Joint Attention in Toddler Vocabulary Acquisition

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Abstract

The present study examined the child-caregiver dyad play environment and its relationship to child language development. The primary aim was to determine if joint attention was related to vocabulary acquisition. Dyads consisting of 19 toddlers and a caregiver were observed in a laboratory during free play. The child-caregiver dyad interactions were coded for object being held, gaze, pointing, noun usage, eye contact, engagement, and joint attention. Child language progression was assessed throughout the 6-month long study using the MacArthur-Bates Communicative Development Inventory. Findings suggest a relationship between joint attention and rate of MCDI percentile increase, and a connection between caregiver and child noun usage.

Keywords: Joint Attention, Vocabulary Acquisition, Language Development
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Joint Attention in Toddler Vocabulary Acquisition

Research has shown that childhood vocabulary acquisition has a lasting impact (Hart & Risley, 1995). Children who enter school with established vocabularies and syntactic skills are more likely to succeed both socially and academically (Weisberg et al., 2013). In contrast, those children who enter school with their language development lagging, often fall behind (Hart & Risley, 1995; Dickinson & McCabe, 2003; Gershoff, 2003). For this reason, bringing children who are linguistically behind up to speed is crucial. Understanding more about the word learning process and the kinds of interactions that best support word learning will allow better interventions to be created. We were interested in how the child-caregiver interaction in play might relate to vocabulary acquisition.

In particular we were interested in the possible role of joint attention within child-caregiver play in relation to vocabulary acquisition. Around 9-12 months old, infants begin to maintain joint-attention with another person. Joint attention occurs when child and caregiver know that they are each focusing on the same objects and/or activities (Tomasello, 2003). Michael Tomasello, the initial researcher on joint attention, asserts there is a positive influence of joint attention on vocabulary acquisition (Tomasello et al., 1986). He argues that joint attention interactions create a necessary environment for adult-child communication to take place. We see research by Lev Vygotsky, a key theorist on learning and play, as further support of the positive influence of joint attention on acquisition. Vygotsky’s research shows that children who are actively engaged and who are given guidance from a mentor learn at a higher rate than children not actively engaged or receiving guidance from a mentor (Vygotsky, 1978). This closely aligns with the requirements for joint attention: the attention and engagement of both the child and the caregiver.
Prior research on joint attention has produced mixed results and it remains unclear whether joint attention is a contributing factor to a child’s vocabulary development. Some research has indicated that positive connections between joint attention and language development exist (Carpenter et al., 1998; Tomasello and Todd, 1983; Tomasello and Farrar 1986; Smith et al., 1988; Carpenter et al., 1998; Markus et al., 2000; Morales et al., 2000), while other research suggests no relation between various joint attention behaviors and language development (Slaughter and McConnell, 2003; Lord & Pickles, 1996; Stone & Yoder, 2001; Travis et al., 2001). This thesis aims to further research joint attention and the possible roles it may have on a child’s subsequent language growth.

Literature Review

Pre-linguistic Skills

Children generally begin producing language around the first year of life (Tomasello, 2003). Research suggests there are certain basic skills a child must have in order to begin speaking (Tomasello, 2003). These skills include: sharing and following attention with a social partner, being able to direct other’s attention to other things, being able to understand cultural intentions and actions, and being able to categorize similar things (Tomasello, 2003). As it is difficult to determine exactly how it is children obtain these skills, continued analysis suggests acquisition involves a more continuous progression rather than the model suggested by Tomasello (Tomasello, 2003; Bertenthal & Boyer, 2015). It is more likely that as infants become better able to follow gaze and pointing behaviors, they also gradually become better able to understand and engage with the intentions of others (Bertenthal & Boyer, 2015).
Joint Attention

Around 9-12 months old, infants begin to maintain joint-attention with another person (Carpenter et al., 1998; Tomasello et al., 2005; Carpenter & Call, 2013; Bertenthal & Boyer, 2015). As children age from 9 to 18 months their ability to respond to a parent's initiation of joint attention increases (Mundy, 2006). In this same time frame, their ability to initiate joint attention on their own remains rather constant (Mundy, 2006).

Joint attention serves as a period of joint engagement in which adult-child communication may take place (Tomasello, 2003). As shown in the Figure 1 below, this can be seen as a caregiver and child alternating between looking at one another and the same object.

