'No I Understand Negation': A preferential looking paradigm study of early knowledge of sentential and anaphoric negation

Jill Gilkerson Nina Hyams Susan Curtiss

University of California, Los Angeles

Before January 21, please send all correspondence to:

Jill Gilkerson
UCLA, Dept. of Linguistics
3125 Campbell Hall
405 Hilgard Avenue
Los Angeles, CA 90095
310-825-0634
gilkerson@psych.ucla.edu

After January 21, please send all correspondence to:

Jill Gilkerson
Infoture, LLC
2060 Broadway
Suite #280
Boulder, CO 80302

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Abstract

This study reports the results of a cross-modal preferential looking paradigm experiment testing infants' interpretation of anaphoric and sentential negation. We tested 32 children between the ages of 14-25 months. Our results show that children at this age, who have little or no productive language, demonstrate knowledge of sentential negation (e.g. *The girl's not sleeping*). Our results also suggest that children at this stage "incorrectly" interpret anaphoric *no* (e.g. *No she's sleeping*) as a sentential negator. The latter result is consistent with the idea that children go through a very early "external negation" stage (cf. Klima and Bellugi 1966, Deprez and Pierce 1993), the remnants of which may be visible in spontaneous speech only in the earliest stages of language production.

1. Introduction

Much research in the area of early grammatical development is concerned with the extent to which child grammar differs from adult grammar. Although children utter sentences that are seemingly non-adultlike, it is argued that children's grammatical representations are similar to adult representations and are subject to the same constraints as adult grammars. The Continuity Hypothesis (Klein, 1982; Hyams, 1983; Pinker, 1984; White, 1980), for example, maintains that at every stage child grammars conform to principles and parameters of Universal Grammar (UG); and the Early Morphosyntactic Convergence Hypothesis (EMC) (Hoekstra & Hyams, 1998) claims that children converge on the specific morphosyntax of the adult grammar at a very early age.

This study tests the EMC and the Continuity Hypothesis in the domain of negation. Studies of spontaneous speech have shown that *no* is acquired earlier than *not* in production (Klima & Bellugi (K&B), 1966; Bloom, 1970; Stromswold, 1997). Anecdotal evidence suggests that children understand negation before they produce it, but this has not been tested under controlled experimental conditions. It is therefore still unclear whether children understand clausal negation with *not* before they produce it. In this paper we report the results of a preferential looking paradigm experiment that tested infants and toddlers comprehension of sentential *not*. There is also disagreement concerning an earlier stage of negation (K&B's Stage 1) in which children produce *no*–initial utterances (e.g., *No the sun shining*). Does initial *no* in such cases have an anaphoric interpretation, essentially referring back to a previous utterance, or a clausal negation interpretation, meaning *The sun is not shining* (Klima & Bellugi, 1966; Bloom, 1970; Deprez & Pierce, 1993; Drozd, 1995; Stromswold, 1997)? Since interpretation of such utterances is often difficult to determine from spontaneous speech samples, comprehension studies are called for. Thus, our study also tested whether sentence-initial *no* has an anaphoric or sentential negation interpretation for very young children.

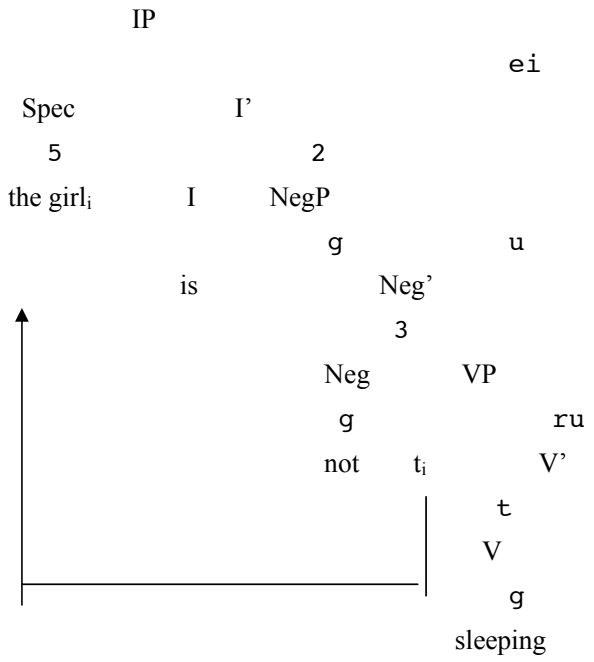
In the Background section that follows we review the structure of negative clauses in adult English and we briefly discuss current theories of grammatical development. This section also provides a detailed review of production studies concerned with the acquisition of *no* and *not*. We then turn to our preferential looking paradigm comprehension study.

2. Background

2.1 Adult clausal structure

Following Pollock (1989) (and many others), we assume that n*ot* occupies the head position of a functional projection, Negative Phrase (NegP) that is located between IP and VP.[1] We further assume, in line with the VP-internal subject hypothesis, that subjects are base-generated inside the VP and raise to subject position (Spec-IP) (cf. Kitagawa, 1986; Koopman & Sportiche 1991).[2] Languages vary with respect to the obligatoriness of the subject raising operation. In Italian and other null subject languages, the subject may remain inside VP at S-structure (Koopman & Sportiche, 1991). In English and many other languages, however, the subject must raise. In English, therefore, subjects necessarily precede negation in declarative clauses (e.g. *We don't support this occupation*), while in languages like Italian the subject may occur below negation *(Non sono arrivati i ragazzi ieri* 'The guys didn't arrive yesterday'). Subject raising is thus a point of parametric variation. The structure of the English sentence *The girl is not sleeping* is as in (1).

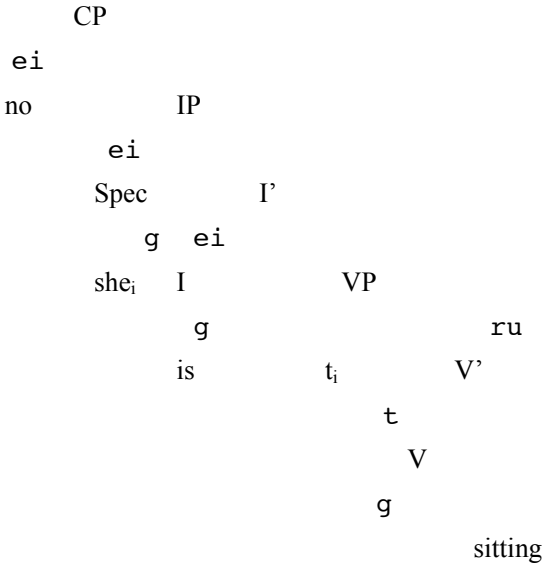
(1)



Similarly, null subjects are base-generated (as *pro*) in Spec-VP. We return to the VP-internal subject hypothesis below.

In adult English, sentence-initial *no* (e.g., *Is she sleeping? **No**, she's sitting*) has an anaphoric interpretation and relates back to the previous sentence. Laka (1990) and others propose that anaphoric *no* occurs in CP, the projection that houses clausal-typing elements such as overt or abstract markers of declarative, interrogative and imperative force. The structure of the sentence *No, she's sitting* is given in (2).

