

First-Word Characteristics of Individuals with Autism Disorder Based On Onset of Language

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Abstract:

Background/Purpose: Autistic Disorder (AD) is pervasive developmental disorder that markedly affects social development and communication. One of the earliest warning signs for AD is a delay in the onset of language. However, there is a substantial population of individuals diagnosed with AD who do develop language in the normal age range. It is important for clinicians to recognize that just because a child is developing language does not mean he will not develop AD. An additional warning sign for AD may be presented by the quality of the newly developing language skills if it is different from the quality associated with typically developing language. The goal of this study is to compare qualitative categories of the first words of individuals with AD without a language delay to the first words of individuals with autism who do have a language delay. If significant qualitative differences are found between the two groups, this study will provide information to clinicians that will improve the early detection of autism.

Methods: This study was a retrospective analyses of data collected from 103 (*91 Males, 12 Females; Onset of language range of 9 - 60 months; mean onset of language 24.16 months*) individuals with AD who participated in a family/genetic study at the Southwest Autism Research & Resource Center. All subjects had their diagnosis confirmed with the Autism Diagnostic Interview – Revised (ADI-R), an informant based, semi-structured interview that is considered the gold standard assessment for autism. According to the ADI-R, the onset of language is defined by a vocabulary of at least five words, at least one of which should be used spontaneously and communicatively on a daily basis. Subjects who do not meet this benchmark by 24 months are considered to have a language delay. Based on the aforementioned criteria, the sample was divided into two groups. Group 1 included subjects without a language delay (*n = 52, 46 Males, 6 Females; Onset of language range 9-24 months; mean onset of language 16.25*) and Group 2 included subjects with a language delay (*n = 51; 45 Males, 6 Females; Onset of Language Range – 26-60 months; Mean onset of language 36.33*). Words reported on the ADI-R were placed into word categories using the MacArthur Communicative Development Inventories and Adaptations into Other Languages Lexical

Development Norms Database (CDI). Frequencies within each category were compared between the groups with the chi square statistic.

Results: There were significant differences between the two populations. Subjects in Group 1 were more likely to develop words that were in the categories of *Animals*, *Body Parts* and *Small Household Items*. Subjects in Group 2 were more likely to develop words that were included in the *Food & Drink* and *Quantifier* categories.

Conclusion: Among individuals with autism, there are significant differences found in the categorized first words between individuals with and without a delay in language. These data show that children who develop language by 24 months may still be showing early warning signs for autism via word categories. Enhanced early screening for autism should include a brief qualitative assessment of a child's first words.

Introduction:

Although social deficits and restricted behaviors are more specific, one of the hallmarks of autism spectrum disorders (ASD) is a lack of or a delay in language acquisition. Up to 25% will remain without speech into adulthood and if language is acquired, the average age of first word use is 36 months (Lord, Risi, Pickles, 2004; Tager-Flusberg, Rogers, Cooper, Landa, & Lord, 2009; Howlin, 2003). Consequently, the lack of language development has long been an indication for an evaluation for an ASD (American Academy of Pediatrics, 2001; Johnson & Myers, 2007). Furthermore, speech is one of the most objective means by which parents are able to assess development. Other characteristics can be subtle and it has been shown that parents have a difficult time recognizing these warning signs in the first two years of life (Maestro, Muratori, Cesari, Pecini, Apicella & Stern, 2006; Mitchell, Zwaigenbaum, Roberts, Szatmari, Smith & Bryson, 2006). This notion is supported by the fact that the majority of children that are ultimately diagnosed present to their primary care providers with a complaint of speech delay (De Giacomo & Fombonne, 1998; Howlin & Asgharian, 1999).

