A Qualitative and Quantitative Study: A Look at the Production of Emotive Words and Questions by Children with ASD vs. TD Children

Any Capps

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Bryn Mawr College

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Abstract

This thesis investigates the language development in children with autism spectrum disorder (ASD) versus that of typically developing (TD) children. This topic has been explored from various angles across various fields, but still many uncertainties remain in regard to the apparent language impairment in children with ASD. To home in on one area of language development, this thesis explores the production of emotive words and wh- and yes/no questions in children with ASD and TD children. I first provide a literature review of the general language acquisition process in TD children, the social development of children with ASD, and the ability of children with ASD to understand and correctly interpret communicative intents. To investigate their ability compared to TD children’s ability to produce such utterances, I collected data from the CHILDES and ASD TalkBank databases. A straight count of the emotive words and a count and analysis of the questions revealed a disparity in the language abilities of these two groups of children. While the emotive words data was not completely conclusive, the data from the wh- and yes/no questions suggested an impairment in the language abilities of children with an ASD diagnosis. This is likely due to differences in their semantic and pragmatic systems, in addition to their social behaviors and skills.

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1 Introduction

The language acquisition in children with autism spectrum disorder (ASD) versus that of typically developing (TD) children is a field of research that has received a great deal of attention over the years. This topic is worth investigating because children with ASD often have developmental delays in regard to language. Pinpointing parts of their language that may be affected more than others (and why that might be) is crucial for the creation of easier intervention processes that may need to be enacted. Research has shown that children with an ASD diagnosis often struggle with understanding communicative intents. I argue that this includes both emotions and questions, as children with ASD often exhibit differences in these areas of linguistic comprehension (Eigsti et al., 2011; Filipe et al., 2019; Tager-Flusberg, 1981). With this in mind, I aim to look at the flipside of that and explore their abilities to produce these types of utterances. To do this, I am utilizing online transcripts to investigate the emotive words and question formations (both yes/no and wh-) produced by children both with and without an ASD diagnosis.

2 Background

2.1 Language Development in TD Children

In order to investigate the language acquisition in children with an ASD diagnosis, it is important to first understand the language acquisition process that most TD children go through. Two theories that have gained popularity are the innateness theory (part of Chomsky’s nativist theory) and Tomasello’s usage-based theory. Various other theories exist in regard to language development, but I will be focusing on these two, as I feel that while they initially appear to be in conflict, they actually complement each other and are both important components of the first language acquisition process. There is not simply one theory at play throughout the language
development process, but rather both the innate and usage-based theories are present here. The specifics of exactly what these two theories are and how they contribute to first language acquisition are explained in the following sections.

2.1.1 Innate Theory
The innateness theory attributes first language acquisition to “a species-specific capacity with a largely innate capacity” (Chomsky, 1967). In other words, it is the idea that humans are born with a hardwired language faculty in the brain. There does seem to be some truth to this notion, particularly in regard to the phonological and syntactic systems of language development.

Chomsky presents three arguments that support his innateness theory, the first being the ability of humans to produce and interpret novel sentences. He also argues that the abstractness of deep structures, in addition to an apparent universal grammar further proves this theory (Chomsky, 1967).

In regard to the abstractness of deep structure, Chomsky explains that with sentences consisting of the same smaller items (i.e. active and passive sentences conveying the same idea), their deep structures will be the same, but their surface structures will differ. He argues that an innate system of language acquisition allows humans to understand the “abstract underlying forms” across various syntactic forms (Chomsky, 1967).

Embedded in the theory of a universal grammar is the Poverty of Stimulus Argument, which is the notion that the linguistic output of a child is determined more heavily by an innate acquisition device than by the linguistic input in their surrounding environment (Laurence, 2001). All languages have sentence structures that would not be considered the most natural or straightforward construction; despite this, children do not make errors that would result in such
syntactic errors. In the case of auxiliary and lexical verbs, a second language learner may use them in the same position, as it would seem sensical to do so, but first language learners do not tend to do this. A concrete depiction of what these types of errors might look like is indicated below:

<table>
<thead>
<tr>
<th>He seems happy. → Does he seem happy?</th>
<th>She could go. → *Does she could go?</th>
</tr>
</thead>
<tbody>
<tr>
<td>He did eat. → He didn’t eat.</td>
<td>He did a few things. → *He didn’t a few things.</td>
</tr>
</tbody>
</table>

(Laurence, 2001)

2.1.2 Usage-Based Theory

The innateness theory, while holding true in many regards, does not explain the language acquisition process as a whole because it fails to account for how the relationships that infants and children form contribute to their language development; this is where Tomasello’s usage-based theory comes into play. This theory postulates that humans learn language through the linguistic input they receive and the interactions they then have with those around them. The usage-based theory lays claim to the following sets of cognitive skills that TD children will possess by the age of 1: intention reading (understanding communicative intent) and pattern-finding (to create abstract constructions) (Tomasello, 2005).

Focusing first on the first part of Tomasello’s theory, there are various ways that infants and children come to discern communicative intents, including imitating things that they hear, and developing joint attention (shared attention or focus on a single object) with their caregivers. Much of infants’ and children’s earliest speech patterns are simply imitations of phonemes, words, or phrases from their immediate environment. These repetitions serve to both allow the child to produce a new term and to fully understand and accept the adult term (Clark, 2016). Imitation also creates common ground between a child and his or her caregiver. Like imitation, joint attention
helps to establish common ground. Joint attention is established through various means, such as eye gaze and pointing gestures (Clark, 2016; Tomasello, 2005). For example, if a girl and her mother are cleaning up and the mother points to a specific toy, the child will understand that her mother wants her to clean up that toy (Tomasello, 2005). Situations like these, where common ground is established, allow children to grasp the communicative intents of those with whom they are interacting. In the situation of the girl and her mother, if another adult had walked in and done the pointing, the girl would not have understood that to mean the same thing as when her mom pointed to the toy. This is because there was no common ground established through joint attention on that toy with the new adult (Tomasello, 2005).

