

The participant, a male aged 2;9 years, was selected for the study and given the alias Michael after obtaining parental consent (see Appendix A). He was the youngest child of two and lived with his mother and father in a middle-class home. The highest levels of education completed by Michael's mother and father in years were both 16. Michael was diagnosed with autism at two years of age by a pediatric neurologist. During the project, Michael received Applied Verbal Behavior (VB) Therapy, which is a style of Applied Behavior Analysis (ABA), four to eight hours a week. Additionally, he received speech therapy half an hour a week and Relationship Development Intervention (RDI) half an hour a week. Prior to the start of the project, Michael had been in an ABA program for 11 months and speech therapy for 18 months.

ABA/VB is a behavior-modification program based on B.F. Skinner's (1957) analysis of Verbal Behavior to elicit and reinforce speech. It is used with many children who present with a condition on the autism spectrum under the assumption that appropriate behavior in speech, life skills, and academics can be taught using reinforcement to influence children's behaviors. According to Skinner (1957) behaviors are more apt to be repeated when they are rewarded, and behaviors are reduced when they are not rewarded.

RDI is a parent-based intervention program for individuals with a diagnosis of autism. Steven Gutstein developed this program with an emphasis on experience sharing and relational development. One of the main goals in this intervention is to teach the motivational factors and skills for sharing experiences with others in one's environment (Gutstein & Sheely, 2002).

The *Autism Diagnostic Observation Schedule General Test* (*ADOS*; Lord, Rutter, DiLavore, & Risi, 1999) was administered to Michael when he was 1;9, one year prior to the beginning of this project's data collection. The test was administered by an educational specialist. The results were obtained from this administration to serve as a benchmark for where Michael was one year prior to the experiment. Michael's performance on the *ADOS* was consistent with his diagnosis of autism. The four areas examined on the *ADOS* are communication, social interaction, play, and repetitive/restricted behaviors. Although the *ADOS* is not typically used as a stand-alone diagnostic tool, the first two sections provide cut-off scores to help clinicians decide if a child's behaviors are consistent or inconsistent with a diagnosis of autism. High scores are consistent with autism and low scores are not. The education specialist reported on the first, second, and fourth sections of the *ADOS*. The results are summarized below (see Appendix B for the written evaluation).

Communication Section. Within this subset, Michael scored at the autism cut-off level. He was described as pre-verbal producing a variety of sounds and a few single-word imitations. One time during the session, he demonstrated the communicative function of requesting by handing a toy to the examiner in an attempt to activate it. He

did not use pointing or other gestural behaviors and produced minimal facial expressions. Additionally, he failed to respond to his name when it was called.

Reciprocal Social Interaction Section. Michael fell above the autism cut-off level in this category. Michael displayed some eye contact but it was not always consistent or coordinated with nonverbal behaviors. Within his play, he primarily focused on the actions of the toy rather than the interaction with the examiner. Michael was observed to play with several toys in a functional manner, yet he engaged in some repetitive behaviors with other toys. The social aspect of sharing an experience with another person was also lacking in his play. Michael did demonstrate partial joint attention because occasionally he was able to follow the examiner's point.

Stereotyped Behaviors and Restricted Interests Section. This section does not use cut-off scores but provides descriptions of the child's behaviors. Michael displayed numerous repetitive behaviors and exhibited difficulty transitioning from one activity to another especially when the former activity was highly desired. He was more interested in the toys when he explored them on his own rather than when he was prompted by the examiner. Michael did not demonstrate any unusual repetitive hand or body movements.

The *ADOS* was re-administered to Michael, aged 2;9, on July 14, 2006 by the researcher in his home. The evaluation was completed in order to obtain a point of reference of his social/pragmatic communication skills at the start of the current project. He was not accompanied by a guardian during the administration because he knew the researcher and was comfortable and responsive to her. The examiner had no previous experience with the *ADOS* and received training solely by watching three video recorded

training sessions prior to the administration. The results are presented below (see Appendix C for the written evaluation).

Communication Section. Michael scored above the autism cut-off level in this category. His overall language use during the assessment included 1-4 word utterances many of which were labels of objects and a few repetitive utterances. From time to time, he directed vocalizations to the examiner which were primarily protests or requests for objects or actions. Most of the time, Michael demonstrated appropriate intonation patterns for a child his age as well as appropriate speech volume and rate. It was noted, however, that occasionally when he wanted to label a known object, he used a stereotyped utterance with the same peculiar intonation each time (i.e. "Oh, what is that? That's a x."). With the exception of one context, Michael used either vocalization or eye contact to indicate communicative intent. Michael pointed occasionally but did not coordinate gaze shifting between object and person. Additionally, he failed to produce spontaneous gestures.

Reciprocal Social Interaction Section. Michael scored above the autism cut-off level on this section as well. He was observed to demonstrate some smiles and laughter which were directed to a toy or activity and rarely to the examiner. Moreover, he displayed occasional appropriate pleasure in the examiner's actions with the bubbles and jack-in-the-box. He did not, however, respond consistently to the facial expressions demonstrated by the examiner. Michael displayed joint attention during multiple tasks using eye contact alone and demonstrated the ability to redirect his focus of attention by following a shift in the examiner's gaze alone. He responded to the examiner by making

eye contact when the examiner called his name. Apart from the snack context, he used poorly modulated eye contact to initiate, terminate, or regulate social interaction.

