

Negation and Headshake in Bimodal Bilingual Development

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Acknowledgments

Firstly I need to give enormous thanks to my advisors, Diane Lillo-Martin at the University of Connecticut and James Morgan at Brown University. I'm so grateful that they were willing to work with me on this project that stretched unconventionally across two universities. I'm also grateful for their consistently thorough and insightful feedback, guidance, and advice. They never let me get away with doing anything halfway, and pushed me to make this project the best it could be. I could not even have begun, much less completed, this endeavor without all their help.

I also want to thank my friends and my parents for their support and understanding while I worked on this project. Having them there made everything a little easier.

Monolingual children's acquisition of negation, the structure of negation in American Sign Language (ASL), and adult use of the negative headshake in ASL have all begun to be studied. However, there is an area that combines and complicates these topics and has yet to be studied in depth: the development of bimodal bilinguals, children who are bilingual in ASL and English. This paper is a longitudinal case study of one bimodal bilingual child. It both makes claims about the affect of bimodal bilingualism on the child's acquisition and attempts to reproduce previous findings on child and adult use of negation in ASL. The data in this study contradict previous literature, finding the headshake for adults near-obligatory but not strictly obligatory, and finding a less systematic development of negative lexical items in conjunction with headshakes than prior studies have found.

Negation and Headshake in Bimodal Bilingual Development

Hearing children of Deaf¹ adults exist at a rather unique junction of languages. Those whose parents are fluent users of American Sign Language (ASL) grow up bilingual in ASL and English. Because these two languages are conveyed primarily across the separate modalities of face/hands and voice, respectively, children acquiring both languages at once provide insight into a particularly rich area of bilingual acquisition research: bimodal bilingualism. In this paper I will focus specifically on a single case study, investigating one bimodal bilingual child's acquisition of the negative headshake utilized in ASL.

ASL is the visual language primarily used by the American Deaf population. It is independent of any spoken language, with its own natural grammar and development. In addition to manual signs, ASL makes use of many non-manual signals (NMS). NMS are grammatical and rule-governed aspects of the language that are conveyed elsewhere than the hands – for example, the head, the face, and the torso. NMS occur simultaneously with manual signs, analogous to the use of intonation in spoken languages.

While most users of this language are Deaf, there is a segment of the hearing population that also frequently uses ASL – the hearing children of Deaf adults (CODAs). In many ways, their situation does not differ from that of children who grow up bilingual in two spoken languages. However, because of the languages' differing modalities, bimodal bilingual CODAs have the ability to produce both of their languages simultaneously, something that unimodal bilinguals cannot do.

¹ Throughout this paper I will use Deaf with a capital 'D' to denote Deafness as a linguistic and cultural group as well as an audiological classification.

Previous research has investigated monolingual Deaf children's acquisition of NMS as well as their acquisition of negation in ASL (Anderson and Reilly 1997, Reilly 2006). In ASL in particular, negation and NMS are closely linked in that the negative headshake, a NMS, is frequently associated with semantic and lexical negation. However, there has yet to be a study that investigates the acquisition of the negative headshake by bimodal bilingual hearing children, as this paper will do. Broadly speaking, I will be addressing the question, "How does bimodal bilingualism affect a child's acquisition of negation in both English and ASL?" In addressing this broad question, I will both see if the findings of previous literature can be reproduced, and investigate several new questions unique to the acquisition of bimodal bilinguals.

Background

The structure of negation itself in ASL has begun to be studied, though not exhaustively. Anderson and Reilly (1997) provided a summary of this structure. "Word order in ASL is quite flexible because of the use of inflections and grammaticized facial expressions to mark role relations and topics. Thus, a negative lexical manual sign can actually occur in a variety of positions within a sentence: primarily before the verb, at the end of the sentence, or in both positions" (Anderson and Reilly p. 413). Depending on the sentence, pre-verbal negative lexical items can occur sentence-initially or sentence-medially. The following adult utterances, taken from the data used for this study, give examples of lexical negatives in these different positions.

neg
(1) NO REFUSE EAT IX(BEN)
'No, I refuse to eat you'

neg
 (2) NOT AFRAID NOT
 'So you're not afraid?'

neg
 (3) MOTHER CAN'T SIT SURFACE
 'Mommy can't sit on the floor'

neg
 (4) RAIN NO
 'No, it's not raining'

Additionally, in ASL the headshake can be used as the sole negator of an utterance. In other words, it can appear in a sentence that has no manual lexical negative items, and give the utterance a negative meaning. An example of this is the following, again taken from the adult data in this study:

neg
 (5) IX(self) TEACH THAT
 'I didn't teach him that'

Negative concord thus plays a role in ASL; that is, when a negative headshake is used in conjunction with a negative lexical item, the two do not cancel out – rather, they work together to convey negation simultaneously (Anderson and Reilly p. 414). This finding was reproduced in Veinberg and Wilbur (1990).

Veinberg and Wilbur studied the use of the negative headshake in ASL by Deaf adults. Interestingly, they found a stark difference in the tendencies of their two adult subjects, with one subject using a headshake in 79.69% of their negative utterances, and the other in only 20.9% (Veinberg and Wilbur p. 228). Additionally, the authors found multiple instances of sentences that could be used with the same string of manual signs and with or without a headshake, and sentences that could be used with a headshake and with or

without the negative lexical item. These two findings suggest that there is some flexibility in what is allowed in production of negative sentences in ASL.

With regards to the timing of the headshakes, they found that “79% of shakes started and ended in conjunction with a marked syntactic component. Of those that did not correspond to larger syntactic constituents, 55% of the headshakes occurred in conjunction with just the negative lexical item” (Veinberg and Wilbur p. 230). They did not find similar patterns in non-signers. Rather, those subjects used headshakes that did not line up with the syntactic or constituent boundaries of their utterances.

I intend to use the adult data I have collected to see if Veinberg and Wilbur’s findings can be reproduced. In addition, I will investigate the negative utterances that are not used with headshakes in order to make a conclusion about whether the headshake is in fact obligatory. In other words, I will look for a rule or rules that allow negative utterances to be used without headshakes in ASL.

Anderson and Reilly neatly summarized the reason for studying negative headshakes in acquisition at all: “Early research on the acquisition of negation focused on lexical and sentential negation as marked by explicitly negative manual signs (Ellenberger, Moores, & Hoffmeister, 1975; Fischer, 1974; Lacy, 1972). However, given the flexible syntax of ASL and the grammatical role of nonmanual behaviors, a more fruitful area for the study of negation would appear to be the intersection and interaction of manual and nonmanual behaviors” (Anderson and Reilly p. 413).

Anderson and Reilly’s work also provided a background in monolingual Deaf children’s acquisition of NMS. In particular, they found that Deaf children’s acquisition of the negative headshake follows a consistent trajectory: first, children use the headshake by itself,

without any lexical items. When negative lexical items first appear, each is used without headshakes. Finally, the children learn to integrate the headshake with the negative lexical items, one at a time. Anderson and Reilly theorized an explanation for this development, which they called “hands before face,” meaning that Deaf children, though they already know how to use a headshake on its own, must learn lexical signs (hands) alone before they can integrate their previous knowledge of headshakes (face) (Anderson and Reilly p. 421). Using the longitudinal data analyzed for this paper, I will see if the case study I investigated fits this pattern.

With regards to bimodal bilingualism, Pyers and Emmorey (2008) showed that there is a tendency among adult bilingual CODAs to blend grammatical aspects of ASL with English. Pyers and Emmorey had bimodal bilingual CODAs speak English with interlocutors whom the CODAs knew were monolingual in English. When the CODAs used structures that, in ASL, would require the use of NMS, they were likely to use that NMS while speaking English.

This is important because it shows one of the ways in which bimodal bilingual CODAs blend grammatical aspects of ASL and English. Two spoken languages can interact when used by a unimodal bilingual in the form of code-switching, wherein words and structures from each language are stitched together into a single linear utterance. In contrast, bimodal bilingualism provides the unique possibility of producing items from each language *simultaneously*. This is part of the reason why bimodal bilingual CODAs’ acquisition of the negative headshake is worth investigating. The fact that adult CODAs blend ASL and English even when speaking to monolingual English users lends credibility to the hypothesis that the language development of young CODAs would also incorporate such blending, and thus

differ from the development of monolingual users of English or ASL.

One complication with the study of ASL's negative headshake is that headshakes may be grammatical/linguistic or simply communicative. Anderson and Reilly argue that the two usages "can be differentiated by their timing and scope with respect to accompanying manual signs as well as by the overall intensity and regularity of the headshake" (Anderson and Reilly p. 415). They base this assertion on Baker-Shenk (1983), who found that "the syntax of nonmanual signals requires that the onset and offset of the signal be carefully integrated with the accompanying manual utterances. In other words, the grammatical headshake (or other nonmanual behavior) must start and end with the signs over which it has scope" (Anderson and Reilly p. 415).

However, these researchers do not more precisely define what it means to "have scope" over lexical signs, making it difficult to test this assertion. If a headshake "having scope" over lexical signs means occurring at the same time as those signs, then saying a grammatical headshake is one which starts and ends with the signs over which it has scope is circular. In contrast, if they mean that a headshake "has scope" over the signs that it is semantically negating, that concept (while still not very precisely defined) can be tested using the data I have analyzed for this paper. As such, I will use the adult data I have gathered to investigate whether the timing of the headshake in ASL must be constrained as tightly as Anderson and Reilly and Baker-Shenk believe.

Finally, since this is the first study to look at a bimodal bilingual child's acquisition of the negative headshake, I will compare the child's use of the headshake with hearing and Deaf adults' linguistic tendencies, and with the existing research on Deaf children's language development, in order to draw some conclusions about the way the child's use of

negation and the headshake varies within each modality and as a result of being a bimodal bilingual child.

In light of what previous literature has shown about Deaf children's language development, Deaf adults' use of negation and headshake, and adult CODAs' modality-blending tendencies, in this paper I will investigate the following questions:

1. Is a headshake required to produce a grammatical, adult-like negative utterance in ASL? How does the negation type in use relate to the scope of the headshake required over the utterance?
2. Does the child in this case study follow what Anderson and Reilly call the "hands before face" theory?
3. How does the CODA's use of negation compare to that of Deaf and hearing adults?
4. How does the CODA's use of negation change over time within each modality?
5. How does the CODA's use of headshake compare to that of Deaf and hearing adults?

Methods

Participants

The participants in this study were a bimodal bilingual hearing child (Ben) and his adult interlocutors. Ben has been studied extensively as part of the work of the Development of Bimodal Bilingualism Lab at the University of Connecticut and Gallaudet University (Chen Pichler et al. 2013, Quadros et al. 2014). Lillo-Martin et al. (2014 p. 7) characterize his language environment as follows, “Ben has two Deaf parents, one Deaf older sibling and one hearing older sibling, one Deaf grandparent and three hearing grandparents. His parents characterize the home environment as predominantly ASL, with some sign+speech blending.”