Figure 1

*Joint Attention: Caregiver and child share attention between one another and an object/activity.*

For example, a child who is playing with a toy pasta fork, places the meatballs onto the pasta fork and approaches the caregiver. The child feeds the meatballs to the caregiver, and
while doing so, alternates its gaze between the caregiver and the pasta fork. The caregiver trades eye contact between the child and the pasta fork while being fed. As these actions occur, the child and caregiver talk about what is happening. The caregiver asks questions about the activity, “Are you feeding me meatballs?” and the child feeds the caregiver in response. This is a moment of joint attention because both child and caregiver switch their attention between one another and the pasta fork with meatballs and there is a collective understanding of the communication taking place. Joint attention allows for communication between caregiver and child to take place. Moments of attention without communication, do not signify joint attention.

**Scaffolded Learning.** The support for why joint attention may influence learning, may be explained with research from Lev Vygotsky. Vygotsky has suggested that learning occurs at a higher rate when the learner is actively participating and when a mentor is providing guidance (Vygotsky 1978). Vygotsky also asserts that at a given moment in time, there are both tasks that a child will be able to complete on their own, and there are more advanced tasks that a child will be able to complete only with the assistance of a mentor. He argues that if a child is actively participating in experiences that are scaffolded by a mentor, what a child was once only able to do with assistance, the child will soon be able to complete independently (Vygotsky, 1978). Joint attention may mimic this scaffolded environment, and Vygotsky’s research may explain why the crucial aspects of joint attention: collective participation and understanding of the communicative intentions, may further learning.

**Impact of Joint Attention.** In 1983, Jerome Bruner argued that the establishment of a common communicative ground between adult and child is crucial for the child’s language production (Bruner & Watson, 1983; Tomasello, 2003, p. 65). Joint attention, by definition, is submerged within a common communicative environment. Research has shown that joint
attention has an impact on language development (Tomasello and Faar 1986; Smith et al., 1988; Carpenter et al., 1998; Markus et al., 2000; Morales et al., 2000). Tomasello and Todd (1983) observed six mother-child dyads, from the infant’s 12th to 18th month, and discovered a high correlation between the amount of time an infant spent in joint attention with their mothers and the size of the infant’s vocabulary at the end of the study (Tomasello, 2003, p. 65). These results are further supported in a 1986 study by Tomasello et al. In this study it was found that twins, who generally experience a significant delay in language development, experienced one-tenth of the dyadic joint attention that singleton infants received (Tomasello et al., 1986). This shows that those experiencing less joint attention, may also have a decreased speed of acquisition.

Research on autistic children matches these results. Children on with Autism Spectrum Disorder, who have been shown to have an alternative pattern to language acquisition than typically developing children, tend to struggle with maintaining and initiating attention (Mundy, 2006). In connection to joint attention, research has shown that autistic children achieve joint attention far less than typically developing children. The relationship between their reduced rate of language development, and their decreased amount of joint attention, has led researchers to consider the impacts of joint attention.

**Is Joint Attention Necessary?** Although many studies have indicated a positive relationship between joint attention and language development (Tomasello and Faar 1986; Smith et al., 1988; Carpenter et al., 1998; Markus et al., 2000; Morales et al., 2000), there are still many questions regarding its necessity and influence. We know that word learning does not require joint attention. Some children with autism, Williams syndrome, and down syndrome, for example, are all able to learn words despite decreased levels of joint attention (Akhtar & Gernsbacher, 2007; Mundy et al., 1988; Mundy et al., 1990, Bertrand et al., 1993, Laing et al.,
This research and others, indicated no relationship between joint attention and vocabulary development (Lord & Pickles, 1996; Stone & Yoder, 2001; Travis et al., 2001).

The Present Study

Play is a leading factor in development as it creates the communicative learning environment (Vygotsky, 1978). According to previous research, the play environment serves as a reenactment of what a child has experienced in their lives (Vygotsky 1978) and provides insight into the child’s typical environment. With this in mind, we believe the communicative play environment to be well situated for studies on joint attention and language development. As research has questioned the impact and connection of joint attention with language development, this study aims to better understand any possible connections joint attention has with language development. We predict that a relationship between joint attention and vocabulary acquisition exists.

In this study, 19 child-caregiver dyads (Child M=22.01 months) were each observed during free play intervals in a laboratory. Each dyad was recorded playing in the lab with either a box of vehicle themed books and toys or a food themed box of books and toys. These observations occurred over multiple lab visits throughout a period of six weeks. Two of the sessions from each participant were selected for analysis. The same caregiver was present in both of the selected sessions. From the selected sessions, a two minute section was coded. Videos were coded in ELAN 4.1.2 for object being held, gaze, pointing, noun usage, eye contact, engagement, and joint attention. Child language progression was assessed throughout the study using the MacArthur-Bates Communicative Development Inventories (MCDI).
Developing the Research Methods.