Stereotypes Behaviors and Restricted Interests. Michael did not demonstrate any unusual hand or finger mannerisms or any self-injurious behavior during the session, but he did display an unusually strong sensory response of anxiety to the balloon and pop-up toy when they were activated. He frequently looked back to the object that caused the anxiety while maintaining a concerned visage. He also displayed a fixation on the music box, which interfered slightly with his ability to complete the *ADOS*. Throughout the *ADOS*, Michael often fidgeted and moved about, but this was not an unusual amount given his age and the length of the assessment.

Table 4 lists summary scores of the 2005 and 2006 administrations of the *ADOS*. Upon comparing the results of the two testing periods, Michael's total communication and social interaction score did not change. However there were some small differences found in the subsections within communication scores and social interaction scores. Namely, in the 2006 *ADOS* administration, Michael produced more pointing gestures and more idiosyncratic use of words. Within the realm of social interaction during the 2006 administration, he produced fewer facial expressions directed toward the examiner but produced more initiations of joint attention and more responses to joint attention. Additionally, he engaged in more stereotyped behaviors in the 2006 results.

Between the two *ADOS* administrations, Michael demonstrated a relative strength in the area of pragmatic/social use of language including his use of vocalizations directed towards others, joint attention, as well as his use of words, pointing, and handing an object to someone for the purpose of requesting. However, he exhibited some difficulties

in his pragmatic/social use of language for the purpose of social communication with others. Specifically, he demonstrated unusual eye contact that, when produced, was rarely integrated with vocalizations or other behaviors. Also, he did not direct appropriate facial expressions to others or respond to them consistently. Additionally, he failed to use spontaneous gestures such as showing objects to another person with communicative intent. Because the results of the *ADOS* are based on the subjective appraisal of the examiner, the reader must be cautioned that the above comparisons are not based on frequency counts of behaviors.

Materials and Procedures

Data were collected seven times (every other month) over the course of 14 months. At each testing period, Michael's use of intentionality, vocabulary, and grammar were examined using two tools. One involved a language sample, and the other was the *MCDI*. All of the materials obtained during the project were kept in a confidential location, and the participant was given an alias.

Language Sample. The language sample sessions occurred within Michael's home. During each sample collection, there were four separate contexts: a garage/carwash scene, a picnic, a baby with related items, and books with flash cards. Only one context was in Michael's view at any moment in order to decrease potential distractions of having numerous contexts in which to engage. The language samples lasted on average 14:10 minutes with a range of 12:48 to 15:59. Each session was audio and video recorded. The samples were transcribed by the researcher using the *Systematic Analysis of Language Transcripts 8.0* (*SALT*; Miller & Chapman, 1992). Each audiotape was reviewed two times.

Table 4

2005 and 2006 *ADOS* results.

Sections	July 2005	July 2006
Communication total	4	5
Frequency of vocalization directed to others	1	1
Stereotyped/Idiosyncratic use of words or phrases	0	1
Use of other's body to communicate	0	0
Pointing	2	1
Gestures	1	2
Reciprocal social interaction total	9	8
Unusual eye contact	2	2
Facial expressions directed to others	1	2
Shared enjoyment in interaction	1	1
Showing	2	2
Spontaneous initiation of joint attention	1	0
Response to joint attention	1	0
Quality of social overtures	1	1
Communication and social interaction total	13	13
Stereotyped behaviors and restricted interests total	3	4
Unusual sensory interest in play material/person	1	1
Hand and finger and other complex mannerisms	0	0
Unusually repetitive interests or stereotyped behaviors	2	3

One context, the picnic scene, was used to measure Michael's intentional abilities, while the entire language sample was used to measure his vocabulary and grammar abilities. Three dependent measures of intentionality were examined, total number of

intentional behaviors, mode of intentional abilities (nonverbal or verbal), and communicative function of intentional abilities (behavior regulation or social engagement). To identify intentionality, the researcher only looked at Michael's initiations and not responses because initiatory intentions have been shown to better reflect the child's underlying communicative ability (Rollins & Snow, 1998). The coding of intentional acts was facilitated by seven behavioral codes from Wetherby and Prizant (1989) which are as follows: (1) alternating eye gaze between goal and listener; (2) persistent signaling until the goal is accomplished or failure indicated; (3) changing the signal quality until the goal has been met; (4) ritualizing or conventionalizing the form of signal within specific communicative contexts; (5) awaiting a response from the listener; (6) terminating the signal when the goal is met; and (7) displaying satisfaction when the goal is attained or dissatisfaction when it is not.

Once Michael's intentional behaviors were identified, they were further classified as nonverbal or verbal behaviors. Criteria used for these two categories were as follows: (1) Nonverbal Intentional Behaviors: These behaviors included gestures and vocalizations, which are transcribable vowel or vowel plus consonant-like sounds. If the gesture was produced either simultaneously or overlapping in time with a verbalization, the gesture was coded separate from the verbal behavior. (e.g., reaching for toy). (2) Verbal Intentional Behaviors: Recognizable words. Taken from complete and intelligible utterances. (e.g., ball, chicken).

Finally, Michael's intentional behaviors were further classified as to their communicative function. Specifically, all behaviors were categorized as one of two types, behavior regulation or social engagement. Criteria for these two categories were:

(1) Behavior Regulation Functions: Acts that are used to regulate another's behavior for the purpose of obtaining or restricting a goal. These include acts to request an object, to request an action, or to protest.