The adult interlocutors were split into two groups, hearing and Deaf. The predominant Deaf interlocutor is Ben’s mother, and the secondary Deaf interlocutor is Ben’s father. They are both fluent but non-native signers of ASL. The hearing adult interlocutors are native speakers of English, all but one of whom are fluent but not native in ASL.

The videos used for this study make up a longitudinal case study of a single child. The videos consist of Ben and his interlocutors, selected from the full set of recordings, roughly every three months between Ben’s ages of 1;11 and 3;6. Every video takes place in a room at Gallaudet University (with the exception of Ben_061, which takes place in Ben’s home). In the videos, Ben plays with toys provided by the researchers. Each video is either an ASL-target session or an English-target session. The adult interlocutors in the ASL-target sessions are Deaf and the adults in English-target sessions are hearing. Adults are encouraged to use the target language of a given session, but Ben was not given any

direction as to which language to use. In some videos there are multiple adult interlocutors. Occasionally other children, such as Ben's older siblings, also interact with him during the videos. However, the primary interlocutor is always an adult, and only the primary adult interlocutors' utterances and Ben's utterances were used for this analysis. Table 1 describes the ages, target languages, and number of negative utterances in each video for child and adult. There is no number of utterances listed for the adult in BEN_090 because the adult utterances in that session were not transcribed.

File name	Child age (years;months)	Target language	Number of child negative utterances	Number of adult negative utterances
Ben_021	1;11	English	28	13
Ben_022	1;11	ASL	19	12
Ben_039	2;3	English	13	36
Ben_041	2;3	ASL	26	29
Ben_048	2;6	English	54	54
Ben_049	2;6	ASL	15	16
Ben_061	2;9	ASL	31	21
Ben_062	2;9	English	39	25
Ben_074	3;0	English	70	50
Ben_075	3;0	ASL	29	28
Ben_090	3;3	English	78	-
Ben_091	3;4	ASL	82	52
Ben_097	3;5	English	104	76
Ben_098	3;6	ASL	8	10

Table 1: Age, target language, and number of utterances for child and adult in each video

Data coding

All of the videos used for this project were annotated and coded using ELAN software (Crasborn and Sloetjes 2008). The first step of the data processing, transcribing the videos, had already been completed by members of the Development of Bimodal Bilingualism Lab at UConn and Gallaudet University. The research assistants who did the transcription were native or near-native speakers of the language they transcribed. An

additional RA's perspective was used to check the accuracy of the transcription. See Chen Pichler et al. (2010) for detailed transcription conventions.

For this analysis, several tiers were added to the videos. Each tier made use of its own controlled vocabulary of annotations. The tiers used were as follows, and are explained in more detail below:

- Modality
 - Speech
 - Sign
 - Bimodal
 - Excluded
- Polarity
 - Negative
- Head
 - shake
- Negation type
 - Anaphoric
 - Sentential
 - Constituent
 - Interjection
 - Not sensible
 - Other
- Shake scope
 - full negated utterance
 - shake alone
 - lexically negated fragment of negative utterance
 - non-lexically negated fragment of lexically negated utterance
 - negative item only
 - fragment of non-lexically negated utterance
 - full non-lexically negated utterance
 - no overlap
 - ASL and English differ
 - no shake
 - other i() -gesture
 - other

Modality: *Speech* and *sign* refer, respectively, to utterances that are presented purely in one modality or the other. *Bimodal* utterances contain at least one item from each language. Following Lillo-Martin et al. (2014), utterances were *excluded* if they were

“completely unintelligible, or consisted of only spoken or signed routines, interjections, non-speech communicative vocalizations or non-sign communicative actions (gestures), or complete imitations of the interlocutor’s immediately previous utterance—with no other speech or sign. For example, a spoken “well,” “yes,” “no,” a head nod, an “oops” gesture, or a clap, if occurring by itself, was Excluded. Utterances were also Excluded if modality could not be determined; e.g., there was audible speech but the speaker’s hands were off-camera.” However, my exclusion conventions differ in one important way. Whereas Lillo-Martin et al. (2014) excluded utterances that consisted of only a headshake, only the spoken word “no,” or only the sign NO, I included them.

Polarity: The only item in the controlled vocabulary that was used in this analysis, of course, was the *negative* polarity marker. This was used to make it easy to locate all negative utterances across the videos. Only semantically negative utterances were considered in this research. Utterances not interpreted as negative were not coded for this tier.

Head: Similarly, the only annotation used here was *shake*. This was used to provide a carefully timed annotation of where a given headshake began and ended, for ease in discerning how the headshake aligned with the spoken and/or signed components of the utterance.

Negation type: *Anaphoric*, *sentential*, and *constituent* negation classifications were assigned based on an assessment of the meaning of the utterance itself. *Anaphoric* in particular, in addition to being used in cases such as “no, I want this book,” was used when a participant merely said or signed “no” or shook their head, provided the context of the conversation made negation sensible at that point. If the context showed that a negative

utterance did not make sense at that point, a classification of *not sensible* was given. (This only needed to be used for Ben, never for the adults.) *Interjection* was used for utterances like “oh no!” which technically contain negative lexical items but which don’t seem to convey semantic negation in the same way as the *anaphoric*, *constituent*, and *sentential* negative utterances. *Other* was used as a catch-all for utterances which did not fit into any of the other five categories.

Shake scope: These classifications described the way in which the headshake overlapped with the signed and/or spoken utterance. *Full negated utterance* was used when lexical negation was present, there were no signs or words which did not fall under the temporal scope of the headshake, and when the utterance itself was a complete sentence, rather than a fragment.

Shake alone was used when the headshake is by itself, completely devoid of any signed or spoken lexical items.

Lexically negated fragment of a negative utterance was used when, in an utterance that contained lexical negation, the headshake fell over the part of the utterance that contained the lexical negation, but did not fall over the entire utterance.

Non-lexically negated fragment of lexically negated utterance, relatedly, was used when an utterance contained lexical negation, but the headshake fell over only a part of the utterance, and not over the lexically negated part.

Negative item only was used when the headshake fell over nothing more than a lexical negative item, regardless of whether that negative lexical item appeared as part of a longer utterance or on its own.

No overlap was used when the headshake and the lexical items did not overlap in time at all, but were considered to be part of a single utterance by virtue of the contextual interpretation.

ASL and English differ was used when the headshake overlapped differently with the ASL than it did with the English, making a unified classification impossible. This was very rare, occurring in only one adult utterance and six child utterances.

Because ASL allows utterances to be negated using only a headshake, some utterances considered in this paper do not contain lexical negation. However, they are still semantically negative. The following two classifications were used for such utterances.

Full non-lexically negated utterance: the headshake falls over an entire utterance, but the utterance lacks lexical negation.

Fragment of non-lexically negated utterance: the utterance lacks lexical negation, and the headshake falls over only some part of that utterance.

No shake was used, obviously, for negative utterances that did not contain a headshake.

Other i() -gesture was used when the headshake overlapped with a manual gesture which is not considered a lexical item in ASL, such as a shrug or a clap.

Other was used as a catch-all for utterances which did not fit any of the other categories.

Procedure

Aside from the transcription and some of the modality, I performed all the coding for this analysis. The “polarity” tier was coded first, since only negative utterances were of interest for this study. Following this, I added modality coding to files that did not already

have it. For these files, I added modality coding only to the negative utterances, as they were the only utterances analyzed. The “shake” tier was coded next, with careful consideration given to the timing of the headshake. That is, the annotation for each shake aligned with the onset and offset of the shake. After this, I coded the shake scope type of each utterance that used a headshake, and marked all others as “no shake.” Finally, I coded the negation type. After each video was completed, I reviewed the files to ensure accuracy. I solicited the opinions of my advisor, Diane Lillo-Martin, in cases where my understanding of ASL was not sufficient for me to be certain of a specific utterance’s coding.

Results

For the purposes of these analyses, participants in the videos were split into four categories: adult in an English target session, adult in an ASL target session, child in an English target session, and child in an ASL target session. For analyses that separated data by modality, but without regard to the target language of the session, the two child groups were combined, because the child in ASL and English target videos is the same person. The two adults groups were never combined because the adults in the English session were hearing and those in the ASL sessions were Deaf. As such, the two groups cannot be assumed to have similar linguistic patterns. Every graph shown here deals with only the negative utterances used by participants.

The first few figures display data that provide foundational information about the utterances used by each participant. Figure 1 shows the rates at which each participant used each modality.

The pattern here is clear. For both sets of adults, and for the child in the English target sessions, the target modality of the session dominated, though utterances not in the target language did appear. The rate at which the Deaf adults used signed utterances, the hearing adults spoke, and Ben spoke in English target sessions were all approximately equal. However, Ben showed a very different tendency in the ASL target sessions. He spoke and signed at equal rates, but blended the two modalities more than he used either one alone. His greatest tendency was to use a headshake by itself.

A difference between the two groups of adults is evident in the fact that, while the Deaf adults used a headshake without lexical items in 14% of their negative utterances, the hearing adults never did this.

