



Negation, questions, and structure building in a homesign system

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ABSTRACT

Deaf children whose hearing losses are so severe that they cannot acquire spoken language, and whose hearing parents have not exposed them to sign language, use gestures called *homesigns* to communicate. Homesigns have been shown to contain many of the properties of natural languages. Here we ask whether homesign has structure building devices for negation and questions. We identify two meanings (negation, question) that correspond semantically to propositional functions, that is, to functions that apply to a sentence (whose semantic value is a proposition, ϕ) and yield another proposition that is more complex ($\neg\phi$ for negation; $?\phi$ for question). Combining ϕ with \neg or $?$ thus involves sentence modification. We propose that these negative and question functions are structure building operators, and we support this claim with data from an American homesigner. We show that: (a) each meaning is marked by a particular form in the child's gesture system (side-to-side headshake for negation, manual flip for question); (b) the two markers occupy systematic, and different, positions at the periphery of the gesture sentences (headshake at the beginning, flip at the end); and (c) the flip is extended from questions to other uses associated with the *wh*-form (exclamatives, referential expressions of location) and thus functions like a category in natural languages. If what we see in homesign is a language creation process (Goldin-Meadow, 2003), and if negation and question formation involve sentential modification, then our analysis implies that homesign has at least this minimal sentential syntax. Our findings thus contribute to ongoing debates about properties that are fundamental to language and language learning.

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1. Introduction

Homesign systems are gesture systems created by deaf children whose hearing losses are so severe that they cannot acquire the spoken language that surrounds them, and whose hearing parents have not exposed them to sign language—in other words, gesture systems created in the absence of a conventional language model. Despite the lack of conventional linguistic input, the homesigns that deaf children create in these circumstances exhibit many properties of natural languages, including morphological

(Goldin-Meadow, Mylander, & Butcher, 1995; Goldin-Meadow, Mylander, & Franklin, 2007) and syntactic (Feldman, Goldin-Meadow, & Gleitman, 1978; Goldin-Meadow, 2003) structures (e.g., operations that combine verbs with their arguments, Goldin-Meadow & Mylander, 1998). The properties that are found in homesign do not need to be handed down from generation to generation but can be invented *de novo* by a child.

Interestingly, it is likely that many, if not all, current day sign languages have their roots in a home sign system. We can, for example, trace the birth of the newly emerging Nicaraguan Sign Language to the period when home signers were brought together for the first time (Kegl, Senghas, & Coppola, 1999; see also Sandler, Meir, Padden, & Aronoff,

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2005, who describe the birth of another newly emerging sign language, Al-Sayyid Bedouin Sign Language). Home sign systems thus present a unique opportunity to observe and analyze the language creation process, with the potential to offer us important insight into what is fundamental about language.

The debate about what is fundamental to language lies at the heart of current linguistic theory and psychological studies of language. One influential position, assumed by many in the field of linguistics (see, for example, Nevins, Pesetsky, & Rodrigues, 2009) is that *recursion* constitutes a basic property of language (Chomsky, Hauser, & Fitch, 2002; Pinker & Jackendoff, 2005). In current terms (Chomsky, 1995), recursion can be understood as the property that creates constituents via *Merge*, or, in different systems, syntactic phrase structure rules that combine any two or more linguistic items to create a new one. Recursion is involved in sentence modification (when a proposition is modified by a sentential operation involving, for example, negation, tense, questions, or modals) and in sentence complementation (when a verb takes a sentence as its complement, e.g., *Bob believes that Bill said that Mary thinks that Amy is sick*).

In the present work, we examine utterances produced by a homesigner, whom we call David, that are *nonveridical* (Giannakidou, 1998, 1999; Zwarts, 1995); specifically, we examine utterances that convey negative or question meaning. Our focus on nonveridical utterances provides evidence for two structure building operations in homesign systems: one for negation, and one for question formation, two language properties that have not previously been demonstrated to arise in the context of homesign. We begin with the background on nonveridicality and sentence modification necessary to understand the claim that the two meaning markers developed by the homesigner we have studied (a side-to-side headshake for negation, and a manual flip for questions) are part of a sentence building process.

2. Sentence modification: negation and questions

Negation is one of the most basic ways to build a complex sentence out of a basic one: in the logical syntax, the logical connective \neg takes a sentence (or a *proposition*) as its input, and gives back a new sentence while reversing the truth value of the original. The natural language words *no*, *didn't*, *not* in English, and their counterparts in other languages, convey logical, truth functional, negation (see Horn, 1989, for extensive discussion of the properties of logical negation and its mapping onto natural language negation) and can thus be called (sentential) negation markers. Negation markers have been argued to have a syntax that is consistent with their sentence embedding function, that is, they tend to appear in peripheral positions, sentence initial or VP peripheral (we will have more to say about this point in Section 4). The truth reversal property of negation is identified as *antiveridicality* in Giannakidou (1998).

A question, on the other hand, is a request for information. When a speaker asks a question, she is in a state of uncertainty and lacks knowledge of the answer to the question she is posing.