(2) Social Engagement Functions: Acts that are used to direct another's attention for the purpose of sharing the focus of an entity or event, or acts that serve to attract and maintain another's attention to oneself for affiliative purposes. These include acts to comment in order to direct another's attention to an object or event, to request information, to clarify a previous utterance, to request a social routine, to show off, to greet another person, to call out in order to gain the attention of another, to acknowledge a person's previous statement or action, and to request permission.

Six dependent measures were analyzed from each language sample to examine Michael's vocabulary and grammar abilities. The measures included:

(1) Total Number of Utterances: The total number of utterances spoken by the child from the moment he entered the room until the video recorder was turned off. These included all vocalizations and verbalizations.

(2) Complete and Intelligible Utterances: This number excluded any utterances that were unintelligible, abandoned, or interrupted.

(3) Intelligibility Percentage: This measure was determined by dividing the number of complete and intelligible utterances by the number of complete verbal utterances.

(4) Mean Length of Utterance: This was calculated in morphemes from the complete and intelligible utterances.

(5) Number of Word Types: This was the total number of different words Michael produced within his complete and intelligible utterances.

(6) Number of Word Tokens: This was the total number of words produced in the complete and intelligible utterances.

MCDI. Given that a brief play session with a child provides a limited sample of a child's communication skills, the Words and Sentences version of the *MCDI* (Fenson et al., 1993) was also completed once every other month by Michael's mother. At each testing session, she was given one week to complete the inventory, at which time the researcher scored her responses according to the *MCDI* manual.

The *MCDI*/*Words and Sentences* contains two main sections and seven subsections. The measures that pertain most closely to the current study are number of words produced, sentence complexity, and mean length of utterance. The first measure that the researcher analyzed included a 680-word vocabulary production checklist, which is organized into 22 semantically-related categories. The second measure is designed to assess morphological and syntactic development by using a forced-choice recognition format. The parent is asked to choose which member of the 37 sentence pairs best reflects the child's present speech level, of which the second member is the more advanced form (i.e., Baby crying vs. Baby is crying). Lastly, with the third measure, the parent is asked to provide the three longest sentences the child has recently said. The normative data of the *MCDI/Words and Sentences* is based on 1,789 children between the ages of eight and 30 months. For the purpose of this study, the researcher examined raw scores among the seven testing sessions instead of using the norms because Michael's chronological age (33 months) at the start of the project exceeded the upper limits of the inventory.

Reliability

Reliability was examined in two ways. First, ten one-minute excerpts from the language samples were randomly selected and transcribed by an independent researcher. This reflected 12% of the data. When this transcript was compared to the original, 171 morphemes were in agreement out of 229 (75%). Although this rate of agreement was lower than the desired 90%, when the MLU's were calculated from both samples, they were identical (MLU=3.02). Given this, the MLU values calculated in this project were considered reliable.

Secondly, fourteen one-minute excerpts were randomly selected from the picnic scene. These were coded for communicative mode and function by the same independent researcher. This reflected 44% of the data. During these fourteen minutes, there were 90 behaviors exhibited by the child, and for each of these, three sets of codes were possible (intentional vs. non-intentional; verbal vs. nonverbal; social engagement vs. behavior regulation). This resulted in 270 opportunities for the coders to agree or disagree. Of these 270 opportunities, 192 codes (71%) were in agreement. This rate of agreement, although low, is consistent with other studies that have examined the pragmatic skills of children with autism (e.g., Stiegler, 2007).

Results

The language samples and *MCDI* were used to examine Michael's intentional abilities, vocabulary, and grammar development. These data are presented in Tables 5 through 7. The data in each table will be discussed separately. However, in general, the data show an increase in scores across most measures with the exception of the sixth testing session. One week prior to the sixth testing session, the participant began toilet

training which his mother described as a traumatic experience for him. This added environmental distraction will be noted when analyzing the sixth data point.

Table 5 provides an account of Michael's use of intentional communication. The table displays the minutes of the selected excerpt, the number of utterances within the excerpt, the rate of utterances per minute, the total number of intentional behaviors (both nonverbal and verbal), and the rate of intentional behaviors per minute. Additionally, the table presents the raw numbers and percentages of intentional behaviors that were nonverbal or verbal in nature and that served behavior regulation or social engagement functions. Recall that for these analyses only the picnic scene was analyzed.

As can be seen, the first three measures, namely minutes of analyzed excerpt, total number of utterances, and rate of utterances per minute, serve as background information to give the reader an idea of the amount of talking that occurred within the selected excerpts. Across the data points, there was an increase in the total number of intentional behaviors produced as well as the rate of intentional behaviors per minute (with the exception of the sixth data point). Additionally, there was a shift from nonverbal to verbal behaviors across the data points. This can be seen by comparing the percentages of nonverbal and verbal behaviors. Nonverbal behaviors decreased from 67% to 0% while verbal behaviors increased from 33% to 100%. Michael displayed high percentages of social engagement acts (67%) at the start of the study and moved to even higher percentages (100%) throughout the study while his use of behavioral regulation acts decreased (from 33% to 0%).

Table 5

Measures of intentionality and communicative function from samples.