We used a combination of quantitative and qualitative research methods.

**Quantitative Research Methods.** For the quantitative research, videos were coded using the computer program ELAN 4.1.2. I conducted an initial pass of the videos to gain a basic understanding of the wide variety of behaviors present. Based on the initial observations, Dr. Eliana Colunga, Lauren Goode, and I researched common methods used for measuring attention, and it was decided to code the videos for gaze, object of attention, and pointing. After the completion of the videos from five dyads, this process was deemed too time intensive and I suggested that we code with a faster, and more cumulative measure of attention. This procedure involved coding for eye contact and engagement between the child-caregiver dyad. This measure of attention in addition to the audio of the videos was used to determine the presence of joint attention.

Tomasello & Farrar (1986) have suggested that naming objects is more effective when mother and infant are jointly attending to an object than when the infant’s attention has to be directed to it. With this in mind, also measured noun usage. We were interested in seeing whether any connections between joint attention, noun usage, and vocabulary growth existed.

**Joint Attention.** Research by Tomasello defined joint-engagement as a situation in which a social partner and child share attention with one another and an object (Tomasello, 2003). A large part of defining these moments is based on the assessment that the child and the caregiver are indeed sharing the same attention. In the chapter, The Development of Social Attention in Human Infants, Bennett I. Bertenthal and Ty W. Boyer summarize that shifts in joint-attention can be seen in an infant’s gaze cueing, head orientation, body posture, and pointing (Bertenthal & Boyer, 2015, p. 35). A variety of studies completed on the subject have asserted the validity
of these methods of assessing these infant attention assessing methods (Behne et al., 2012; Gliga & Csibra, 2009; Liebal et al., 2009). Extensive research has shown that an adult’s attention is strongly correlated to where the gaze of the adult is directed (Frischen et al., 2007; Langton et al., 2000; Bertenthal & Boyer, 2015). It has also been suggested, that pointing may be a more accurate measure of attention than gaze cueing or head orientation (Butterworth, 2003; Deák et al., 2008, Langton et al., 2000; Ricciardelli et al., 2002).

**Assessing attention.** We assessed attention in this study with the above research in mind. We assessed attention in two ways. For a subset of five dyads we conducted a time-intensive assessment of attention which included the measurement of gaze, object being touched and pointing. Attention was assessed in all of the videos by coding for eye contact and engagement. Engagement was present when dyads were touching or looking at the same object. When comparing the two measurements of attention, the results correlated and were found to be summarized within the faster, second method.

**Qualitative Research Methods.** As I completed this study, I noticed that the process of quantifying joint attention may leave many crucial moments of child-caregiver communication unaccounted for. We decided because of this to include qualitative research as well. Research from Nameer Akhtar and Morton Ann Gernsbacher (2007) has demonstrated how the broader definition of joint attention is operationalized for research purposes. In most research, joint attention is measured through gaze direction and gaze alternation (Akhtar & Gernsbacher, 2007). Although the operationalization of joint attention is necessary for quantitative research, quantifying joint attention relies on the assumption that the quantified measures are reliable measures of joint attention.
Once such assumption is the effort to measure attention. By measuring attention through eye gaze we assume that one needs to be engaged through gaze in order to discern another individual's communicative intentions. It has also been shown though that one's gaze is not necessarily an indicator of their attention (Posner et al., 1980). We also know that the individuals attend to objects and activities through the use of other senses. In 1977, Adamson et al. studied the interactions of two blind parents and their sighted child. His research highlighted how the blind parents were able to establish joint attention with the children without visual modality. Researchers that identify joint attention largely off of gaze may miss the possible breadth of joint attention situations. With this in mind, we decided to conduct both a qualitative and a quantitative analysis to gain a wider understanding of the environment affecting vocabulary acquisition.

For the qualitative analysis, I reviewed the videos and took notes of what I saw. I then organized my notes by which participants had joint attention and which ones did not. I observed the notes for those with joint attention and those without joint attention, and noted what similarities were present.

**Predictions and Results.**

We hypothesized that instances of joint attention provide insight into the amount of child-caregiver engagement occurring. We predicted that a positive correlation exists between the amount of joint attention in dyad play sessions and the rate at which the children acquire vocabulary during the study. By examining the relationship between word learning and child-caregiver play, this research contributes to the long line of research investigating the impact different aspects of interaction have on first-language acquisition. With an increased
understanding of the influences impacting word learning, updated interventions that address vocabulary deficiencies can be integrated into language treatment programs.