In regard to the second set of cognitive skills laid out in the usage-based theory (pattern-finding), Tomasello recognizes the importance and existence of an innate structure that allows for abstract sentence constructions. He explains, however, that children need to have heard concrete utterances to form a basis for new constructions. While Chomsky does make this claim this as well, the emphasis in Tomasello’s theory is based less so on the innate faculty than is Chomsky’s, and more so on the input and interaction that help to elucidate how children establish language to only what is “conventional in their linguistic community” (Tomasello, 2005).

The most important takeaway in regard to the usage-based theory is that understanding communicative intent, in addition to having adequate input and interaction, is at the heart of language acquisition (Tomasello, 2005). For the purpose of this thesis, I will be focusing more heavily on the communicative intent aspect of language acquisition; it is important, however, to understand the interplay between innateness and interactions in regard to how children come to understand abstract syntactic utterances. In other words, children must have both the innate language faculty as originally proposed by Chomsky, in addition to sufficient social interactions to
fully acquire their language. Understanding the various aspects of the general language acquisition process in TD children may help to home in on areas that may lead to hindrances in the language acquisition process in children with an ASD diagnosis.

2.2 Social Development of Children with ASD

As demonstrated, a large part of first language acquisition can be attributed to social interactions. The social skills in children with an ASD diagnosis have been researched extensively across various fields, including linguistics. Before diving into the specifics of how differences in social skills play out in the various language acquisition systems, I will first identify and investigate some of the key variances that children with an ASD diagnosis may present in comparison to TD children.

2.2.1 Social Impairments

Emotion dysregulation, while not necessarily a criterion for an ASD diagnosis, is a common characteristic of children with ASD. This may manifest in a variety of ways, including tantrums and outbursts (Samson et al., 2015). In addition to acting-out, other common behaviors are inattentiveness, social unresponsiveness, and those that are restricted and repetitive (RRBs), all of which could have its hand in the language development of children with ASD. Bopp et al.’s (2009) research investigated the effects of such behaviors and linked their prevalence to stunted language development. They attribute this finding to a social isolation factor resulting from the behaviors listed above (Bopp et al., 2009). In order to explore this idea, the researchers looked at 69 children under the age of six with an ASD diagnosis over the course of two years. Within that time, they created individual growth trajectories as they examined and measured the participants’ “problem behavior” patterns and the development of their vocabulary and language. The problem behaviors
(acting-out, inattentiveness, etc.) were measured with a seven-step process that integrated parent-report measures and input from experienced professionals with a focus in autistic diagnoses. The vocabulary and language development were measured by speech-language pathologists who used the Peabody Picture Vocabulary\textsuperscript{2} and Expressive One-Word Picture Vocabulary Tests\textsuperscript{3} to look at vocabulary development, and the Preschool Language Scale-3\textsuperscript{4} to look at language development.

The individual growth trajectories created from the data collected displayed the following results about the relationship between problem behaviors and language development: first, higher inattentive and socially unresponsive behaviors corresponded to lower expressive vocabulary and language comprehension, and second, RRBs and acting-out behaviors were not significantly related to lower expressive vocabulary and language comprehension. I expected all four of the behaviors to lead to some sort of social isolation, thus inhibiting language development, so the second finding was somewhat surprising; the first, however, was not. Bopp et al. (2009) argue that inattentive behaviors result in disengagement from others and “negatively impact children’s ability to learn from the environment” and that socially unresponsive behaviors reflect fewer social interaction skills in children with an ASD diagnosis (Bopp et al., 2009). Consequently, they have fewer opportunities to participate in social experiences in which they would interact with, learn, and practice language in a social context (Bopp et al., 2009).

\begin{itemize}
  \item \textsuperscript{2} The Peabody Picture Vocabulary Test is designed to test one’s receptive vocabulary abilities.
  \item \textsuperscript{3} The Expressive One-Word Picture Vocabulary Test is designed to test one’s expressive vocabulary abilities.
  \item \textsuperscript{4} The Preschool Language Scale-3 is designed to test one’s receptive and expressive language abilities.
\end{itemize}
2.2.2 Theory of Mind

A necessary function for understanding social behavior and communicative intent is Theory of Mind (ToM), which accounts for and interprets one’s ability to understand and decipher “the full range of mental states (beliefs, desires, intentions, imagination, emotions, etc.)” that affect the choices and action of human beings (Laurence, 2001). This is crucial for deciphering one’s own and other people’s mental states. To investigate an explanation for the impaired social and communicative skills often seen in children with an ASD diagnosis, Broekhof et al. (2015) conducted a study in which they looked at the intentions, desires, and beliefs (key aspects in ToM) in children with ASD versus TD children. Additionally, they focused on the relationship between these three ToM aspects and the language acquisition of their participants.

What they found was that children with an ASD diagnosis were able to understand intentional actions as well as TD children of the same age, except in the case where social sharing was involved. Social sharing was investigated through imperative and declarative pointing tasks in which the researcher pointed to an object to indicate some intention, and the child’s response was then evaluated to determine if they understood the intention of the researcher. In regard to desires and beliefs, Broekhof et al. (2015) found that children with an ASD diagnosis struggled to predict the choices and behaviors of others when their desires and/or beliefs were in conflict with their own.