(2)



Evidence for Laka's claim that *no* is located in CP is provided by the fact that *no* cannot occur in questions, either with or without *do* support, as shown in (3a,b); it is in complementary distribution with the declarative complementizer *that*, as in (3c); and it cannot occur in imperatives (as noted by Katz & Postal, 1964, cited in Postma and van der Wurff (fn. 20), 2004), as illustrated by the contrast in (3d,e).

(3) a. *Did no you sing that song?
b. *No you sang that song?
c. *I said that no you can't sing. (cf. I said, "No you can't sing")
d. *No do not drive the car!
e. No you will not drive the car.

In each instance the impossibility of *no* can be explained if we assume that Spec-CP is occupied by a clausal typing operator that blocks *no*; an interrogative operator in (3a) and (3b), a declarative operator in (3c), and an imperative operator in (3d) Postma and van der Wurff argue that the imperative in (3d) is ungrammatical (without an intonation break) because *no* competes for the clausal typing position with an (abstract)

imperative operator. *No* is possible in (3e) under the assumption that root clauses assume a default declarative force unless otherwise marked.[3]

2.2 Grammatical representations in child language

Hoekstra and Hyams (1998) (among many others) note that children are sensitive to the morphosyntax of the adult grammar from a very early age. They refer to this finding as Early Morphosyntactic Convergence (henceforth EMC). For example, from the onset of multiword production children largely respect agreement rules (Hoekstra & Hyams, 1998), and show knowledge of target parameter settings for many parameters including the null subject parameter (Valian, 1990) V to I (Pierce, 1992) and V2 (Poeppel & Wexler, 1993 among others). However, it is unclear at what point children actually acquire these aspects of grammatical knowledge; it is possible that they converge on the morphosyntax of their language *before* they produce multi-word utterances. A number of comprehension studies using the preferential looking paradigm have shown that infants have knowledge of certain aspects of morphology and syntax, for example, progressive morphology and word order, before they begin to speak (e.g., Hirsh-Pasek & Golinkoff, 1996). More recently, infant research has shown that 20-month-olds can understand subject and object "What" and "Where" questions (Seidl & Hollich, 2002) long before they reliably produce these kinds of questions. The acquisition of negation has been extensively investigated in the area of production (e.g., Klima & Bellugi 1966; Bloom, 1970; Deprez & Pierce, 1993; Drozd, 1995; Stromswold 1997). It is well known that comprehension typically precedes production in development. Assuming that the grammar is neutral between comprehension and production, by testing infants' understanding of negative sentences we can determine at what point they have knowledge of negation.

The Continuity Hypothesis asserts that child grammars are subject to the constraints of UG, and should therefore be similar to some adult language at every stage of development (White, 1980; Klein, 1982; Hyams, 1983). The fact that children's productions deviate from the adult language has led to various proposals that reject continuity in its strongest form. For example, the widespread omission of functional elements in early language has led some to hypothesize that there is a discontinuity

between the adult target grammar and child grammar, and that early grammars either lack functional projections (e.g. Radford, 1990) or have a reduced functional structure relative to adult grammar (e.g. Clahsen et. al, 1996). Rizzi (1994) has hypothesized that in early grammar phrase structure can be truncated below the CP or TP level because children lack the axiom that the root must be the CP. Wexler (1998) takes an optimality-theoretic approach, suggesting that differences between adult and child language result from competing constraints, some of which exist only in child grammar. Others have suggested that differences between adult and child language can be attributed to children's limited production abilities (Valian, 1990; Gerken, 1991; Bloom, 1993), and still others propose that the child's linguistic system differs from the adult's at the interface levels. According to the latter hypothesis, children may be adultlike at the level of sentence grammar, but either they lack certain principles that map sentences onto discourse representations (e.g., Thornton, 1995; Hyams, 1996; Avrutin, 1999; Avrutin & Coopmans, 2000), affecting particular aspects of grammars such as pronominal and temporal reference, or there may be constraints at the syntax-PF mapping that result in omission of functional elements (Gerken, 1991).

In this study we address the issues of continuity and early morphosyntactic convergence by investigating how infants and toddlers represent negation. Does the syntax of early negation differ from the syntax of adult negation? Do very young children acquiring English immediately converge on the morphosyntax of the target grammar, assigning an anaphoric interpretation to sentence-initial *no* and a clausal interpretation to sentence-medial *not*, or is there some development with respect to these elements?

2.3 Previous research

Klima and Bellugi's (1966) seminal study of the acquisition of negation by English-speaking children was based on the spontaneous production data of Adam, Eve and Sarah. According to Klima and Bellugi, all three children went through an initial stage in which negation was "external", in that it either preceded or followed the entire sentence. Klima and Bellugi's Stage 1 is exemplified by the utterances in (4) below.

(4) a. No the sun shining.
b. No sit there.[4]

c. Wear mitten no.

As Klima and Bellugi note, at this initial stage of language production, children's language is generally telegraphic with few inflections or functional morphemes. Additionally, the negative element *not* is rarely used. Since negation is always peripheral to the sentence in the children's productions, Klima and Bellugi suggest that children at this stage may not understand sentence-medial negation in adult language. Most importantly, Klima and Bellugi propose that *no* is a clausal negator in early language rather than an anaphoric negator as it is in the adult grammar.

During Klima and Bellugi's Stage 2, the negative elements *no* and *not* appear inside IP following the subject.

(5) a. I no want envelope.
b. He not little, he big.

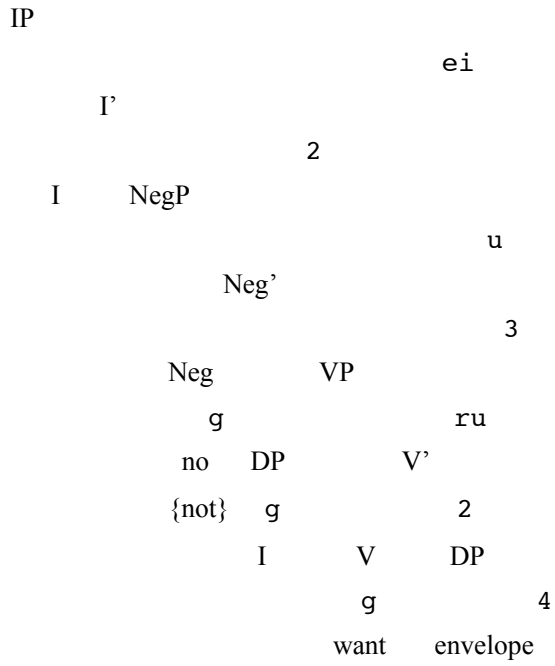
Finally, at stage 3, the children's language is relatively adultlike. Anaphoric *no* consistently surfaces in sentence-initial position, and *not* appears consistently in sentence-medial position often attached to a modal.[5]