Results indicated a moderate significance between the amount of joint attention and the percentile increase within the MCDI. Results also indicated a relationship between caregiver and child noun usage. There was no connection between caregiver or child noun usage and joint attention.

Method

Participants

Participant Selection. Child-caregiver dyads were recruited from Boulder County, Colorado. All child-caregiver dyads were screened for vacations occurring in the first 6-7 weeks. Dyads were not selected if they would be gone for two or more consecutive weekdays (not including weekends) during that time period. There was one exception to this, in which one dyad was scheduled around their vacation. Participants were given a small book as compensation for their participation and five dollars to offset travel expenses.

Subjects were selected from a pool of participants - 47 child-caregiver dyads participating in a separate 6-month longitudinal study. In gathering participants for this study, one dyad was excluded for not completing the study. Another dyad was excluded from the final analysis because the dyad did not want to be videotaped. A total of 24 additional dyads were excluded, as the video of the play did not provide a clear view of where participants were looking. There were two additional dyads that were excluded due to incomparable situations; where either an additional caregiver or sibling participated in the recorded play.
Participant Demographics. On average, participants were of middle to upper class. Caregivers were of average child-bearing age and the majority were White. Only one caregiver per child participated in this study. In observing the education of both caregivers of the child, there was 1 caregiver with no high school diploma, 1 caregiver with a high school diploma, 4 caregivers with a high school diploma and some college, 17 caregivers with a college degree, and 15 caregivers with a graduate degree. Seventeen children were reported as monolingual and 2 were reported as multilingual. None of the children were reported to have any diagnosed disorders. Starting MCDI percentiles ranged from the 9th percentile to the 96th percentile ($M = 47$).

Participant Groups. Three cohorts were incorporated into this study. Cohort 1 ran from June 2015 to December 2015. Cohort 2 ran from September 2015 to March 2016. Cohort 3 ran from January 2016 to July 2016.

After the aforementioned participant selection process, subjects consisted of 19 child-caregiver dyads, in which children were between the ages of 18.2-25.5 months old ($M = 22$). There were 10 girls and 9 boys.

Design

This six month study was a between subjects design. During the first six weeks dyads were exposed to boxes with either food or vehicle themed books and toys. The videos analyzed in this thesis came from the first six weeks in which dyads were observed playing with the boxes. For the remaining weeks, dyads did not receive any boxes of books and toys. The vocabulary of the child was measured shortly before their first visit and shortly before their last visit.
Materials

Participants completed the study in a quiet, windowless room within the Developmental and Adaptive Cognitive Systems (DACS) Lab at the University of Colorado Boulder. The room had either an alphabet mat, or a cushioned mat with a child-sized table and two chairs. Participants were recorded playing, and the experimenter used a timer to keep track of the session length. The videos were coded on a computer using the program ELAN 4.1.2. Partial correlations were run in the program SPSS.

**Book and Toy Boxes.** In this study, the child-caregiver dyads received 3 boxes of toys and books to play with over a 6 week period. Participants received each box for a total of 2 weeks. Participants either received food themed boxes or vehicle themed boxes. Those who received food boxes received the following boxes: Baked Goods, Food from Farms, and Prepared Foods (see appendix A). Those who received vehicle boxes received the following boxes: Trucks, Air and Trains, and Sea (see appendix B). The books and toys in the boxes were constructed in this way in order to maintain a relatively even distribution of words across boxes and between the food and vehicle categories, once MCDI is controlled for (see Figures 3 and 4).
Additionally, the construction of the boxes is similar to the organization around themes that often occurs in pre-school curriculum.

![Figure 3](image1.png)

**Figure 3**

*Distribution of unique and shared words across food and vehicle boxes (Goode, 2016).*

![Figure 4](image2.png)

**Figure 4**

*Distribution of unique and shared words across food and vehicle boxes, controlling for MCDI (Goode, 2016).*
MacArthur-Bates Communicative Development Inventories (MCDI). The MCDI is a well-tested, normed checklist for assessing vocabulary knowledge in children from 16-months-old up to 30-months-old (Fenson et al., 1993). This checklist is a caregiver-report checklist in which caregivers indicated which words their child had spoken. This checklist was used in the initial selection and group assigning process and was also used to track the vocabulary progress of each child throughout the study.