These findings support the notion that when required to share the mental states of others, children with an ASD diagnosis are less likely to understand their communicative intents (Broekhof et al., 2015). Further research has suggested that understanding one’s own and others’ facial expressions is connected to ToM, which may explain a difficulty in interpreting emotions in individuals with an ASD diagnosis (Cheng et al., 2015). When ToM is impaired, like it has been suggested to be in
individuals with ASD, there may be a subsequent lack in the comprehension of various communicative bids, including those involving emotion (Baron-Cohen, n.d.; Broekhof et al., 2015; Cheng et al., 2015; Jones et al., 2018).

2.3 Language Development in Children with ASD

While the first language acquisition process is similar for children with an ASD diagnosis to that of TD children, there do exist some differences which often lead to delays in their language development. A digestible way to break down where these groups of children may differ with regards to language development is to explore the following four linguistic systems: phonological, syntactic, semantic, and pragmatic.

2.3.1 Phonological & Syntactic Systems

It is important to first note that research has shown that children with ASD tend to not differ in their phonological and syntactic systems compared to those of TD children (Tager-Flusberg, 1981). Peculiar voice quality and monotone speech have often been related to children with ASD; research, however, has shown that this does not affect their perception of prosody (Tager-Flusberg, 1981). Additionally, studies have also reported speech errors and a delayed articulation development in children with an ASD diagnosis, but the speech errors parallel those of TD children. Except on rare occasions, the phonological system in children with an ASD diagnosis remains unimpaired.

Similar to the phonological system, the syntax and grammatical development in children with ASD also does not appear to be impaired. Studies, such as that of Bartolucci et al. (1980) concluded that there is no significant difference in the morpheme ordering of children with an ASD diagnosis versus that of TD children (Tager-Flusberg, 1981). Research has also shown similar mean length
utterance (MLU) and grammatical structure acquisition between both groups of children (Tager-Flusberg, 2000).

More recent studies, however, have found slightly different results. Tek et al. (2014) conducted a longitudinal study to investigate the linguistic growth of children with ASD, with both high and low verbal skills, compared to TD children. Data was collected through six home visits over 1.5 years, in which a 30-minute parent-child play session (semi-structured for consistency between participants) was video-recorded. The spontaneous speech was later measured, and individual growth curve analyses conducted. Tek et al. (2014) found that the TD group exhibited greater increases in many of the grammatical language measures, including MLUs and morpho-syntactic measures. The ASD group, however, exhibited a wider range of linguistic ability, leading the researchers to split the group into High and Low-Verbal subgroups. Upon doing this, they found the ASD-HV group and TD group to have similar growth trajectories, and the ASD-LV group to have greater language impairments with regards to syntax, which appears to contradict the previous research discussed. This finding does not discredit previous studies, though, as the researchers specify that the language delay in the ASD-LV group “was suggestive of a global impairment in expressive language” (Tek et al., 2014). They found this group to struggle with morphology and vocabulary as well, and further concluded that the autism severity in each child also impacted this impairment finding. The syntactic abilities of children with an ASD diagnosis versus TD children is still debated but seems to lend itself to the conclusion that the syntactic domain of language is not specifically impaired in children with an ASD diagnosis. There is variation, however, among those with ASD that is based on expressive language delay and autism severity, as shown in Tek et al. (2014).
Drawing from the conclusion that the phonological and syntactic systems in children with an ASD diagnosis are comparable to that of TD children, it would seem that their innate language faculty is not impaired. With the knowledge that there do exist differences in the language development between these groups of children, we must look to other domains of language to pinpoint the variances.

2.3.2 Semantic & Pragmatic Systems

Less debated than the phonological and syntactic systems are the semantic and pragmatic systems of children with an ASD diagnosis. While their phonological and syntactic systems have proven, for the most part, to be unimpaired, numerous studies have shown that their semantic and pragmatic systems may be less developed. This can be attributed to various things, such as less developed social and cognitive skills and the difficulty for children with ASD to establish joint attention (Tager-Flusberg, 1981). These characteristics make it quite difficult for children with ASD to fully grasp the communicative intent of the person they are interacting with.

One of the earliest studies investigating the semantic system in children with an ASD diagnosis is that of Hermelin and O’Connor (1967). Participants were asked to recall sequences of words from two different semantic categories (i.e. *eight, blue, seven, red, ten, green*). Their findings suggested that children with ASD rely more heavily on memory than on meaning because they “tended to repeat the exact order of the words they were presented” and “did not actively reorganize material according to its meaning” (Tager-Flusberg, 1981). It was later suggested that this was the result of a lower understanding of and ability to form relationships between various categories (Tager-Flusberg, 1981). This may also simply be because children with ASD have a stronger verbal memory, so they are more likely to utilize this skill than TD children who may rely more on the semantic information presented to them (Tyson et al., 2014). It is hard to say exactly why the
children with an ASD diagnosis responded the way they did in this study, but the fact that they did not rely on semantic memory might suggest an impairment in regard to their semantic system for language.

The semantic and pragmatic abilities of individuals diagnosed with ASD is a growing area of research that continues to gain traction. While semantic skills simply refer to the understanding of linguistic input, pragmatic skills take that a step further, as they involve using language within an appropriate social context, as well as making inferences about and managing such communicative interactions (Eigsti et al., 2011; Filipe et al., 2019). Eigsti et al. (2011) present research on the language acquisition of those with an ASD diagnosis and investigate the skillsets lacking, including pragmatic abilities in children with an ASD diagnosis. The researchers touch upon various elements in pragmatic discourse, including conversational repair, responsiveness, and narratives.