In contrast to Klima and Bellugi's claims that *no* negates the following verb, others have argued that sentence-external negation has an anaphoric interpretation in child grammar as it does in adult grammar. De Villiers and de Villiers (1979) revisited Adam, Eve and Sarah's data and claim that in Klima and Bellugi's stage 1 all utterances with sentence-initial *no* that also include an overt subject have an anaphoric interpretation. They also note that while some children used sentence-initial *no* with a non-anaphoric interpretation (e.g. *No mommy do it)*, these utterances were more appropriately analyzed as "polite rejections" with an implicit higher predicate meaning something like (*I*) *no* (*want*)[6] *mommy to do it*.[7] Bloom (1970) analyzed the spontaneous speech of three additional English-speaking children, Kathryn, Eric and Gia, and claimed that when context is taken into account, utterances with "external" negation were either polite rejection or anaphoric, in contrast to sentence-internal negation which always negated the following predicate. Bloom further argued that the structure of negative

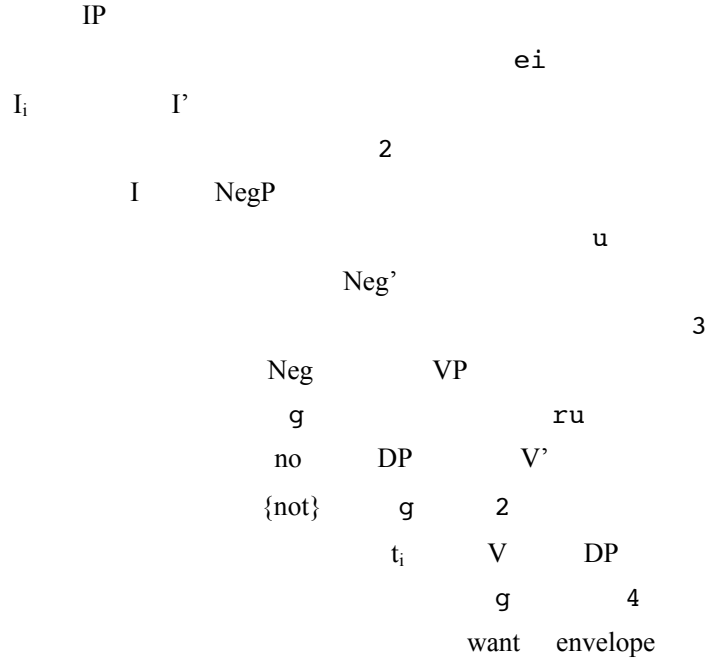
sentences in child language is similar to the adult structure but that children have performance limitations that affect the production of negative sentences.

More recently, Deprez and Pierce (1993) analyzed the spontaneous utterances of three English-speaking children (Eve, Peter, and Nina). They claim, as did Klima and Bellugi, that children go through an early stage in which sentence-initial *no* is clausal rather than anaphoric. Based on the assumption that NegP is located between IP and VP (cf. 1), and that both *no* and *not* are located in NegP in early grammar, they hypothesize that children go through an early stage in which subjects remain internal to VP, even when this is not an option in the adult target grammar. Thus, on their analysis there is a default setting of the subject raising parameter that must be unlearned with exposure to positive evidence in the input. The resetting of this parameter marks the shift from Stage 1 to Stage 2 negation. According to Deprez and Pierce, the Stage 1 sentence *No I want envelope* has the structure (6a) while the stage 2 sentence *I no want envelope* has the structure in (6b).

(6) a. No I want envelope.



b. I no want envelope



Deprez and Pierce's analysis relies crucially on the assumption that the negative element in *no*-initial sentences such as (6a) above is located in NegP and behaves like *not*. It is also important to note that Deprez and Pierce (like Klima and Bellugi) include in their analysis sentences with and without overt subjects. So a sentence with a missing subject (e.g. *No want teddy*) is assumed to contain a phonologically null subject to the right of *no*. (e.g. *No pro want teddy*) and thus all null subject sentences (the majority of sentences at this stage) support their hypothesis by assumption.

Stromswold (1997) reanalyzes Deprez and Pierce's data and includes in her analysis only sentences with overt subjects, hence sentences in which the precise location of the negative element is clear. On her analysis, which takes context into account, most instances of sentence-initial negation have an anaphoric interpretation, similar to what is reported in Bloom (1970). Stromswold also finds strong form-position contingencies

with *no* occurring in initial position and *not* occurring sentence medially. She thus disputes Deprez and Pierce's claim that *no* and *not* have the same distribution in early grammar (between IP and VP). Stromswold finds only three occurrences of sentence-medial *no* and only one clear use of sentence-initial *not* in Deprez and Pierce's data. Additionally, in a separate analysis of the spontaneous utterances of 14 other children in the CHILDES database (MacWhinney & Snow, 1985), Stromswold again concludes that almost all instances of sentence-initial negation have an anaphoric interpretation. The spontaneous speech samples also indicate, consistent with previously reported data (e.g. Bloom, 1970; Klima & Bellugi, 1966), that *not* surfaces later in production than anaphoric *no*. Stromswold thus concludes that the data do not support Deprez and Pierce's claims of an initial VP- internal subject stage. She argues, as did Bloom (1970), that the structure of early negative utterances is identical to the structure of adult negative utterances with *no* in a sentence peripheral position.

Finally, Drozd (1995) suggests that children's non-anaphoric sentence-initial negation has a metalinguistic exclamatory interpretation, as in sentences such as *No way it's yogurt*. Although such utterances may be rare in adult language, Drozd argues that sentence-initial non-anaphoric negation is likewise rare in child language. Drozd reanalyzes Klima and Bellugi's data, along with the spontaneous speech samples of 120 other children in the CHILDES database between 0;11 and 3;4 (MacWhinney & Snow, 1985). Out of 456 examples of sentence-initial negation, Drozd finds that all but 20 (about 5%) had an anaphoric interpretation once context was taken into account. According to Drozd, of those 20 examples, 17 are consistent with a metalinguistic exclamatory interpretation. Based on these results, he claims that sentence-initial non-anaphoric negation exists only as metalinguistic exclamatory negation.

The studies described above are all based on the spontaneous speech of young children acquiring English. Although all of these studies agree that the negative element *no* surfaces earlier in production than *not*, subjective interpretation of neg-initial utterances has led to inconsistent analyses and conclusions. Both Klima and Bellugi (1966) and Deprez and Pierce (1993) argue for a stage in which sentence-initial *no* is clausal, and hence that the early grammar of English differs from the adult grammar with respect to the structure of negation. For Deprez and Pierce these differences do not

constitute a violation of continuity, however, since VP-internal subjects are an option available in UG. Bloom (1970) and Stromswold (1997) argue that sentence-initial negation is always anaphoric and hence that the syntax of negation in child English is virtually identical to adult negation, in line with early morphosyntactic convergence. Stromswold notes that examples of sentence-initial *no* with clausal scope are low throughout development, while examples of sentence-medial *not* increase over time. Based on this observation, she reasons that the data are "more consistent with children acquiring sentence-medial negation, rather than children switching from a Neg-initial to a Neg-medial strategy as the VP-internal-subject hypothesis would predict" (Stromswold, 1997, p. 12). Thus, according to Stromswold, children first develop knowledge of anaphoric *no* and later acquire sentential *not*. Alternatively, her suggestion might mean that children acquire knowledge of anaphoric *no* and sentential *not* at the same time, but *no* simply surfaces in production prior to *not*. Our study addresses these different possibilities and also tests whether very young children have an adultlike understanding of the two kinds of negation. We now turn to our study.