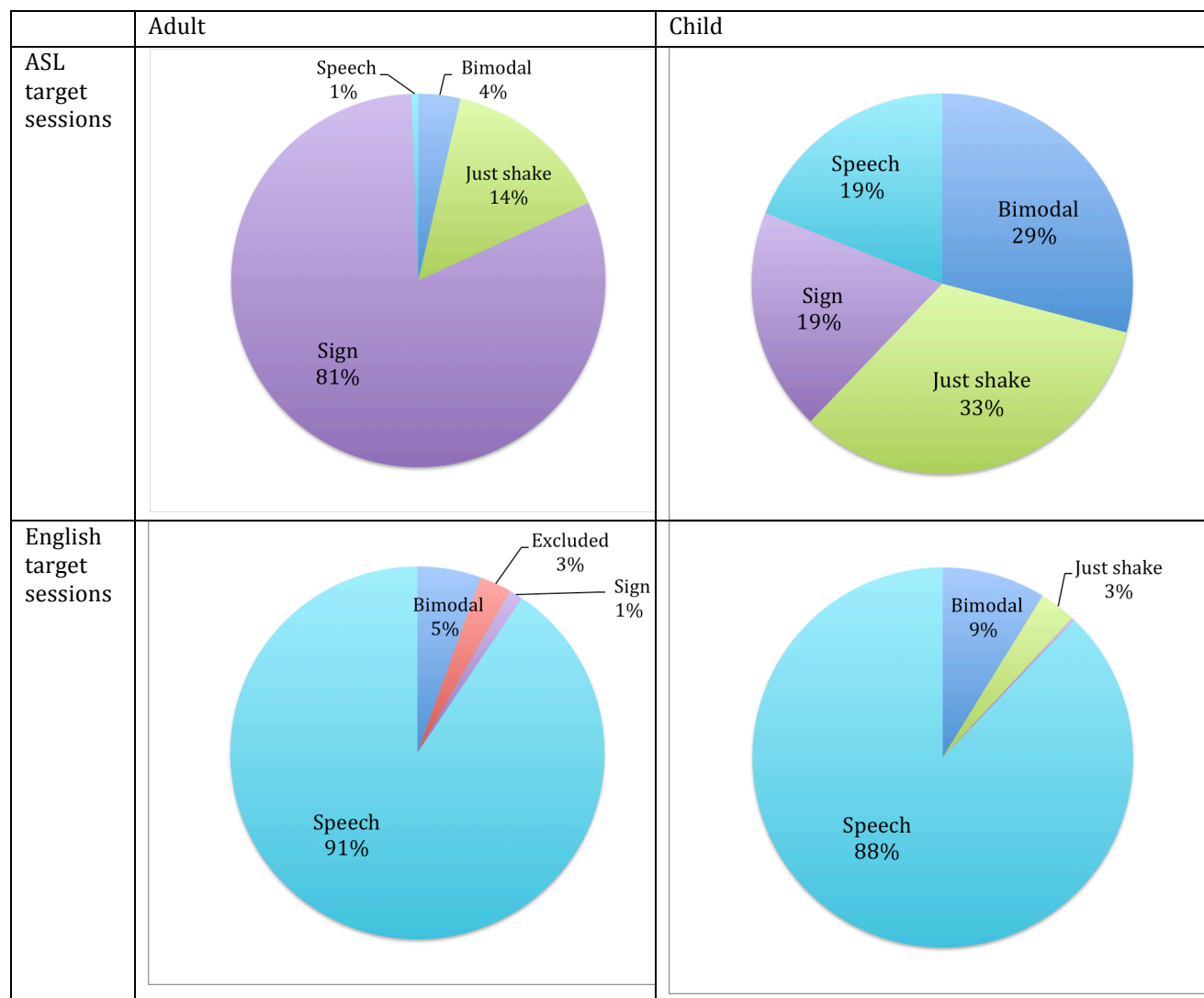


Figure 1: Modality of participants' negative utterances

Figure 2 shows the rates at which each participant used headshakes within each modality, addressing the question of whether or not the headshake is obligatory for adult-like negation in ASL. Where there is no bar, the participant did not produce enough utterances in that modality to include in the graph.

Comparing the child data in each modality shows one key difference. With spoken and bimodal utterances, in ASL target sessions Ben used a headshake substantially more frequently than he did with the same kinds of utterances in English target sessions.

Additionally, within the English target sessions, Ben tended to use shakes more with bimodal utterances than spoken utterances, and in sign sessions, Ben used shakes about equally with spoken and bimodal utterances, and substantially more with signed utterances.

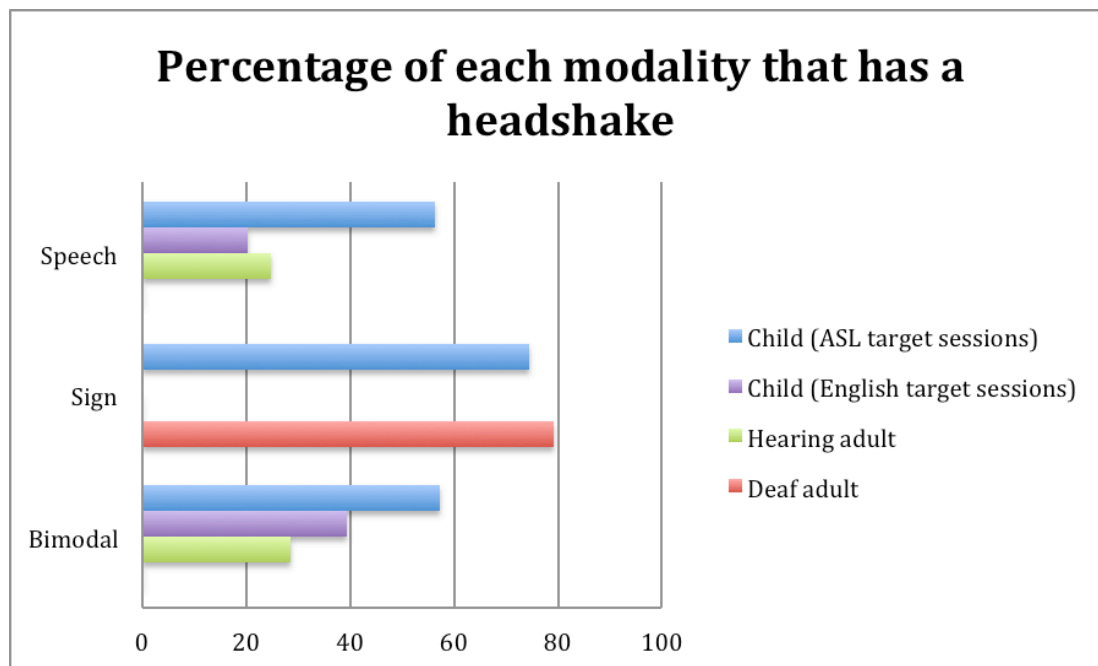


Figure 2: Frequency of participants' use of shake by target language, split by modality

The hearing and Deaf adult interlocutors in each target language group showed distinct patterns of headshake usage. The Deaf adults in the sign sessions used a headshake with almost 80% of their signed negative utterances. In contrast, hearing adults in the speech sessions used headshakes comparable amounts with both bimodal and spoken utterances, and at a much lower rate than the Deaf adults used shakes with signed utterances.

Interestingly, though further data in this section will show the many ways Ben differed

from the adults, his percentage of shake use in the target language essentially matched both the Deaf and hearing adults.

Figure 3 shows the rates at which each participant used the different kinds of negation within each modality. These figures begin to address the question of how the CODA's use of negation differs from that of the Deaf and hearing adults.

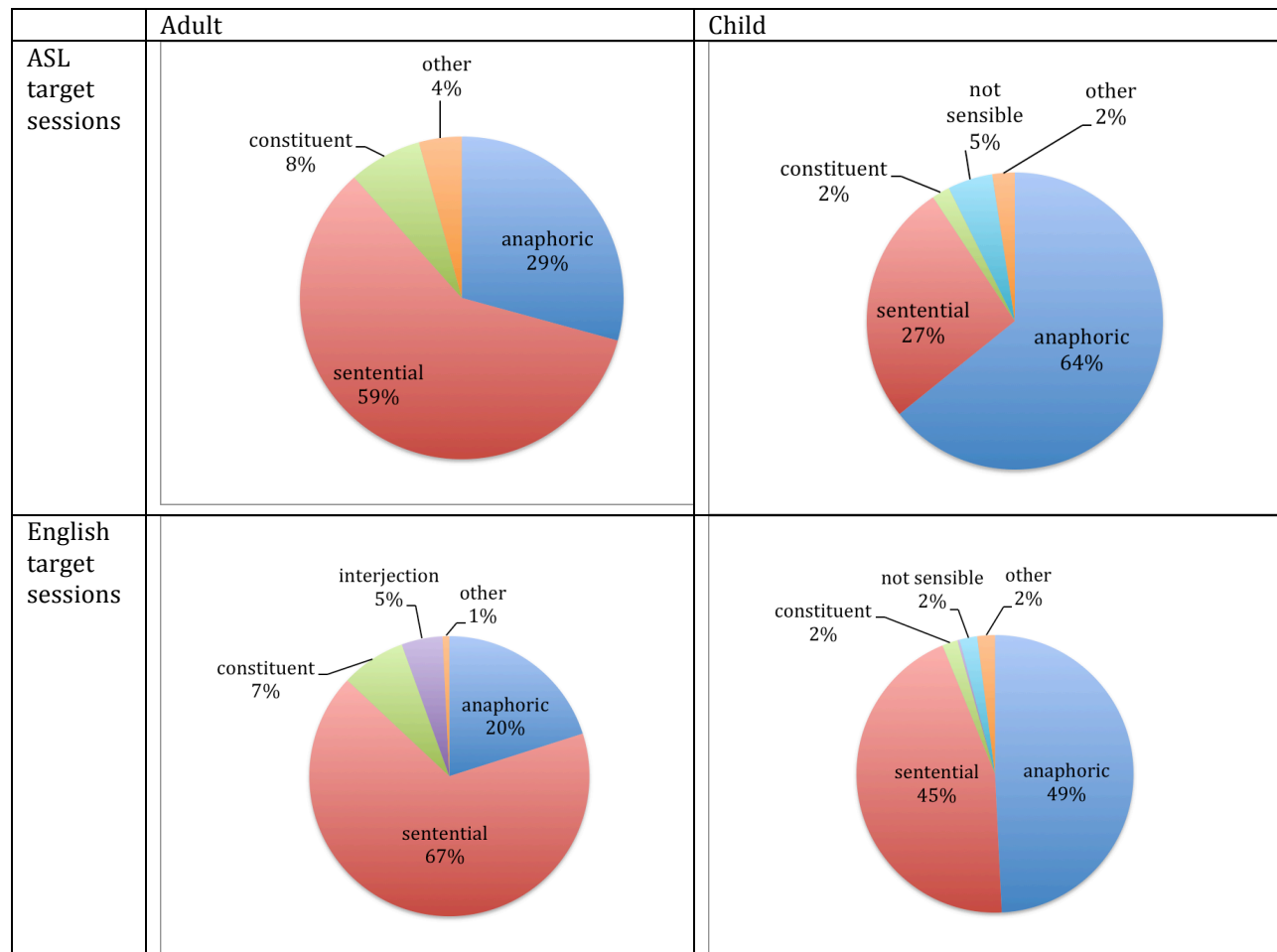


Figure 3: Participants' use of negation type in each target language

The hearing and Deaf adults were alike in that the majority of the negation they used was sentential (hearing: 67%, Deaf: 59%), followed by anaphoric (hearing: 20%, Deaf: 29%). Rather unsurprisingly, neither group used negation that would be classified as "not sensible." The two groups also used constituent negation at a similar rate (hearing: 7%,

Deaf: 8%). Grouping the negation types into sentential, anaphoric, constituent, and all other, the hearing and Deaf adults were not different from each other in their proportion of use according to a 2x4 chi-square test of independence ($n = 418$, $\chi^2 = 4.81$, $p = 0.19$). The fact that the two adult groups used the various negation types at similar rates suggests that the rates can serve as a baseline for the natural rates of these negation types in adult speech cross-linguistically.

Ben showed a clear difference in his use of negation type compared to both hearing and Deaf adults. In both target languages, he used dramatically more anaphoric negation than did his adult interlocutors. He also, perhaps unsurprisingly as well, used instances of “not sensible” negation, which the adults did not. “Not sensible” negation primarily consisted of saying/signing “no” in response to an utterance where there was nothing to disagree with or negate. Additionally, Ben showed a marked difference in his use of negation types between sign and speech sessions. In sign sessions, he used much more anaphoric negation (sign: 64%, speech: 49%) and less sentential negation (sign: 27%, speech: 45%) than in speech sessions, where the two were roughly equal.