Procedure

During the first 6 weeks, participants came into the lab for four visits that were 2 weeks apart. During these visits, children were given a box of toys and books to take home for 2 weeks (in between lab visits). In total, participants were given either three food themed boxes or three vehicle themed boxes of books and toys. The child-caregiver dyads were recorded playing with each box in the lab twice; once before taking the box home and again after the two week play period at home. The lab visits were conducted by myself and three other lab members.

During play sessions, the caregiver and child were instructed to play with the toys and books in the same manner as they would at home. The experimenter set an alarm for five minutes, sat away from the play area, and only engaged with the participants when necessary. After the five minute play period was up, the experimenter explained to the participants that the experiment had come to an end, but that they could continue playing and could put the toys away at their own pace if need be. When returning to the lab two weeks later for their next visit, participants were given the same instructions as in the initial play session and were again recorded playing with the box they were returning. Later during the visit, the participants were recorded in the same manner with the new box they were receiving to take home with them. This allowed for pre and post measures. This procedure was repeated for the remaining sessions.
Coding Procedure

Quantitative Coding Procedure.

Coding procedure. The videos were coded in multiple sweeps. In the first phase, videos from a subset of 5 participants were coded by me for object being held, gaze, and pointing. In the second phase coded the 2 minute video segments for the presence of eye contact, engagement, and joint attention. In the third phase, noun usage was coded by two members in the DACS lab and I.

All additional coders were given verbal and written instructions by me and directed to forward any questions that they may have had to me. Other lab members and I reviewed the coding for consistency. Throughout these phases, Dr. Colunga and Lauren Goode provided guidance.

Video Selection. Two videos from each of the 19 participants, for a total of 38 videos, were analyzed. The videos came from either Box 3 Pre and Post, or if this option did not provide an ideal view of the participants, videos from Box 2 Pre and Box 2 Post were used. If these videos did not provide a credible view of the participants as well, then videos from Box 2 Post and Box 3 Pre were used. Coding began 30 seconds after both caregiver and child were within view of the camera and continued for 2 minutes. Videos were coded for utterance, eye-contact, engagement, and joint-attention. A subset of 5 participants were also coded for gaze, pointing, and object being held.

Phase 1.

Eye contact. Eye contact was marked as present when both child and caregiver looked at one another.
Engagement. Engagement was marked as present when both child and caregiver were either touching the same object or “looking” at the same object. Looking included head orientation towards an object in view.

Joint Attention. Joint attention was marked as present if participants alternated between looking at one another and at the same object. In accordance with Tomasello’s definition of joint attention, we ensured the presence of the following two conditions: first, that caregiver and child attention was brought to the same object; and secondly, that both individuals understood the communicative intentions within the shared attention period (Tomasello, 2003). When eye contact occurred, coders determined whether any engagement surrounded the eye contact. When this was present, we listening to the audio to determine whether the dyad conversed back and forth on a topic connected to the object of attention. This assessed the understanding of communicative intentions.

Phase 2.

Noun Usage. In the videos, we marked nouns said by the child and nouns said by the caregiver. Participant-created nouns were not included. For example, if child spoke of their imaginary friend, “Digalus,” this noun was not coded.

Phase 3.

Gaze. Eye-gaze was coded based off of the direction of the participant’s eyes. For example, in instances where a caregiver was watching a child play with a tomato it was coded as (Child: tomato). In this instance the child, whose gaze is oriented towards the tomato, would be coded as (tomato). If no view of eye-gaze was present, this was marked as (unknown). Gaze was also coded as (unknown) if the object being looked at was not in view of the camera.
Object Being Held. We defined an object being held as any instance when the participant touched an object with any part of their hand. All durations of touch were coded. In instances where one object was being touched by one hand and another object was being touched by the other, the coder made note of which hand the objects were in. For example, if a caregiver had the helicopter from the Air and Trains box in their left hand and had the rocket in the other it was coded as (L: helicopter, R: rocket). If a participant had multiple objects in one hand, but used them each separately they were coded with a comma to signify the plurality (L: helicopter, rocket). If a participant touched an object that contained another object within it, the instance was coded with a “+” sign between the two objects. For example, if a child was holding in their left hand the pasta fork and the meatballs from the Prepared Foods box were placed in the pasta fork, it would be coded as (L: pasta fork + meatballs). If a participant touched a book, the instance was coded with book and the specific book name (Book: book name). Beyond objects from the box, the researcher also coded for touches between child or caregiver or the box itself. The researcher did not code for objects that were being touched as part of the environment, such as a caregiver resting their hand on the floor. All other objects part of the interaction were labeled as other and then specified (Other: name).