	1	2	3	4	5	6	7
Minutes of analyzed excerpt	3:06	4:26	4:16	4:21	6:18	4:36	4:59
Total number of utterances	16	20	24	22	41	21	27
Rate of utterances per minute	5.23	4.69	5.77	5.23	6.63	4.82	5.88
Total no. of intentional behaviors	3	15	12	19	36	14	22
Rate of intentional behaviors per min.	.98	3.52	2.88	4.51	5.83	3.21	4.79
Intentional behaviors by mode							
Number of nonverbal behaviors	2	2	3	10	4	4	0
% of nonverbal behaviors	67	13	25	53	11	29	0
Number of verbal behaviors	1	13	9	9	32	10	22
% of verbal behaviors	33	87	75	47	89	71	100
Intentional behaviors by function							
Number of behavior regulation	1	2	0	2	1	0	0
% of behavior regulation	33	13	0	11	3	0	0
Number of social engagement	2	13	12	17	35	14	22
% of social engagement	67	87	100	89	97	100	100

Table 6 presents Michael's vocabulary and grammar behaviors that were measured in the language samples. Recall that the entire language sample was analyzed for these measures. The first four measures, namely total utterances, complete and intelligible utterances, rate of utterances per minute, and intelligibility percentage, serve as background information to give the reader an idea of how much talking was occurring, as well as how intelligible Michael was during the sample. For all four of these measures, there was a general increase across the testing sessions (with the exception of the lower numbers in data point six).

The final three measures, namely mean length of utterance, number of word types, and number of word tokens, are the most relevant to the current study. As seen from the table, there is a general increase throughout these measures with the most dramatic change seen in the fifth data point. Michael's sixth data point does show an increase from the first data point, which would be expected; however, these numbers are lower than the fifth data point which could be accounted for by the environmental distraction in which he was undergoing at that time.

The bottom three rows of Table 6 present the raw numbers obtained from three subsections of the *MCDI*. Recall that the *MCDI* is a checklist that is filled out by the caregiver. As is seen from the table, there is a general progression throughout the data points for these measures. Upon comparison of the number of word types in the language samples and the number of words produced according to the *MCDI*, there is a slight difference in the sixth data point. The number of word types from the language sample decreased while the number of words from the *MCDI* slightly increased. The lower number in the language sample may also be accounted for by the toilet training experience. This type of decrease would not be expected on the *MCDI* because the caregiver's word counts are cumulative in nature.

Table 6

Measures of vocabulary and grammar development from samples and *MCDI*.

	1	2	3	4	5	6	7
Language samples							
Length of sample	13:14	12:48	14:03	14:31	14:31	14:04	15:59

Total utterances	80	84	91	79	124	68	109
Complete and intelligible utts.	49	61	75	57	96	57	95
Utterance rate per minute	3.73	4.89	5.35	3.98	6.71	4.06	6.09
Intelligibility percentage	79	81	90	89	94	93	98
Mean length of utterance	2.51	2.70	3.81	2.89	4.68	3.30	3.99
Number of word types	65	66	92	58	131	85	140
Number of word tokens	121	143	256	158	402	166	348
MCDI							
Number of words produced	273	474	432	427	482	495	551
Sentence complexity	5	26	28	26	31	31	37
Mean length of utterance	3.67	6.33	4.00	5.67	5.67	12.67	9.67

Michael's MLU values from the two tools can also be compared. Unlike the language sample, which averages all of the utterances produced during the entire sample, the *MCDI* is based on the three longest utterances which the caregiver can recall. Given this, the MLU of the sixth data point of the *MCDI* was unusually high, and it is inconsistent with the sentence complexity score of the *MCDI* and with the MLU of the sixth data point of the language sample. Table 7 displays the utterances that Michael's caregiver recalled on each of the seven *MCDI*s. Overall, he produced four interrogatives and 14 declarative statements. As seen from the table, much of the content of his utterances did not match the content available in the language sample. His utterances in the third data point revolved around wanting highly motivating items which were not present in the room during the elicitation of the language samples. Three of Michael's utterances also related to school or going to school, and a school setting was not one of the four settings provided in the language sample. Also, in the sixth data point, two of the three utterances focused on toilet training.

Relationship Between Measures Across Sessions

Spearman correlations were computed to examine the relationship between Michael's intentionality, vocabulary, and grammar abilities across the seven testing sessions. As shown in Table 8, there was a high positive correlation between Michael's rate of intentional behaviors per minute and his use of verbal behaviors. Thus, as his rate of intentionality increased, so did his number of verbal behaviors. The table also documents a high positive correlation between Michael's intentional behaviors per minute and his use of social engagement acts. This shows that as he increased his production of intentional behaviors, he was using acts of social engagement rather than acts of behavior regulation. Finally, there was a high positive correlation between Michael's use of verbal behaviors and acts of social engagement. This shows that the verbal behaviors he was producing became more closely tied with social engagement purposes. Behaviors that were not related to each other included: intentional behaviors per minute and nonverbal behaviors; intentional behaviors per minute and acts for behavior regulation; nonverbal

Table 7

Three longest sentences recalled on each of the *MCDI*s.

Data collection	Sentences
1	I want letter book. Wait for me. Mickey, where are you?
2	Here's the balloon mama. Come play with me. Do you want to play with the beads X?
3	Where's my leapster? I want my leapster. I want my juice.