The data in the remaining figures address more specific questions. Figures 4 and 5 address the questions, “How does the CODA’s use of negation compare to that of Deaf and hearing adults?” and “How does the CODA’s use of negation change over time?” The figures first break down data by modality of utterance, then by session, and finally by negation type. The x-axis displays Ben’s age in years and months (e.g., 1;11) at the time of the session. Figure 4 shows the adult data, and figure 5 shows the same information for the child. In figure 4, the data are divided by target language because the Deaf and hearing adult data cannot be mixed. In figure 5, the child data are not separated by target language.

Graphs are included only in the modalities in which participants produced a significant number of utterances.

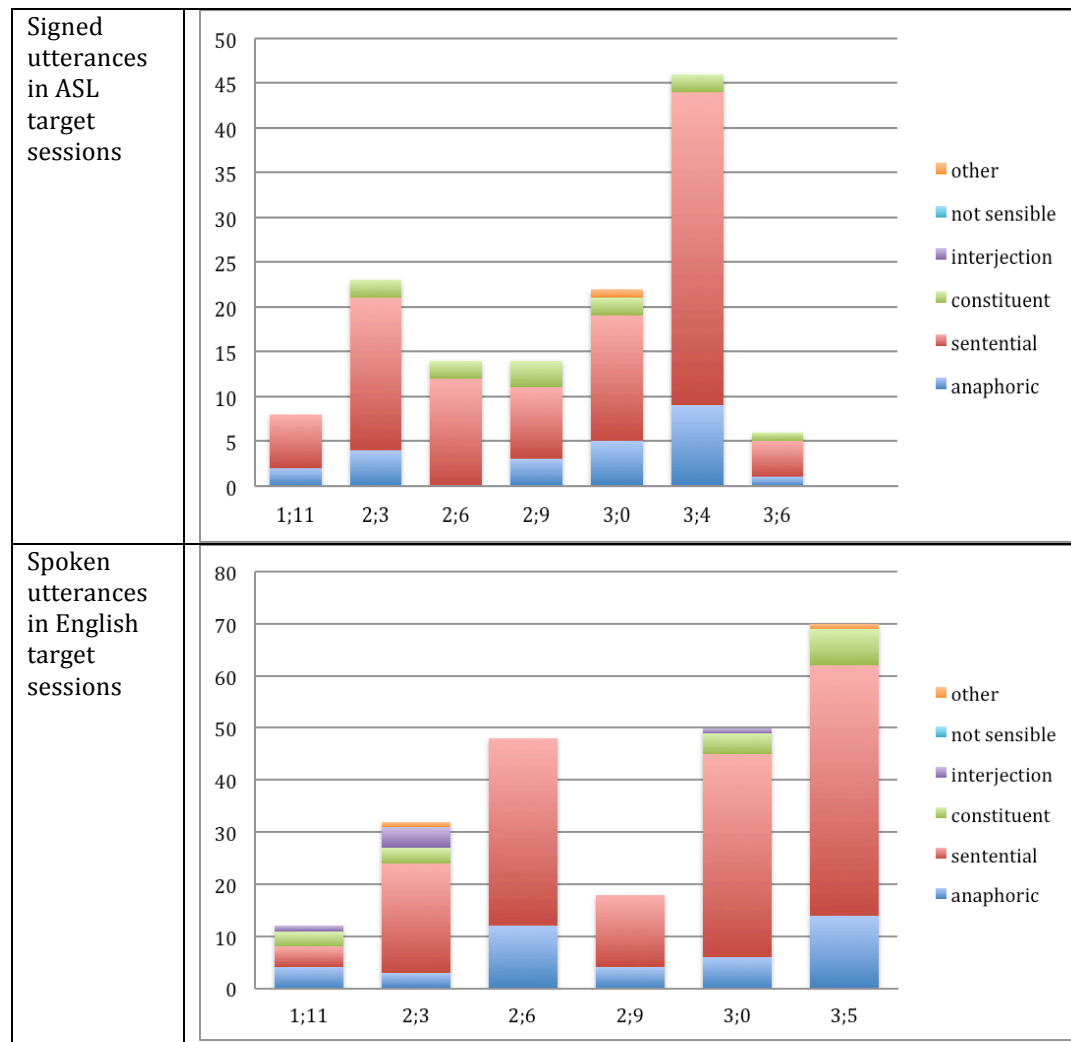


Figure 4: Adult use of negation type in each target language, split by modality and session

For both sets of adults, within the target language their use of negation type stayed relatively consistent across sessions. That is, the Deaf adults' signed utterances and the hearing adults' spoken utterances both showed a predominant use of sentential negation, followed by anaphoric and then constituent. This again provides a helpful baseline; since the adults' tendencies remained consistent, it will be easier to note differences in the child's development over time.

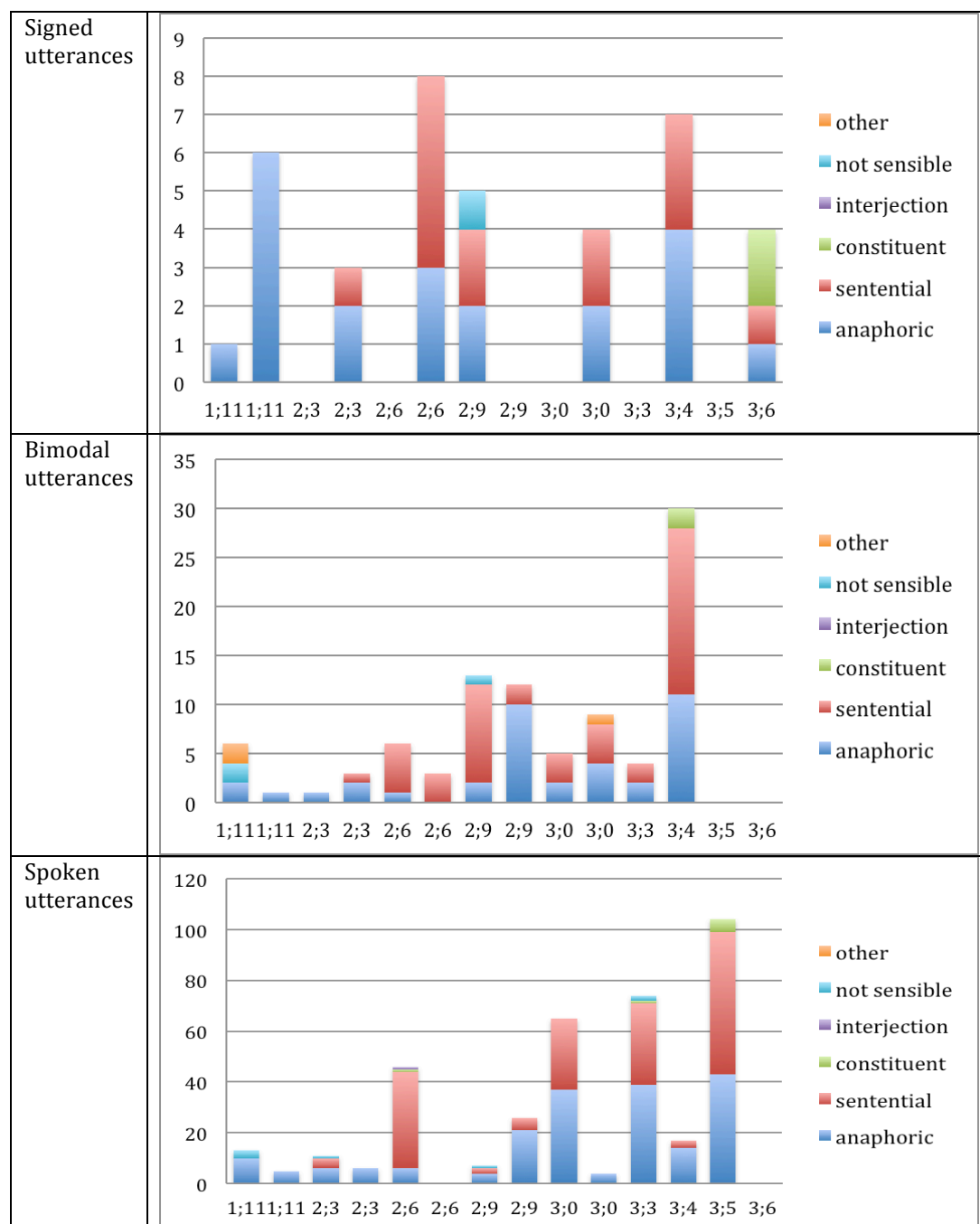


Figure 5: Child use of negation type, split by modality and session

Ben's use of negation type did not stay consistent the way the adults' patterns did. Rather, his proportion of sententially negated utterances grew (irregularly) over time, and constituent negation appeared only towards the end of this timeframe. Sentential negation first appeared at the same point in all three modalities: age 2;3. Similarly, constituent

negation appeared at 3;4, 3;5, and 3;6 in bimodal, spoken, and signed utterances respectively.

Figure 6 is the first to incorporate the notion of the temporal scope a headshake has over the utterance it is modifying, addressing the question of how the CODA's use of headshake compares to that of Deaf and hearing adults. For the purposes of simplification, I grouped the less frequent shake scope types into one catch-all category, and analyzed the following groups: (1) *full negated utterance* (the shake falls over every word/sign including lexical negative item), (2) *negative fragment of negated utterance* (shake falls over some words/signs, including lexical negative item), (3) *negative item only* (headshake falls over only negative lexical item), (4) *shake alone* (just shake, no words or signs), (5) *no shake*, and (6) *all other categories*.

Similar to the way that the Deaf adults in the sign sessions used headshakes on their own, in sign sessions a substantial amount of the headshakes that Ben used are used without any other speech or sign. Another interesting distinction between the two target languages is that in English-target sessions, Ben used the negative fragment shake scope, which did not appear in his ASL-target session utterances. Additionally, he used negative item only with a much greater frequency in speech sessions than in sign sessions.

As for the adults, in English-target session they overwhelmingly used no shake at all. When they did use a shake, it occurred most frequently with full negated utterances. While they also used "negated fragment" shakes, the rate at which they used this is small compared to their use of no shake.