However, a delay in speech is certainly not pathognomonic for an ASD and onset of language is broad amongst all populations. Typically children develop language at 12-18 months but there is a large population of typically developing children that speak much later (Zubrick, Taylor, Rice & Slegers, 2007; Bates, Marchman, Thal, Fenson, Dale, Reznick, Reilly & Hartung, 1994). Similarly, while most children with ASDs experience a delay in the onset of speech, up to 30% of will exhibit language use prior to 24 months (Werner & Dawson, 2005; Turner, Stone, Pozdol & Coonrod, 2006). Furthermore, studies have shown that the words spoken by children with autism can often be complex in nature and are easily mistaken as typical or even advanced language (Johnson & Myers, 2007; Szatmari, Bryson, Boyle Streiner & Duku, 2003). As a result, interpreting the significance of the onset of language, although generally considered to be reassuring, can be troubling for clinicians. Ultimately, combined with the how difficult it can be for to assess for other known characteristics of ASD, the presence of speech theoretically could impede the recognition of an underlying developmental disorder. So, the question is in children with ASD that do not experience a language delay, are

there clues in what they are actually saying and the words they are using which might provide insight into their disorder?

With regards to earliest language, the significance of the timing of language onset has been the primary area of research that has been well established in ASD. Early language acquisition in children with ASD has been associated with higher verbal acuity, higher cognitive capacity and improved long-term outcomes (Rutter, Greenfield & Lockyer 1967; DeMyer, Hingtgen & Jackson 1981; Howlin, 2005; Rutter, 1970; Venter, Lord & Schopler (1992); Gillespie-Lynch, Sepet, Wang, Marshal, Gomez & Sigman, 2012). Mild features of ASDs (such as joint attention, nonverbal cognitive ability, symbolic play, imitation, communication of requests and comprehension of vocabulary) correlate with the ability to acquire language and vocabulary growth (Charman, Baron-Cohen, Swettenham, Baird & Drew, 2003; Dawson, Toth, Abbott, Osterling & Munson, 2004; Sigman, 1999; Toth, Munson, Meltzoff & Dawson, 2006; Thrum, Lord, Lee, & Newschaffer, 2007). While the prognostic significance of onset of speech is well-established; research regarding the qualitative features of speech is less clear. As it turns out, there is evidence of both similarities and differences between children with ASD and those that are normal developmentally. There have been several studies that when compared to typically developing children, individuals with ASDs have deficits in expressive speech, emotional speech and exhibit a predilection for using nominals (Firth & Happe, 1994; Rapin & Dunn, 1997; Rapin & Dunn, 2003; Williams, 1993). However, it has also been shown that like typically developing children, individuals with ASD comprehend words prior to vocalizing and they exhibit a bias towards common nouns as vocabulary expands (Charman et al., 2003; Swensen, Kelley, Fein & Naigles, 2007).

Unlike this study, most of the research performed on vocabulary has been on children with autism that already have at least moderate language skills (vocabulary of 50-200 words). This is primarily due to the fact that the earliest vocabulary amongst all children is known to be highly “unstable.” Specifically, the earliest language of all children is extremely variable in content and categorization. As vocabulary develops, children form a predilection towards

nouns that becomes distinct when a child has a vocabulary of 50 words (Charman et al., 2003; Luyster, Lopez, & Lord, 2007). This variability is also well documented by the MacArthur Communicative Developmental Inventory for Lexical Development Norms (CDI) used to categorize words in this study. The CDI identifies the norms of word production by reporting frequencies of word production and comprehension month-by-month from 8 to 30 months. The CDI identifies 396 words in the months of 8 to 16 months and 680 words in the 16 to 30 month age range (Dale & Fenson, 1996). As a result of this instability that is prevalent during earliest language, little research has been done on the categorization of first few words that children with ASD speak.