While older studies found that children with an ASD diagnosis struggled to repair conversational misunderstandings (a skill that TD children develop around age five) (Geller, 1998; Volden, 2004), a more recent study suggested that this may not actually be the case, concluding that children with ASD do actually generate responses to repair such misunderstandings (Eigste et al., 2011). Eigste et al. (2011) did, however, find that the children with ASD produced more inappropriate responses than did their TD counterparts, which lends itself to the idea that individuals with ASD may lack certain social skills. In regard to responsiveness, children with ASD produce less utterances and responses in conversation than TD children (Baltaxe & D'Angiola, 1996; Eigsti et al., 2011; Tager-Flusberg & Anderson, 1991). More specifically, their responses to questions and comments are often inadequate (Capps et al., 1998; Eigste et al., 2011). Researchers that have looked at longer conversation have investigated the narrative abilities of children with an ASD diagnosis. What they
have found is that children with ASD struggle with identifying causes of internal states, constructing a cohesive storyline, and grasping the main points of a narrative (Eigste et al., 2011). Each of these deals heavily with fully understanding the linguistic input in the immediate environment.

Based on the notion that children with ASD generally do not have impaired phonological and syntactic systems for language development, it seems that their innate language faculty is comparable to that of TD children. Research has shown, however, that they do struggle with understanding communicative intent, as demonstrated through studies focused on the semantic and pragmatic systems. Expanding upon those findings, Tomasello’s usage-based theory would argue that children with an ASD diagnosis will have developmental delays in regard to their language acquisition because he attributes a large part of this process to social interactions. The semantic and pragmatic systems, depending on if they are impaired or not, are what can either help or hinder a child’s communicative understanding within such interactions.

2.3.3 Interpreting Emotion

Stemming from the semantic and pragmatic systems, is the ability to interpret the emotions of others. Children with an ASD diagnosis often present difficulties with this, which may be attributed in part to a less developed ToM and also to their semantic and pragmatic systems (Downs & Smith, 2004). Regardless of the exact source of the ability to interpret emotions for children with ASD, research suggests that it is in fact the case that children with an ASD diagnosis struggle to do this when compared to their TD counterparts (Ben-Itzchak et al., 2016; Downs & Smith, 2004).
Downs and Smith (2004) investigated the emotional understanding, in addition to other areas that are less relevant to this paper, of 10 children with an ASD diagnosis and 10 TD children. To explore this cognitive skill, each child was presented with a set of questions and then evaluated based on their responses. Their abilities were measured “beginning at level 1 and continuing through to level 5.” (Downs & Smith, 2004). The levels ranged from identifying facial expressions to identifying desire and belief-based emotions. What they found was that the children with an ASD diagnosis performed much worse on level 1 emotional understanding tasks (identifying emotional facial expressions in photographs) than their TD counterparts. They performed equally as well on levels 2 through 5, which contradicts previous research. The researchers were hesitant, however, to draw the conclusion that children with ASD and TD children do not differ in their abilities to interpret emotions because the participants with ASD diagnoses in their study received social skills training. This led to the unintentional finding that while children with ASD may struggle to fully understand emotions, intervention and training can vastly improve this cognitive skill (Downs & Smith, 2004).

Researchers in a later study, as another attempt to answer the question as to whether emotional understanding is impaired in individuals with ASD, investigated the ability to understand one’s own emotions of preadolescents with ASD an diagnosis (Ben-Itzhak et al., 2016). In order to do this, they presented each participant (ASD and TD) with questions on the perception of their own emotions. The responses were then coded. They found that the ASD group produced more ‘odd’ (does not make sense to listener) or ‘mixed’ (containing an odd and coherent aspect) responses to the questions, while the TD group produced ‘coherent’ responses much more often. More specifically, Ben-Itzhak et al. (2016) found that the majority of participants with ASD diagnoses only responded with a coherent response for questions on their perception of the ‘happiness’
emotion. In contrast, the TD participants produced "coherent responses for questions on their perception of [all of] their own emotions," including fear, anger, and sadness (Ben-Itzchak et al., 2016). Based on their findings, they concluding that individuals with ASD present difficulty in perceiving their own emotions. This is relevant to my study as it begs the question as to whether this apparent difficulty will manifest in the ability of children with an ASD diagnosis in their display of emotion and production of emotive words.

2.3.4 Interpreting Questions

The other language process I aim to explore in this paper is the production of questions by children with an ASD diagnosis. As with emotions, it is important to first understand and investigate their ability to understand and interpret questions directed at them. Using ethnographic observations and video recordings, Kremer-Sadlik (2004) looked at how children with an ASD or Asperger Syndrome (AS) diagnosis responded to questions presented by family members at dinnertime. Her findings at first glance appeared to contradict previous research, as the participants in her study responded adequately to questions 75 percent of the time. Kremer-Sadlik then went on to discuss why this may have been her finding. She explains that her participants’ adequate responses were likely due to the family members’ communicative strategies employed to increase the target child’s awareness of expected behaviors. For example, “parents and other family members [often] modified and simplified a question until it was adequately answered” (Kremer-Sadlik, 2004). Additionally, if they do not receive a response from their child, parents might answer the question themselves in order to show their child that an answer is expected to follow the question asked. I would argue then, that Kremer-Sadlik’s work does actually support the notion that children with an ASD diagnosis struggle to interpret questions when compared to TD children, as scaffolding is extremely necessary for their ability to adequately understand and respond to questions.
In regard to wh-questions in specific, Daar et al. (2015) investigated the emergence of these question-answers in children with an ASD diagnosis. The researchers looked at three children previously diagnosed with ASD and conducted various 30 to 60-minute sessions with them, in which three phases were conducted. Phase 1 dealt with making connections between community helpers (i.e. teacher), the place you would see that helper (i.e. classroom), and the activity they do (i.e. teach kids). Phase 2 then added another element to the three from phase 1; rather than simply relating a person, place, and activity, they had to relate each element to the correct noun class (i.e. “teacher” with “person,” “classroom” with “place,” and “teach kids” with “activity”). Finally, phase 3 involved making the connection between the noun-class words (“person,” “place,” “activity”) and the wh-word (“who,” “where,” and “what”) that would be used with it (i.e. “person” with “who”). After each phase, the participants were asked a series of wh-questions and their responses were evaluated. Daar et al. (2015) found that while the participants were able to successfully associate the elements in the first two phases, they were unable to respond adequately to the wh-questions asked of them. It was not until after phase 3 that they were better able to respond sufficiently (Daar et al., 2015).