2.4 Objectives of this study

The conclusions of all of the studies described above are based on the subjective interpretation of spontaneous speech. In fact, some of the same speech samples that were analyzed in the Klima and Bellugi (1966) and Deprez and Pierce (1993) studies were also analyzed by Drozd (1995) and Stromswold (1997), yet fundamentally different interpretations and conclusions resulted. Interpretation of spontaneous speech can be unreliable because contextual information is not always clearly specified, and naturalistic studies are rarely controlled.

Since virtually all work on the acquisition of negation has involved production data with little attention to comprehension, it is unclear whether children have knowledge of negation before it surfaces in production. One exception is a study by Curtiss and Yamada (1985), who tested 30 two-year-olds (mean age 2;6) on their comprehension of clausal negation on a 5-item picture-matching task. They found that the children did understand this kind of negation. There are to our knowledge no comprehension studies of younger children and no comprehension studies of anaphoric negation. Our study was

designed to determine whether children between the ages of 14 and 25 months have knowledge of negation before it surfaces in production. Our results allow us to evaluate the claims of the EMC and Continuity hypotheses in the realm of negation. Do children have the target syntax "all the way down", and if not, is their grammar within the limits imposed by the principles and parameters of UG, or do they treat negation in an "unlinguistic" way? Also, by investigating comprehension in very young children, the current study addresses the claim that early negative utterances are affected by production difficulties (Bloom, 1970). If the participants in our study show target-like knowledge of negation, that would strengthen the performance-based account. On the other hand, if children do not show target-like understanding of negation, then this would be consistent with the view that the early grammar differs from the adult grammar in some respect.

We take Continuity and the EMC as null hypotheses because they postulate no difference between the two groups, adults and children. EMC leads to the prediction that children will show adultlike knowledge of negation. Accordingly, our hypotheses are as follows:

Hypothesis 1: Children represent sentence-medial *not* as sentential negation.

Hypothesis 2: Children represent sentence-initial *no* as anaphoric.

These hypotheses entail that children have full clausal structure including NegP and CP. The fact that many studies find independent evidence for IP and CP (Boser et. al, 1992; Guasti, 1993; Hyams, 1992; Poeppel & Wexler, 1993; Phillips, 1995 among others) makes it reasonable to suppose that NegP is present as well.

A corollary to hypothesis 2 is that very young English-speaking children have the correct setting of the subject raising parameter, and hence know that sentential negation (in NegP) must occur to the right of the subject. If this is so, then a negative element appearing to the left of the subject is necessarily in CP, hence, anaphoric. A last hypothesis, then, is as follows:

Hypothesis 2': The subject raising parameter is set to require subject raising out of the VP.

Thus, our study will also allow us to explore whether there is some early stage, prior to productive multi-word utterances, at which the subject raising parameter (and hence possibly all parameters) has a default setting.

3. Method

3.1 Cross-Modal Preferential Looking Paradigm

The methodology we adopt is the cross-modal preferential looking paradigm, developed by Spelke (1976). This methodology has been used in a number of experimental studies (e.g. Golinkoff & Hirsh-Pasek, 1995; Hirsh-Pasek & Golinkoff, 1996, Seidl and Hollich, 2002) to investigate the grammar of preverbal infants. The child is seated on a caretaker's lap in front of a large split-screen television monitor. The child sees two different images, one on each side of the screen, while hearing a sentence that matches only one of the images. A video camera records the infant's eye-gaze, providing a quantitative measure of the child's interest in each image. According to Spelke (1976), infants prefer to look at an image that matches an auditory stimulus. This being the case, measuring an infant's eye-gaze in relation to an auditory linguistic stimulus can provide information about children's language comprehension and hence their grammatical knowledge.

Studying language comprehension using the preferential looking paradigm makes it possible to test children at the very earliest stages of language development, when productive language is too limited for investigation of grammar. The technique does not require the child to talk nor does it require active cooperation or responses. Hence, there is little risk of untoward task-related effects or effects arising from production limitations.

3.2 The Experiments

We used the cross-modal preferential looking paradigm in two experiments. The first looked at comprehension of *not* and the second of anaphoric *no*. The clausal and anaphoric negation experiments, as well as predictions related to Hypotheses 1 and 2, are described below.

For the clausal negation experiment, during each trial the children heard a linguistic stimulus while they were shown two competing images. Children simultaneously saw an image of a sleeping girl and an image of the same girl sitting, while hearing one of the sentences in (7).

(7) Clausal negation study

a. The girl's **not** sleeping.

b. The girl's sleeping.

We were interested in how long the children would look at a given image in response to the negative sentence compared to how long they looked at the same image in response to the affirmative sentence. For example, we measured how long the children looked at the image of the sleeping girl when they heard sentence (7a) compared to how long they looked at the sleeping girl in response to (7b). In contrast to other preferential looking paradigm studies, we did not compare fixation time toward the competing images within each trial. That is, we did not compare how long the children looked at the image of the sleeping girl vs. the competing image of the sitting girl when they heard sentence (7a). As will be discussed in the *Stimuli* section, by holding the image constant in the analysis, we avoided the possibility of a picture preference biasing the results.

We hypothesized that if children have knowledge of clausal negation, then the negative element *not* in sentence (7a) should direct their attention away from the image representing the negated predicate (i.e., the image of the sleeping girl). Therefore, Hypothesis 1 predicts that children will look longer at the sleeping girl while hearing (7b) than while hearing (7a).

The goal of the anaphoric negation experiment was to determine whether children assign an anaphoric or sentential interpretation to sentence-initial *no*. Sentences (8a) and (8b) illustrate the kind of sentence pairs we used to test children's knowledge of anaphoric negation.

(8) Anaphoric negation experiment

a. Is the girl sitting? **No**, she's sleeping.

b. Is the girl sitting? Hey, she's sleeping.

Children simultaneously saw an image of a sleeping girl and an image of the same girl sitting, while hearing one of the sentences in example (8). The lead-in question was necessary to provide a felicitous context for the experimental sentence. For this analysis, we were interested only in where the children looked during presentation of the second sentence, beginning with the onset of *no* or *hey***.** Thus, fixation time was measured from the onset of the second sentence (as indicated by the lines between the sentences in (8a) and (8b)). As in the clausal negation study, we were interested in how long the children looked at a particular image in response to the negative and affirmative sentence. For example, we compared how long the children looked at the image of the sleeping girl while hearing sentence (8a) to how long they looked at the image of the sleeping girl while hearing sentence (8b).

The *hey* sentences (e.g. 8b) served as control for a possible recency effect. There are two possible reasons why children might look longer at the sleeping girl than the sitting girl in response to sentence (8a). It might indicate that *no* has an anaphoric interpretation. However, a less interesting but equally plausible interpretation of such a response is that the children are simply attending to the image that matches the last word they heard, in this case *sleeping.* Thus, to control for this possibility, we compared gaze duration to sentences (8a) and (8b). We predict that the children will look longer at the sleeping girl in response to sentence (8a) than sentence (8b). Our reasoning was as follows. In sentence (8a) the children are given enough information about where to look immediately after hearing the word *no* (if *no* has an anaphoric interpretation), but in the case of (8b), they must wait until they hear the verb at the end of the sentence before they know to look at the sleeping girl. This being the case, if the children assign an anaphoric interpretation to sentence-initial *no*, they will have more time to look at the sleeping girl in response to sentence (8a) than (8b). Therefore, Hypothesis 2 predicts that children will look longer at the image of the sleeping girl in response to sentence (8a) than in response to sentence (8b).