Prior to further discussion, it is important to note how the significance of understanding early vocabulary in children with ASD that do not experience language delay is changing as in recent years. This is due to an increased effort to diagnose individuals with ASD as early as possible. This is also due to a well-documented improved stability of diagnoses at younger ages and overwhelming evidence that early enrollment in an interventional program has a profound impact on prognosis (National Research Council, 2001; Bryson, Rogers & Frombonne, 2003; Matson, Wilkins & Gonzalez, 2008; Charman, Taylor, Drew, & Brown 2005; Chawarska, Klin, Paul & Volkmar, 2007; Sigman, Dijamco, Gratier & Rozga, 2004). In fact, the American Academy of Pediatrics has recommended that all 18-month to 24-month children be screened for ASD (American Academy of Pediatrics, 2006). Multiple authors have published data on the earliest signs of disease, including those that precede normal language development milestones (Johnson, 2004; Chawarska & Volkmar, 2005; Zwaigenbaum, Bryson, Rogers, Roberts, Brian & Szatmari, 2005). Consequently, there has been a push by the media, clinicians, researchers and public agencies to raise public awareness of the early clinical signs of the disorder. Failure to make eye contact, poor orientation to social stimuli, delayed babbling, deficits in joint attention, failure to respond to vocalizations and lack in to-and fro vocalization patterns are just a few of the earliest clinical signs that these studies suggest parents and clinicians should look for. However, as mentioned above, many of these signs are subtle and difficult to recognize. A recent study showed that most parents retrospectively recall features of an ASD around 15-18

months once educated in the disorder; however amongst this same population the average diagnosis was not determined until around the age of 5 years (Wiggins, Baio & Rice, 2006).

Understanding early vocabulary trends in individuals with ASDs has the potential to be significant both scientifically and clinically – both of which we seek to explore with this study. We hypothesize that there will be unique vocabulary used in those that do not experience a delay in the onset of language compared to those that do. By comparing the preferences in language between groups based upon onset of language, we also hope to identify patterns within each population. Although not the focus of this study, we hypothesize that the vocabulary in those that experience a delay in the onset of language will be more typical of language development in normal children. If differences are found, a qualitative review of early vocabulary might provide information that will aid clinicians in the early detection of autism and increase the likelihood of early intervention.

Methods:

This study was a retrospective analysis of data collected from 103 individuals with autism (*91 Males, 12 Females; Onset of language range of 9 – 60 months; mean onset of language 24.16 months*) who participated in a family/genetic study at the Southwest Autism Research & Resource Center. Institutional Review Board (IRB) approval was granted under an existing IRB approval in place at SAARC. All subjects had their diagnosis confirmed with the Autism Diagnostic Interview – Revised (ADI-R), an informant based, semi-structured interview that is considered the gold standard assessment for autism. According to the ADI-R, the onset of language is defined by a vocabulary of at least five words, one of which should be used spontaneously and communicatively on a daily basis. Subjects who do not meet this benchmark by 24 months are considered to have a language delay. Based on the aforementioned criteria, the sample was divided into two groups. Group 1 included subjects without a language delay (*n = 52, 46 Males, 6 Females; Onset of language range 9-24 months; mean onset of language 16.25*) and Group 2 included subjects with a language delay (*n = 51; 45 Males, 6 Females; Onset of Language Range – 26-60; Mean onset of language 36.33*). Words reported on the ADI-R were placed into word categories by using the MacArthur Communicative Development Inventories and Adaptations into Other Languages Lexical Development Norms Database (CDI) (Dale & Fenson, 1996). Proper nouns were excluded and in cases in which words fit into multiple categories, the one with the reported higher frequency in the CDI was used. Words not falling into the database were categorized into an appropriate category (i.e. “hamburger” (*Food & Drink*), “pretzel” (*Food & Drink*); “puma” (*Animals*), etc). Frequencies within each category were compared between the groups with the chi square statistic. A statistical threshold of 0.01 was used to identify those categories that were the most significant and those categories were focused on for discussion.

Results:

Table 1 shows the gender characteristics and language onset for the two groups. In both cohorts, the majority were males although the two cohorts were not statistically different in gender characteristics ($p = .971$). The average age of speech was approximately 16 months in those without language delay (Group 1) compared to 36 months in those with a language delay (Group 2). Furthermore, the range in onset of language development was significantly larger in Group 2.