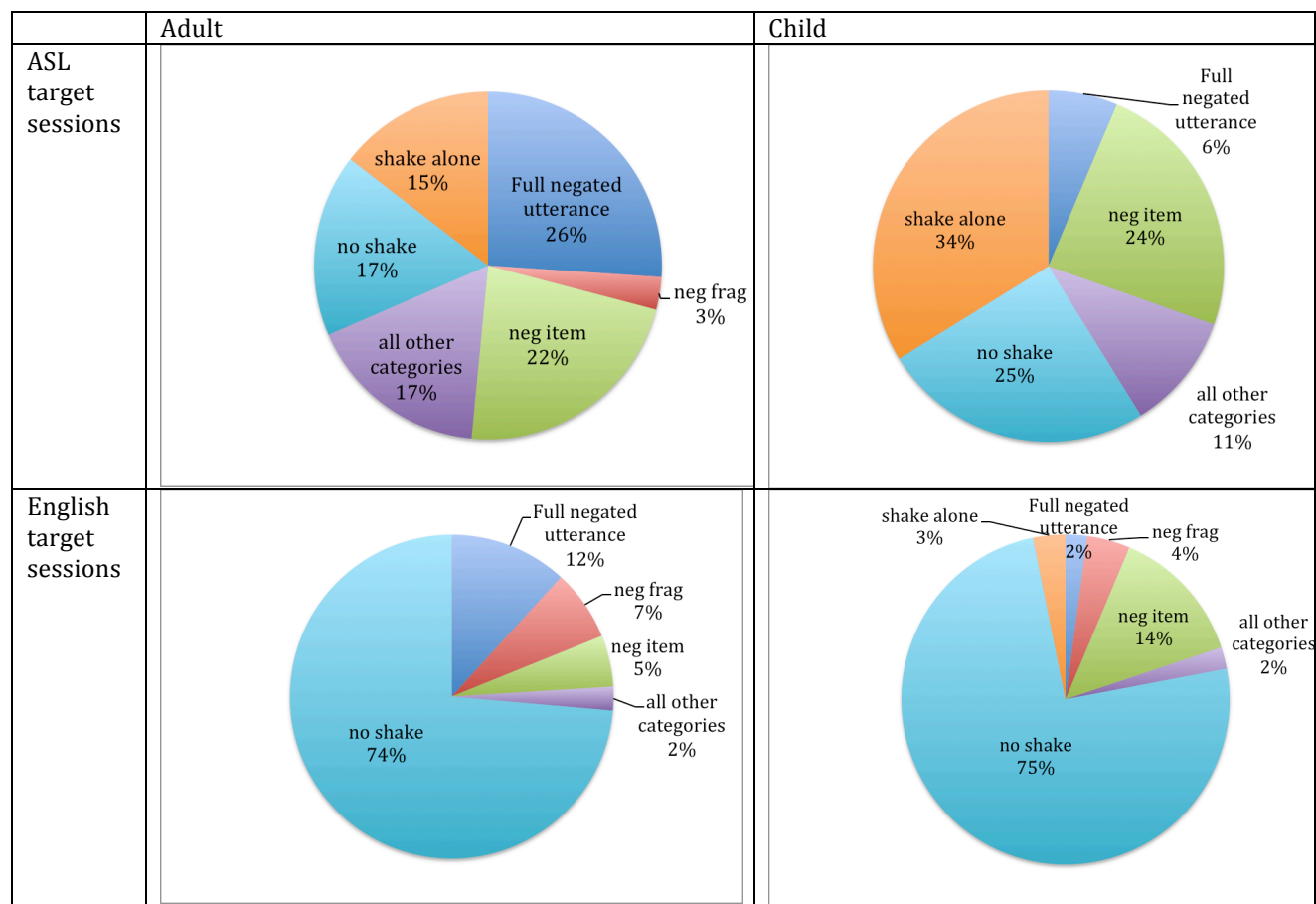


Figure 6: Percentage of each shake scope type within each target language

Figures 7 and 8 show the way that participants used the different shake scope types within each modality, over time. Again, the x-axis shows Ben's age at the time of the session. The shake scope category of "just shake" is not included here because a shake by itself was always classed under its own modality, never as speech, sign, or bimodal. Once again, for the adult data, utterances not in the target language were more rare, so those graphs are not included.

In the Deaf adults' signed utterances, while the proportions do not stay perfectly consistent in each session, the number of "full negated utterance" and "negative item only" used stays relatively consistent. Both of these categories were used more often than "negated fragment of negative utterance." In spoken utterances, the hearing adults showed

a somewhat consistent usage of “full negated utterance” shake scope, but didn’t appear to show the same preference as the Deaf adults for “negative item only” over “negated fragment of negative utterance.”