(1) Did Bob see a snake?

The speaker does not know whether Bob saw a snake, which is why she is asking the question. This state of uncertainty is known as *nonveridicality* (see Montague, 1969, and more recently, Giannakidou, 1998, 1999; Zwarts, 1995): a proposition embedding function F is nonveridical if the sentence $F\varphi$ does not entail the truth of the proposition φ . As is obvious, the antiveridicality of negation makes it nonveridical. Just like negation, the question operator is also assumed to reside in a sentence peripheral position—e.g., the complementizer position, which is a bit higher than negation and associated with illocutionary force (see discussion below and in Section 5). In some languages, the question operator is realized by special morphemes such as *li* in Serbian/Croatian (Progovac, 1994), and similar items in languages as diverse as Arabic, Caddo, and Chinese (Cheng, Cheng, & Tang, 1996). In some languages, there is a common morphological source between negation and question operators, e.g., transition points in a language's history where the negation marker provides the basis for the morphological formation of the question marker, or even concurrent uses of negation as the question marker (Cheng et al., 1996).

We illustrate below the proposition embedding property of negation and questions; φ stands for a sentence, \neg for negation, and $?$ for the question operator; “ \rightarrow ” indicates the mapping from input to output:

(2) Negation: $\varphi \rightarrow \neg\varphi$ Question: $\varphi \rightarrow ?\varphi$

Negation does not affect the speech act of the utterance: if φ is an assertion, then so is $\neg\varphi$. The question operator, on the other hand, alters the speech act, i.e., it adds the illocutionary force (Searle, 1969) of a question. If φ is an assertion, $?\varphi$ is a question. We will have more to say about the meaning of a question in Section 5.

We argue that the homesign system we studied possesses lexical items corresponding to \neg and $?$, and that, in employing them, the system applies syntactic modifications of the kind just described.

3. Method

3.1. Participant

Deaf children born to deaf parents and exposed from birth to a conventional sign language acquire that language naturally; that is, these children progress through stages in acquiring a sign language similar to those of hearing children acquiring a spoken language (Lillo-Martin, 1999; Newport & Meier, 1985). However, 90% of deaf children are not born to deaf parents who could provide early exposure to a conventional sign language. Rather, they are born to hearing parents who naturally expose their children to speech (Hoffmeister & Wilbur, 1980). Unfortunately, it is extremely uncommon for deaf children with severe to

profound hearing losses to acquire the spoken language of their hearing parents naturally – that is, without intensive and specialized instruction. Even with instruction, deaf children's acquisition of speech is markedly delayed when compared either to the acquisition of speech by hearing children of hearing parents, or to the acquisition of sign by deaf children of deaf parents. By age 5 or 6, and despite intensive early training programs, the average profoundly deaf child has only limited linguistic skills in speech (Conrad, 1979; Mayberry, 1992; Meadow, 1968). Moreover, although some hearing parents of deaf children send their children to schools that teach signed systems modeled after spoken languages (e.g., Signed English), other hearing parents send their deaf children to "oral" schools in which sign systems are neither taught nor encouraged. Thus, these deaf children are not likely to receive input in a conventional sign system, nor be able to use conventional oral input.¹

The subject of this study, whom we call David, is profoundly deaf (>90 dB bilateral hearing loss). His hearing parents chose to educate him using an oral method. At the time of our observations, David had made little progress in oral language, occasionally producing single words but never combining those words into sentences. In addition, at the time of our observations, he had not been exposed to a conventional sign system of any sort. David participated in a longitudinal study by Goldin-Meadow and her colleagues exploring the gesture systems developed by deaf children of hearing parents who are not exposed to conventional sign languages (Feldman et al., 1978; Goldin-Meadow, 2003; Goldin-Meadow & Mylander, 1984). As a participant in this study, David was observed over a period of years. Here we focus on eight time points beginning at age 2;10 until 3;11 (years;months).

Despite his lack of a conventional language model, David (and other homesigners) create gesture systems to communicate. These homesign systems include morphological structure (Goldin-Meadow et al., 1995, 2007), recursion at sentence (Goldin-Meadow, 1982; Goldin-Meadow & Mylander, 1998) and phrase (i.e., noun phrase, Hunsicker & Goldin-Meadow, submitted for publication) levels, and grammatical categories (Goldin-Meadow, Butcher, Mylander, & Dodge, 1994). We concentrate here on negations, questions, and structure building in a case study of a deaf child's self-styled gesture system.

3.2. Coding procedures

In each session, David was observed in the home playing with his mother, siblings or the experimenter. The same set of toys, including puzzles, mechanical and wind-up toys, and books, were brought to the child's home with each visit. The child was observed on average for one and half hours per session.