Table 2 shows the frequency of responses by each group as in the various categories used by the MacArthur CDI. Figure 1 displays the information in a graph. Collectively, the most common responses were in the categories of *Food & Drink* (76 words), *Animals* (55 words), *Games & Routines* (45 words), *Toys* (44 words), *People* (40 words), *Vehicles* (29 words), *Action Words* (27 words), *Small Household Items* (20 words), *Quantifiers* (15 words), *Outside Things & Places to Go* (13 words), *Descriptive Words* (8 words), *Body Parts* (5 words), *Sound Effects & Animal Sounds* (4 words), *Pronouns* (2 words), *Furniture and Rooms* (2 words) and the least common responses fell into the categories *Clothing* (1 words) and *Words About Time* (1 words). There was an overall statistical difference between the two groups ($p = .001$). Furthermore, there were multiple individual categories that were shown to have statistically relevant differences. These included vocabulary references in the categories of *Animals*, *Body Parts*, *Food & Drink*, *Quantifiers* and *Small Household Items*. Specifically, Group 1's vocabulary was more likely to reference *Animals*, *Body Parts* and *Small Household Items*. Group 2's vocabulary was more likely to reference *Food & Drink* and *Quantifiers*. The categories that were the most statistically significant were the *Food & Drink* and *Animals* categories.

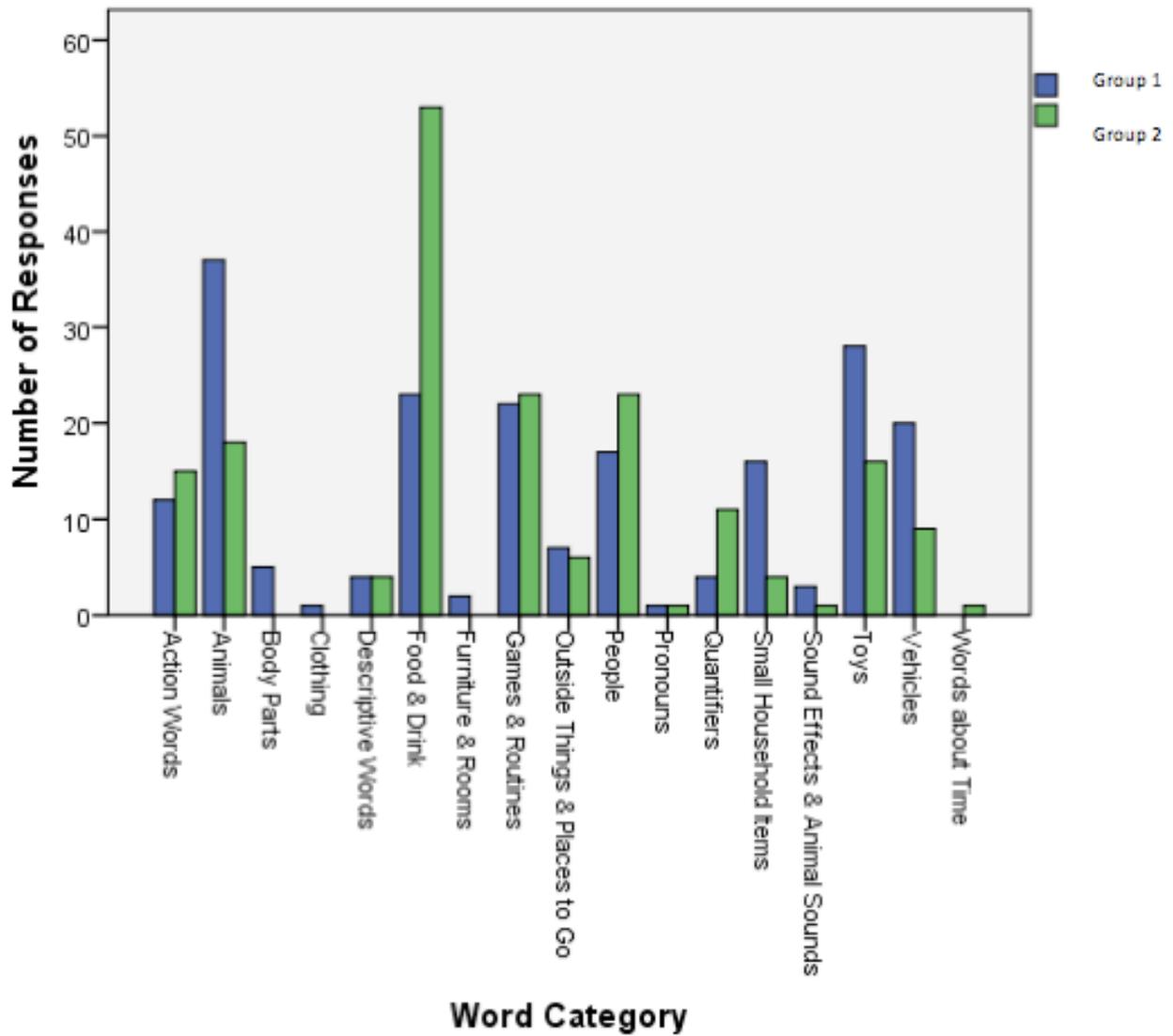
Table 1. Characteristics of Sample Population