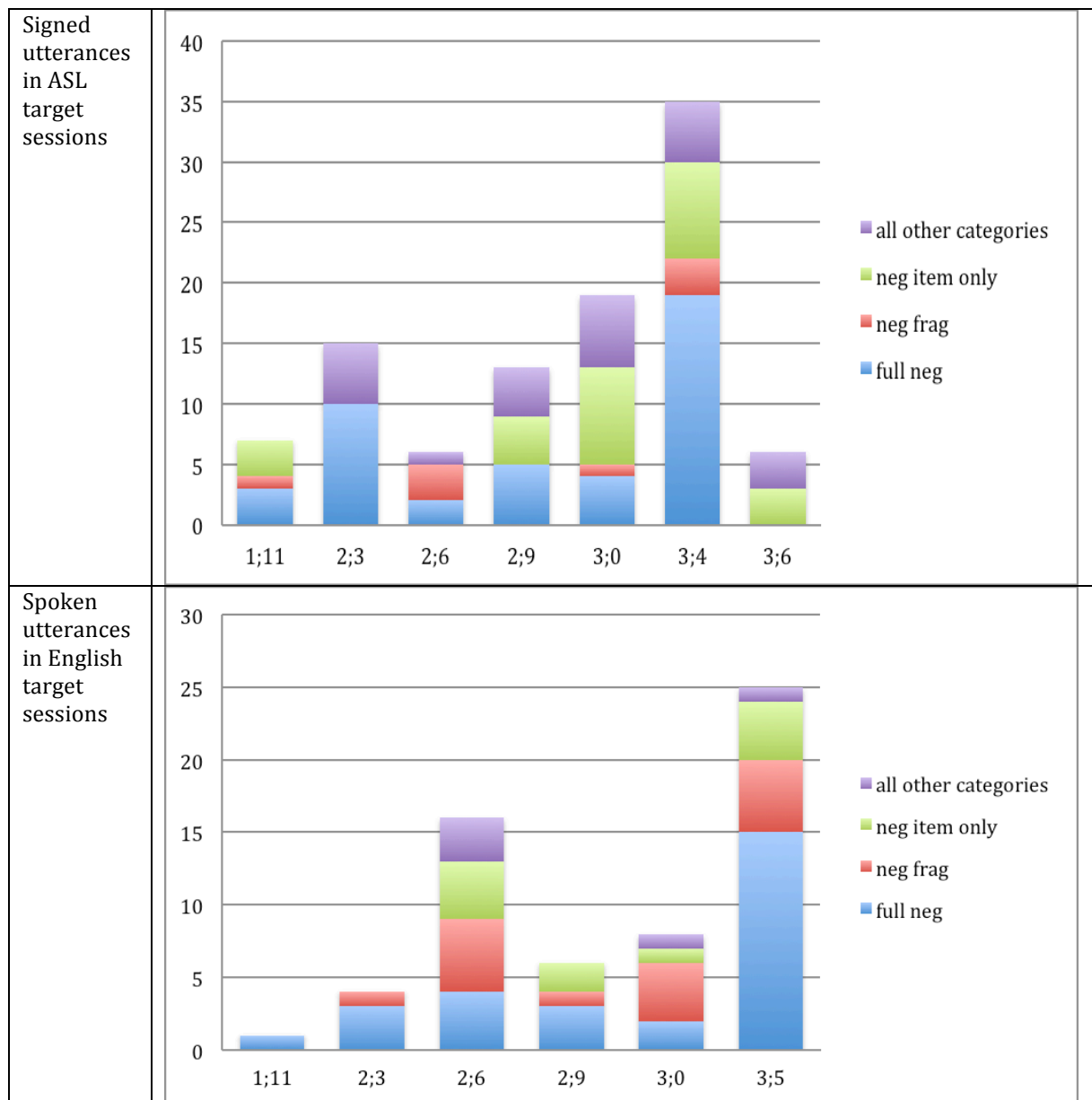


Figure 7: Adult use of shake scope in each modality, in each session

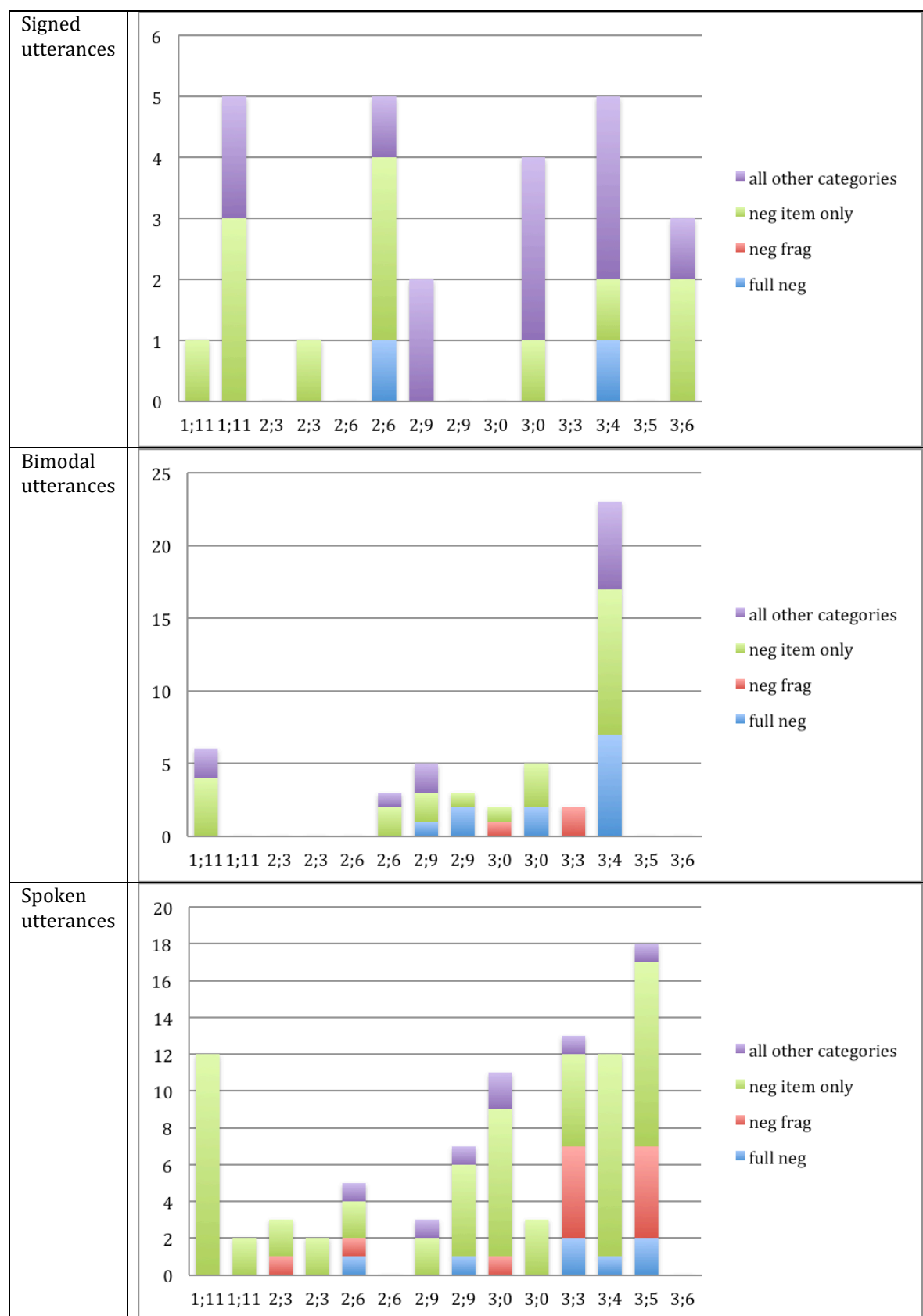


Figure 8: Child use of shake scope in each modality, in each session

In the child data in figure 8, it is clear that Ben showed a preference for “negative item only” shake scope. This is not surprising, given the amount of anaphoric negation he used. Much of his anaphoric negation manifested as simply the word “no,” frequently with a headshake. As such, it makes sense that the majority of his utterances were categorized with the “negative item only” shake scope. Ben also appeared to begin using the “full negated utterance” shake scope at roughly the same time in all three modalities: 2;6 in speech and sign, and 2;9 in bimodal utterances. It is particularly striking to note that, while Ben used “negated fragment of negative utterance” throughout his bimodal and spoken utterances, it never appeared in his signed utterances.

Figures 9, 10, and 11 break down the data by modality, then by negation type, and finally by shake scope type. Figure 9 deals with signed utterances, figure 10 with spoken utterances, and figure 11 with bimodal utterances. Once again, the Deaf adults did not produce enough spoken utterances nor the hearing adults enough signed utterances to merit graphs, and neither group produced a substantial amount of bimodal utterances. As such, Ben’s signed and spoken utterances are each compared only against one set of adult data, and his bimodal utterances stand alone in figure 11.

In figure 9, given that anaphoric negation almost always hinged on a single negative word before a separate clause, it is not very surprising that both Ben and the Deaf adults would use a majority of “negative item only” in this case. In sententially negated signed utterances, however, Ben’s tendencies did not look like the adults’. He used much less of the “full negated utterance” shake scope, and much more “no shake.”

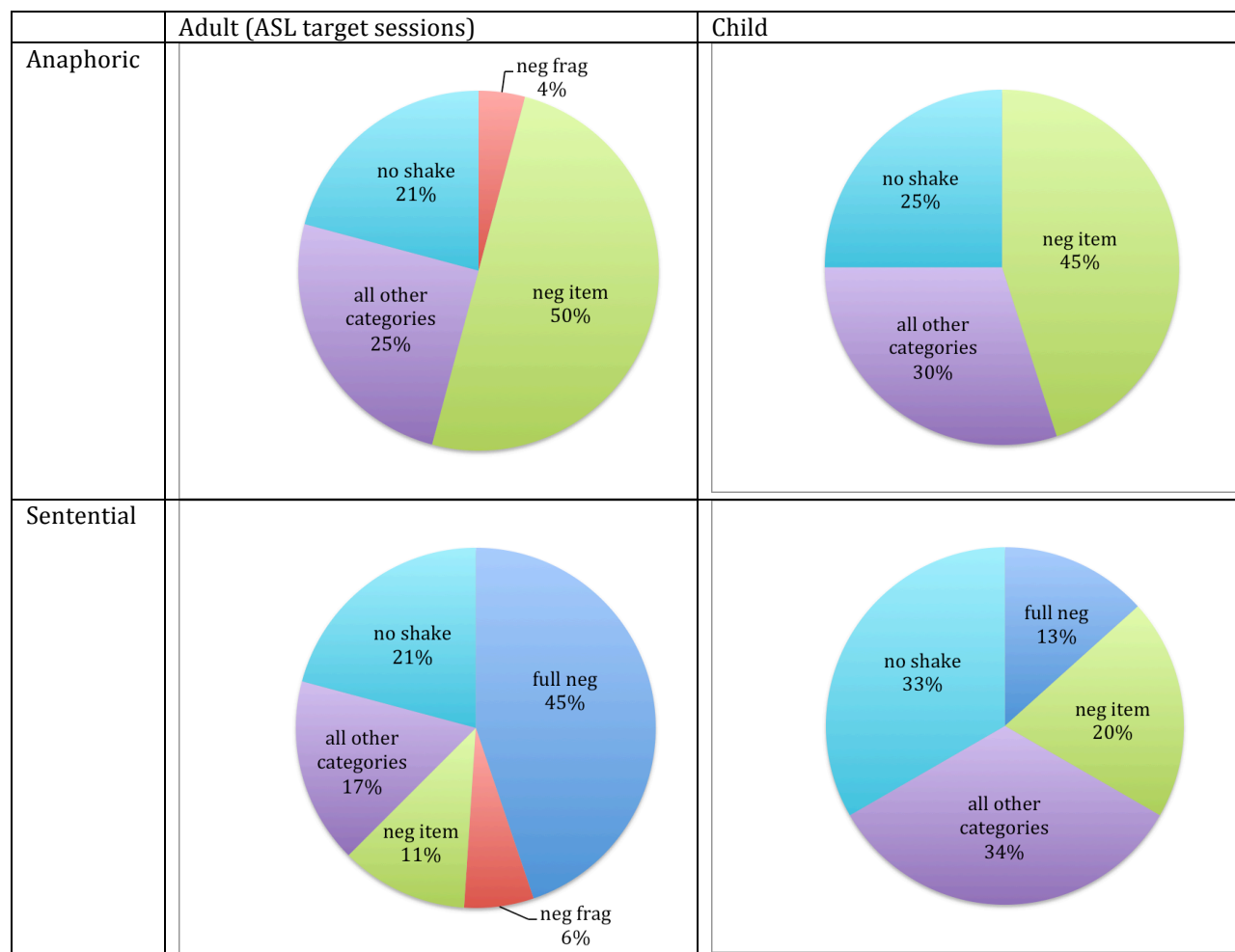


Figure 9: Participants' use of shake scope within each negation type, in signed utterances

The data in figure 10 show a different phenomenon than the pattern observed in figure 9. Here, Ben's use of shake scope matched the hearing adults somewhat closely in both sententially negated utterances and in anaphoric utterances. Across the board, the hearing adults tended not to use a shake at all, regardless of the negation type they were using. However, Ben used a surprising amount of "full negated utterance" in anaphoric utterances when speaking, which was very different from his tendencies while signing. In sentential utterances, both Ben and the adults tended not to use a headshake at all. When they did use one, it was almost never over the negative item only. Instead, it was slightly likely to be either over a negated fragment or over the full utterance.

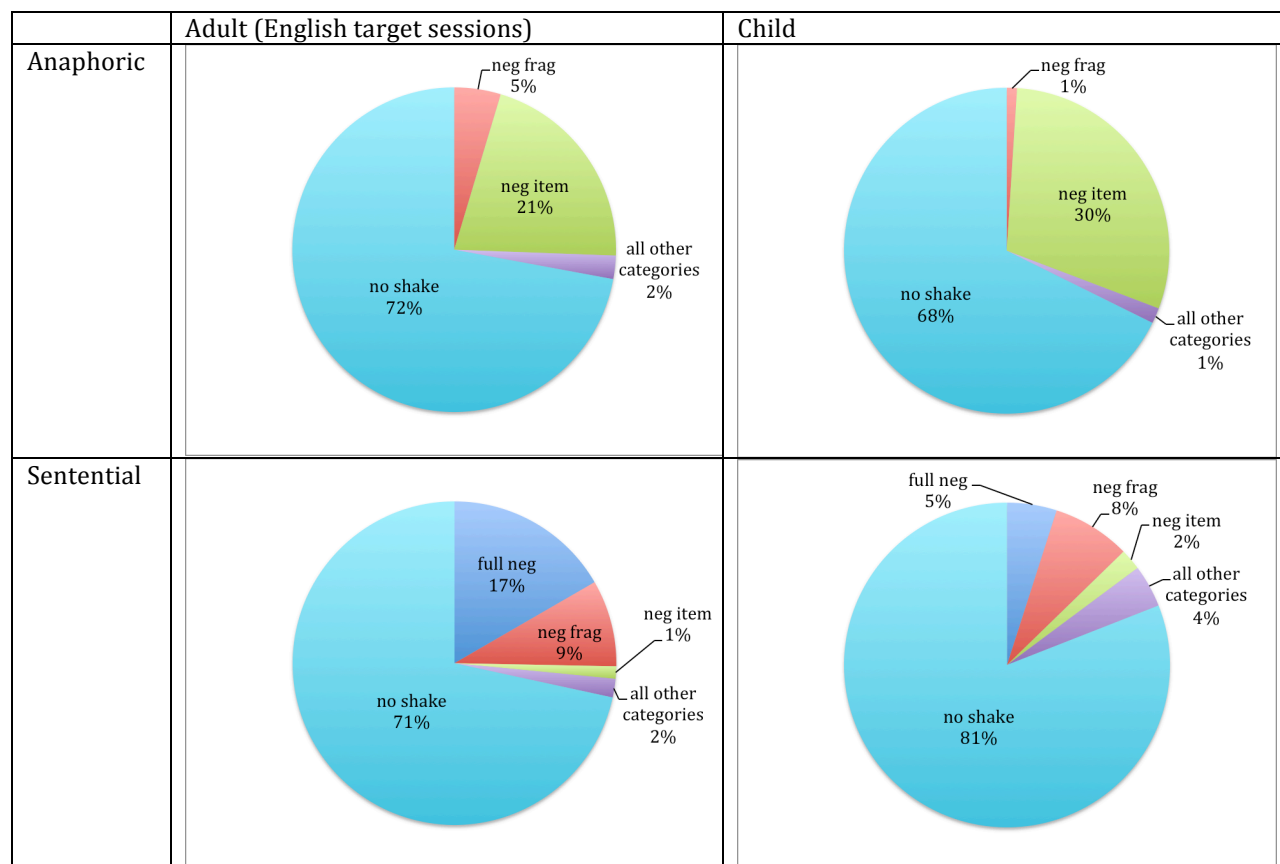


Figure 10: Participants' use of shake scope within each negation type, in spoken utterances

Additionally, while shakes overlapping with “negative item only” were non-existent or nearly non-existent in the hearing adults' sentential negation, the overlap of “negative item only” with anaphoric negation could be explained by the fact that much of the adults' anaphoric negation consists of only a single negative lexical item.