4	You have a big lunchbox. I need my leapster please. Let's go get X from school.
5	Mama, I need something. We're going to get X from school. What is that sound?
6	I need to go in the bathroom and wash my hands. I need to poopoo on the potty so I can play with my letters. You are beautiful like a princess and I am a king.
7	You can eat your lunch before I play on the computer We're going to get X from her camp. I can play on the computer after bathtime.

and verbal behaviors; nonverbal behaviors and acts for behavior regulation; nonverbal behaviors and acts for social engagement; verbal behaviors and acts for behavior regulation; and acts for behavior regulation and social engagement. Not only did these correlations not reach statistical significance, but they were also low in magnitude.

Table 8

Correlational data of five measures of intentionality.

	Nonverbal behaviors	Verbal behaviors	Behavior regulatory acts	Social engagement acts
Intentional behaviors per minute	.164	.847*	.170	.964**
Nonverbal behaviors	-	-.110	.260	.273
Verbal behaviors		-	-.086	.811*
Behavior regulatory acts			-	.000

**p < .01 *p < .05

As seen in Table 9, the number of Michael's word types and word tokens within the language samples also showed a positive correlation to each other. This illustrates that Michael was not just repeating himself throughout the language sample but rather was using a wide variety of words. His word types and word tokens were also positively correlated to his MLU values. Thus, as his number of total and different words increased, so did his MLU. Word types and tokens were also positively correlated with his *MCDI* vocabulary and sentence complexity scores. These correlations show that as Michael expressed more language, the complexity of his language also increased.

For the *MCDI*, Michael's vocabulary counts also were positively correlated with his MLU and sentence complexity scores. This finding indicates that as Michael's vocabulary repertoire increased, so did the complexity of his utterances. Another interesting point in the data is the positive correlation between the MLU of the language sample and the sentence complexity score of the *MCDI*. This finding suggests that both tools were similar in measuring the complexity of Michael's expressive language. The validity of these tools is further confirmed by the positive correlation between Michael's word type counts from the language sample and his *MCDI* vocabulary counts.

Table 10 shows high positive correlations between Michael's use of intentional verbal behaviors and MLU from the language samples and his vocabulary and sentence complexity scores on the *MCDI*, with the correlation between intentional verbal behaviors and *MCDI* vocabulary reaching statistical significance. Given that all of these correlations were above .70 in magnitude, one can argue that as Michael increased his use of intentional verbal behaviors, his vocabulary and grammar skills also increased. Finally, Table 10 shows that the sentence complexity of the *MCDI* was positively correlated with

Table 9

Correlational data of six language measures.

	Language samples		*MCDI*		
	Tokens	MLU	Vocabulary	Sentence complexity	MLU
Language sample					
Types	.857*	.857*	.786*	.873*	.342
Tokens	-	1.00**	.679	.873*	.288
MLU		-	.679	.873*	.288
MCDI					
Vocabulary			-	.927**	.847*
Sentence complexity				-	.661

**p < .01 *p < .05

the number of acts for social engagement but negatively correlated with the number of acts for behavior regulation. These positive and negative correlations are illustrated in Figure 2 and 3. As can be seen in these figures, as Michael decreased his use of acts for behavior regulation and increased his use of acts for social engagement, his sentence complexity scores on the *MCDI* increased.

Figure 2

Correlational data between *MCDI* sentence complexity and behavior regulation.

Figure 3

Correlational data between *MCDI* sentence complexity and social engagement.

Table 10

Correlational data of measures of language and measures of intentionality.

	Intentional behaviors per minute	Nonverbal behaviors	Verbal behaviors	Behavior regulatory acts	Social engagement acts
Language sample					
MLU	.679	.109	.721	-.510	.750
MCDI					
Sentence complexity	.600	-.083	.743	-.664	.709
Vocabulary	.571	-.218	.811**	-.529	.643

**p < .01 *p < .05

Discussion

The purpose of this study was to examine the intentional, vocabulary, and grammar skills of one child with autism. The author also studied how these skills develop in relation to each other over a 14-month period. Four questions guided the study. The first question focused on the rate of Michael's intentional behaviors as well as the means and communicative functions of those behaviors. This study found that Michael produced intentional behaviors in all of the testing sessions with rates of use ranging from three to 36 intentional behaviors across sessions. Furthermore, over the 14-month period his use of nonverbal means decreased (from 67% to 0%) while his verbal means increased (from 33% to 100%). In regards to the communicative functions of his behaviors, the study found that Michael displayed one behavior regulation act in four of the seven testing sessions and at least one social engagement act in each testing session. His use of acts for behavior regulation decreased from 33% to 0% over the 14 months and his use of acts for social engagement increased from 67% to 100%.

The second question focused on Michael's vocabulary and grammar development by observing his MLU, word types, and word tokens. His MLU at the start of the project was 2.51 and it increased to 3.99 by the seventh testing session. Over the 14 months, Michael's number of word types also increased from 65 to 140, and his number of word tokens increased from 121 to 348.

The third question asked whether Michael's behaviors, in regards to intentionality, vocabulary, and grammar, changed over time. In general, all measures increased over time, with the exception of the sixth testing session.