	Gender		Age of Language Onset		Maximum	Minimum
	Male	Female	Mean	Std. Deviation		
Group 1	46	6	16.25	4.672	24	9
Group 2	45	6	36.33	8.154	60	26
Total	91	12	24.16	11.688	60	9

Table 2. Categorization of First Words Based Upon MacArthur Communicative Development Inventories and Adaptations into Other Languages Lexical Development Norms Database

Word Category	Group 1		Group 2		Sig
	# of responses	%	# of responses	%	
Action Words	12	5.9%	15	8.0%	0.403
Animals	37	18.3%	18	9.6%	0.016
Body Parts	5	2.5%	0	0.0%	0.031
Clothing	1	0.5%	0	0.0%	0.338
Descriptive Words	4	2.0%	4	2.1%	0.894
Food & Drink	23	11.4%	53	28.3%	0.001
Furniture & Rooms	2	1.0%	0	0.0%	0.175
Games & Routines	22	10.9%	23	12.3%	0.637
Outside Things & Places to Go	7	3.5%	6	3.2%	0.904
People	17	8.4%	23	12.3%	0.195
Pronouns	1	0.5%	1	0.5%	0.95
Quantifiers	4	2.0%	11	5.9%	0.043
Small Household Items	16	7.9%	4	2.1%	0.010
Sound Effects & Animal Sounds	3	1.5%	1	0.5%	0.359
Toys	28	13.9%	16	8.6%	0.107
Vehicles	20	9.9%	9	4.8%	0.06
Words About time	0	0.0%	1	0.5%	0.295
Overall	202		187		0.001

Figure 1. Group Comparison of Responses by Categories



Discussion:

In typically developing children first birthday is a common age to expect a few single words. According to the CDI, a sample of 8 month old infants speak 18 different words in the Food and Drink Category, and only 1 word falls into the category of Small Household Items. 12-month-old infants speak 17 different Food and Drink words, and 12 Small Household Items words. At 18 months, 68 words in Food and Drink, and 50 Small Household Items; and at 24 months, toddlers speak 67 words in the Food and Drink Category, and only 49 different small household items. (Dale & Fenson, 1996) Thus, in earliest language the word categories spoken by typically developing children tend to favor *Food and Drink* Items and this continues, albeit to a lesser degree, throughout development. In our study Group 1 tends to speak significantly more words in the small household item category, while Group 2 tends to speak significantly more words in the Food and Drink Category. These results indicate that Group 2 is better aligned with typical development than Group 1.

The degree to which the populations in this study align with typically developing children was not the primary focus of this study. Ultimately, there are several conclusions one may directly draw from this study. First, there is a substantial degree of variability among the aggregate vocabulary spoken by individuals with ASD (Groups 1 and 2 combined), which is consistent with samples of typically developing children. This suggests that like typically developing children, children with ASD have early language that is “unstable” and greatly dependent upon their environment (Bates et al., 1994). However, the fact that children with ASD show variability in overall vocabulary does not mean that the social qualities of words spoken are the same as compared to those with typical development. While difficult to assess the social quality of words, this study suggests that amongst children with ASD there are subtle but significant differences in the categories of words children choose to speak based upon the onset of their ability to speak. These differences may be suggestive of an underlying developmental disorder when there is no obvious language delay. In other words, first words in children that do not experience a delay may be a verbal indication of autism. In our study we show that there are significant differences in the frequency of how often the two populations reference words in

the *Small Household Items* and *Food & Drink* categories. The social quality (or lack there of) of those word categories may be a measure of typical development. More specifically, if the first words can be spoken without any purpose of involving another person, then the lack of social quality may suggest the child is still at risk for autism even though language is developing early.