3.2.1 Materials

MacArthur Communicative Development Inventory

Parents were asked to complete a slightly modified version of the *MacArthur Communicative Development Inventory: Infants* (Fenson et. al, 1991), an instrument designed to measure the language of infants and toddlers. *The MacArthur Communicative Development Inventory: Infants* is a checklist of words typical of children's early lexical repertoires, and parents are asked to 'check off' those words their children comprehend and/or produce. As will be discussed below, a portion of the *MacArthur Communicative Development Inventory: Words and Sentences* was added to the end of the questionnaire. The *MacArthur Communicative Development Inventory: Infants* focuses on early words, and asks parents whether their child understands certain common phrases, and whether their child imitates words. The *MacArthur Communicative Development Inventory: Infants* also contains a checklist of 396 words and asks the parents to assess whether their child 'understands' or 'understands and says' each of the words on the list.

All of the words used in the auditory stimuli appeared on the original questionnaire except for the word "sit", which was inserted into our modified version. We added two additional elements. First, we inserted a question about when the child began to speak, if they were already speaking. Secondly, we added a portion of the *MacArthur Communicative Development Inventory: Words and Sentences* that asks caretakers about the types of sentences their toddlers produce and provides information about whether or not each child is at the telegraphic stage. One additional question about external negation was added to this part of the questionnaire.[8]

3.2.2 Participants

We began with 34 14-25 month-old children from monolingual, Standard American English-speaking households. We recruited the infants in several ways. Letters were handed out at various local preschools, inviting parents to come to the UCLA Infant Language Laboratory to participate. Additionally, recruitment letters were mailed to parents of children between 14-25 months using a mailing list provided by a marketing

company. Parents were reimbursed $10 for travel expenses, and all children who took part in the study received a baby book and a Junior Scientist Diploma.

According to parental report, some children were preverbal (N = 3), the majority were in the holophrastic stage (N = 19), and the others were beginning to use multiword sentences (N = 10). One participant was eliminated because she was no longer in the telegraphic stage. A second participant was eliminated because the parent did not complete the language inventory.

We also eliminated from our analysis responses from children who did not meet our inclusion criteria, which required that they look one second longer at a corresponding image (e.g., the sitting girl) in response to an affirmative control sentence (e.g., *The girl's sitting*) than to a non-corresponding image (e.g. the sleeping girl). Previous research has shown that when children understand a sentence, they look longer at a matching image (e.g. Hirsh-Pasek & Golinkoff, 1996; Seidl and Hollich, 2002). The fact that some of the children in our study did not look longer at the target than the non-target image in response to the affirmative control sentence suggests that some of them simply did not understand the sentence (either because they did not understand all of the lexical items or because they had not reached a sufficient level of grammatical development). If children did not understand the basic affirmative control sentence, then their response to the negative sentence would reveal nothing about their grammatical representation of negation, which was the object of our study. Thus, we did not include in our analysis responses from children who failed to demonstrate knowledge of the affirmative control sentence.

3.2.3 Apparatus

The children were seated on their caretakers' laps 2' 2'' back from the center of a 56'' split-screen television monitor. For each trial, the children saw two different images, one on each side of the screen, while they heard a linguistic stimulus that matched only one of the images. Each image was 10'' X 18,'' and the images were spaced 3'' apart. A digital camera located on top of the monitor, exactly 79'' from the floor, recorded the infants' eye movements throughout the experiment.

3.2.4 Coding

The data tapes were coded on an IMAC using the editing software EditDV and a Sony DCR-TRV520 Digital-8 Handycam. Four research assistants coded the data tapes frame-by-frame, recording right and left fixations. In order to test for inter-rater reliability, each research assistant coded 20 trials of the same tape. The reliability as measured by Cronbach's alpha was .998. The recordings were then exported to a spreadsheet program, which calculated the duration of each fixation. To control for experimenter bias, the tapes were coded off-line and without sound

3.2.5 Stimuli

The auditory stimuli were organized into 4 Sentence Structure Conditions (SSC). An example of each SSC, as well as a description of the visual and auditory stimuli used in this experiment, is provided in table 1 below.

Table 1. Visual and auditory stimuli testing sentential negation.

SSC	Description	Auditory stimuli	Visual Stimuli
SSC1	Intransitive verb	Variant A: Look, The girl's (not) sleeping. Variant B: Look, The girl's (not) sitting.	sleeping girl / sitting girl
SSC2	Transitive verb and DO	Variant A: Look, The boy's (not) hugging the doggie. Variant B: Look, The boy's (not) feeding the doggie.	boy hugging dog / boy feeding dog
SSC3	Verb and PP	Variant A: Look, The hat's (not) on the table. Variant B: Look, The hat's (not) under the table.	hat on a table / hat under a table
SSC4	Verb and AP	Variant A: Look, The boy's face is (not) clean. Variant B: Look, The boy's face is (not) dirty.	boy with clean face / boy with dirty face

We used different SSCs to add variety and to see if structural variables would have an effect on the children's understanding of negation. We used all 4 SSCs in both the clausal negation and anaphoric negation studies. Each of the 4 SSCs contained 4 negative and 4 affirmative sentences. Thus, there were 16 sentences used to test anaphoric negation and 16 sentences used to test sentential negation. Negative and affirmative pairs for SSC1 in the sentential negation experiment are illustrated in (9):

(9) Negative and affirmative control pairs testing sentential negation in SSC1

SSC1, Variant A, negative sentence:	Look, the girl's **not** sleeping.
SSC1, Variant A, affirmative sentence:	Look, the girl's sleeping.
SSC1, Variant B, negative sentence:	Look, the girl's **not** sitting.
SSC1, Variant B, affirmative sentence:	Look, the girl's sitting.

As indicated in (9), the only difference between the negative sentence and the affirmative sentence is the presence of *not*.

The negative and affirmative sentence pairs used to test anaphoric negation in SSC1 are presented in (10):

(10) Anaphoric negative and affirmative control pairs testing anaphoric negation in SSC1

SSC 1, Variant A, anaphoric negative sentence:	Is the girl sitting? **No**, she's sleeping.
SSC 1, Variant A, affirmative control sentence:	Is the girl sitting? Hey, she's sleeping.
SSC 1, Variant B, anaphoric negative sentence:	Is the girl sleeping? **No**, she's sitting.
SSC 1, Variant B, affirmative control sentence:	Is the girl sleeping? Hey, she's sitting.