3 Hypotheses

3.1 Hypothesis A

With the underlying knowledge that children with ASD have difficulty grasping the communicative intents of others and fully perceiving their own emotions, I hypothesize that this will lead to a difference in their production of emotive words as well, when compared to TD children. More specifically, I expect that they will construct fewer utterances expressing emotion than TD children of the same age and gender.
3.2 Hypothesis B

I also hypothesize that children with an ASD diagnosis will differ in their production of wh- and yes/no questions when compared to TD children, as research has demonstrated a lack of understanding questions directed at them much of the time. Because perception and production are intrinsically linked, I expect there to be fewer questions produced by children with ASD as well, and that those questions will be less developed than those of TD children of the same age and gender. More specifically, I anticipate that children with ASD will utilize less social information when asking questions and may require more scaffolding from their parents or converser than will TD children.

4 Methods

4.1 Participants

In order to conduct this study, I used two components of the TalkBank system: CHILDES TalkBank and ASD TalkBank. The TalkBank system is a resource for researches to share and study conversational interactions. CHILDES and ASD hold numerous transcripts of conversational interactions between TD children and children with ASD, respectively. Each transcript used was originally used for another researcher’s work. I did not conduct and transcribe any conservations of my own for the purpose of this study.

Twenty transcripts were chosen from each TalkBank semi randomly. This was not a completely random selection because I wanted to ensure that all the participants were within a certain age range. Additionally, I had to filter out transcripts that were of a child directly reading something, as that would not accurately portray their own production and usage of the target words and questions. Finally, this was only a semi randomized selection of transcripts in order to ensure that
each transcript from ASD TalkBank had a transcript from CHILDES TalkBank matched for age and gender. All transcripts were from participants between the ages of 2 and 9, with a mean age of 5 years. There were five girls’ and 15 boys’ transcripts from each group5, making a total of 40 transcripts.

4.2 Data Collection

4.2.1 Emotive Words

For each selected transcript, I did a straight count of the following emotive words produced by the target child:

- Happy, Excited
- Sad, Upset
- Mad, Angry
- Bored
- Scared, Afraid
- Feel* (i.e. feels, feeling, etc.)

The words that are listed within the same bullet point were counted in the same category, as they are synonymous to each other, so I expected them to be equally common in the transcripts. I did not account for age or gender when counting the emotive words produced by each child. I simply counted the frequency of each target word produced by each child and recorded it, accounting for whether or not the child had an ASD diagnosis. Something worth noting in regard to the target emotive words is that with the exception of ‘happy’, all of these words express temporary properties, making them stage-level predicates. ‘Happy’, on the other hand, expresses more

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5 I originally wanted an even split between girls and boys, but the ASD TalkBank did not allow for that. The database did not have a wide enough range of female transcripts, so I had to use more male transcripts. This is not surprising, though, as autism is diagnosed more frequently in boys than in girls.
permanent properties, making it an individual-level predicate (Manninen, 2001). The effect of this will be discussed in the discussion section 6.1.

4.2.2 Questions

In regard to the question aspect of this study, the process was more complex than the straight count that I did for the emotive words. While I did do a straight count of questions in each transcript initially, it was not feasible to closely analyze and categorize each question produced by each child, as there were well over 50 question formations in more than half of the transcripts. I still, however, needed to get an accurate read of the questions produced by each child.

In order to do this, I selected portions of each transcript that had an even distribution of the types of questions that target child was producing. After selecting sections from all 40 transcripts, I placed those sections into a table which displayed the ASD transcript on the left and the TD counterpart (matched for age and gender) on the right. Next, each question was highlighted, and then categorized as either a wh- or yes/no question. Each question was then further placed into one of the following subcategories for its respective initial categorization:

For Wh-Questions:
- Who
- What
- What (acknowledgement): “what?” as a response to someone trying to get the target child’s attention
- Where
- When
- Why
- How
- Which
- Imitation: formed from a majority of words said to them right before
For Yes/No Questions:

- Imitation
- Clarification: response to a direction in order to clarify understanding
- Curiosity: asking about someone or something not in the direct vicinity
- With account for the needs/wants of others: asking about what someone else wants/thinks/feels/etc.
- Confirmation: tag, such as “right?” on the end of a sentence to ensure the listener is on the same page as the target child
- Request for help
- Request for permission
- Guess: an attempt to spell or count something
- Other

Each question was numerically counted for each category and organized based on whether or not it was produced by a child with ASD or a TD child. The age and gender, while accounted for initially in order to get even sample size groups, were not investigated as variables related to the questions produced.