Finally, question four focused on the relation between Michael's use of behavior regulation and social engagement acts and his development of vocabulary and grammar. Results showed that there was a moderate negative correlation between acts for behavior regulation and the *MCDI* vocabulary counts, as well as a moderate to high negative correlation between acts for behavior regulation and *MCDI* sentence complexity scores. On the other hand, there was a moderate to high positive correlation between acts for social engagement and the *MCDI* vocabulary counts and sentence complexity scores. Thus, the data showed that the direction of change in Michael's social engagement acts and his vocabulary and grammar abilities was the same.

Michael's findings can be compared to the results of some of the studies in the literature review. For example, Michael's decrease in use of nonverbal means with an increase in verbal means was similar to the children who were typically developing in the study conducted by Wetherby et al. (1988). Also in that study, the rate of intentional behaviors per minute of the children was 5.07 at the multiword stage of development. It must be noted that in that study, the multiword stage was characterized as a lexicon of 67.47 (32.70), and an MLU of 2.20 (.64). Michael's behaviors matched those of these typically developing children's rates of intentional abilities by the fifth testing session when he produced 5.83 intentional behaviors per minute. However, by the fifth testing session, Michael was older and further along in his vocabulary and grammar development than the children in Wetherby et al.'s (1988) study (see Table 11).

In another study conducted by Crais et al. (2004), behavior regulation acts were documented within a child's repertoire of skills as early as 5.75 months, and joint attention acts were documented within a child's repertoire of skills as early as 7.17

Table 11

Comparison of Michael to children in study conducted by Wetherby et al. (1988).

	Wetherby et al. (1988)	Michael
Age	1;11 to 2;3	3;5
Intentional behaviors per minute	5.07	5.83
Number of word types	67.47	482
MLU	2.20	5.67

months. Michael displayed one behavior regulation act in four of the seven sessions and at least one social engagement act in each testing session, thus showing that he had these skills within his repertoire during the study period.

When comparing Michael's results to the clusters created by Smith et al. (2007), Michael looked most like Cluster 3 whose members displayed a high, steady increase in vocabulary development and who produced a total of 399-620 words after a two year period.

Michael's data were also consistent with Rollins' (1999) speculation that an increase in conventional means (gestures or words) with an increase in joint attention skills is associated with an increase in vocabulary acquisition. For example, his use of behavior regulatory acts comprised less than 40% of his intentional behaviors, and they consistently decreased throughout the testing sessions (33% to 0%). In contrast, Michael's use of social engagement acts comprised more than 40% of his intentional behaviors, and they all increased with time (67% to 100%). He also increased his total number of intentional behaviors throughout the study (3 to 22). These results were found at the same time that his vocabulary was increasing from 273 to 551 according to the *MCDI* vocabulary counts.

To further compare Michael's development to the literature, the author analyzed Michael's total number of utterances and his number of intentional utterances in the selected excerpts (see Table 12). As can be seen in the first testing session, Michael produced 16 utterances, but only one (6%) of those was intentional. Although Michael's percent of utterances that were intentional increased throughout the study, in every session he also produced some utterances without intentionality. These data show that children with autism can produce words and grammar that are void of intention and communicative function. This finding is consistent with Rollins (1999). Recall that Rollins (1999) noted that the ability to utter words, which many children with autism can do, may not always be associated with social acts.

Table 12

Comparison of total utterances to intentional utterances from the selected excerpt.

	1	2	3	4	5	6	7
Total number of utterances	16	20	24	22	41	21	27
Number of intentional utterances	1	13	9	9	32	10	22
Percent of intentional utterances	6	65	40	41	78	48	81

Limitations

There were five main limitations to this study. The first limitation was that data were collected on only one child. Michael's behavior may not have been typical of all children with autism, so generalizations are difficult to make. The second limitation was that only two tools (language sample and *MCDI*) were used to examine Michael's behaviors. By using only two tools, the entire developmental profile of Michael may not have been captured. A third weakness involved the sampling context. Data were collected

for only 10 minutes every other month in only one setting, structured play. Moreover, all play sessions were elicited in the same room, with the same toys, and with the same examiner. This could have influenced the intentional behaviors, vocabulary, and grammar that were elicited in this study. A fourth limitation was that the behaviors for intentionality were only examined in one portion of the language sample. Thus, the data are reflective of only a small selected part of Michael's behaviors. Finally, a fifth weakness, and perhaps the most limiting, is the very nature of a correlational design. The results can only be discussed in terms of relationships; cause and effect conclusions cannot be made. Therefore, it is unknown whether an increase in acts of social engagement causes an increase in vocabulary and grammar, vice versa, or if there is a third variable causing both.

Future directions for research include using a larger sample of children with differing severity levels of autism. Observing children with diagnoses across the autism spectrum may provide a more comprehensive profile of autism. Increasing the number of sampling contexts and types of tools used to measure a child's development of intentionality, vocabulary, and grammar could also improve the quality of the analysis. Future studies could also increase the portion of behaviors analyzed within a child's day in order to obtain a more comprehensive evaluation of a child's behaviors.

Conclusions

Michael, a young child who presented with a diagnosis of autism, expressed intentionality through nonverbal and verbal means for behavior regulation and social engagement purposes. These behaviors changed over the course of the study as Michael expressed more verbal behaviors for more social engagement purposes and as a greater

percentage of his utterances became intentional. In addition, Michael produced words and grammar in every testing session, and his skills in these areas also increased over the course of the study. Furthermore, Michael's vocabulary and grammar development were positively correlated with his acts of social engagement. This suggests that intentionality, and more specifically social engagement, was positively related to Michael’s development of language.