The only difference between the anaphoric negation sentences and the affirmative control sentences was the presence of anaphoric *no* in the "negative" sentence and the word *hey* in the affirmative control sentence. To control for differences in intonation between the two sentences of each pair, we digitally copied the entire anaphoric negative sentence, then cut the word *no* out and inserted the word *hey* in its place for the affirmative counterpart. Thus, the intonation of both sentences was exactly the same. As mentioned earlier, we began measuring fixation time from the beginning of the second sentence in each trial.

3.2.6 Procedure

Before the experiment began, the infant was seated on his/her caretaker's lap in front of the monitor, and the caretaker was asked to pull a visor over his/her eyes. The purpose of the visor was to block the caretaker's view of the screen so that she would not

inadvertently influence the child. The lights were dimmed, and a picture of a giggling baby with sound was presented on the screen for two seconds. The giggling baby was presented for two seconds between each trial to orient the children to the center of the screen before a new trial began. The children were first shown each pair of images used in the experiment along with the neutral linguistic stimulus *Oh, look at that*. The purpose of presenting the image pairs with a neutral stimulus was to familiarize the children with the procedure before the experimental trials began. The 32 negative and affirmative control trials followed the four familiarization trials. Each trial was 6 seconds in duration and the entire experiment lasted 4 minutes 48 seconds.

The SSCs and sentence types were randomized in blocks of 4. Each block contained one of the 4 SSCs, and each sentence type (i.e. clausal negation, affirmative control, anaphoric negation, and affirmative control) was represented in each block. The image matching the linguistic stimuli appeared the same number of times on the left side of the screen as it appeared on the right side of the screen to control for side preferences. The target image (i.e. the image that matched the sentence in the adult grammar) was always presented in the order left-right-right-left (or its mirror image), so that the children could not use ordering strategies to find the match. We did not counterbalance for side-of-the-screen and target image for each specific trial because the duration of the experiment would have doubled from 4 minutes 48 seconds to 9 minutes 36 seconds, too long for a 14 month-old to stay on task. Instead, a between-subjects design was chosen. All participants were presented with the same linguistic and visual stimuli, except that for any given trial, the matching image was on the opposite side for group A and group B. To control for item order effects, two tapes, each containing the same trials but in reverse order, were used with each group. For example, a child in group A would see either tape A1 or tape A2 (which contained the same trials in reverse order), and a child in group B would see either tape B1 or B2 (again, containing the same trials in reverse order).

If a child became uncomfortable (i.e. if s/he started to cry or otherwise indicated s/he wanted to stop), we paused the tape between trials and brought the child and the caretaker into the playroom until the child was ready to resume the experiment. Once the child was ready to begin again, the stimuli were presented starting at the point where the experiment had stopped. All 32 children completed the entire experiment.

4. Results

4.1 Clausal Negation

A preliminary analysis revealed a strong picture preference bias for each image pair. Regardless of the stimulus sentence, the children preferred to look at the images of 1) the sitting girl (sitting girl vs. sleeping girl); 2) the boy feeding the dog (boy feeding dog vs. boy hugging dog); 3) the hat under the table (hat under the table vs. hat on the table); and, 4) the boy with the dirty face (boy with a dirty face vs. boy with a clean face). Given this bias, we focused on the children's responses to the dispreferred pictures, as responses to the preferred pictures would be uninformative since fixation toward the preferred picture could not be disentangled from preference related to the stimulus.[9] Our decision to base our analysis on the dispreferred picture required that we depart from the standard analysis used in PLP studies, whihc compares gaze durations to the two competing images. Rather, we compared gaze duration to a specific (dispreferred) image as a function of the sentence type (negative or affirmative). For example, we measured how long the children looked at the sleeping girl when they heard the affirmative control sentence (e.g. *She's sleeping*) vs. the negative sentence (*She's not sleeping*). Thus, our analysis was based only on Variant A in each SSC (see table 1).

An analysis of variance (ANOVA) revealed no main effect for the Tape condition ($F(1,64) = 2.009$, $p = .166$). Since the participants were unaffected by the difference between Tape A and Tape B, and the sample size was so small for each tape (Tape A, N = 15, Tape B, N = 17) we collapsed the data across the Tape conditions for all subsequent analyses. [10]

As mentioned in the *Stimuli* section, four Sentence Structure Conditions (SSC) were used to test clausal negation, as illustrated in Table 2 below. Recall that we did not analyze data for those subjects who failed to demonstrate knowledge of the affirmative control sentence. Since each SSC contained different lexical items (e.g., SSC1 = *The girl's sleeping*; SSC2 = *The boy's hugging the doggie*), and some children demonstrated understanding of some affirmative control sentences but not others, the sample sizes for each SSC varied (see *Participants* section). Table 2 indicates the number of subjects included for each SSC.

Table 2. Complete paradigm for trials testing sentential negation.

SSC	Sample size	Sentence Type	Auditory Stimuli	Image
SSC1	10	Affirmative	The girl's sleeping.	A girl sleeping
		Negative	The girl's **not** sleeping.	
SSC2	6	Affirmative	The boy's hugging the doggie.	A boy hugging a dog
		Negative	The boy's **not** hugging the doggie.	
SSC3	7	Affirmative	The hat's on the table.	A hat on a table
		Negative	The hat's **not** on the table.	
SSC4	4	Affirmative	The boy's face is clean.	Boy with a clean face
		Negative	The boy's face is **not** clean.	

Table 3 shows mean fixation times for each dispreferred image as a function of sentence type (negative and affirmative control).

Table 3. Mean fixation time to each image for sentential negation affirmative control and negative sentences.

SSC-Variant	Sample size	Image	Affirmative control Sentence	Clausal negative sentence
SSC1	10	sleeping girl*	3.923 sec	2.637 sec
SSC2	6	boy hugging dog*	3.300 sec	1.344 sec
SSC3	7	hat on table	2.871 sec	2.733 sec
SSC4	4	boy with clean face	3.692 sec	2.333 sec

As Table 3 indicates, in all conditions children looked less at a given image in response to the negative sentence containing *not*, than in response to the affirmative control sentence. Thus, there is a clear trend in the direction predicted by Hypothesis 1. A one-way ANOVA shows that the effects reached significance in 2 cases (marked by an asterisk in table 3): SSC1 $F(1,18) = 13.131$, $p = .0055$, and SSC2 $F(1,10) = 15.177$, $p = .0115$.

According to a one-way ANOVA, two analyses fail to show significant effects: SSC3 $F(1,12) = .069$, $p > .5$ and SSC4 $F(1,6) = 5.877$, $p = .0938$. Although results for these analyses failed to reach significance, they are all in the predicted direction: Children looked less at a given image when it corresponded to the negated verb than when it matched the affirmative sentence.

4.2 Anaphoric Negation

Following the technique used in the sentential negation experiment, we analyzed fixation to the dispreferred pictures in response to the anaphoric negative and affirmative control sentences, as illustrated in table 4 below.

Table 4. Complete paradigm testing anaphoric negation.