5 Results

5.1 Emotive Words

Overall, there were not as many emotive words throughout the 40 transcripts as I had expected. There were 10 “happy/excited,” 3 “sad/upset,” 7 “mad/angry,” 0 “bored,” 13 “scared/afraid,” and 13 “feel*.” With the exception of the “feel*” category, the TD children produced more emotive words than did the children with an ASD diagnosis. The distributions are displayed in Chart 1 below.
5.2 Questions

In regard to the questions produced by the target children throughout the selected transcript portions, there were a total of 171 (yes/no and wh-). Of those 171 questions, 49.7 percent were yes/no and 50.3 percent were wh-questions. Furthermore, 34.5 percent of those questions were produced by children with ASD, while the remaining 65.6 percent were produced by TD children. Overall, the TD children were producing more questions than were the children with an ASD diagnosis.

5.2.1 Wh-Questions

Upon looking more closely at the wh-questions produced, it was again apparent that the majority of the questions came from transcripts with a TD target child. 41.4 percent of the wh-questions were produced by children with an ASD diagnosis, and 68.6 percent by TD children. While this is significant in and of itself, what is even more telling are the distributions within each wh-word category. In all but three categories (what (acknowledgement), when, and imitation), the TD
children produced more than twice as many questions as the children with ASD. The distribution is shown in Chart 2 below:

*Chart 2. distribution of wh-questions produced by children with ASD versus TD children*

5.2.2 Yes/No Questions

Similar to the wh-questions, the majority of the yes/no questions were produced by TD children. TD children produced 62.4 percent of the yes/no questions, while children with an ASD diagnosis only produced 37.6 percent. Chart 3 below shows the distribution of each yes/no question category.
6 Discussion

6.1 Emotive Words

As mentioned in 5.1, there were not as many emotive words found throughout the 40 transcripts as I had expected there to be, so I am hesitant to draw any hard conclusions with regards to this section. Despite that, the results found here do not necessarily disprove Hypothesis A, as the TD children did produce more emotive words than the children with ASD.

The emotive words that had the biggest disparities between the two sets of transcripts were "mad/angry," "scared/afraid," and "feel*." Based on Ben-Itzchak et al.'s (2016) study discussed in 2.3.3, this is unsurprising, as they found that the majority of their participants with an ASD diagnosis responded adequately only to questions surrounding their perception of happiness, while TD participants did so in regard to their perception of happiness, fear, anger, and sadness. The results in my study are consistent with this, as none of the children with ASD produced "mad/angry" or "scared/afraid." In contrast, these were two of the most frequently used emotive
words throughout the TD children’s transcripts. It makes sense that children who have trouble perceiving certain emotions in themselves would be less likely to then make statements containing such emotions. Recall the difference between stage-level and individual-level predicates discussed in 4.2.1. Given that the participants with ASD produced “happy” frequently, but not the other emotive words, it seems that children with an ASD diagnosis have trouble perceiving stage-level predicates, but not individual-level predicates. Perceiving temporary properties requires more attention to the current situation, and thus likely relies on social information. This may explain why the participants with an ASD diagnosis produced “happy” (an individual-level predicate) much more frequently than they produced any stage-level predicates.

In regard to the production of “feel*”, the data is not completely representative of all of the participants. The majority of the “feel*” data points produced by children with ASD came from one boy who repeated “I am feeling…” seven times in a row.

It is worth noting that nobody from either the ASD or TD group produced the emotive word, “bored.” This was surprising to me based not on the research, but rather on my own observations. I have heard children of all ages produce statements using the word “bored” quite often, so I expected it to be used at least a few times throughout the transcripts.

6.2 Questions

The questions portion of this study is more conclusive than the emotive words portion because there was a greater amount of data found. As shown in Charts 2 and 3, the majority of questions in the 40 transcripts were produced by TD children, which supports the first part of Hypothesis B. In regard to the second part of Hypothesis B, we must look more closely at the individual categories in both the wh- and yes/no questions.
Before diving into the specifics of the wh- and yes/no questions, I first want to present an example of two transcripts matched for age and gender in order to provide a clear basis for the types of patterns found throughout the data. Below are portions of transcripts from two boys just under the age of 5. The first transcript is from a TD child, Tony, and the second is from a child with ASD, Roger:

1. **Target Child: Tony, TD male, 4;09.**
   Exp: Just stay there for a second. Okay we’re gonna take this shirt off temporarily.
   Chi: &- uh *where you gonna put the microphone?*
   Exp: Well you’re gonna put your sweater on then we’ll put this on over it. Just for a little while.
   Chi: *And then?*
   Exp: And then what?
   Chi: *You gonna put in my coat?*
   Exp: And then we gonna put it in the coat right.
   Chi: Okay let me go get my sweater.
   Exp: Okay. That’s the sweater you’re gonna wear?
   Chi: Yeah but it’s hot every time. *Aren’t you gonna keep that?* Huh?
   Exp: Alright, &- um what do you mean am I gonna keep it?
   Chi: I &aaw &aaw *aren’t you gonna take it back home?* Huh?
   [referring to microphone vest]
   Exp: Yeah I will tomorrow.
   Chi: I don’t want it (Hall, 1984).

2. **Target Child: Roger, male with an ASD diagnosis, 04;10**
   [M is pointing to the toy table]
   Chi: Your table.
   Mot: No. My table.
   Chi: My table.
   Chi: *Where's the table?*
   Chi: I don't know where it is.
   Chi: xxx found it.
   [...]
   Mot: What's this? Ask me.
   Chi: A fish. Oh, no.
   Chi: I wanna need help. *Wanna see the book?*
   [C means he needs help to get stickers out]
   Mot: Nice book.
   Chi: Look _it._
Mot: Get the crayons and the paper.
Chi: Would you get the crayons and the paper?
Mot: That's right. Do it quietly. Okay, get the crayons.
Chi: Never. Never. Where are they?
Mot: Right there.
[m points to the desk]
Mot: On the desk Roger.
Chi: On desk (Tager-Flusberg et al., 1990).