Figure 11 shows only Ben's shake scope within bimodal utterances, because neither set of adults produced enough bimodal utterances to make a meaningful comparison. Ben's use of shake scope in anaphoric utterances was an unexpected blending of his signing and speaking tendencies; he showed a substantial preference for no shake, but was also just as likely to use “negative item only” as he was in signed utterances. His tendencies in bimodal sentential negation most closely matched the pattern in his spoken utterances.

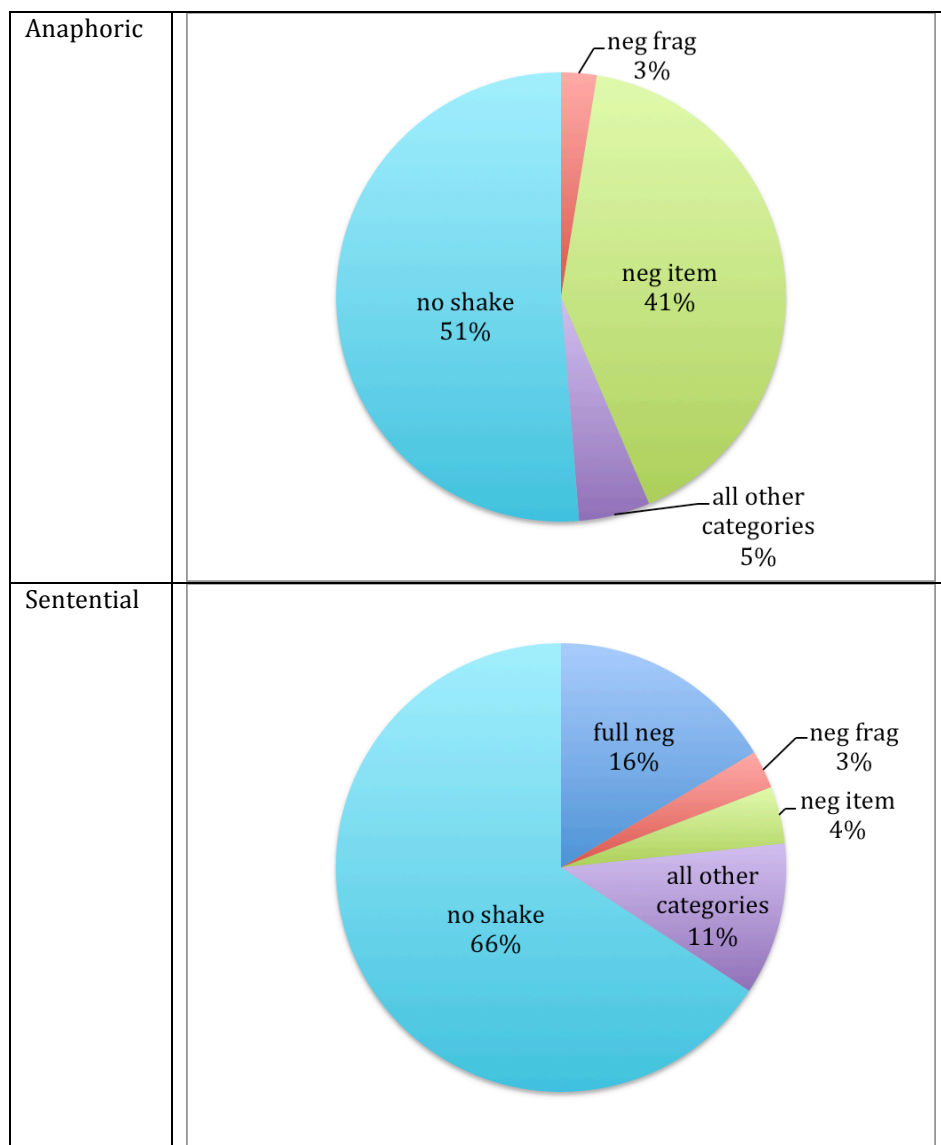


Figure 11: Child's use of shake scope within each negation type, in bimodal utterances

Discussion

In this section I will use the preceding data to address the questions I raised in the introduction, and to begin to draw some conclusions.

1. *Is a headshake required to produce a grammatical, adult-like negative utterance in ASL?*

How does the negation type in use relate to the scope of the headshake required over the utterance?

Based on the data from the Deaf adults in figure 2, it seems reasonable to conclude that a headshake is near-obligatory with negative utterances, but not completely obligatory. My data show a 79% rate of headshake use with signed utterances, but I don't believe that rate is high enough to conclude that the headshake is completely obligatory.

Looking at figure 6 shows that, while the Deaf and hearing adults showed similar patterns in the negation type they use, they had remarkably different tendencies when it came to the scope of the headshake over the negative utterances. For the Deaf adults, even though 59% of their utterances were sententially negated, only 26% of negative utterances contained a headshake that fell over the full negated utterance. Indeed, figure 9 shows that only 45% of sententially negated adult utterances in the ASL target sessions were used with a headshake over the full negated utterance.

For example, see the following sentences from the adult data:

neg _____
 (a) NOT LIKE GRAPES IX(self)
 'I don't like grapes'

(b) IX(self) NOT-YET BITE IX(BEN) NOT-YET
 'I didn't bite you!'

- neg
 (c) NOT POSS(self) PREFER
 'It's not my favorite?'

These examples show three of the ways the headshake can overlap with the lexical signs of a sententially negated utterance when used by a Deaf adult. (a) shows a sententially negated utterance with the headshake falling over the entirety of the utterance. (b) shows another sententially negated utterance, but without any headshake at all. In (c), the headshake falls only over the negative lexical item, even though in all three cases the negative lexical item has semantic scope over at least one other word.

Additionally, 17% of the Deaf adults' negative utterances were used with no shake at all. These two facts combine to cast some doubt on the idea that the negative headshake is obligatory and that it must have a precise scope over the negative utterance.

In order to try to conclude whether or not the headshake is truly obligatory, it is helpful to look at some specific instances from the adult data, and see if any generalizations can be made about the distinctions between utterances used with a headshake and those used without. Some of the Deaf adults' utterances that didn't use headshake were instances of joking with or scolding Ben, or of self-repetition. However, such cases don't account for all the utterances used without headshake.

The Deaf adults show several examples of anaphoric, constituent, and sentential negation all used without a headshake, in ordinary negative declarative contexts.

- (d) FS²(fatal) FASCINATED NO[+]
 'Fatal Attraction... No...'³

² FS signifies fingerspelling, the spelling of an English word using the ASL letters of the alphabet. This is commonly used for unfamiliar proper nouns.

³ For context, in utterance (d) the adult is signing with another adult, trying to recall the name of a movie.

(e) i(hey) KNIFE MAYBE NOT SHARP IX(knife)
 'Hey, maybe the knife is not sharp'

(f) i(hey) NOT SEE DUCK
 'Hey, I don't see the duck'

These observations lead me to conclude that the headshake is not strictly obligatory for negation. At the very least, given the variety of ways the headshake can overlap with sentential negation in (a), (b), and (c), the timing of the headshake is not very precisely constrained with respect to specific lexical items. However, given that the Deaf adults' headshakes were more likely to start and end either with a full negated utterance or with a negative item only, it seems that there are some constraints in place.

Within constituent negation, the tendency of the headshake to fall over the negative item only was an overwhelming one. That seems to indicate a connection between the semantics of a negated utterance and the way that the headshake must overlap with it. However, the production of constituent negation was rare, making it difficult to draw a generalization from such a limited dataset.

Since much of the Deaf adults' anaphoric utterances used headshake scopes in the "all other categories" classification, it is worth going through some examples of those other categories and the way they are used by the Deaf adults.

neg
 (g) IX(self) SEE IX(book)
 'I can't see what's in the book.'

neg
 (h) NOW LEARN TRUCK FROM FS(CDC) i(no) IX(self) TEACH THAT
 'Now he learned the sign 'truck' from CDC. I didn't teach him that.'

neg
 (i) FATHER GO WORK i(no) FATHER HOME TODAY REST
 'Daddy went to work? No, Daddy is at home today, resting.'

Utterances (g) and (h) are classic examples of the way the headshake by itself can be used to negate an utterance that is not lexically negated. While they were not used as commonly in the current data as the construction including both a headshake and lexical negation, they typically used a headshake that fell over everything which was being semantically negated by the shake.

Utterance (i) is interesting in that it reflects one of Ben's tendencies. Here the adult used a headshake by itself to negate what she had just said, before introducing a non-negated clause. The headshake did not overlap with any manual signs. This is reminiscent of Ben's habit, in signed utterances, of using a headshake without any manual signs for anaphoric negation. Recall as well that the hearing adults did not use wordless headshakes at all. As such, this pattern seems to be related to the use of ASL.

As for the way the scope of the headshake interacts with the type of negation being used, there appeared to be a slight tendency for the Deaf adults to use "negative item only" with anaphoric negation and "full negated utterance" with sentential negation. Though the hearing adults overwhelmingly used no shake at all for anaphoric and sentential negation, when they did use shakes they also predominantly used "negative item only" for anaphoric and "full negated utterance" for sentential negation. However, this might be a rather superficial finding, given that anaphoric utterances in this study were typically of the construction "no, (semantically non-negative clause)." This means that there was really no other option for the scope of the headshake than "negative item only"; a headshake over both the lexical negative item and the non-negative clause in ASL would be very strange because the headshake does not have semantic scope over the non-negative clause. The use of "full negated utterance" with sentential negation, however, is a more meaningful

correlation, especially since it so greatly outweighed the Deaf adults' use of the "negative item only" scope in this category.

2. *Does the child in this case study follow what Anderson and Reilly call the "hands before face" theory?*

By and large, my data did not reproduce Anderson and Reilly's findings. The signs DON'T-WANT and CAN'T each appeared first without a headshake, and later in conjunction with a headshake, and the sign NONE appeared first without a headshake, but never made an appearance with a headshake. However, many negative signs were already being used with a headshake the first time they appeared. Figure 12 shows Ben's age at each of these appearances. In parentheses are the earliest ages at which Anderson and Reilly found these signs to appear in their study of 51 Deaf children.

Sign	Age without shake	Age with shake
NO	n/a (1;6)	1;11 (1;8)
DON'T-WANT	2;6 (1;7)	3;4 (2;0)
NONE	3;4 (1;9)	n/a (1;9)
CAN'T	3;0 (2;0)	3;4 (2;3)
DON'T-LIKE	n/a (2;0)	3;4 (2;8)
NOT	n/a (2;7)	1;11 (3;0)
DON'T-KNOW	n/a (2;7)	2;3 (3;0)
NOT-YET	n/a (3;0)	3;4 (3;4)

Figure 12: Age at which Ben first uses a sign with and without shake

The fact that some of these signs first appear with a headshake does not definitively mean that Ben never used them without a headshake at an earlier stage of development, as he could have produced a bare sign at a time when he wasn't being filmed. However, for the

signs NOT and DON'T-KNOW, Ben is using them with shakes before Anderson and Reilly's data would predict such a thing. Additionally, the ages at which Ben used these signs with or without shakes rarely matched the age at which Anderson and Reilly found the monolingual Deaf children to do so. They only matched or came close to matching in the cases of NO with a headshake and NOT-YET with a headshake. These two facts combine to suggest that Ben does not follow the "hands before face" theory.