SSC	Sample Size	Sentence Type	Auditory Stimuli	Images
SSC1	10	Affirmative	Is the girl sitting? Hey, she's sleeping	A girl sleeping
		Negative	Is the girl sitting? **No**, she's sleeping	
SSC2	6	Affirmative	Is the boy feeding the doggie? Hey, he's hugging the doggie	A boy hugging a dog
		Negative	Is the boy feeding the doggie? **No**, he's hugging the doggie.	
SSC3	7	Affirmative	Is the hat under the table? Hey, its on the table	A hat under a table
		Negative	Is the hat under the table? **No**, its on the table	
SSC4	4	Affirmative	Is the boy's face dirty? Hey, its clean	A boy with a clean face
		Negative	Is the boy's face dirty? **No**, its clean	

As table 4 shows, the auditory stimuli for each trial consisted of two sentences (e.g., *Is the girl sleeping? No, she's sitting*). We were interested only in whether participants understood the second sentence. As in the previous experiment, we analyzed responses from those participants who demonstrated knowledge of the affirmative control sentences in the clausal negation test sentences, that is, the same children whose data were reported in the clausal negation experiment. Table 5 shows the mean fixation times to each image in response to the affirmative control and anaphoric *no* sentences.

Table 5. Mean fixation time to each image for affirmative control and anaphoric negative sentences.

SSC-Variant	sample size	Image	Affirmative Control Sentence	Anaphoric negative sentence
SSC1	10	Sleeping girl	2.027 sec	1.573 sec
SSC2	6	boy hugging dog	1.233 sec	1.500 sec
SSC3	7	hat on table	1.457 sec	0.662 sec
SSC4	4	boy with clean face*	2.042 sec	1.425 sec

As in the previous study, Table 5 reveals a clear trend. In all but one instance, the children looked *less* at an image (e.g., the sleeping girl) in response to the anaphoric negative sentence (e.g., *No, she's sleeping*), than in response to the affirmative control sentence (e.g., *Hey, she's sleeping*). In other words, the presence of *no* seemed to cause the children to look away from the matching image. Thus the children responded to anaphoric *no* just as they did to *not* in the previous study. A one-way ANOVA indicated a significant effect for SSC4 ($F(1,6) = 38.383$, $p = .0085$). The other three SSCs did not show significance (SSC1 $F(1,18) = 1.047$, $p = .3328$; SSC2 $F(1,10) = .221$, $p > .5$; SSC3 $F(1,12) = 3.186$, $p = .1245$.

The direction of these results goes against Hypothesis 2: children appear to interpret anaphoric *no* as sentential negation.

5. Discussion

In line with the Continuity Hypothesis and EMC, Hypothesis 1 states that children will understand *not* as negating the clausal predicate just as adults do. The clausal negation experiment tested this hypothesis. Essentially, Hypothesis 1 predicts that the presence of the negative element *not* in the negative sentence should draw children away from the image representing the negated verb. Our results generally bore out this prediction. As table 3 indicates, the children looked longer at a given image, such as the sleeping girl, when it was accompanied by the affirmative sentence describing it (e.g., *The girl's sleeping*) than when it was accompanied by the negative sentence (e.g., *The girl's not sleeping)*.

This result was significant for SSC1 and SSC2, but was not significant for SSC3 and SSC4. In some cases the small sample size makes it clear why the effect was not always significant. For example, after participant elimination, only four participants remained in SSC4, which contained a predicate adjective construction (e.g. *The boy's face is clean* / *The boy's face is not clean*). Still, the effect was close to significant (p = .0938), leading us to believe that a larger sample size would have yielded a statistically significant effect. For SSC3, however the effect was not significant, even though the number of participants was slightly higher (N=7). Nevertheless, the data in table 3 revealed a clear trend in the predicted direction; the mean looking time to a particular image was longer in response to the affirmative sentence than in response to the negative sentence. Thus, we take our results from this study to indicate that preverbal holophrastic infants and children who are at the earliest stages of multiword sentences demonstrate comprehension of clausal negation, thus supporting the EMC and Continuity Hypotheses and the claim that functional categories are present in early grammar before they are evidenced in production.

Klima and Bellugi (1966) proposed that children go through an early stage (their Stage 1) in which they do not yet understand sentence-medial negation. Similarly, Stromswold (1997) suggests that sentence-medial *not* is acquired later than anaphoric *no*. These claims are based on the observation that children initially fail to produce sentence-medial *not*. Our data are inconsistent with these claims and indicate that children between 14-25 months of age demonstrate comprehension of *not*. However, it is unclear

why, if children have knowledge of *not*, they fail to produce it early on. Thus our results are consistent with the claim that children's early grammars contain the structure for negation, but that their negative utterances are limited by production difficulties (Bloom 1970).

The anaphoric negation experiment was designed to test Hypotheses 2 and 2', which state that (i) sentence-initial *no* has an anaphoric interpretation for children (as for adults) and that (ii) infants as young as 14 months have set the subject raising parameter to disallow VP internal subjects. Our hypotheses predicted that children would look longer at a given image (e.g. the sleeping girl) in response to the sentence containing sentence-initial anaphoric *no* (e.g. *Is the girl sitting? No, she's sleeping*) than in response to the affirmative control sentence (e.g. *Is the girl sitting? Hey, she's sleeping*). This is because the anaphoric *no* would direct children's attention away from the sitting girl and towards the sleeping girl. The affirmative control item, in contrast, would not give the children sufficient information about where to look until they heard the verb *sleeping.* On the other hand, if *no* takes scope over the following predicate, then we would expect the results to pattern like the clausal negation study. Attention would be drawn away from the sleeping girl in response to the negative sentence (e.g. *Is the girl sitting? No, she's sleeping*), since *no* would be negating the verb *sleeping*. Since Hypothesis 2 predicts that children will assign an anaphoric interpretation to sentence-initial *no*, it would be refuted if children assigned a clausal interpretation to *no*, and looked less at the sleeping girl in response to *No, she's sleeping* than to *Hey, she's sleeping*. However, contrary to our prediction, our results (Table 5) indicate that the children looked at an image longer in response to the affirmative control sentence (e.g. *Hey, she's sleeping*) than in response to the anaphoric *no* sentence (e.g. *No, she's sleeping*), suggesting that sentence-initial *no,* like sentence-medial *not,* is negating the following predicate. Thus, these children are not adultlike with respect to their interpretation of anaphoric *no*.

The effect was significant for SSC4. Although there were no further significant effects, we do see a clear trend in the data (table 5): In 3 out of 4 trials, the children looked longer at a given image in response to the affirmative control sentence than in response to the anaphoric *no* sentence. Thus, our data failed to support Hypothesis 2 and suggest that sentence-initial *no* can be a clausal negator in early grammar.

These results are surprising: Although Klima and Bellugi (1966) and Deprez and Pierce (1993) claim that sentence-initial *no* can have clausal scope in child grammar, Stromswold's (1997) reanalysis of the data (taking context into consideration), along with her analysis of the spontaneous speech of 14 other children, showed that virtually all instances of sentence-initial *no* had an anaphoric interpretation. Drozd (1995) also reanalyzed the Klima and Bellugi (1966) and Deprez and Pierce (1993) data, along with the data of 120 other children, and came to similar conclusions. Similarly, Bloom (1970) analyzed s the spontaneous utterances of 3 children and claimed that sentence-initial sentential negation in child language is a "myth". The data collected in this experiment indicate the contrary, however.

