ABSTRACT

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Few experimental studies provide data on early comprehension of negation. Commonly accepted norms are based on parental report and observational studies using a small number of participants. The purpose of this study was to determine if 18-month-olds (n=24) understand the word *not*. The study used a preferential looking paradigm, in which children saw two video screens showing a puppet performing a different action in each video. They then heard a voice, telling them to "Look! The ____'s *not* ____ing." For the three sets of videos used in the study, children only looked significantly longer at the matching video during one set of trials. However, for no set of trials did the children look longer at the puppet overtly named in the auditory stimulus. These results suggests that although children did not demonstrate a clear understanding of the word *not*, they may be developing an understanding of *not* at this age.

EARLY UNDERSTANDING OF NEGATION: THE WORD "NOT"

By

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Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

Language development is a phenomenal yet basically universal human achievement (Gleason, 2001). Human language is different from any other animal communication system. This difference is defined by three criteria. Language has productivity, semanticity, and displacement (Brown, 1973). Productivity is the ability to use what is already known to create new and unlimited utterances; semanticity is the symbolic representation of ideas, events, and objects; and displacement is the ability to talk about or refer to things that are not occurring in the immediate context. All children acquire the major components of their native languages by three or four years of age, even when learning languages with complex grammar and sound systems (Gleason, 2001). One major aspect of any language is the ability to use negation.

Negation

Negation is the process of making a sentence negative, usually by adding *no*, *not*, or any form of these words (Gleason, 2001). This allows us to discuss what is not happening, or what we do not want. Bloom (1970) suggests that when children are learning language, it is likely that they learn to produce and distinguish between two basic types of sentences: the affirmative and the negative. Although negation is one of the most important aspects of language, few research projects exist on this topic. The current study examines early comprehension of negation by typically developing children. The sections below discuss what is known about the acquisition of negation, with respect to both production and comprehension.

<u>Production of Negation</u>

Although a number of studies have investigated children's production of negation longitudinally, most were case studies involving only a few participants. One of the first studies of this kind was conducted by Klima and Bellugi (1966), who examined the utterances of three children (Adam, Eve, and Sarah, also described by Brown, 1973) to gain information on the changes in syntactic form of negation. When the study began, Eve was 18 months old, Sarah was 26 months old, and Adam was 27 months old. Samples of the children's expressive language were collected several times each month until Eve was 27 months old, and Sarah and Adam were 48 months old. Klima and Bellugi found that children go through an initial phase of development in which *no* or *not* is affixed to the beginning (or at rare times to the end) of an utterance to negate the sentence (e.g., *No the sun shining.*). This stage was observed to occur from the beginning of the study when each child's Mean Length of Utterance (MLU) was approximately 1.75 morphemes until each child's MLU was approximately 2.25 morphemes. Through their observations, Klima and Bellugi also determined that there was no clear evidence that children at this stage were able to comprehend negative forms when these forms were embedded in sentences. For example, children might understand, "No cookies," but would not comprehend, "That's not a cookie." This determination was based on observation of interactions between each child and his or her parent. During the second stage of development (MLUs of 2.25-2.75 morphemes), children began to use some auxiliary verbs in the contracted form (e.g., *don't* and *can't*). Negative elements were also located within sentences (e.g., *That no Mommy.*). The researchers also determined that the children understood negatives when they were embedded in the auxiliary verb of

2

the sentence during this stage. For example, children might understand sentences such as, "I don't want it." In the third stage (2.75-3.5 morphemes), children began to use forms of the verbs *do* and *be* in declarative sentences and questions, as well as additional contracted forms of these verbs (e.g., *didn't* and *isn't).* In general, Klima and Bellugi observed that comprehension of negation was consistent with the children's productions of negative sentences. Since Klima and Bellugi only studied the language of three children, the universal existence of these three syntactic stages is inconclusive. Klima and Bellugi's research provides us with useful information on syntactic changes in the production and understanding of negation, but it does not account for individual differences in development, nor does it give us a broad range for typical development of each stage.

Bloom (1970) later gathered data on the utterances of three different children and determined that the three children learned negation in the sequence of three semantic categories: nonexistence, rejection, and denial. Nonexistence refers to something that no longer exists (e.g., a child says, "No more cookies," when there aren't any). Rejection refers to something that is not wanted (e.g., a child says, "No juice," when he does not want any). Denial refers to an actual (or supposed) prediction that was not the case (e.g., a child says, "No touch that," meaning that he did not touch the referent) (Bloom, 1970). As in Klima and Bellugi's study that was discussed above, Bloom only studied the development of three children. Therefore the universal existence and order of acquisition of these three semantic stages are also inconclusive. However, these two studies provided useful accounts of different stages (syntactic and semantic) seen in children's development of negation that provide a basis for future research in the area of negation.

Existence of External Negation Stage

Although much of the research on early expression of negation examined developmental stages, another area that received attention is a debate regarding whether children go through an early stage of "external negation", where the child places the *no* or *not* external to the sentence. As mentioned above, this stage was first identified by Klima and Bellugi (1966). Bloom (1970), however, argued that such utterances were generally anaphoric, referring to the preceding utterance (e.g. Is the boy running? No, the boy is jumping). More recently, both Deprez and Pierce (1993) and Drozd (1995) examined data on English-speaking children and found evidence to support the stage of development using "external negation". Deprez and Pierce used data from a child database to examine the language of three children, including two children who were studied by earlier researchers in the area of negation, one from Bellugi's 1967 study and one child from Bloom's 1970 study. Drozd (1995) studied the spontaneous utterances of ten children who were studied longitudinally. These data were also taken from a database of child language samples. All of the 13 children in these two studies showed external negation at one point in their development.

Stages of Negation Across Languages

A limitation of the earlier studies by Klima and Bellugi (1966) and Bloom (1970) is the small number of children sampled, which made it difficult to generalize the results to the larger population. Although these studies examined stages of negation in English, it was not known whether these stages of development could be generalized to other languages. However, later studies examined different languages and determined that these same stages of development were apparent across languages. Choi (1988) collected