We used the following criteria to isolate gestures from the stream of motor behavior that David produced (see Feldman et al. (1978) and Goldin-Meadow and Mylander

(1984), for discussion): (1) A gesture must be directed to another individual. (2) A gesture must not be a direct manipulation of an object; the one exception is the *hold-up* gesture where the object is held up to draw attention to it, not to directly act on it. (3) A gesture must not be part of a ritual act. Hand gestures were described in terms of handshape, motion, and place of articulation. Non-manual gestures such as head movements (e.g., nods and side-to-side headshakes) and facial expressions² (e.g., mouth open) were also transcribed and coded.

Gestures were classified into one of three categories: (1) *Deictic gestures* indicate objects, people, and locations in the immediate environment, and their meanings are context-bound. David produced two types of deictic gestures—hold-ups in which the gesturer holds up an object in the partner's line of sight, and points in which the gesturer extends a finger or palm toward an object. (2) *Iconic gestures* depicted actions or attributes of concrete or abstract referents via hand or body movements (e.g., moving the index finger in circles to indicate the movements of a rolling ball, or placing two vertical palms on the head to indicate the shape of a rabbit's ears). (3) *Conventional gestures* included hand and body movements that were conventional in form and that were associated with conventional meanings in David's hearing community (e.g., shaking the head from side-to-side; flipping downward facing palm(s) over so that the palm(s) face upward).

Gesture sentences were identified using motoric criteria (Goldin-Meadow & Mylander, 1984). A relaxation of the hands or extended pause signaled the end of a sentence. This criterion results in gesture sentences that can be as short as a single gesture or include many connected gestures. Simultaneous gestures include movements of the head and hand produced at the same time (e.g., shaking the head while pointing at an object); in these examples, the non-manual headshake is indicated above the manual gesture with which it occurs. Simultaneous gestures also include two different gestures, each produced by a different hand (e.g., a point to an object with the left hand and a flip gesture with the right hand.) Manual gestures that are produced at the same time are indicated by a plus (+) between the two simultaneously produced gestures. Gestures that follow one another within a sentence are indicated by a dash (–) between the two gestures.

Because the deaf child's gesture system is not a conventional system shared by a community of users, our interpretations represent our best guesses as to the child's intended meaning. Context, including interlocutor responses and the child's reaction to those responses, played a central role in our interpretations. As a result, the communicative functions request-comply, question-answer, and statement-reply informed our analyses, as in the following example that took place when David was 3;11. The researcher asks David which toy (a guitar or drum)

¹ Cochlear implants were not widely available when David was a child. He did wear hearing aids but was unable to learn speech even with his aids.

² Facial expressions, including brow and mouth movements, may play a role in homesign negatives and questions, as non-manual features do in established Sign Languages. Facial expressions and movements were included as allowed by the limitations of the data (e.g., angle of camera, age of videotape, distance to camera).

goes with a toy soldier: “Look at that. Look at that. Which one?” said while holding up the toy guitar and drum. “Which one goes with him [soldier]?” The child replies that the guitar should *not* be put on the toy soldier: he produces a side-to-side headshake, points at the guitar, and produces a PUT ON gesture [O-hand moved down in the direction of the soldier], followed by a point at soldier. The researcher then places the drum on the soldier. The child’s utterance here is understood in the context of the adult-child exchange. David’s response to the researcher’s question is that the guitar should not be placed on the soldier. We do not attempt to code the children’s gestures in isolation; rather we use context and prior interlocutor turns to inform our analyses. In this fashion, utterances by the child can serve to ask questions, exclaim emotions, and make statements.

David produced 3080 gesture sentences within the observed recordings, 60% containing only a single gesture. A small number of the sentences ($n = 150$) were excluded because of taping difficulties that rendered the gestures uncodable (e.g., David had his back to the camera). Each gesture sentence (including single gestures produced in isolation) was classified as a statement, negative statement, question, negative question, or exclamation/emotive expression. We focused initially on sentences expressing negative meanings (described in Section 4) and questions (described in Section 5). A second coder transcribed and coded a sampling of videotapes taken across the sessions. Agreement between coders was 89% ($N = 148$) for glossing or providing the English translation of the gesture sentence, 96% ($N = 148$) for assigning communicative function to the sentence (statement, negative, question, etc.), and 89% ($N = 148$) for assigning meanings to specific gestures.

4. Negatives

David produced 327 negative gesture sentences, roughly 11% of the sentences he produced. We focus first on the types of negative meanings that David expresses. We then turn to the forms that David uses to express negative meanings and, finally, to the positions those forms occupy in David’s multi-gesture sentences.

4.1. The types of negative meanings David expresses

Bloom (1970) identified three types of negative meanings in the early speech of children learning English: rejection, denial, and nonexistence. The category of rejection negations are those in which “the referent actually existed or was imminent within the contextual space of the speech event and was rejected or opposed by the child,” as seen in the example, ‘no dirty soap,’ a rejection of an unwanted piece of soap. In denials, the negation “asserted that an actual predication was not the case. The negated referent was... manifest symbolically in a previous utterance,” as in the example, ‘no truck,’ a statement that the car in front of the child was not a truck (Bloom, 1970, p. 173). In nonexistence, “the referent was not manifest in the context, where there was an expectation of its existence, and was correspondingly negated in the linguistic expression,” as in the example ‘no pocket,’ a comment on the absence of

a pocket that the child expected to see. Nonexistence differs from denial in that it does not imply the negation of a predication, but is merely a statement of surprise at the absence of an object or action. We found that David expressed the same three types of negative meanings in his gestures.