While this example in particular shows a fairly even amount of questions produced by each child, the types of questions being produced are of more interest. Upon looking at the questions produced by Tony, it seems that while he is asking wh-questions about the objects in the vicinity, they are more complex than simply asking what or where something is. Namely, he is relying on and using more social information than Roger is. Tony’s questions are drawing on knowledge that is in the common ground between him and the researcher. Additionally, Tony is making assumptions and eliciting more information through each of his questions – he is producing questions that fall within the “accounting for the wants/needs of others” category of yes/no questions. For example, when he asks, “Aren’t you gonna keep that?”, he is referring to something they were discussing earlier (the microphone), in addition to accounting for what the experimenter is planning on doing.

The questions formed by Roger on the other hand, are much less complex than those of Tony. Rather than drawing on common ground and making assumptions, Roger is asking more basic wh-questions, such as “Where’s the table?” or “Where are they?” Furthermore, the majority of Roger’s questions appear to need some sort of elicitation from his mother. For example, his question, “Would you get the crayons and the paper?”, is almost a direct repetition of his mother’s previous statement, “Get the crayons and the paper.” This would be categorized as an imitation, as he did not produce this question spontaneously.
Overall, these transcript portions from Tony and Roger seem to support the second part of Hypothesis B. Now that we have a better basis for what the data look like, I want to look more closely at the wh- and yes/no questions produced by both groups of children.

6.2.1 Wh-Questions

Overall, I found that TD children produce more wh-questions than children with an ASD diagnosis. In both groups, however, the most common wh-question were “what” questions. This is unsurprising because children generally acquire wh-words in the following order: first, “what,” “where”, and “who,” second, “when,” “why,” and “how,” and third, “which” and “whose” (Rowland et al., 2003). Based on this order, it was surprising, however, that none of the children produced any “when” questions.

In regard to the “what” questions, while this was the most frequently used question in both the TD and the ASD group, a sheer count does not quite tell us enough. Take the following questions produced by two boys just under the age of 6, for example:

3. Target child: male with an ASD diagnosis, 05;11
   CHI: What’s a bed? It’s gone. It’s missing.

4. Target child: TD male, 05;09
   CHI: What time did we get back?
   FAT: It was before dark because you, ya know, warm weather.
   CHI: Well, what time is xxx do you think it was?

In both examples, the target child forms a question starting with “what,” however in example 3, the target child is asking what a certain object is. Furthermore, his statement as a whole does not seem to be completely logical; it is unclear if what he states after “What’s a bed” is related to the question, as there is no response before or after from his mother that related to his question.

Compare that to example 4 where the TD child’s “what” questions are much more complex. They
involve verbs, utilize information that appears to be in the common ground between him and his father, and seem to be logical.

The two categories that were produced more frequently by children with ASD than by TD children are “what (acknowledgement)” and “imitation.” As discussed in section 2.3.2, children with an ASD diagnosis are often less responsive than TD children (Baltaxe & D’Angiola, 1996; Eigsti et al., 2011; Tager-Flusberg & Anderson, 1991). Since this is often the case, parents or other conversers will likely have to say the child’s name to get their attention and elicit a response. This was very common throughout the ASD transcripts and thus accounts for the high amount of “what (acknowledgement)” questions produced by children with an ASD diagnosis. Furthermore, another strategy that was used often by parents of a child with ASD was scaffolding or demonstrating what they would like the child to say. This was not seen very often of parents of TD children, which explains the “imitation” wh-question results shown in Chart 2.

6.2.2 Yes/No Questions

The yes/no question portion of this study was arguably the most telling. Overall, the fact that 62.4 percent of the yes/no questions were produced by TD children lends support to the first part of Hypothesis B. In regard to the complexity aspect of Hypothesis B, like with the wh-questions, we again have to look more closely at the individual categories. Before diving into that analysis, I want to first give an example of a question from each category, as they are not universal categories in the same way that the wh-words are.

*Imitation – ASD, 04;10*
MOT: Get the crayons and paper.
CHI: Would you get the crayons and paper?

*Clarifying – TD, 03;04*
KAR: Put it beside the TV okay?
CHI: Right here?
Curiosity – TD 05;01
CHI: Do you think that they’re coming back soon?

With account for the needs/wants of others – TD, 03;06
CHI: Daddy, wanna see me make that disappear?

Confirming – TD, 05;02
CHI: This sure is a little playroom, isn’t it?

Requesting help – ASD, 04;04
Mother and child dressing baby dolls
CHI: Can you put that on?
MOT: Yeah, you wanna put the shirt on?

Requesting permission – TD, 03;02
[2 kids playing with a baby doll]
CHI: Can I change her?

Guess – ASD, 09;08
MOT: You know how to spell it?
CHI: C [?].
MOT: Mhm [?].

Other – ASD, 02;07
[Mother and Child playing with toy phones]
MOT: Is there anyone there?
CHI: Hello?