One explanation for this difference is simply that as an individual, Ben differs from the children whose development was studied by Anderson and Reilly. Another possibility is that the number of videos taken of Ben was not sufficient to catch his first uses of each of these signs. However, it is also possible that the fact that he is a bimodal bilingual language learner has an influence on his development, causing him to differ from the monolingual Deaf children in Anderson and Reilly. It is possible that bimodal bilingualism slightly slowed Ben's acquisition of some negative lexical items, or his integration of lexical items with headshake. Since the input Ben received from the hearing adults featured far fewer headshakes than the input from the Deaf adults, it's possible that that input delayed or otherwise hindered his integration of headshake with negative lexical signs in ASL.

3. How does the CODA's use of negation type compare to that of Deaf and hearing adults?

Comparing Ben's use of negation types in ASL target sessions with the Deaf adults' use of the same (figure 3), there is a clear distinction. The adults showed a preference for sentential negation, while Ben predominantly used anaphoric negation. While Ben used slightly more sentential negation and less anaphoric in the English target sessions, virtually the same comparison holds true between Ben's English target session data and the hearing

adult data. From these two comparisons, it can be concluded that, in terms of the kind of negation being used, Ben's patterns are not yet completely adult-like.

As mentioned earlier, the Deaf and hearing adults used almost the same proportions of sentential and anaphoric negation (they are not significantly different), providing some evidence that adult negation type trends are similar cross-linguistically.

4. How does the CODA's use of negation change over time within each modality?

Separating Ben's utterances by modality (not target language) and by his age in each session (figure 5) shows that Ben appeared to acquire sentential negation at the same time across languages. In each modality, he first used sentential negation at age 2;3, and used it to a greater extent at age 2;6 and onwards. One caveat here is that the number of purely signed utterances in each session was considerably smaller than the number of bimodal utterances, which was in turn lower than the number of spoken utterances, making a comparison difficult. However, at age 2;6 Ben signed more utterances than in any other video, so I think that the relative use of sentential negation there is still worth noting.

Similarly, Ben seemed to acquire constituent negation at around the same point cross-linguistically as well. He first used it bimodally at age 3;4, in speech at 3;5, and in sign at 3;6. Unfortunately 3;6 is the oldest session used for these results; it would be interesting to see how Ben's use of constituent negation continued to develop over the next few months, especially given that the adults in either language did not produce much constituent negation, so it might not take long for Ben to approach an adult-like use of constituent negation.

5. *How does the CODA's use of headshake compare to that of Deaf and hearing adults?*

Ben's use of shake scope compared to target language is markedly different in ASL versus English. In signed utterances, his greatest tendency was to use a headshake by itself, followed by "negative item only" scope. In spoken utterances, on the other hand, he used a great majority of "negative item only" shakes. Recall that Ben used a lot of anaphoric negation regardless of modality or target language. Given that tendency, one possible explanation for the difference in Ben's shake scope in sign versus speech could be that, while in ASL sessions he feels comfortable using headshakes by themselves (as the adults do), in English sessions he tends to say "no" in an anaphoric utterance that would otherwise consist of only a headshake. While the Deaf adults did not use headshakes by themselves extremely often, they certainly used them more than the hearing adults, who never used a headshake without lexical items. This could indicate that Ben is sensitive to the acceptability of headshakes alone in each of the two modalities, and as such rarely uses headshakes by themselves when he is using English. Instead, the number of "negative item only" items increases in spoken utterances as compared to signed utterances.

Unlike the Deaf adults, who used a "full negated utterance" headshake with 45% of their sententially negated signed utterances, Ben tended to use no shake (33%) rather than a shake over the full negated utterance (13%). This could indicate that whatever distinction accounts for the adults' rate of "full negated utterance" scope was not fully developed in Ben by age 3;6. However, the fact that there was no discernible distinction between the Deaf adult utterances that used and did not use headshakes (as discussed above) weakens this assertion. That is, Ben cannot lack a distinction that the adults don't appear to have.

As for the hearing adults, while figure 6 shows that they used “full negated utterance” about half as often as the Deaf adults overall, figure 10 shows that they used that scope with only 17% of their sententially negated spoken utterances, compared to 45% of the Deaf adults’ sententially negated signed utterances. One distinction between the two groups was the hearing adults’ tendency to use a headshake that fell over a negated fragment of the negative utterance. Because the hearing adults used headshakes so infrequently, their rate of “negated fragment” appeared close to that of the Deaf adults. But when considered in terms of only the utterances that used headshakes, the hearing adults used “negated fragment” substantially more than the Deaf adults did. The following examples show utterances in which the hearing adults used a headshake that fell over a negated fragment of a negative utterance:

neg
(j) LNF⁴ doesn’t eat hamburgers.

neg
(k) Oh, he can’t close his eyes?⁵

neg
(l) That’s not it.⁶

It is important to note the way that, in utterances (k) and (l), the boundary of the headshake does not line up with the boundary of a word. That is, the headshake ends in the middle of a word, something that rarely occurs in the Deaf adult data. The Deaf adults’ tendency for either “full negated utterance” or “negative item only” shake scopes means

⁴ LNF is the pseudonym of one of the hearing adults

⁵ In this utterance, the headshake overlaps with all of the word “can’t” as well as the onset of the word “close.”

⁶ In this utterance, the headshake overlaps with all of the word “that” as well as the onset of the word “not.”

that their headshakes tend to end with a word or sentence boundary, suggesting a more precise timing of headshake than the hearing adults.

One possible explanation for this difference between the Deaf and hearing adults' language patterns is that the "negative fragment" headshake is a common way to use a communicative headshake with English. That is, it could be that when a hearing English-speaker shakes their head to emphasize the lexical negation in English, they frequently shake over the negative item but also over some neutral items in the utterance, because they don't use the same careful headshake timing as native signers. It is important to note here that while the hearing adults in this study are native speakers of English, they also became fluent in ASL as adults, meaning that they could be blending some ASL NMS with their speech. The way they use headshakes might not be the way monolingual English speakers use them.

Conclusions

This study addressed the question, “How does bimodal bilingualism affect a child’s acquisition and use of the negative headshake in ASL and English?” Additionally, it attempted to reproduce the findings of studies on both adult use of negation in ASL and monolingual children’s development in ASL.

With respect to previous studies’ findings on adult negation in ASL, this study did reproduce their findings but did not agree with their conclusions. I found adult use of headshake with negation at a similar rate to previous studies, but when looking more closely at the utterances that used and did not use headshakes, as well as the ways the headshakes overlapped with negative utterances, I found that there was no systematic reason for the use or lack of headshake with a given utterance. From this I concluded that, while the headshake is near-obligatory for adult-like negation in ASL, it is not strictly obligatory. Additionally, when it is used, the timing of the shake’s scope over the lexical items in the utterance is not strictly constrained, though a sharp onset and offset at a word boundary do seem to be required.

Regarding the acquisition questions, my research did not reproduce Anderson and Reilly’s findings. Whereas they found a clear pattern of negative lexical items appearing first without shakes and later with shakes, many of the first times Ben used negative lexical items already included shakes. Additionally, the ages at which he first used these signs rarely matched the ages that Anderson and Reilly found.

Concerning child and adult use of negation type, I found that Ben used much more anaphoric negation, compared to the adults’ preference for sentential negation. Both groups of adults showed similar patterns of negation type use, suggesting that there are

cross-linguistic similarities to the use of negation type. Additionally, constituent and sentential negation for Ben each appeared around the same time across all three modalities (signed, spoken, and bimodal).

In terms of headshake scope, Ben used headshakes on their own much more than either set of adults did. Deaf adults did use headshakes without lexical items on occasion, but the hearing adults never did so. Ben also used a lot of “negative item only” shakes, which makes sense in light of his heavy use of anaphoric negation. While Deaf adults frequently used “full negated utterance” shakes with sententially negated utterance and “negative item only” shakes with anaphoric negation, the hearing adults’ strongest tendency was not to use a headshake with negation at all. When the hearing adult did use headshakes, the timing of the shakes was less precise than it was for the Deaf adults.

Ben’s shake use more closely matched the hearing adults than the Deaf adults. This could be because the hearing adults, while not CODAs themselves, are bilingual in ASL and English, and might be blending aspects of ASL NMS with their speech. Ben’s language profile is closer to theirs than it is to the Deaf adults, which could explain why he was better able to match their shake use tendencies than the Deaf adults’.

Further research

This analysis is a case study. The first and broadest expansion of this study would be simply to involve more bimodal bilingual hearing children in order to be able to make more generalizations about the data. In doing so, it would also be beneficial to widen the age range in both directions. Examining data from younger children could improve the chances of finding negative lexical items without headshakes, per Anderson and Reilly. More data on the later side of the age range could give the opportunity to see the children’s use of

negation type approach an adult-like pattern. Ben was just learning to use constituent negation at age 3;4. If the videos went to age 4;0 or 4;6, perhaps his rates of constituent negation would more closely mirror the adult rates.

It would also be valuable to perform this analysis on children monolingual in ASL or monolingual in English. While there have been studies on monolingual acquisition of negation, against which this case study was compared, it would be more useful to have directly comparable data from children in the same age range who are being recorded under the same conditions.

It would also be useful to include more adult-to-adult interactions in order to draw more definitive conclusions about adult negation in ASL. While the adult data in this study provided some information to this end, the majority of adult data included was child-directed sign, and there is no guarantee that the adults use completely adult-like language when interacting with a child. There could be a “parentese” effect that is obfuscating the patterns of true adult-like negation in ASL.

With more adult data, it could also be possible to draw some firmer conclusions about why 20% of negative utterances are not used with a headshake. I believe that there is some systematic explanation, perhaps a pragmatic one, but that more data is needed to discover it.

While in this study all headshakes were treated as equal, with distinctions made based only on the timing and alignment of the shake, there are questions to be raised about whether all shakes actually have the same quality. Further research could try to separate grammatical headshakes by qualities such as speed, intensity, distance of head travel, and eye gaze during headshake. This could help elucidate the difference in shake usage with

various negation types, as it is possible that there are distinct qualities of shakes used in different conditions.

In summation, this case study is the first to look specifically at the acquisition of negation by a bimodal bilingual child. As such, while it cannot draw entirely firm conclusions, it is the first step in an understudied area, and opens the door to much future research.

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