4.1.1. Rejection

We follow Bloom’s definition of rejection in identifying instances of this negative meaning in David’s gestures. A rejection is not a contradiction in the logical sense, but an exertion of will, opinion, or preference. This type of negation is used to reject objects, ongoing actions, or proposed actions. Rejections of objects offered by others are common in the play setting, as toys, puzzle pieces, snacks, and other objects are often passed back and forth. For example, while playing on the floor with David, the experimenter offers him a bag of toys. David does not want this particular bag but wants another bag instead. He first shakes his head side-to-side and points to the bag that the experimenter has offered. He then points to the second bag.

(3) side-to-side headshake—point to bag 1—point to bag 2
No, I don't want bag 1, I want bag 2. (3;10, #322)³

David also uses his gestures to reject the actions of others, as in example (4). The experimenter is about to put a mask on her face. To express his dissatisfaction with her actions, David shakes his head from side-to-side and produces a PUT-ON-MASK gesture. The upper-case items, which represent iconic gestures, will be glossed in the key below each relevant example, as in (4) below:

(4) side-to-side headshake
 PUT-ON-MASK
Don't put on mask. (3;08, #344)

Key: PUT-ON-MASK = two fists on both sides of face pulled towards face

Note that example (4) could, in principle, be considered a negative imperative. However, because negative imperatives are conceptually similar to rejections, and because we have not discovered a formal marking for imperatives in David’s homesign, we classify the sentence as a rejection. Pea (1980) identified rejection as the stage preceding truth-functional negation in children acquiring spoken English. We return to a comparison between David’s negations and negation in English child language in Section 6.

4.1.2. Denial

The second form of negation described by Bloom (1970) is *denial*. A gesture sentence is coded as a denial when the sentence asserts that an actual or supposed proposition is not the case. Unlike rejections, which require the presence of objects or the suggestion/offer of an action, denials are

³ The first number in parentheses is David’s age in years and months at the time he produced the example; the second is the number of the gesture sentence in that taping session.

comments on the truth or falsity of a proposition and do not require that the denied proposition be explicitly stated. One could, for example, state that *a robin is not a duck* without anyone explicitly stating the first proposition, that *a robin is a duck*. Denial involves the prototypical use of negation as a truth functional connective.

As an example, while looking at photos with the experimenter, David gestures that his brother (who is pictured in the photo) is at school; he shakes his head and points to the door and then produces a gesture for school (two palms held together as if praying; David attends a Catholic oral school for the deaf where the children often pray) to indicate that his brother is currently at school. When the experimenter points to David, he responds by pointing to his chest while shaking his head and then points again to the door, glossed as *I did not go to school*.

-
- (5) side-to-side headshake
point to self- point to door
I did not go to school. (3;03, #160)
-

In addition to denying actions, David also uses his gestures to deny states. In example (6), David begins a discussion of belts by making a gesture at his waist for BELT (he clasps his hands together at his waist as if fastening the belt) and then pointing to the location on his pants where a belt would sit. David then goes around the room asking if each person has a belt. The experimenter asks David if he has a belt, and he replies:

-
- (6) side-to-side headshake
flip- PULL UP
I don't have a way to hold up my pants. (3;10, #383)
Key: PULL-UP = act of pulling on imaginary pants
-

As a third example of denial, David uses his gestures to deny the similarity between two objects. While looking at a picture of a policeman, he points at a picture of a fireman and shakes his head from side-to-side (example 7).

-
- (7) side-to-side headshake
point to picture of a fireman
A policeman is not a fireman. (3;10, #209)
-

4.1.3. Non-existence and non-occurrence

The third type of negative meaning described by Bloom (1970) is *nonexistence* of entities and *non-occurrence* of actions. Non-existence/non-occurrence statements are comments about the absence of an object or action whose presence is expected in that context. We adopt here Bloom's differentiation of this category from denial because it conveniently sets apart a set of negations whose communicative purpose is not only to negate, but also to express a kind of emotion or surprise. In this sense, non-existence/non-occurrence is qualitatively different from denial, whose purpose is simply that of the truth functional

connective, which *asserts* the sentence with the reverse truth value. In logical terms, in the utterances described as non-existence/non-occurrence, what is negated is the predicate "exist" or "happen," which can be understood as *term* negation in the Aristotelian sense (not P, where P is a predicate, not a sentence; see extensive discussion in Horn, 1989). It even seems plausible to say that what underlies the distinction between these two categories is a difference in the syntactic category of negation: a term negation (non-existence/non-occurrence) vs. a sentential truth functional connective (denial). As we will see in the next section, non-existence/non-occurrence is acquired earlier than denial, perhaps suggesting a developmental progression from term negation to sentential negation.