longitudinal data from children in three different language groups to determine if differences existed in early stages of production of negation. She found that children who spoke English (n=2), French (n=5), and Korean (n=4) all followed similar stages in development. She also expanded on the three stages of development identified by Bloom and named nine categories of negation. These categories were (1) non-existence (e.g., looking in an empty box of cookies and saying, "Allgone cookies"); (2) prohibition (e.g., saying "No play" to prevent someone else from using a toy); (3) rejection (e.g., a child saying "No eat" when he does not want to eat a cracker); (4) failure (e.g., saying "No move," after winding up a toy car and seeing that it is not moving as would be expected); (5) denial (e.g., saying "No, that's a spoon," when shown a picture of a cup and asked if it is a spoon); (6) inability (e.g., a child saying "Can't" when he is unable to climb up a step; (7) epistemic negation (e.g., saying "I don't know" when asked a question for which the child does not know the correct answer); (8) normative (e.g., after seeing his mother put a bear in a car, a child says, "He can't go in a car"); and (9) inferential negation (e.g., after the child is told by his caregiver not to break crayons, the child picks up a crayon that he did not break and says, "I not broken this"). All of these stages were noted in each language group, and the sequence of development was similar in all three languages. Although each language group had few participants, the similarity in development among the children suggests that these stages may be universal. The notion of universal development was further supported by Tam and Stokes (2001) who found the same developmental stages identified by Bloom (1970) in the functions of early negation in Cantonese. However, a study of Tamil (n=2) found a preference for rejection as an earlier developmental stage than non-existence (Vaidyanathan, 1991). Based on the limited

number of participants, it is not possible to determine if this preference exists for all children who speak Tamil. This study confirms that the same stages exist across languages, and that individual differences occur among language learners. However, it is unclear whether the minor variations observed among language learners are grammatical or conceptual.

While most studies on the expressive linguistic development of negation are based on observation, Hummer, Wimmer, and Antes (1993) studied the functions of negation using an experimental design. Their study is one of few large experimental studies in the area of negation. They studied 48 German-speaking children to determine if the stages of rejection and denial were developmentally related and at what age children begin to deny. They used an elicitation procedure that required the participants to answer simple yes/no questions (e.g., The child is shown a picture of a dog and asked, "Is this a cat?"). They found that children begin to deny at around 1:8 years. Moreover, the acquisition of these two stages (denial and rejection) is continuous, such that children's use of "no" in earlier forms helps them to develop the use of "no" for denial, rather than learning denial *no* as a separate entity. This finding is consistent with stage-wise progression. Individual differences are expected to be observed, accounting for minor differences noted by Choi (1988) in the order of acquisition of the stages of negation.

Comprehension of Negation

Even less research has been completed in the area of comprehension of negation. Singer (1986) examined the understanding of more complex forms of negation in school-aged children (between 5-13 years of age). Participants were asked to respond by saying "yes" or "no" to questions regarding sentences with complex embedded negatives and

matrix negatives. Embedded negatives are those negatives that are located within the embedded clause in a complex sentence. Examples of embedded negatives are "That John didn't jump over the fence surprised Dave," and "Dave knew that John didn't kiss Irene." Matrix negatives are negatives that are located in the matrix (or main) clause of a complex sentence. Examples of matrix negatives are "That John jumped over the fence didn't surprise Dave," and "Dave didn't know that John kissed Irene." Based on the theory that when presented with complex sentences, children attach the negative element to the matrix verb in the sentence, Singer hypothesized that children would correctly interpret sentences with matrix negatives but would incorrectly interpret sentences with embedded negatives. For example, the children would incorrectly interpret "Dave didn't know that John kissed Irene," and "Dave knew that John didn't kiss Irene," to have the same meanings. As hypothesized, children at all ages understood more of the sentences containing matrix negatives than sentences containing embedded negatives. The mean number of correct responses to all sentence types increased with age. These results demonstrate that children are still developing an understanding of negation throughout the school-age years.

Studies examining younger children have investigated the effects of plausibility (likelihood that something will be believed) on the comprehension of negative statements (De Villiers & Flusberg, 1975). Children aged two-, three-, and four-years of age were shown sets of stimuli, each consisting of 6 or 7 similar items and one item that was different. The different item could be a member of the same general category (e.g., six horses and one cow), or of a different category (e.g., seven flowers and one shoe). The authors presumed that an item from the same category would be more confusable with

the other items in its set than would an item from a different category, and thus that it would be more plausible to deny the similar items. To quote their example, "it seems plausible to deny that a cup is a jug, but implausible to deny that it is a table"(p. 281). The authors then tested whether this aspect of plausibility would influence children's ability to complete negative sentences. Children were told to complete sentences of the form, "This is a ___" and "This is not a ___". Children successfully completed the plausible sentences at an earlier age. Moreover, plausible negatives were processed more quickly (measured by reaction times) at all ages tested. However, the ability and response time needed to process certain negatives may be related more to the statistical probability of encountering such an utterance rather than the plausibility of the utterance, since a child is more likely to hear and produce utterances that are plausible. Therefore, the results of the study cannot be clearly attributed to plausibility vs. statistical probability of encountering the utterances used in the study.

The examiners also noted that in the group of 2-year-old participants, only 8 of 13 demonstrated the ability to process the negative probes. The other children in this age group simply named the object to which the examiner was pointing. These children were not included in the experimental task, but this may indicate that many children at this age do not yet comprehend plausible negatives. Difficulty with the probes also may be related to the task of completing a sentence. The task requires the child to not only comprehend but also produce a response orally, which may be more difficult than responding by another means, such as pointing or eye gaze. The findings of this study show how different dimensions of understanding of negation are developing in the preschool years,

but the study does not provide information on when young children first begin to understand the simplest forms of negation.

Methods for Testing Comprehension of Language

A number of methodologies have been utilized to test young children's comprehension of language experimentally. One method is to have the children use objects, such as dolls, to act out what is presented to them auditorily. For example, the child is given two stuffed animals, a cat and a dog, and told to, "Make the cat chase the dog." Another method is to have the child act out the auditory stimulus. For example, the child is told to, "Stand behind the block." One difficulty with these types of tasks is that the children may refuse to complete the task on command (Hirsh-Pasek & Golinkoff, 1996). Another difficulty is that children tend to act in certain ways when surrounded by certain objects (e.g. kicking a ball, even when told to squeeze or roll a ball). Therefore, these tasks may underestimate children's linguistic knowledge.

Another common method of measuring language comprehension is using picture selection tasks. Children are presented with several pictures and given a word, phrase, or sentence that can only be matched to one of the pictures. One difficulty in using this type of experimental design is that it requires children to complete an action in order to demonstrate understanding. That is, the children need to actually reach out and pick up or point to the appropriate picture. Another difficulty is attempting to represent action verbs in still pictures (Hirsh-Pasek & Golinkoff, 1996).

A more recent method of determining comprehension of language is referred to as the preferential looking paradigm. This method is based on work that shows that infants and toddlers prefer to look at something that matches what they are listening to auditorily

9

(Spelke, 1976). The child is placed in front of two video screens, which play different images simultaneously. At the same time, the infant hears a sentence that matches one (but not both) of the videos. By measuring the proportion of eye gaze to the matching versus mismatching video, the child's level of comprehension can be assessed (Golinkoff, Hirsh-Pasek, Cauley, & Gordon, 1987). If children understand what they are hearing, they are expected to look at the video monitor that matches what they hear longer than a video monitor playing a scene that does not match. This method is useful for testing early comprehension of language since no oral and minimal physical response is necessary. Also, the design allows the experimenter to visually demonstrate actions. Drawbacks to this procedure include the inability to examine more than a few stimuli at one time, and that it is difficult to examine individual differences in language development (Hirsh-Pasek & Golinkoff, 1996, Chap. 5). These limitations need to be taken into consideration when designing a study using this experimental design.