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Appendix A

Parental Consent Form

Study Title: A Case Study of the Social and Language Skills of a Child With Autism

Performance Site: The child's house

Contact: Heidi Huckabee
225-454-4495
hhucka1@lsu.edu

Janna B. Oetting, Ph.D.
225-578-3932
cdjanna@lsu.edu

Purpose of the Study: This study is intended to help us learn more about the profile and development of language and social interaction skills of children with autism.

Subjects:

A. Inclusion Criteria

1. 2 years of age
2. Has a history of a communication delay
3. Has a case history that includes a diagnostic impression that is consistent with autism

B. Exclusion Criteria

1. Standardized scores within normal range in language
2. Presence of hearing or visual impairment

C. Maximum number of subjects: 1

Study Procedures:

Your child will be observed in your house for 10 minutes six times over a course of one year (once every other month). During each 10-minute observation, your child will play with Heidi Huckabee, the co-investigator of the project. Play sessions will consist of toys, books, and art supplies from the LSU clinic as well as your house. The sessions will be video and audio recorded to obtain your child's social and language skills.

The *Autism Diagnostic Observational Schedule* (*ADOS*) will be administered to your child at the beginning and at the conclusion of the project. Heidi Huckabee will administer this diagnostic tool to your child at your house.

As the mother of the child, you will be asked to complete the *MacArthur Communicative Development Inventory* during the months when we collect the play samples. You will be given one week to complete the inventory.

Benefits:

This research is not intended to benefit your child directly. It may benefit future children in society in general by helping us to understand more about the social and language skills of children with autism. The data obtained will provide a detailed account of your child's social and language development over the course of one year.

Risks/Discomforts:

There are no known significant risks associated with your child's participation in this study.

Measures taken to reduce risks:

To maintain confidentiality, all data will involve the child's alias rather than his actual name. The parent consent form and participant's name will be kept in a locked cabinet in Dr. Oetting's research lab.

Right to Refuse:

Participation in the study is voluntary and you may change your mind and withdraw from the study at any time without penalty or loss of any benefit to which you may otherwise be entitled.

Privacy:

The study is confidential and your child's identity will remain confidential. Your child will be assigned an alias name, and only this name will appear on data sheets. Your child's actual name will be available only to Janna Oetting and Heidi Huckabee. Your child's identity will never be revealed in a research report or presentation. Data will be kept confidential unless release is legally compelled.

Withdrawal:

You may choose for your child not to participate or you may choose to withdraw from the study at any time with no penalties at the present time or in the future. In order to terminate your child's participation simply express your decision to Heidi Huckabee, the co-investigator, at any point during the course of the project.

Removal:

We reserve the right to discontinue your child's participation in the study without your consent if you share with us any information indicating that your child does not meet the inclusive/exclusive criteria for the research project.

Child Assent:

Child assent will be secured by asking the child each session if he wants to play. If the child indicates that he does not want to play or at any time during a session he indicates that he wants to stop playing, we will discontinue the play session. Negative indications from the child will include nonlinguistic vocalizations, like crying, linguistic statements, and/or nonlinguistic actions involving gestures or facial grimaces to indicate disproval or discomfort.

Signatures:

The study has been discussed with me and all my questions have been answered. I may direct additional questions regarding study specifics to the investigators. If I have questions about subjects' rights or other concerns, I can contact Robert C. Mathews, Chairman, LSU Institutional Review Board, (225)578-8692. I agree to participate in the study described above and acknowledge the researchers' obligation to provide me with a copy of this consent form if signed by me. I also agree to let my child participate in the study and that all data will be collected at my home.

_____ _____

Parent Signature Date

Parent's Name:

Child's name:

Appendix B

2005 *ADOS* Written Evaluation

Early Steps Evaluation: 7-22-05
Child: Michael
DOB: 10-21-03
Evaluator: Jane Bergstresser

Description of the Evaluation:
The Autism Diagnostic Observation Schedule- General (ADOS-G) is an evaluative tool which determines whether or not an individual falls within the Spectrum of Autism. The tool focuses on the following three areas of impairment characteristic of the spectrum; Communication, Social Interaction and Repetitive Ritualistic Behaviors. This tool is considered one component of a complete assessment battery which also includes a parent and teacher interview, developmental history, academic or developmental testing, and other background information.

Results of the ADOS-G correlate to the criteria of the DSMIV (299.00.). The ADOS-G can also be considered for an educational evaluation and may be helpful in planning goals and objectives for intervention.

Results:
Michael fell within the range of Autism on the ADOS-G. He demonstrated difficulties in all three areas observed, communication, social interaction, and repetitive restricted behaviors.

Structured Observation:
Michael has a social smile and an easy going manner. He appears to be a content and happy child. Michael was observed in his home with both parents and older sibling present. Michael easily transitioned into the play room with his mother present. He explored the toys the examiner had provided. He was observed to activate several toys and play with them in a functional manner (ex. activate busy box, jack in the box). He played with certain toys in a repetitive manner. For example he put the mechanical bunny on its side and activated the button repeatedly. He returned frequently to an empty bench to climb. Michael will move from one activity to another, exploring the details of the toys.