Pointing. In instances where a single finger was extended out towards an object, the object being pointed at was coded under pointing.

Phase 4. A subset of 15 videos were randomly selected from the 38 videos for a second rater to code. Three additional videos were used to train the second coder. The second coder followed the same procedure outlined in Phase 1, coding these videos again for eye contact, engagement, and joint attention.
Qualitative Coding Procedure. I reviewed the two minute segments of videos and took note of what happened in the play session. Observations included the caregiver’s style of reading, the kind of play (parent-led, child-led, free play or guided), the child’s overall interest in the toys, and the intricacies of the communication. Within communication, the level of questions and responses exchanged, and the amount of praise, demonstrations, and connections given were noted. Anything that may have distracted the child was also observed.

Results

Quantitative Analysis

A partial correlation, controlling for age, was computed for eye contact, engagement, joint attention, MCDI word difference, MCDI percentile difference, caregiver noun usage, and child noun usage. See Table 1 below for the p-values associated with the partial correlation run. The results of these age-controlled correlational analyses indicated a positive correlation between joint attention and MCDI percentile difference and between caregiver noun usage and child noun usage. The bi-variate correlation between joint attention and MCDI percile difference was $r(19) = .478$, $p < .052$, and the bi-variate correlation between caregiver noun usage and child noun usage $r(19) = .492$, $p < .045$. The results suggest that when controlling for age, joint attention is related to MCDI percentile difference. The results also suggest that when controlling for age, caregiver noun usage is related to child noun usage.
Table 1

2-Tailed Significance (p-values)

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<tr>
<th></th>
<th>Eye Contact</th>
<th>Engagement</th>
<th>Joint Attention</th>
<th>MCDI Word Difference</th>
<th>MCDI Percentile Difference</th>
<th>Parent Noun Usage</th>
<th>Child Noun Usage</th>
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<td>0.798</td>
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<td>Engagement</td>
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<td>-</td>
<td>0.618</td>
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<td>Joint Attention</td>
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<tr>
<td>Child Noun Usage</td>
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Qualitative Analysis

General Observations.

Child interest. Most of the videos that were selected came from the third and fourth visit, and by this point many of the children already knew which room they should enter in order to play with the toys. As the children and their caregiver got settled, generally either the caregiver or the child opened the box of toys and selected an item to begin interacting with. Some caregivers asked things like, “What’s in the box?” or “What would you like to play with?”, while others reached in and laid out a scene for the child to play with. Throughout the videos, I noticed that some children were more interested in their box than other children. While some children had trouble saying goodbye to the toys at the end of the play session, others started putting the toys away even before the observation had ended.
Caregiver interest. There was also a varying degree of engagement with caregivers. I noticed that some caregivers took more of a hands-on and demonstrative role, some sat back and did not engage much with their child, whereas others guided the play with suggestions and questions.

Play characteristics. Once the play got started I also observed a wide spectrum of play; parent-led, child-led, guided play, or free play. Some children sought out the books, whereas others were more interested in the toys. For those that read books, some children maintained attention to a single book throughout the clip, whereas others lost attention and sought out other books or activities after a portion of a book had been completed. For the caregivers that engaged in demonstration, there was also a range. Some caregivers would focus on modeling small actions, such as cutting vegetables, and then assist their child as needed. Other modeling caregivers would create an imaginary play scene, for example, the caregiver and child would attend a pizza parlor and the caregiver and child would make and serve pizza together.

Communication. The level of communication between the dyads ranged. On one end of the spectrum, some children babbled up a storm and the caregiver would only respond in sounds. On the other end, some caregivers would ask a lot of questions, and in some cases, the child would answer nearly every question in response. In the middle range, there were also those play situations where a caregiver would occasionally ask a question and the child would occasionally respond. Similarly, some caregivers offered praise when their child achieved something. Some caregivers also worked to provide connections to the child. For example, if the child was playing with the airplane, the parent might ask the child about the airplane trip they just went on, or mention the airplane that they saw in the sky on the way into the lab.

Case Study. Below is a short transcript of a moment of joint attention between one of
the dyads. The caregiver and child were sitting near the open box. The caregiver initiates the question which prompts the child to take out a car from the box.