Individuals with autism that do not experience a delay prefer words in the categories of *Animals*, *Body Parts* and especially *Small Household Items*. While we freely admit that communicative intent is challenging in early language, all of the aforementioned are objects. The fact that individuals without a delay reference objects more frequently may actually show that even though speech is present; there is no social quality to the words spoken and thus provide no indication that typical social development is occurring. In other words, children with autism that speak prior to 24 months may actually be saying things that provide insight into what is significant in their world. They can label objects, toys, animals and speaking the words may not involve another person. Stereotypical behaviors and “*persistent preoccupation with parts of objects*” are part of the diagnostic criteria for AD (American Psychiatric Association, 2000). Perhaps these individuals’ preference to speak words in these categories is a reflection of what is a well-known characteristic of AD – a fascination with objects and/or parts of objects.

In individuals with ASD who experience a delay in the onset of language, their first words maybe more social in nature. Words in the *Food & Drink* and *Quantifiers* categories may indicate a predilection towards using words that indicate a motivation to fulfill basic needs, but very likely involve another person and therefore demonstrates a degree of social quality because there is intent to communicate with another person. While requesting to have needs met does not appear purely social because the intent of communication is to have needs met rather than to use language to engage with someone. Interestingly, of the 11 Quantifiers produced in those with a language delay, 10 of those were reported to be the word “more.” While there is no way to know what they are asking for more of it is not hard to assume that with their predilection to referencing Food & Drink, they may be requesting more of such items.

As mentioned earlier, the first words in Group 1, or subjects without a language delay, were significantly higher than Group 2 in the categories of *Animals*, *body parts* and *Small Household Items*. We cannot ignore the possibility that these words were said with social

intent. Saying a pet's name or type of pet (i.e. dog or cat), or labeling a toy could very well be more social than requesting food or drink, but it should be paired with other indicators of social intent such as eye contact or pointing. That is, a toddler pointing at the dog and saying "doggie" to a caregiver while initiating joint attention to that object is a clear example of social intent. However, since impaired gestures, eye contact and joint attention are all clear symptoms of autism it is unlikely that the subjects in Group 2 exhibited these skills.

One possible reason for the categorical differences between the two groups is intervention. The individuals in Group 2 may have commenced intervention earlier than Group 1 due to their language delay. A primary focus of intervention in young children with autism is to assist the development of functional communication. Considering the possible effect of intervention, Group 2's significantly higher frequency of words in the Food and Drink category is not surprising. While the ADI-R assessment considers only words that were said spontaneously and communicatively, they may still have been learned through intervention.

Future Direction/Conclusion:

While the clinical utility of the study is somewhat limited, it does highlight some potential insights. We accept that early language is variable and that patterns are generally hard to identify within the earliest language. Also, as mentioned earlier, intent and/or context of communication in young children is exceedingly difficult to determine, especially in a retrospective study. However, despite recent advances in understanding earlier signs and a push to educate the public, delayed language remains the easiest to identify and the most common concern for parents. With regards to the population in general, the presence of language is and should be reassuring. However, this study suggests that the presence of language alone is not sufficient and the social qualities paired with language are perhaps the best indicators of an ensuing developmental delay.

Future research on this topic should be undertaken prospectively to better assess the use of language as an indicator of appropriate development. If a clinician leans toward ruling out autism because of the presence of first words, and fails to assess for other indicators of social intent, early detection for that individual could be thwarted. As a result, a child who has autism that is missed because first words are not delayed could be placed at a distinct disadvantage because intervention may not begin as early. Hopefully, if clinicians pay attention to social qualities of language, it may lead to earlier identification of ASD and allow more individuals with autism to reach their full potential.

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