As just noted, non-existence/non-occurrence statements typically include an element of surprise indicating a violation of expectation. In example (8), when looking at a picture in a book of two ice cream cones, one that contains a scoop of ice cream and one that doesn't, David's expresses his surprise that the second ice cream cone is empty.

-
- (8) point to cone without scoop of ice cream – ICE CREAM –
side-to-side headshake
flip
There is no ice cream! (3;10, #232)
Key: ICE-CREAM = fist held at mouth flicks toward mouth
-

Nonexistence statements often occurred when David was playing with a toy that was missing a part. Coding nonexistence was facilitated by the fact that we were familiar with the toys with which David played and that, over the years, the toys began to lose parts. In example (9), David notes that there is no bird in the picture of a nest where the bird is typically found.

-
- (9) point to place where bird is typically found – flip
There is no toy bird! (3;03, #217)
-

Nonoccurrence statements are comments about an action that did not occur in a context where it was expected to occur. Common triggers of nonoccurrence include situations where toys fail to perform their expected actions. When playing with a cash register, David inserts a coin in the slot and triggers the mechanism to move the coin. When it doesn't move, David remarks on how the coin did not go down the hole.

-
- (10) side-to-side headshake
point to hole – flip
It didn't go down the hole! (2;10, #276).
-

In a similar interaction with a toy cash register, the drawer fails to open when David presses the key, and he then comments on the non-action.

-
- (11) flip – tap cash register toy
It didn't open! (2;10, #50)
-

4.1.4. Development of negative meanings

Bloom (1970) found that hearing children learning English initially express nonexistence and rejection in their negative sentences and only later express denial (see also Hummer, Wimmer, & Antes, 1993). To determine whether David displayed a similar developmental pattern, we examined how often David expressed the three types of negative meanings during his first four sessions (ages 2;10–3;03) and during the later four sessions (ages 3;05–3;10). Table 1 presents the proportion of negative meanings expressing rejection, non-existence/non-occurrence, and denial that David produced during his early and late sessions. Rejection is the predominant type of negative sentence across both periods: 48% of the negative sentences David produced during his early sessions and 66% of those produced during his later sessions were rejections of objects and actions. In contrast, non-existence and non-occurrence was prevalent during the early sessions (48%) but not during the later sessions (10%). Denial showed the opposite pattern—it was rarely produced during the early sessions (4%) and increased in frequency in the later sessions (23%). David thus exhibited the same developmental pattern with respect to negation as hearing children learning English from their hearing parents (Bloom, 1970; Hummer et al., 1993).

4.2. The forms that David uses to express negative meanings

Having described the types of negative meanings David expressed, we now ask whether he used a consistent gestural form to express them. In English, sentences are considered negative if they are produced with negative intent and include negative words such as *no*, *not*, *don't* or *no more*. Although David was not exposed to a conventional sign language, he did see the gestures that his hearing parents routinely produced, including side-to-side headshakes that convey negative meaning in American culture. In fact, we found that 276 of the 327 negative sentences David produced (84%) included a side-to-side headshake.⁴ The remaining negatives are expressed using manual gestures, such as a palm swipe away from the body ($n = 7$), a manual flip ($n = 38$, see examples 9 and 11), or a shrug of the shoulders ($n = 3$); in rare instances, negatives are expressed pragmatically without any formal marking at all ($n = 3$).

Are side-to-side headshakes used to convey other meanings beside negatives? We isolated all of the side-to-side headshakes that David produced during the eight sessions ($N = 301$) and determined the meanings they conveyed. We found that 92% (276/301) of the headshakes David produced were used to convey negation. The headshakes that did not convey negation were found primarily in sentences

Table 1

The three types of negative meanings David expressed as a proportion of the total number of negative sentences he produced during his early (2;10–3;03) and later (3;05–3;10) observation sessions.

	Early observation sessions ($n = 179$)	Late observation sessions ($n = 148$)
Rejection	.48	.66
Nonexistence/ Nonoccurrence	.48	.10
Denial	.04	.24

where David was expressing disbelief or disapproval. These emotive expressions of disapproval tend to occur when David scolds the experimenter for teasing him. For example, when the experimenter does not place a penny down horizontally (the only position in which the toy will work) but instead sets it down vertically, David shakes his head with slow deliberation to chastise her actions.

Using the side-to-side headshake to convey non-negative meanings has been reported for both hearing speakers and deaf signers. For example, McClave (2000, 2001) argues that the lateral headshake can signal uncertainty when it accompanies questions (e.g., *where is he going?* side-to-side headshake) or add intensity to affirmative utterances (e.g., *it was real bad* side-to-side headshake). Non-negative uses of this sort have also been reported for headshakes in ASL (McClave, 2001), New Zealand Sign Language (Zeshan, 2004a, 2004b), and Norwegian Sign Language (Vogt-Svednsen, 1990.).