<table>
<thead>
<tr>
<th>Child</th>
<th>Caregiver</th>
</tr>
</thead>
<tbody>
<tr>
<td>01:40.2</td>
<td>who’s driving those cars?</td>
</tr>
<tr>
<td>01:44.2</td>
<td>night night in</td>
</tr>
<tr>
<td>01:45.1</td>
<td>(laugh) digalus</td>
</tr>
<tr>
<td>01:46.4</td>
<td>eye contact</td>
</tr>
<tr>
<td></td>
<td>digalus is driving the car, who else is in that car</td>
</tr>
<tr>
<td></td>
<td>eye contact</td>
</tr>
<tr>
<td>01:50.2</td>
<td>they up in here</td>
</tr>
<tr>
<td>01:52.6</td>
<td>ya digalus is in there</td>
</tr>
<tr>
<td>01:54.4</td>
<td>eye contact</td>
</tr>
<tr>
<td></td>
<td>they up in here</td>
</tr>
<tr>
<td>01:56.2</td>
<td>oh, is he up in there</td>
</tr>
<tr>
<td></td>
<td>eye contact</td>
</tr>
<tr>
<td>01:58.4</td>
<td>he’s driving</td>
</tr>
<tr>
<td>02:00.2</td>
<td>who else is in that car?</td>
</tr>
<tr>
<td>02:03.4</td>
<td>who’s in there, who’s driving?</td>
</tr>
</tbody>
</table>

Figure 5

Transcript from Dyad with High Joint Attention

This dyad engages in joint attention together. Both the caregiver and the child are aware that the car is being talked about and each are aware of the other participants focus. Beyond this, I noticed how many questions the caregiver asks and how these questions encourage the child to engage deeper with the object. Questions like, “Who else is in that car?” and “Who is in there, who’s driving?” encourage this child to participate and contribute vocally. Also notable is how often the child responds to the questions. The caregiver practices reflection, by repeating back what the child has said to clarify and express understanding.

Analysis. In analyzing observational data for the participants of the study, I noticed the following in relation to joint attention. Caregivers were just as likely to give praise, make connections, or demonstrate, regardless of level of joint attention. There was also nothing noticeable about the kind of play: parent-led, child-led, guided play, or free play. There was a
mixture of play types in both children with joint attention and also with those with no joint attention.

Those dyads with higher amounts of joint attention tended to have a lot communication. Caregivers from high joint attention dyads asked a lot of questions and reflected the child’s actions and words. These questions fell into three categories. Some questions were regarding the situation at hand, some questions were to gain clarification on what the child had said, and some questions encouraged the child to further their play. I noticed that the children from high joint attention dyads were very responsive to the caregiver’s questions. They also asked many questions on their own. In general, these children exhibited high interest in the boxes, the activities, and their caregivers.

Looking at the overall play sessions, I noticed that children with low joint attention were less interested in playing, less engaged with the boxes and were more distracted. For example, there was a child distracted by food in both of her sessions, and a dyad who engaged loosely in separate activities for most of the session. I observed that these children changed activities often, and tended to switch books before they were finished. At times the caregiver would draw the child’s attention to items, but the child would not engage in play.

**Discussion**

The present study examined the relationship between word learning and child-caregiver play. The primary aim was to determine if joint attention was related to vocabulary acquisition. Data analysis showed that when controlling for age, joint attention was related to vocabulary acquisition. Prior research has indicated a correlation between age and interaction measures (Tomasello, 2003; Bertenthal & Boyer, 2015). As children age, the more able they are to participate in eye contact, engagement, and joint attention (Bertenthal & Boyer, 2015). Our
results align with the many longitudinal studies that have found positive correlations between the amount of joint attention between dyads and the child’s subsequent vocabulary acquisition (Tomasello and Todd, 1983; Tomasello and Farrar 1986; Smith et al., 1988; Carpenter et al., 1998; Markus et al., 2000; Morales et al., 2000).

This study measured vocabulary acquisition using the MacArthur Bates Communicative Development Inventory (MCDI). Our analysis showed that when controlling for age, the children who had more joint attention experienced a higher increase in MCDI percentile. In finding a specific interaction between joint attention and MCDI percentile, these results provide a unique addition to the field, as little to no research on joint attention has indicated an effect on MCDI percentile change.

Data analysis also indicated a positive relationship between caregiver noun usage and child noun usage. When controlling for age, the caregivers with more noun usage also had children with more noun usage. These results support previous findings which have shown connections between caregiver and child noun usage (Brojde, 2010).