We believe that our results allow us to reconcile these conflicting findings. We propose that there is in fact an early "external negation" stage, as originally claimed by Klima and Bellugi (1966) and later by Deprez and Pierce (1993), but it is earlier than previously thought. This stage seems to occur at a point at which children's productive abilities are very limited—as it was for the children in our study. The fact that few examples of sentence-initial sentential negation in production suggests that most children move out of this stage before they start combining words, while a few show the remnants of an "external negation" stage at the beginning of multiword production.

5.1 Adult-child differences

While the results of the clausal negation experiment support the Continuity Hypothesis and EMC showing that the children have an adultlike understanding of clausal negation, the anaphoric negation study shows that children have not converged on the adult grammar. But what exactly is the nature of the adult/child difference? Deprez and Pierce proposed that children have a default setting for the subject raising parameter that allows subjects to remain inside VP (as in Italian, for example), and this gives rise to the "external negation" effect.

As a hypothesis about older children, the VP-internal subject hypothesis is problematic, however, for a couple of reasons: First, it is at odds with recent studies showing that there is no stage in language production in which children show a non-target setting of UG parameters (e.g., the null subject, verb raising, V2, and head direction

parameters) very early in development (Valian, 1990; Boser, Lust, Santelmann & Whitman, 1992; Meisel & Müller, 1992; Pierce, 1992; Poeppel & Wexler, 1993; Wexler, Schaeffer & Bol, 2004). There is no obvious reason why the setting of the subject raising parameter should be delayed relative to these others. Certainly, the input data provide ample evidence for the position of subjects with respect to negation in English. Moreover, there are in fact very few examples of "external negation" in production (once null subject sentences are excluded). Both these objections disappear, however, if the VP-internal subject stage occurs at an earlier point than previously hypothesized. If the subject raising parameter is set to the target value before the onset of sentence production, then this parameter is in line with others that have been studied.

Our findings thus suggest that English-speaking children (and perhaps all children) converge very quickly on the morphosyntax of clausal negation. Children have knowledge of the functional structure associated with negation (NegP) from a very early age. Anaphoric negation is a later development, most likely due to the fact that the proper construal of *no* depends on a discourse representation, while *not* depends only on sentence level syntax. There is independent evidence that sentence level representations (e.g. of pronouns) develop before discourse level operations. In fact, a number of studies suggest that anaphoric interpretation of structural elements (e.g., pronouns and indefinite determiners) may not be acquired until age 4 (Karmiloff-Smith, 1979; Tyler, 1983; Chien & Wexler, 1990; Schaeffer, 1995, 2000; Hyams, 1996**;** Avrutin, 1999; Avrutin & Coopmans, 2000). Given the difficulty of relating *no* to a previous sentence, placing it in NegP becomes a viable option.

A very early VP-internal subject stage also provides support for the hypothesis that parameters come set at a default value that must be unlearned on the basis of exposure to input (Hyams, 1986; Deprez & Pierce, 1993). The next step would be to test infants' sensitivity to the other parameters that have been studied in production. Although there is little support from production data for a universal null subject stage in older children (e.g., Valian, 1990), our results raise the possibility that there is a null subject stage at an earlier point in development, the remnants of which show up in language production. This would explain why, despite the strong contingency between null subjects and non-finite clauses during the root infinitive stage, there is nevertheless at the

same time, some percentage of null subjects in finite clauses in most of the non-null subject languages (Phillips, 1995; Hoekstra & Hyams, 1998). It is also possible that children acquiring languages with verb movements (either V2 or V to I) show a very early stage at which these movements are not in place. In one of the first preferential looking paradigm studies, Golinkoff and Hirsh-Pasek (1995) found that English-speaking 18-month olds understand SVO word order (*Bert is kissing Ernie* vs. *Ernie is kissing Bert*). It would be interesting to know the effects of OV word order on English-speaking children of this age.

6. Conclusions

The results of our study suggest that although sentential *not* surfaces much later in production than *no*, children between 14-25 months correctly interpret *not*, indicating that they have knowledge of the syntactic structure associated with sentential negation well before they have productive control of negative sentences.

As reviewed above, there has been an ongoing debate concerning the interpretation of sentence-initial *no* in child production data. Our data from children who have little productive language indicate that at some early stage in grammatical development, anaphoric *no* can have clausal scope and need not be anaphoric, as it is in the adult grammar. Our findings are therefore consistent with Deprez and Pierce's hypothesis that there is a default setting for the subject raising parameter, allowing subjects to remain internal to VP. We hypothesize that most English-speaking children exit this stage prior to production. That is to say, they reset the parameter to the correct English value, and VP-internal subjects are no longer possible. For this reason few cases of external negation are found in production data. We propose, however, that the few cases of external negation that are found in production are not performance errors, but represent the remnant of an earlier grammatical stage.

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Endnotes

[1] Since Pollock (1989) IP is split into several inflectional heads, T(ense)P, AGR(eement)P, Num(ber)P, etc. This articulated IP structure is not relevant to our discussion and so for ease of exposition we refer simply to IP.

[2] The VP-internal subject hypothesis proposes that the subject originates within the projection of the head that assigns it a theta role. It moves to Spec IP to check agreement features.

[3] Rizzi (1997) proposes that CP is an articulated structure (like IP – see note 1) consisting of various projections – ForceP, FocusP, TopicP and Fin(iteness)P. It is possible that anaphoric *no* and the clausal typing operators are located in Force P within Rizzi's split CP. For our purposes it is sufficient to note that *no* occurs in the left periphery of the clause.

[4] It is important to note that while Klima and Bellugi analyzed sentences like (4b) as instances of external negation, it is difficult to know the position of the negative when the subject is absent. Most sentences at this stage have missing subjects.

[5] During stage 2 we also find *can't* and *don't,* which Klima and Bellugi analyze as pure negative elements like *no* and *not* even though they have a somewhat different distribution, viz. they do not occur in progressive constructions (e.g. *I no/not going* vs. the non-occurring **I don't/can't going*). Since *can't* and *don't* were not tested in our study we will have nothing more to say about these elements.

[6] Following standard conventions, brackets within child utterances indicate that the child did not say the word but the meaning is implied.

[7] "Polite rejection" (e.g. (*I*) *no* (*want*) *mommy do it*) has roughly the same interpretation as a negative imperative (e.g. *Don't do it*), both of which are non-anaphoric uses of *no*. However, an imperative analysis of such utterances is unlikely given the presence of the subject *mommy* and the low position of the verb.

[8] The question asks parents to indicate which of two sentences sounds most like the way their child talks (e.g. *No baby sleeping* vs. *Baby not sleeping*).

[9] This type of analysis is not unlike what is done in studies using truth-value judgment tasks (Crain & McKee, 1985) in which "no" responses are taken to be a more direct reflection of children's grammatical competence since children (and adults) are more likely to give a "yes" response when they are confused or fail to comprehend the sentence (c.f. discussion in Crain & Thornton, 1998).

Deleted: INSERT CRANE FOOTNOTE.

[10] We did not perform a statistical analysis testing the effects of age because there were too few participants younger than 19 months to conduct a reliable analysis. However, informal comparison of younger and older infants showed no effect of age.