Finally, there are also relatively common occurrences of sentential negative markers in spoken languages that convey non-negative meanings. These markers, known as “expletive negations”, convey a negative attitude or emotive stance (rather than truth-functional negation) or mark the nonveridicality of the context (Yoon, 2010), as in the examples below, from Old English, French, and Korean, respectively:

-
- (12) God fobade her that she **ne** shold
God forbade her that she Neg should
loke behynde her.
look behind her
'God forbade her to look behind her'
(Caxton *Book of Knight of Tower* 79. 14; Middle English)
- (13) J'ai peur que cela **ne** se reproduise.
I have fear that it might Neg happen again
'I am afraid that it might happen again.'
- (14) John-nun Mary-ka oci-**an**-ul-ci kitayha-
koiستا
John-Top Mary-Nom come-Neg-Fut-Q(comp)
hope-Asp
'John hopes that Mary might come (but thinks it is likely that she won't).'
-

⁴ 56 of the 276 negative expressions involving a headshake also include a gesture (one or two hands rotated from palm down to palm up a flip). These headshake + flip combinations were largely used to express non-existence and non-occurrence ($N = 45$). We argue in Section 5.2 that the inclusion of the flip in these expressions signals David's surprise at not finding the expected.

Overall, then, we conclude that the side-to-side headshake is associated with negative meanings in David's homesign system and, in this sense, functions as a sentential negative marker of the kind we find in spoken and signed languages.

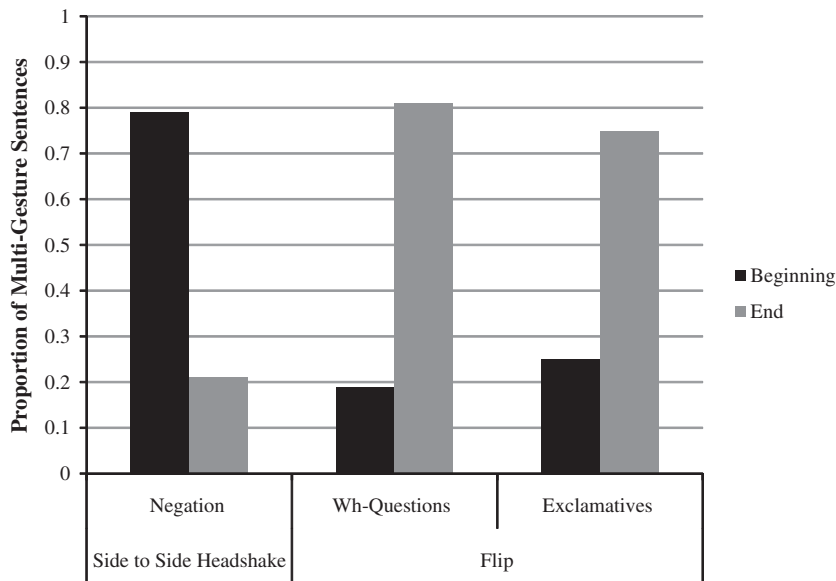


Fig. 1. Side-to-side headshakes used as a negation marker and hand-flips used as either a question or exclamative marker, classified as a function of their position in the sentence. Single-gesture utterances are excluded.

4.3. The positions headshakes occupy in David's multi-gesture sentences

Roughly half of David's side-to-side headshakes that conveyed negative meanings were produced in sentences containing only the headshake ($N = 158$).⁵ Another 35 headshakes were produced simultaneously with all of the gestures they accompanied (e.g., a side-to-side headshake produced at the same time as a point to a toy). The remaining 83 headshakes were produced in multi-gesture sentences and thus allow us to determine whether David produced his negative marker in a consistent sentential position. These multi-gesture sentences included statements of rejection, non-existence, and non-occurrence.⁶

As shown in Fig. 1, 79% of the headshakes David produced in multi-gesture sentence appeared at the beginning of the sentence (63 vs. 20, $\chi^2(1) = 21.5$ $p < .001$), with the remaining 21% occurring at the end of the sentence (9 of the 20 headshakes at the ends of sentences conveyed non-existence or non-occurrence and were produced along with a flip gesture, see Section 5).⁷ Fig. 2 presents a typical example of David's negative multi-gesture sentences, with the side-to-side headshake occurring at the beginning of the sentence.

⁵ This number includes headshakes that were combined with flips but with no other gestures. Without flip + headshake combinations, the number of headshakes alone is 124.

⁶ Denials commonly occur in multi-gesture sentences (over 70% of total produced). This pattern is not surprising as denial emerges relatively late in development as David is beginning to produce longer strings (2/3 of the multi-gesture strings occur in David's later sessions). Some meanings, such as rejections, are prevalent throughout the observation sessions (see Table 1) and occur equally often in sentences containing only a headshake or a headshake plus multiple gestures.

⁷ Only 1 of the small number of utterances that violated David's typical headshake pattern (i.e., where the headshake appeared at the end) was a denial. The other violations were rejections (5) and non-existence/non-occurrence (5).