In regards to the qualitative analysis, I found it very interesting that those dyads with high joint attention exhibited high engagement of the child, high attentiveness from the caregiver, and questions that supported furtherment of the play. The open ended questions that many of the caregivers asked often encouraged the child to expand their thoughts on the play. I noticed that these questions lead to the children probably grabbing more items from the box. I see this situation to be related to Lev Vygotsky’s research. Vygotsky's research suggests that children learn at a faster rate when they are actively participating and when they are receiving guidance, or scaffolding, from an adult (Vygotsky, 1978). The dyads with high joint attention experienced this. The children were actively engaged and the caregivers tended to ask questions that
contributed more to the child’s play experience. With this in mind, it makes sense that the children who experienced a higher change in MCDI percentile were also the children who experienced Vygotsky’s scaffold learning.

Research supports a strong role of social attention on learning (Kuhl, 2007; Bertenthal & Boyer, 2015;) and a connection between social attention and the development of joint attention (Tomasello, 2003; Bertenthal & Boyer, 2015). The dyads with high joint attention experienced a lot of social attention, as demonstrated by their high communication. The amount of language a child hears is strongly related to a child’s linguistic skills (Hart & Risley, 1995; Hoff, 2006; Hoff & Naigles, 2002; Hurtado et al., 2008; Tamis-LeMonda & Bornstein, 2002). It makes sense that the children experience a high social attention would also be the children with a higher rate of MCDI percentile increase.

**Project Limitations**

Project limitations included participant demographics, camera placement, limited time, and self-report data.

**Participant demographics.** Most study participants were White and middle to upper-middle class. Boulder County is a unique population, and may not be representative of larger groups.

**Camera placement.** This project’s small sample size was largely influenced by poor camera placement within the play room. Half of the original subject pool had to be excluded for this reason. From the selected videos, there were also brief instances in which access to gaze was limited, and head orientation was used instead. Even when access to gaze was good, the camera at times was far from the participant, leaving room for coder error.
**Time.** Coding videos was a very time intensive process. This affected the amount of video analyzed. In order to complete the project, a shorter snippet of the videos had to be used. Had time allowed, longer selections of videos could have been analyzed.

**Self-reported data.** The MCDI vocabulary checklist was filled out by parents based on what they believe to have heard their child say. The parent-reporting may have been affected by the parent’s ability to remember what was said and the parent’s ability to remember when words were said. The MCDI also only measures vocabulary that has been produced by the child, and does not account for vocabulary that the child knows but has not yet said.

**Future Directions**

Future research and replication should include larger sample sizes with more representative populations. We would suggest adding an additional camera to increase access to eye gaze.

It is still undetermined exactly how much joint attention contributes to vocabulary acquisition. Further research should work to discover the degree to which joint attention and other factors are related to vocabulary acquisition. Some researchers have indicated that the earliest, or preverbal stages of development, may be especially conducive to joint attention (Tomasello, 1999). Research has also indicated that a child’s ability to respond to joint attention bids may vary with age (Mundy, 2006). Over the second year of life, research has suggested that the relationship between joint attention and vocabulary acquisition may decrease or disappear completely (Carpenter et al., 1998, Morales et al., 2000). This research suggests that the degree to which influences of joint attention on language development may fluctuate with age. Further research should be conducted with a larger age range of children to better determine the strength of the joint attention-vocabulary acquisition relationship at various stages of development.
More information on why it is that some dyads achieve more joint attention would be beneficial to the field. What else characterizes the dyads with joint attention? Is this a factor of the child’s ability to attend or stay focused, or is it perhaps connected to the caregiver or child’s efforts to initiate joint attention? Studying additional populations in relation to joint attention, such as children with ADD, may help answer these questions.

**Conclusion**

Our results indicated that joint attention is related to vocabulary acquisition. Children who had more joint attention in the dyadic play, experienced a higher increase in MCDI percentile. Our results also show a connection between parent noun usage and child noun usage. This adds further research to the study of joint attention and helps us better understand the word learning process. So much of our communication is verbal, and with this, it is very important for one to be able to express themselves verbally. Children who are linguistically able are more likely to succeed both academically and socially. By contributing to the understanding of word learning, this thesis could help with the development of new language intervention programs so that children with language deficiencies can quickly stand alongside their peers. This research shows that joint attention plays a role in the process. Further research should work to understand the degree to which different factors of word learning, such as joint attention, have on increased acquisition rate.
References


Appendix A: Food Boxes

Prepared Foods

Food from Farms
Appendix B: Vehicle Boxes

Baked Goods

Air and Trains
Trucks

Sea