One difficult aspect of a study on understanding of negation is the abstract level of thought needed in order to complete the task. When presented with a sentence such as, "The elephant is not clapping," the child has to first think about what clapping is before they can determine what picture represents *not clapping*. A recent study showed that both preschoolers and adults work through Disjunctive Syllogism or process-of-elimination (i.e., eliminating answers that are known to be incorrect in order to determine the correct answer) when learning novel labels for novel objects (Halberda, 2004). In this study, the participants were presented with two pictures, one showing a known object, and the other showing an unknown object. When presented with an unknown label, both groups of participants first looked at the known object before choosing (by looking or pointing) to

the unknown object. This response pattern demonstrated the need for the participants to rule out what they did know before determining that the unknown label must match the unknown object. This interpretation seems to be accurate, given that the results do not lend themselves to other strategies. Similarly, Halberda found that in a noun selection task in which participants were shown both a known and an unknown object, participants who heard a novel label showed an increase in "double-checks" of the known objects (something they did not do when presented with the known label). This need to rule out an incorrect response may also be utilized by children when presented with a task such as the preferential looking paradigm. Since the preferential looking paradigm examines overall looking time and not the time course of children's looking behaviors, this may be another limitation to consider.

Using the preferential looking paradigm, Gilkerson, Hyams, and Curtiss (2002) examined infants' understanding of *not* as a sentential negator. This study tested children between the ages of 14-25 months using a cross-modal preferential looking paradigm. In this study, children saw two video screens, each showing a different image (e.g., a girl sleeping and a girl sitting) and heard an auditory stimulus that referred to only one of the images (e.g., "The girl's not sleeping," or "The girl's sleeping."). The children were presented with four different sets of visual and auditory stimuli. The researchers found that the children had a strong picture preference bias for one video in each pair of images that were presented. The researchers therefore chose to examine whether the children looked longer at the dispreferred image when they heard the affirmative control sentence that matched the image versus when they heard the negative sentence that did not match the image. (That is, given that infants did not look at the sleeping girl as much as at the

11

sitting girl, would the infants look at the sleeping girl longer when they heard "She's sleeping," or "She's not sleeping"?).

Results indicated that that the children looked significantly longer at the dispreferred image when they heard the matching stimulus than when they heard the stimulus that did not match the image. The researchers concluded that children between the ages of 14-25 months are able to understand the word *not*. However, the data were combined across all ages and there were only 2 participants under the age of 19 months. Thus, it might be that only children 19 or 20 months of age and older show this type of comprehension. Indeed, there are a variety of other grammatical language skills that appear to develop between 18 and 20 months of age. For example, infants aged 18 months (but not 16 months) recognize the grammatical dependency between *is* and *-ing* (Santelmann & Jusczyk, 1998). Similarly, there is a substantial degree of lexical development occurring within this time frame, with children 14-18 months typically having an expressive vocabulary of approximately 30-125 or more words, whereas children between the ages of 19-24 months typically produce approximately 175-325 or more words (Bates, Dale, & Thal, 1995). Given these grammatical and lexical developments, it would not be surprising if only the older children in the Gilkerson et al. study were able to demonstrate understanding of negation.

One long-standing issue is how to define the time period at which children "comprehend" a given language concept or linguistic structure. Measuring children's understanding of language is difficult, especially when studying children who are not yet able to point or answer questions with accuracy. Researchers often use parental judgments and checklists that are subjective and do not make a distinction between when

12

a child understands a concept all the time or just some of the time. Parents do not take into account whether a child's understanding is based on factors such as prosody and context. Therefore, it is difficult to determine the time period when children begin to understand simple forms of negation.

Since few experimental studies have examined early understanding of negation, many questions remain that warrant inquiry: When do children first begin to understand common forms of negation? Do children begin to understand negation in stages, such as the stages seen in the production of negation? If such stages exist in understanding, do they match those seen in production? Does a child's understanding change depending on nonlinguistic context (i.e., the task)? A child may be able to perform a task when it relates to a desire, but not otherwise. One possibility is that motivation plays a role in a child's ability to accomplish a task. For example, children might demonstrate a clear understanding of negation when asked what game they do *not* want to play. However, children may not demonstrate the same comprehension of negation when presented with two pictures and asked to look at the picture where the boy is *not* in a car.

Clinical Implications

Examining children's understanding of negation could have clinical implications. It is important to know how different aspects of language develop at an early age. Once norms for typical development are known, what is considered atypical can also be established. Then the need for intervention can be determined. Negation is a universal component of language. Moreover, negation's simplest forms are learned early in typical development. This typical early development might suggest that negation is fairly universal, and that it would be an area of relative strength even in children with language

difficulties. Yet, negation is also a complicated concept, with multiple different stages; it is possible that children with language delays would have particular difficulties with negation since it is not necessarily about the here and now, therefore requiring more abstract thought processes.

Current Study

The present study was concerned with the understanding of *not*. The study was designed to gather more information on the understanding of this word under experimental conditions. Prior work by Gilkerson, Hyams, and Curtiss (2002) suggests that an understanding of *not* develops sometime prior to 25 months of age, and likely between 14-25 months. The current study examined a smaller range of ages to determine a more exact time frame for its onset. The word *not* is produced by approximately half of 27 month olds (Dale & Fenson, 1996). Therefore, infants should understand the concept of *not* earlier in their development. Parents report that 18% of infants understand *not* at 16 months. It is predicted that most children will understand *not* between the ages of 18 and 20 months, much earlier than when parents typically report infants produce it, but after 16 months when few are reported to understand it.

One problem that might be expected is that children may have difficulty overcoming the desire to look at the video showing the action overtly named in the auditory stimuli. For example, even if children understand the concept of *not* in the sentence, "The girl is not sleeping," they may none-the-less focus their attention on the video showing "sleeping", since that was the action overtly named. Seidl, Hollich, and Jusczyk (2003) demonstrated that this response pattern is not always the case. Their study used the preferential looking paradigm to study 13-, 15-, and 20-month-olds'

development of understanding of what-questions of the forms "What hit the X?" (subject-question) and "What did the X hit?" (object-question). Children saw videos of both the X and the object that hit it; thus, looking appropriately required that infants avoid looking at the named object. For example, after seeing a flower hit an apple, children would be shown both an apple and a flower while hearing sentences of the form "What did the flower hit?". Responding correctly requires not looking at the named object (the flower). The study showed that by 20 months of age, infants responded appropriately to both kinds of questions. At no age did infants look longer at the object overtly mentioned in the question. This finding suggests that children are able to overcome any desire that they have to look at the action overtly mentioned.