Headshakes occur in isolation or, when produced in combination with other gestures, either at the periphery of the utterance (primarily at the beginning) or continuously throughout the entire utterance. Headshakes do not occur in the middle of sentences in David's system, suggesting that negation does not take partial scope within a proposition; that is, it does not negate pieces of a proposition and operates instead over the proposition as a whole. This pattern is expected from sentential negation.⁸

To summarize, we have found that side-to-side headshakes crystallize early as the expression of logical (i.e., sentential) negation in David's homesign system, and that the form for this meaning has a fixed position at the beginning of the sentence. This fact places David's homesign system typologically in the class of languages with sentence initial negative markers (for a general overview, see Bernini & Ramat, 1996), which turns out to be a numerous class.

5. Questions

A question is a request for information. For example, if we ask, "Where is the cup?" we typically do not know the location of the cup and we pose the question to find out. We expect an answer that will give us information corresponding to the *wh*-phrase *where*. If we ask, "Did John leave?" we do not know whether John left, but here we seek a *yes* or *no* answer. We focus our analyses on the development of *wh*-questions rather than *yes-no* questions in David's homesigns.

⁸ Constituent negation, on the other hand, takes partial scope, as in "Not every boy left", and has been argued to involve local syntactic scope (e.g., negation is an adjunct on the phrase it attaches to, Giannakidou, 1998). Although David's gestures do, at times, co-occur with a subset of the manual gestures in a sentence (see Franklin, Copeland Johnson, & Goldin-Meadow, in preparation, for further discussion), thus far we have no evidence that the scoping is local enough to constitute the kind of partial scope we find with constituent negation.



Fig. 2. An example of a multi-gesture negative sentence with the side-to-side headshake at the beginning of the sentence. David has just told the experimenter that his brother is at school. In the example displayed here, he shakes his head while pointing at himself and then points outside to indicate that he is not at school.

The essential point for our analysis is that questions are a speech act that is distinct from assertions, the speech act performed by a declarative sentence (Searle, 1969). Questions are marked by particular syntax that distinguishes them from assertions. For example, in English, questions contain a *wh*-form and exhibit subject–verb inversion (“Where is the cup?” vs. “The cup is on the table”). The particular syntactic structure used to mark interrogative sentences differs from language to language. Some languages employ an overt question operator, others do not; some move the *wh*-form into sentence-initial position, others do not. But formally marking questions as distinct from assertions appears to be universal in language.

We coded utterances as questions based on context and the interlocutor’s responses. We found that David produced 90 question sentences, accounting for 3% of the sentences he produced. We focus first on the types of questions David expresses. We then turn to the forms David uses to express these questions and, finally, to the positions those forms occupy in David’s multi-gesture sentences.

5.1. The types of questions David expresses

David produced *where*, *what*, and *how/why* questions. *Where* questions request information from the interlocutor about the location of an entity. For example, while playing with a drummer toy, David notices that the drumstick is missing. He points to the toy’s hand where the drumstick ought to be and, looking at the experimenter, produces a flip gesture. In this instance, David is not just commenting on the absence of the drumstick, he is asking for information about the object’s location (example 15).

-
- (15) point to spot where drumstick ought to be—flip
Where is the drumstick? (3;00, #146)
-

As another example, David is looking at everyone’s eyebrows and becomes curious about where the experimenter’s eyebrows (which are hidden under her bangs)

are. He points at the experimenter with a *lift-up* gesture (indicating that she needs to lift up her bangs in order for her bangs to be seen), points at his own eyebrows, and then produces a flip gesture.

-
- (16) LIFT-UP toward experimenter – point at own eyebrows—flip
Where are her eyebrows? (3;10, #50).
-

What questions are used to request information about an object. For example, the experimenter is attempting to fix a toy and asks David to give her a bag that is out of her reach to help her do it. She points at the bag and produces a give gesture (palm up held in air). David walks over to the bag, looks in it, but does not immediately see anything that would help fix the toy. He asks for clarification by holding up the bag and flipping his wrist to ask, “What do you want?” The experimenter signals that he should bring the whole bag and when she gets it, she removes her Swiss Army knife from the bag and proceeds to fix the toy.

-
- (17) hold up bag + flip
What do you want in the bag? (3;00, #79)
-

Interestingly, David does not ask for clarification about people and thus does not produce anything akin to a *who* question. Nor does he ask about the timing of events and therefore produces no *when* questions. He does, however, produce *why* and *how* questions. These questions request information about events or objects that are puzzling. In example (18), David and the experimenter are playing with a car on the floor. When the experimenter places the car on an overturned box, David appears puzzled (rather than surprised) by this action and produces a pointing gesture at the car followed by a flip, thus asking the experimenter to explain why she placed the car in this spot.

Table 2

The three types of questions David expressed as a proportion of the total number of question sentences he produced during the early (2;10–3;03) and later (3;05–3;10) observation sessions.