Many yes/no questions rely on and utilize social information and common ground knowledge. I would argue that two of the categories that do this the most are “with account for the needs/wants of others” and “confirming.” In regard to the first of the two, recall the ToM findings that children with an ASD diagnosis struggle to understand the intents of others when their beliefs/feelings/etc. do not align with their own (Broekhof et al., 2015). With this in mind, it makes sense that children with ASD would tend to not construct questions eliciting this type of information. This was evident in my data, as none of the ASD transcripts contained yes/no questions that accounted for the needs/wants of others produced by the target child, whereas the TD transcripts contained 15 of these types of questions. In fact, this was the most frequently produced yes/no question type amongst the TD children.
In regard to the “confirming” yes/no questions, the results found here also support the complexity part of Hypothesis B. These questions almost act more as a social cue than anything because they are used in order to ensure that both people in the conversation are on the same page. Children with an ASD diagnosis tend to have less developed social skills, so it was anticipated that they would be less likely to produce a question that utilizes that ability.

7 Limitations

The main limitation to this thesis deals with the method used to conduct the research. Because I did not set up my own experiment to create novel data, there was little control over the participants and the types of conversations in which they were engaged. By using data previously published for other studies, it was impossible to control for each variable (i.e. setting, participant race, conversation topic, additional conversers, etc.). The available transcripts allowed for me to control only for age and gender. The uncontrolled variables likely had an effect on the results, particularly the variations in the conversation topic and the additional conversers from each conversational interaction. For example, many of the TD transcripts involved the target child conversing with another child of the same age in a play scenario, which created ample opportunity for production of emotive words and questions. In comparison, there were no ASD transcripts that involved the target child conversing and playing with another child. Instead, they were conversing with a parent or researcher, in which the adult was facilitating the majority of the conversation. While I cannot be certain that there would be a difference in the emotive words and question production had the participants been conversing within the same type of situation, I expect that there would have been some difference. This is interesting, however, because previous research has shown that adult scaffolding during play is crucial for language development (Weisberg et al., 2013). Nonetheless,
the results here show that children produced many of the target utterances when engaged with other children.

Also, in regard to the method used to collect the data for the questions produced, human error may have played a role. Because I extracted portions of each transcript to count and analyze the questions, it is quite possible that I missed significant questions. I selected portions that appeared to be the most representative of the total questions presented in each transcript, however, it is impossible to be completely sure that I was successful in doing so. It is unlikely that the results would differ greatly had I counted and analyzed every question from every transcript, but I cannot ignore the possibility of that disparity.

Lastly, another limitation to this thesis specifically regards the emotive words data. There were fewer emotive words produced by the target children than expected, so the results were not totally conclusive. As discussed in section 6.1, the results did not necessarily disprove my hypothesis, but the limited amount of data made it difficult to draw any concrete conclusions. Doubling the number of transcripts used for this portion of the thesis likely would have resulted in more conclusive results.

8 Further Research

Something that was not investigated in this thesis, but would be worth exploring further, is the difference in children’s production of wh- versus yes/no questions. Syntactically speaking, there is some debate over whether inversion in yes/no questions precedes that in wh-questions. While both types of questions require movement of the auxiliary, wh-questions also require movement of the wh-phrase (Capdevila i Batet, 1993). Furthermore, Rowland (2007) investigated the “error rates in yes-no and wh-questions with auxiliary DO and modal auxiliaries.” She found that in regard to
yes/no questions, the error rates were higher with the auxiliary DO than with modal auxiliaries, but the rates were equal in regard to wh-questions (Rowland, 2007). While she did find a structural difference between the two types of questions, it was unclear as to why the error rates occurred as they did. It seems that there is a difference in the production of yes/no versus wh-questions, but further investigation of child speech is needed to understand why that might be.

If it is the case that inversion in yes/no questions does in fact precede that in wh-questions, then it might be expected for yes/no questions to be more common, and additionally, for more frequent syntactic errors to be associated with the wh-questions produced by children. This thesis found a fairly even amount of yes/no and wh-questions in the transcripts, but slightly more wh-questions, which contradicts the previous statement. A closer look at the syntax of those questions is needed to fully evaluate the difference in children’s production of wh- versus yes/no questions.

9 Conclusions
The language development in children with an ASD diagnosis is a unique field of research that has received much attention. The ability to understand and correctly interpret communicative intents has been researched extensively and the results of many studies have suggested that children with ASD may struggle to do so. More specific to this thesis is their ability to understand and correctly interpret the emotions of others, in addition to questions directed at them, both of which are key communicative bids. Research dedicated to such linguistic utterances has been consistent with previous communicative intent research, indicating an impaired ability for children with an ASD diagnosis to fully understand and interpret the emotions of others and questions directed at them. These findings may be attributed to various things. Discussed in this paper are impairments
associated with social behavior, ToM, and the semantic and pragmatic systems of children with an ASD diagnosis.

With the background knowledge that children with ASD have difficulty understanding and correctly interpreting emotions of others and questions directed at them, this thesis investigated their ability to *produce* such utterances. With regards to the production of emotive words, while the data was limited, the results did not disprove *Hypothesis A*, that children with an ASD diagnosis will produce fewer emotive words compared to their TD counterparts. The results suggested that this was the case, but the low number of emotive words produced throughout all 40 transcripts makes me hesitant to draw any concrete conclusions. With regards to the production of wh- and yes/no questions, the results lend support for *Hypothesis B*, that children with an ASD diagnosis will produce fewer questions overall, and additionally, for those questions, will utilize less social information and require more scaffolding compared to TD children. These findings suggest, in accordance with previous research, impaired language abilities in children with an ASD diagnosis.

Moving forward, it is my hope that the findings of this study help to highlight some of the underlying causes of the language impairment seen in many children with ASD. In working to improve these abilities, it is crucial to target the social aspect of communication as there exists a link between the social abilities and the language production abilities of children with an ASD diagnosis.

10 Works Cited