In the current study, verbs were chosen to be the word class that was negated in each sentence. Verbs were chosen rather than nouns for several reasons. After reviewing samples of speech directed at young children, it appeared that *not* and contracted forms of *not* were more often used in conjunction with a verb, rather than a noun (Bernstein Ratner database in CHILDES, MacWhinney, 2000). Also, when a sentence uses *not* with a noun, in order to teach the child the correct label for the object, a statement naming what the object is often accompanies the negative sentence. For example, "No, it's not an eye, it's his nose. By contrast, when *not* or any of its contracted forms are used with a verb, it is rarely paired with a corrective statement, e.g., "No, he's not sleeping." If a child is told that an object is not one thing, the object has to have another label, which is then presented to the child for learning purposes. This is not the case with verbs. If someone or something is not doing a particular action, that person could be doing any of a variety of other actions, or nothing at all, making it unnecessary to specify what the alternative

action is. Since for purposes of the experiment, the auditory stimuli could only include a statement with *not*, and not a corrective statement, verbs were the most appropriate choice. Verbs also were chosen for practical reasons. In particular, it was thought that children would be less likely to have a preference for one video over another if they portrayed the same puppet performing different actions, as opposed to two different puppets or objects.

In the current study, it is hypothesized that children will demonstrate an understanding of the word *not* by approximately 18 months of age. It is presumed that they will demonstrate this understanding by looking for a longer duration to the video displaying the correct visual match. If the children understand the concept of *not*, it is presumed they will look at the video monitor where the puppet is performing an action that is different than the one named.

Chapter 2: Method

<u>Participants</u>

Twenty-four children (12 males, 12 females) aged 18 months (mean: 18 months, 21 days, range: 17 months, 30 days to 19 months 20 days) participated in this study. Data from an additional nine participants were excluded for fussiness or failure to complete the study (n=5), experimenter error (n=1), being in therapy for speech-language (n=1), or having a primary language other than English (n=2). The participants in the study were recruited from largely middle-class suburban areas. Of the children whose data were included, all were from English-dominant homes, and none had any reported hearing or language difficulties.

<u>Materials</u>

Materials used in the current study consisted of visual and auditory stimuli, as well as the use of *The MacArthur Communicative Development Inventories:Toddlers (MCDI)* (Fenson, Dale, Resnick, Thal, Bates, Hartung, Pethick, & Reilly, 1991). The *MCDI* was sent to parents prior to their participation in the experimental part of the study, in order to reduce the time of their visit to the laboratory. It was used to gain informal information on the children's levels of language development at the time of their participation in the study. All parents were given copies of the *MCDI* to complete, however only 22 out of 24 parents of the participants returned the copies. Visual stimuli, auditory stimuli, and information obtained from the *MCDI* will be discussed below.

Visual stimuli consisted of three pairs of videos, each approximately 8 minutes long. The entire test session (including all 3 of the videos) lasted approximately 7

minutes, so the tapes did not run out and did not need to be in a continuous loop. Therefore, no visual interruption existed during any trials. Each pair of videos showed a puppet performing two different actions. The three puppets used were a ladybug (referred to as a bug), a puppy, and an elephant. The majority of toddlers produce these words between 20 and 22 months (Fenson, et. al., 1991). Unfortunately, the *MCDI* only gathers data on comprehension up to 16 months. Therefore, we do not have any standardized data on comprehension of these words for typical 18-month-olds. According to the comprehension data that exist for younger age groups, at 16 months approximately 30% of children understand "elephant" and "bug" and approximately 60% understand "puppy". According to parental reports for the participants in the present study, 5 children were producing "puppy", 5 produced "bug", and 3 produced "elephant" at the time of the study. It is therefore likely that even more of the participants comprehended these words.

The bug was shown flying in one video and jumping in the other. The puppy was shown sitting and sleeping, and the elephant was shown clapping and dancing. Each set of stimuli compared two verbs depicting an equal level of action rather than action to no action (e.g. a bug flying vs. a bug sitting). It was assumed that children would likely prefer to watch any action to no action, no matter what auditory stimulus was presented. Therefore, the children would not demonstrate any understanding they might have of the sentences presented. Furthermore, video pairs were matched such that the puppet performed equivalent levels of action in each video to minimize preference for one video over the other. The verbs also were chosen to be easily picturable and familiar to a young child. All but one of the verbs (fly) is a test item on the *MCDI*. Although most children

are not speaking much by 18 months, these words are all in children's productive vocabulary by approximately 22 months of age (Fenson, et. al., 1991). Parental report on the *MCDI* showed that few children were producing these words at the time of the study. The results showed that 3 children produced "sit", 1 produced "clap" and "sleep", and 1 produced "dance". Although "fly" was not listed, 13 of the participants produced "airplane" by this age, and we assumed "fly" was then likely to be in their vocabularies. Of the verbs used in this study, lexical comprehension norms for 16-month-olds were only available for "dance", "jump", and "sleep" (understood by 87%, 43%, and 61% of children, respectively).

Auditory stimuli were created to match each visual stimulus. A female native speaker of English recorded all auditory stimuli. All items were recorded in a noise-reducing chamber at a 44.1 kHz sampling rate, 16 bits resolution, and were stored on computer disk. The speaker used infant-directed speech to increase interest among the participants. Auditory stimuli consisted of three types: familiarization stimuli, test stimuli, and baseline stimuli.

Familiarization stimuli were intended to instruct the children as to what verbs were intended to be demonstrated by each video. This is important because some actions could be potentially described by multiple verbs (e.g., flying is also gliding, etc.). An example is "Look! The bug is flying. Wow! The bug is flying. See? The bug is flying. Can you see? The bug is flying." A familiarization stimulus was recorded for each of the 6 different actions.

Test stimuli instructed the infant to attend to a particular video. All test stimuli included the word *not*. This word was prominently stressed, using a slightly increased

volume so as to make it clearly audible to the children. An example of a test stimulus was "Look! The bug's not jumping. Do you see? The bug's not jumping. Find the bug not jumping. Can you see? The bug's not jumping."

The baseline stimulus was intended to provide an equally long auditory presentation as the test stimuli, but without referring to any particular video. This stimulus was "Oh, wow! What's that? Look there. Look at that. Oh, boy! Do you see? How neat! Do you see that? What's he doing?" Looking times during these trials were later compared to looking times on test trials to determine the children's understanding of *not*.

The length of teaching trials and test trials were not the same across sets of stimuli, because of the difference in length of each word that was being taught or negated. However, each pair of sentences was exactly matched in duration. Trials ranged in duration from 9.5 seconds to 14.4 seconds.