Communication:

Michael is primarily pre- verbal, however he has a variety of sounds and some single words in imitation (uh-oh, more, pop, Michael, yeah) (vowels sounds such as eh, ah, uh, oh, were noted.). Michael would hand the examiner an item to indicate a request for help or continuance of an activity. For example he gave the jack in the box to the examiner to turn the crank. Michael laughed and giggled at the actions of many of the toys. Michael used sign language for "more" to request a cookie. Michael did not respond to his name being called. No pointing or gesturing was noted. Michael had minimal facial expressions or gestures. Michael did not use an adults hand or body to communicate.

Social Interaction:

Michael had eye contact; however it was not always consistent and coordinated with non verbal behaviors such as gestures or facial expressions for communicative intent. Michael's interactions lack a quality of social reciprocity. He appears to enjoy interacting with toys and playing some games, however the primary focus is on the actions of the toy rather than the interaction with the examiner. Although Michael has many functional skills and good use of toys, he does not share his interests in these toys in a social manner. Michael did not show items of interest to the adults present. He followed a point and had partial joint attention.

Behaviors: restricted interests and stereotypical patterns of behavior.

Michael displayed many repetitive behaviors. He would explore objects in a repetitive manner and have difficulty transitioning away from the desired object or activity. He is active and moved about the room randomly exploring the test items. He preferred to explore the test items on his own rather than following the directions of an adult. He appears to seek sensory input. No repetitive hand and body movements were noted. Parents noted that Michael will repeatedly open and close doors. Michael appeared to be afraid of the balloon and the bubble toy at first and went to his mother for comfort.

It was a pleasure evaluating Michael and sharing with his family. Michael has tremendous potential and with appropriate teaching and support should function well in school and continue to be the sweet happy child we see today.

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Appendix C

2006 *ADOS* Written Evaluation

Michael's overall language use during the assessment included 2-4 word utterances with some occasional one-word utterances. Michael labeled most objects (ex: two cars, four blocks, singing pig) and also repeated a few utterances on several occasions (ex: no, I wanna blow bubbles, blow a balloon). He infrequently directed vocalizations to the examiner across various contexts but when he did they were primarily for the purpose of requesting (ex: more bubbles, pretzel, open). Additionally, for the majority of his interactions, Michael demonstrated appropriate intonation patterns for a child his age as well as appropriate speech volume and rate. It was noted, however, that occasionally when he wanted to label an object and knew what it was, he would say, "What is that? That's a x." This utterance was used in a stereotyped, repetitive way with the same peculiar intonation each time. He was also observed to say "no" while smiling. For example, when the examiner said, "I'm gonna tickle you," Michael replied "no" while smiling but without eye contact. Once the examiner took her hands away, he requested, "tickle." Thus, his expression of "no" was not accompanied by any other form of protest, and he even requested the action when the examiner stopped attempting to tickle him. Michael was also observed to demonstrate some smiles and laughter in response to animated toys and bubbles. When he smiled, it was directed to a toy or activity and rarely to the examiner. Michael did not respond consistently to the facial expressions demonstrated by the examiner.

Michael was observed to integrate eye contact with his verbal language during the snack portion of the assessment to request more pretzels and juice. Apart from the snack context, he used poorly modulated eye contact to initiate, terminate, or regulate social interaction. Additionally, with the exception of the snack context, Michael would use either vocalization or eye contact, never coordinating them, to indicate communicative intent. He was observed to hand an item to the examiner for the purpose of requesting and used words to request pretzels and the social routine of tickling. He did not show objects to the examiner during the assessment. Michael displayed occasional appropriate pleasure to the examiner's actions with the bubbles and jack-in-the-box. He did respond to the examiner or make eye contact when the examiner called his name.

Furthermore, Michael pointed (ex: to bubbles in the air) occasionally but did not coordinate gaze shifting between object and person. He also didn't produce any spontaneous descriptive, instrumental, emotional, or conventional gestures. Michael displayed joint attention during multiple tasks using eye contact alone. Additionally, he used the orientation of the examiner's eyes and face alone to look toward an object without the need of the examiner pointing. He used gaze shifting during breaks when the examiner was taking notes or setting up for the next situation. The majority of his play was spontaneous and in a conventional manner with a variety of toys. He displayed some pretend play with the doll (ex: put blanket around baby, and laid her down) but no spontaneous use of objects as a placeholder.

Michael did not demonstrate any unusual hand or finger mannerisms or any self-injurious behavior during the assessment. He engaged in occasional unusual strong sensory responses to the balloon and pop-up toy. For example, when the pop-up toy was

activated he immediately withdrew from the toy area and displayed a concerned look on his face. Even when the examiner moved the pop-up toy away and attempted to reengage him in a different toy, it took him a few minutes to come back to the area. Even then, he would frequently look back to the pop-up toy expressing a scared affect. He also displayed a stereotyped interest in the music box, which interfered slightly with his ability to complete the *ADOS*. This peculiar interest was displayed in his persistent desire to play the music on the box. He would press a button, wait for the entire song to play, and then immediately press another button. While the song played, he simply stared at the toy or shifted his eyes up and left but never made eye contact with the examiner. The examiner tried to engage him in a different toy on a few occasions; however, Michael insisted that he have the music box. Eventually, after hiding the object, the examiner was successful in redirecting his attention to other objects. Throughout the *ADOS*, Michael often fidgeted and moved about, but this was not an unusual amount given the child's age and length of the assessment.