Procedures

As previously mentioned, the parents of each participant were asked to complete *MCDI* (Fenson, Dale, Resnick, Thal, Bates, Hartung, Pethick, & Reilly, 1991). These data were used to provide the examiners with an idea of how many vocabulary words these particular infants were producing at 18 months, as well as to determine any correlation that may exist between present vocabulary and performance on this task. In addition, the parents were asked to fill out a short questionnaire on the day of the study. This questionnaire contained questions about the home environment, language background, and whether the child knows the word *not*.

The participants were tested using a variation of the preferential looking paradigm (Golinkoff, Hirsh-Pasek, Cauley, & Gordon, 1987). The experiment was conducted in a testing room where the parent and infant were seated in a booth. The booth consisted of three sides made of pegboard. The fourth side of the booth was a curtain that was drawn during the study. The infant participants were seated on their parent's lap in a chair in the center of the booth. The infants were at eye-level with two 19" video monitors spaced 18" apart. A computer was used to control when the videos were playing or when the infants were viewing a blank screen. A light below the two monitors, centered in the front panel, signaled the beginning of each trial. The light was used to focus the child's attention forward. The video screens remained blank until the experimenter began the trial by using a button box connected to the computer.

To prevent parents from influencing their children accidentally, the parents were asked to remain still during the trials. In addition, they were asked to wear headphones playing masking music. The masking music was played at a level sufficient enough to cover the sound of the auditory stimuli, but not loud enough to be uncomfortable for the listener (approximately 60-70 dB SPL).

Once the participant and parent were oriented to the booth, the lights were dimmed and the experiment began. Trials were administered in three blocks. Each block used a different set of videos. The order of video presentation, the video shown first during the familiarization trials, and what video (of each pair) was located on the left vs. right sides were counterbalanced across infants. The order of test and baseline trials was randomized for each block for each infant.

The first two trials consisted of familiarization. In these familiarization trials, only one video was shown at a time along with the matching auditory stimulus. These trials were used to introduce each video to the children and help them adjust to the test set-up.

The next 5 trials consisted of 2 test trials for each action, and 1 baseline trial. Both videos were played during these trials. As mentioned earlier, for the baseline trial, children heard auditory stimuli encouraging them to look without specifying a particular video. During the remaining 4 test trials, the children heard sentences telling them to look at where a puppet was *not* performing an action. There were a total of 21 trials (2 familiarization, 1 baseline, and 4 test trials for each of three blocks) presented. The number of trials was limited because children often have a short attention span at the age tested. The number of trials is also comparable to other studies using a similar experimental design.

During the test and baseline trials, the auditory signal began first. The video came on after the offset of the critical word (i.e., the video came on at the end of the action word). During the baseline trials, the video onset was delayed for the same amount of time as in the test trials for that block.

All auditory stimuli were played through two loudspeakers located on the left and right sides of the booth. Speech was played at a normal conversational level, at approximately 60-70 dB SPL.

Data Collection and Coding

Each session was videotaped so that the infant's looking behavior could be coded after the test session. This procedure was completed by using a video camera at the front of the booth. A second camera recorded the two video monitors throughout the

experiment. This recording was viewed by the experimenter to ensure that each video played correctly during each trial.

Coding of looking behavior was completed from video recordings at a later time by the experimenter who was blind to condition. Although coding reliability was not calculated for this study, reliability for prior experiments using this coder and coding method have averaged .95 for total looking and .93 for longest looks.

The experimenter used a computer program to calculate response times by pressing buttons on the keyboard to code the time the infant spent looking either left or right for the entirety of each trial. This quantified how long the infant looked at each screen during a given trial. Summary statistics were then gathered from this data for further analysis.

Data Analysis Procedures

Two measures were recorded from the trials: the total look time to each video during each trial, and the single longest look to each video during each trial. These data were then used in several analyses. The first analysis involved the total average time spent looking at the mismatching video vs. the matching video. Total looking times to each video were measured in seconds and compared using a paired *t*-test. It was hypothesized that if children understand *not*, the number of seconds spent watching the matching video will be significantly higher than the time spent watching the mismatching video. The second analysis was the proportion of time spent watching each video during baseline vs. the time spent watching the same video during test trials where the participant was directed to look at that video. These proportions were compared using a paired *t*-test. It was hypothesized that if children understand *not*, then the proportion of

time spent watching the video during the test trial will be greater than the proportion of time spent watching the video during the baseline trial. That is, children would look longer at each video when they are told to look at it than when they are not told anything. The final type of coding was based on research by Schafer and Plunkett (1998) suggesting that the duration of the single longest look on each trial is a more sensitive measure than is total look time to determine infants' true preferences. Therefore, the final analysis used the longest look during baseline trials compared to the longest look during test trials when the participant was directed to look at that video. Longest looks were measured in seconds and compared using a paired *t*-test. It was hypothesized that if children understand *not*, longest looks during test trials should be significantly longer than longest looks to the same video during baseline trials.

Chapter 3: Results

Looking to matched vs. mismatched videos was examined for an overall effect across the three sets of videos and for an effect for each set of stimuli. No overall effect was present $t(23)=0.95$, p>.05. This is shown in Figure 1. However, when each pair of stimuli was examined separately, the children looked longer at the videos that matched what they were hearing during the trials when they saw the "puppy", $t(23)=2.9$, p<.05, as shown in Figure 2. During the "bug" and "elephant" trials, children did not look significantly longer at either video, $t(23)=1.54$, p>.05 for the bug trials and $t(23)=-1.58$, p>.05 for the elephant trials (refer to Figure 2). For the bug trials, the children showed a nonsignificant trend toward looking at the appropriate condition, while during the elephant trials, the children showed a nonsignificant trend in the opposite direction, toward the inappropriate condition. Mean looking times for all pairs of stimuli are shown in Table 1. When examined individually, only 3 out of the 24 children looked to the appropriate video for a longer period of time across all three sets of stimuli. This low number could be the result of chance responding, and suggests that the lack of significant findings is not the result of individual variation. That is, if some children had the full concept of negation, while others did not, we would have expected a larger subset of children to have been successful on all three items.

A second analysis compared the proportion of time the children spent watching each video during test trials (when they were being told to look at a particular video) to the time children were watching the video during baseline trial (when they were just being encouraged to look at the videos). These proportions were each compared using a paired t-test. These paired t-tests revealed that infants looked marginally (but not

significantly) more often to "jump" during the "jump" test trials than on "bug" baseline

trials, $t(23)=1.77$, p<.09. None of the other comparisons were significant (either), as

shown in Figure 3. Although children did show a marginal preference for "jump" during

test trials, given that six separate paired t-tests were performed (one for each verb),

without adjusting for probability for the multiple comparisons, this one marginal effect is

likely to be spurious.

The final analysis compared longest looks during test trials compared to longest

looks during baseline trials using paired t-tests. Much like the proportions of look time,

when comparing longest looks during test trials to longest looks during baseline trials, no

significant effects were seen. Although children showed an overall effect of looking to

match vs. mismatched videos during the "puppy" stimuli, there is no effect seen for either

"sit" or "sleep". This difference in performance demonstrates the variable nature of

children's looking on these tasks.

Total looking match vs. mismatch
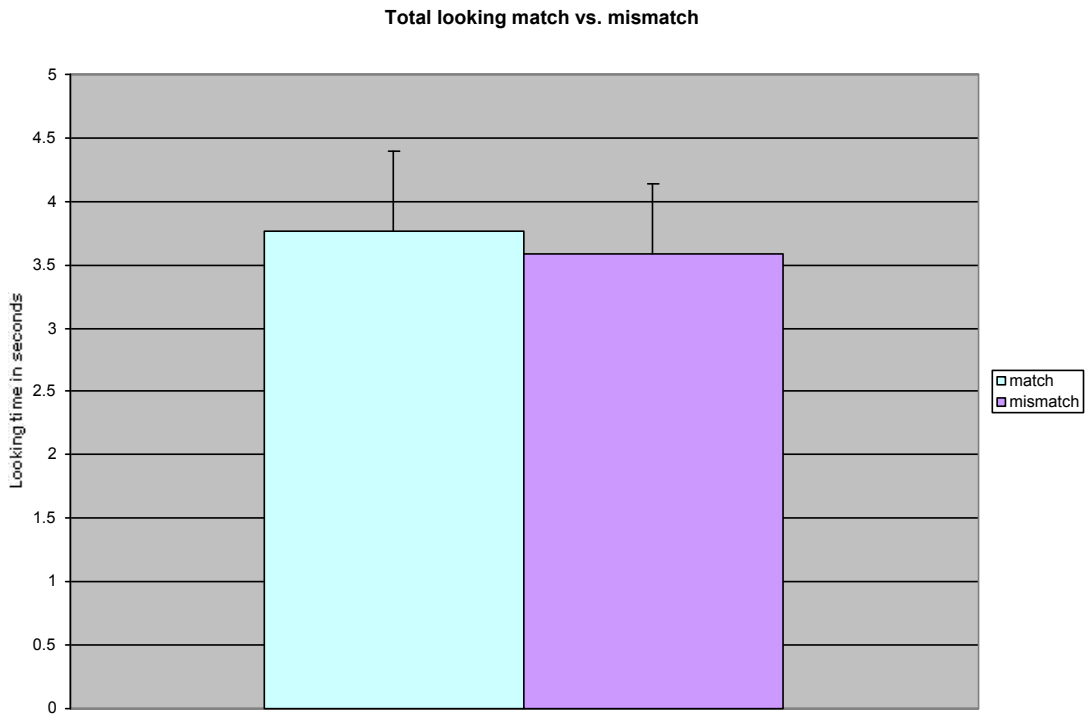
Figure 1. Total looking time in seconds to matching vs. mismatching video and standard deviations.
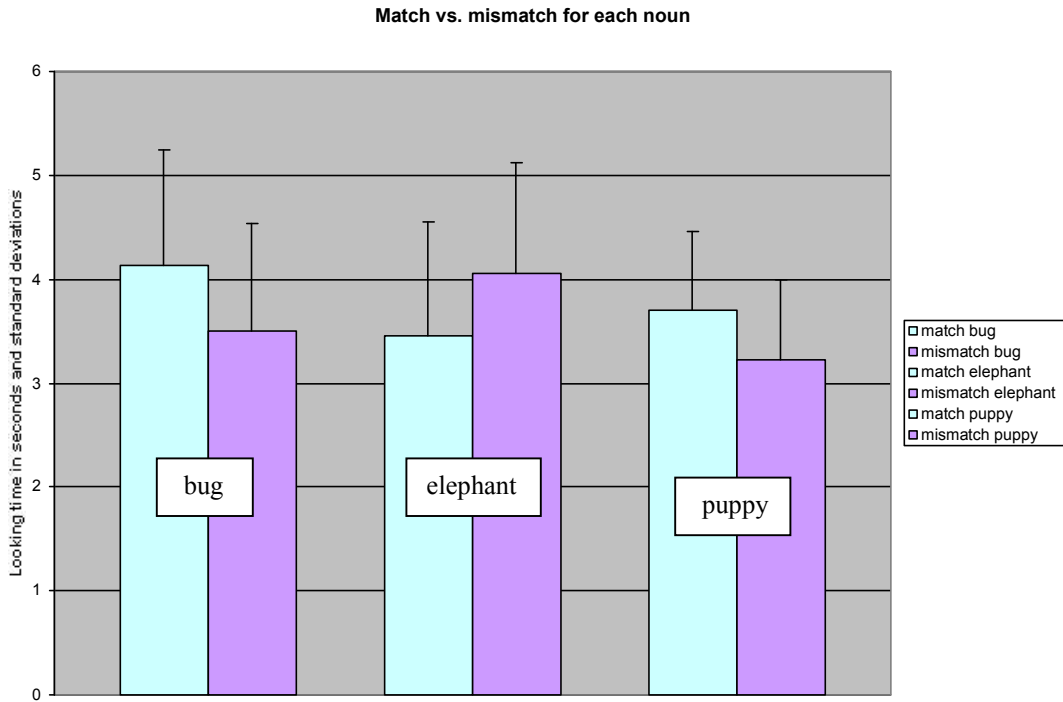
Figure 2. Looking times in seconds to matching vs. mismatching videos for each noun and standard deviations.

Table 1 Mean looking times in seconds to matching video and mismatching video for each set of stimuli and overall.

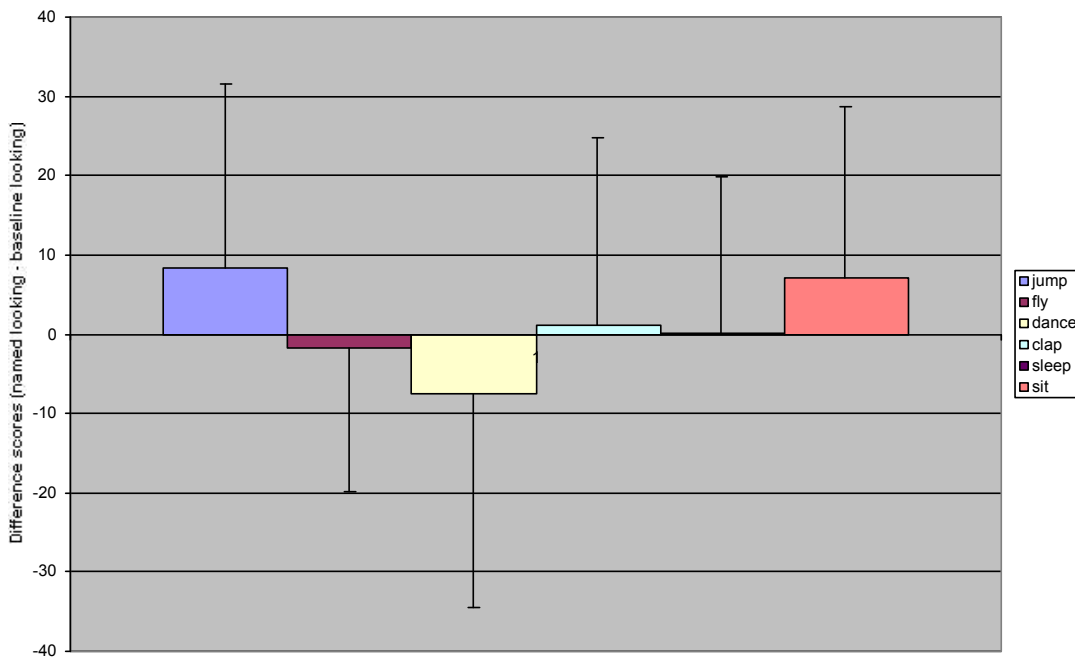|	Mean looking times in seconds	
Visual Stimuli	*Matching*	*Mismatching*
Bug	4.13	3.50
Elephant	3.46	4.05
Puppy	3.70	3.22
Overall	3.69	3.53

Figure 3. Difference scores for each verb (named looking – baseline looking)

Chapter 4: Discussion

The aim of this study was to determine if 18-month-old children understand negative statements using the word *not*. It was hypothesized that children would understand such statements by approximately 18 months. However, the children in the present study did not demonstrate a clear understanding, as shown by the variable nature of their looking to each set of stimuli. In the sections below, the results of the current study will be discussed and compared to the results of other related studies.

The results of the current study suggest that most children at the age of 18 months do not yet have a clear understanding of the word *not*. However, since the children did look significantly longer at the appropriate video during one set of trials, this suggests that children may be developing an understanding of *not* around this age. It is possible that children can only demonstrate their understanding under certain conditions or with certain words. As noted previously, more children at 16 months understand the word "puppy" than the word "elephant" or "bug" (Dale & Fenson, 1996). Perhaps children are better able to focus on other aspects of the sentence when the object nouns are better known. (That is, perhaps they focus on the nouns first, and thus stronger lexical representations for these words result in more resources available for other processing.) An alternative explanation has to do with the videos themselves. The pair of videos using the puppy (sleeping and sitting) was the only video pair that did not show movement. Perhaps the overt movement in the other videos captured the infants' attention in a way that prevented them from responding to the meaning of the sentence. Either (or both) of these factors could have made the task easier for young children to complete accurately.

The results of the current study differ from the results reported by Gilkerson, Hyams, and Curtiss (2002) in their study on understanding of anaphoric and sentential negation. This difference could be the result of at least two factors. One factor is the wide range of ages used in the Gilkerson, Hyams, and Curtiss (2002) study. In fact, the researchers note that they did not complete a statistical analysis to determine effects of age because of the small number of participants under the age of 19 months (n=2). Taking this into consideration, the data collected in the current study may suggest that children at 18 months are in an emergent stage of comprehending negation. These children are only beginning to understand the word *not*, but gain a more thorough understanding during the next few months of language development. This idea that children at 18 months are in an emergent stage of understanding is further supported by the null effect observed on two out of three sets of stimuli ("bug" and "elephant"). If children had not noticed the word *not* at all, they should have looked at the named action and thus shown an effect opposite of the one expected. Therefore, finding a null effect might suggest that children have begun to pick up on the *not* by the age tested.

The second factor may be related to the stimuli presented in the two experiments. Whereas the Gilkerson, Hyams, and Curtiss study appears to have used still images in all of their visual stimuli, the current study used two sets of videos showing actions, and one set of stimuli with a still image. Perhaps children are able to better complete the task when the visual stimuli are simplified, thus creating less distraction. Indeed, simplifying the actions has been shown to help toddlers in other tasks involving verbs (see, for example, Maguire, Hennon, Hirsh-Pasek, Golinkoff, Slutzky, & Sootsman, 2002). This notion is further supported by the fact that the only significant looking preference was

found for the "puppy" test trials (the only set of stimuli with a still image). This was the only set of test trials where the participants looked significantly longer at the matched video vs. the mismatched video. Another difference across the stimuli used in the two studies was the use of puppets compared to humans or animals. Puppets may be more symbolic to children at this age, therefore adding more cognitive demands to the task. Color photographs and video images of real items are the first symbolic objects that infants master (Deloache, 2006).

As discussed earlier, children use both process-of-elimination and "double-checking" when presented with certain word learning tasks (Halberda, 2004). Since children use many strategies for learning language at this age, it seems likely that young children would use both process-of-elimination and "double-checking" when presented with the abstract concept of what is *not* happening. If so, we might expect that children in this study would first need to look at the wrong object (the one overly named), or to look back and forth between the two objects, before then looking at the target object. This would result in longer looking at the target object only in the second part of the trial; averaging across the trial as a whole, the child might show roughly comparable looking to the two videos. Future work should look at the time-course of children's looking, not just at the overall looking behavior across each trial. However, these issues should not arise if a child comfortably understands the concept of *not*.

Limitations of the Present Study

One limitation of the present study was not including test trials to determine if the children comprehended what was shown in each video. The test trials all focused on determining whether the children understood where an action was *not* happening. The

children heard an auditory stimulus matching the visual stimuli for each video during the familiarization trials, but were never tested to determine if they understood the content of each video. If children had demonstrated an understanding of what each video was showing when presented with the affirmative sentence, but not when presented with the negative sentence, then it could have been determined that children do not have a clear understanding of *not* at this age. Without affirmative test trials, it cannot be determined with certainty whether the children comprehended where the named action was occurring. Another limit is that the current study did not examine time course, so process-of-elimination was not assessed. As mentioned above, if the children were using process-of-elimination, they would need to know where a certain action is taking place before determining where it is not taking place. This would imply a change in looking over the time course of the trial. It is also possible that the frequent changes in visual and auditory stimuli made the task too difficult for the children. Therefore, reducing the number of different stimuli presented may allow children to demonstrate their understanding of *not* with just one or two simple verbs, rather than six.

Implications for Future Research

The variability shown by the participants in this study (e.g., demonstrating an understanding of *not* when presented with stimuli using "puppy", but not with any other stimuli) suggests that children's understanding of *not* at this age is an emerging ability. Therefore, the next step would be to test children at the slightly older age of 20 months. It also would be important to include trials determining understanding of what each video is explicitly showing, as was mentioned as a limitation in the current study. To determine if children used a process-of-elimination in the current study, we could inspect the data and

compare total look time to the matching video during the first half of each test trial as compared to the total look time during the second half of each trial. This comparison also could be performed using longest looks to matching video during the first and second halves of each trial. Another analysis that could be performed on the looking data would be to use a frame-by-frame analysis, thus gathering information regarding the time-course in the children's looking.

Another area of interest is whether or not children understand the word *not* when it is negating other parts of speech such as nouns or adjectives. It is possible that children are able to understand *not* when presented with very familiar nouns or adjectives. Children may be able to demonstrate an understanding when shown a picture of a book and a picture of a ball and told "It is not a book," because "book" and "ball" are known lexical items to almost all 18-month-olds. Children may have less success when presented with stimuli contrasting descriptive words, since few descriptive opposites are well known to young children (Dale & Fenson, 1996).

As discussed earlier, much of the literature and research on negation has concentrated on the stages that children go through in production. However, there are no experimental studies that have examined the stages of development in comprehension of negation. The current study focused on the syntactic form of negation, not the semantic concept. However, research could be done to determine how early children demonstrate a conceptual understanding of negation. For example, children could be presented with pictures and auditory stimuli of "Cookies" and "No more cookies" to determine if children understand the concept of nonexistence. Other future projects may seek to

determine whether children proceed through the same stages in understanding or if the acquisition of understanding differs in its development.

Conclusion

      Negation is an important aspect of language. This study was designed to gather more information on typical language development in regards to the understanding of *not*. The children in the current study did not demonstrate a clear understanding of the word *not* at the age tested, approximately 18.5 months. More research in this area is needed to determine if children (both typically developing and special populations) are able to comprehend *not* at this age in different contexts or are able to understand it under the same conditions at other ages.

References

Bates, E., Dale, P. S., & Thal, D. (1995). Individual differences and their implications for theories of language development. In Fletcher, P., & MacWhinney, B. (Eds.), *The handbook of child language* (pp. 96-151), Oxford, England: Blackwell Publishers.

Bernstein Ratner, N. (2000). Mother-child interaction database. In MacWhinney, B. *The CHILDES Project: Tools for Analyzing Talk*. 3rd Edition. Mahwah, NJ: Lawrence Erlbaum Associates (print edition). Retrieved at http://childes.psy.cmu.edu/manuals/02englishusa.doc

Bloom, L. (1970). *Language development*, Cambridge, MA: The M.I.T. Press.

Brown, R. (1973). *A first language– The early stages*, Cambridge, MA: Harvard University Press.

Choi, S. (1988). The semantic development of negation: a cross-linguistic longitudinal study. *Journal of Child Language*, *15*, 517-531.

Dale, P. S., & Fenson, L. (1996). Lexical development norms for young children. *Behavioral Research Methods, Instruments, & Computers, 28*, 125-127.

de Villiers, J. G., & Tager-Flusberg, H. (1975). Some facts one simply cannot deny. *Journal of Child Language*, *2*, 279-286.

Deloache, J. S. (2006). Mindful of symbols. *Scientific American Mind*, *17*, 71-75.

Drozd, K. (1995). Child English pre-sentential negation as metalinguistic exclamatory sentence negation. *Journal of Child Language*, *22*, 583-610.

Fenson, L., Dale, P., Resnick, J. S., Thal, D., Bates, E., Hartung, J. P., Pethick, S., & Reilly, J. S. (1991). *The MacArthur Communicative Development Inventories*. San Diego: San Diego State University.

Gilkerson, J., Hyams, N., & Curtiss, S. (2002). *'No I understand negation': a preferential looking paradigm study of early knowledge of sentential and anaphoric negation.* Unpublished masters thesis, University of California, Los Angeles, CA, United States of America.

Gleason, J. B. (2001). The development of language: an overview and a preview. In Gleason, J. B. (Ed.), *The development of language* (pp. 1-39), Needham Heights, MA: Allyn and Bacon.

Gleason, J. B. (Ed.). (2001). *The development of language*, Needham Heights, MA: Allyn and Bacon.

Golinkoff, R. M., Hirsh-Pasek, K., Cauley, K. M., & Gordon, L. (1987). The eyes have it: Lexical and syntactic comprehension in a new paradigm. *Journal of Child Language*, *14*, 23-45.

Halberda, J. (2004). Is this a dax which I see before me? Use of the logical argument disjunctive syllogism supports word-learning in children and adults. Manuscript submitted for publication.

Hirsh-Pasek, K., & Golinkoff, R. M. (1996). The intermodal preferential looking paradigm: a window onto emerging language comprehension. In McDaniel, D., McKee, C., & Cairns, H. S. (Eds.). *Methods for assessing children's syntax* (pp. 105-124). Cambridge, MA: The MIT Press.

Hummer, P., Wimmer, H., & Antes, G. (1993). On the origins of denial negation. *Journal of Child Language*, *20*, 607-618.

Klima, E. S., & Bellugi, U. (1966). *Syntactic regularities in the speech of children*. In Lyons, J., & Wales, R. J. (Eds*.), Psycholinguistics papers: The proceedings of the 1966 Edinburgh conference*. (pp. 183-208). Edinburgh: Edinburgh University Press. Printed in Bar-Adon, A., & Leopold, W. F. (1971*). Child Language–A book of readings*. Englewood Cliffs, NJ: Prentice-Hall.

Maguire, M. J., Hennon, E. A., Hirsh-Pasek, K., Golinkoff, R. M., Slutzky, C. B., & Sootsman, J. (2002). Mapping words to actions and events: How do 18-month-olds learn a verb? In Howell, S., Fish, S., & Keith-Lucas, T. (Eds.), *Proceedings of the 26th annual Boston University Conference on Language Development.* Boston, MA: Cascadilla Press.

Santelmann, L., & Jusczyk, P. W. (1998). Sensitivity to discontinuous dependencies in language learners: Evidence for limitations in processing. *Cognition*, *69*, 105-134.

Schafer, G., & Plunkett, K. (1998). Rapid word learning by fifteen-month-olds under tightly controlled conditions. *Child Development*, *69*(2), 309-320.

Seidl, A, Hollich, G., & Jusczyk, P. (2003). Early understanding of subject and object wh-questions. *Infancy*, *4*(3), 423-436.

Singer, M. (1986). A developmental study of children's comprehension of negation in complex sentences involving clauses. *Journal of Genetic Psychology*, *148*(2), 189-196.

Shipley, K., & McAfee, J. (1998). *Assessment in speech-language pathology*. San Diego, CA: Singular Publishing Group.

Spelke, E. (1976). Infants' intermodal perception of events. *Cognitive Psychology, 4*, 553-560.

Tam, C., & Stokes, S. (2001). Form and function of negation in early developmental Cantonese. *Journal of Child Language, 28*, 373-391.

Vaidyanathan, R. (1991). Development of forms and functions of negation in the early stages of language acquisition: a study in Tamil. *Journal of Child Language, 18*, 51-66.