	Early observation sessions (n = 54)	Late observation sessions (n = 36)
Where	.72	.70
What	.13	.11
Why/how	.15	.19

(18) point to car—flip
Why is the car there? (3;05, #193)

As another example, the coins that David is inserting into the slots of a toy cash register all of a sudden stop sliding in smoothly. If David had turned to the experimenter and simply commented on this event, we would have coded the sentence as a statement about the non-occurrence of an event. However, what David did was produce a flip gesture and turn to the experimenter with the clear intent of asking why the toy had stopped working. His gaze to the experimenter and pause in the conversational flow were taken as indicators that David expected a response. The experimenter responded by saying, “I don’t know” in speech, and examining the toy to discover the problem.

Table 2 lists the proportion of *where*, *what* and *why/how* questions that David produced during his early and late sessions. *Where* is the predominant type of question across sessions: 72% of early questions and 70% of late questions are requests for information about the location of objects. *What* questions were slightly less frequent than *how/why* questions and both showed little change over time: 13% *what* questions at the early sessions, 11% at the later sessions, compared to 15% *how/why* questions at the early sessions, 19% at the later sessions. These findings are similar to Bloom et al.’s (1982) data on hearing children learning English in which *where*, *what* and *who* account for three-fourths of all questions with verbs, with *how* and *why* occurring far less frequently.

5.2. The forms that David uses to express questions

5.2.1. The flip form used to mark questions

When hearing speakers in the United States ask questions, they often produce what we call a “flip” gesture along with their speech—the wrist of one or two hands flips so that the palm rotates from palm down to palm up (Johnson, Ekman, & Friesen, 1975). Perhaps not surprisingly, we found that, of the 90 question sentences that David produced, 83 (92%) contained a flip gesture. The questions that did not contain a flip were conveyed by a shrug, a quizzical facial expression, or (in a single instance) a headshake.

But is the flip form a specific question marker? Recall that, for negations, we found that 84% of David’s negative meanings were conveyed using the side-to-side headshake and 92% of David’s side-to-side headshakes were used to convey negative meanings. Thus, there was close to a one-to-one mapping between form and meaning for negation in David’s homesign. The situation for questions is dif-

ferent. Although 92% of David’s questions were conveyed using the flip gesture, the flip gesture was *not* used exclusively for questions. David produced 208 flip gestures during the observation period and, of those, only 83 (40%) were used to convey questions.⁹ The remaining gestures were used to convey two different types of meanings: what we call here exclamative meanings (Section 5.2.2), and referential expressions of location (Section 5.2.3).¹⁰

5.2.2. The flip form used to mark exclamatives

The primary use to which David put the flip gesture, other than to mark questions, was to convey a heightened emotive stance on the part of the speaker. The exclamative sentence is the vehicle that languages typically use to convey this heightened emotive stance (although there are others; for example, swear words, see Potts, 2007). Of the 208 flip gestures David produced, 109 (52%) can be characterized as exclamative—13 (6%) were used to express outrage, 85 (41%) were used to express surprise, and 11 (5%) were used to express doubt. We illustrate these three uses of the exclamative flip below.

David used the exclamative flip to express outrage. Just as hearing gesturers might flip their hands as a sign of frustration or surrender, David similarly uses this gesture to signal his disengagement and frustration. For example, David becomes exasperated with the experimenter because she repeatedly offers a puzzle piece that is not the one David needs. After a number of attempts asking her for the correct puzzle piece, David flips his wrists “*Whatever!*” (2;10, #193) and discontinues the task.

David also used the exclamative flip to express surprise, typically surprise that an object he expected to be in a particular place was not there, or surprise that an event he expected to happen did not take place. These flips of shock and surprise often accompany negative expressions of non-existence/non-occurrence, as discussed in Section 3. The flip component of these utterances carries the emotive expression of violation of expectation. For example, David was playing with bubbles and he expresses his surprise when, in the middle of a series of successful bubbles, his efforts do not result in a bubble. He flips his wrist (here without any headshake) as if to exclaim “*What! It didn’t bubble.*”

Finally, David used the exclamative flip to express doubt or uncertainty. These uses of the flip do not seem to signal a genuine request for information; nor are they epistemic in nature. David does not seem to be asking for the reason behind the experimenter’s act or for the actual location of the object. Rather, he seems to be expressing attitudes such as “what do I know” or “I don’t know” (see Ellenberger, Moores, & Hoffmeister, 1975, who describe a similar use of the *wh*-form in American Sign Language in deaf children and their deaf parents). For example, in (19) David uses the flip to

⁹ Although extensive coding was completed to capture the variation in flip form (e.g. one vs. two hands, placement relative to the body, shape of the hand), we found no relation between the different meanings David expressed using the flip and any of the form variations.

¹⁰ A small number of flips (13, accounting for 6% of all flips) were used for emphasis in rejections and denials; for example, in one of the many conversations about puzzles, David emphatically flipped his hands while admonishing the experimenter that the piece she was incorrectly trying to place ‘won’t fit’ in the puzzle (2;10, #56).

express bafflement at the experimenter's lack of action. David asks the experimenter to fasten the two ends of a crown together so that he can wear it. Even though the crown is in the experimenter's hands, she does not put the crown together. David then produces a flip gesture and shakes his head to express his lack of control over the event.

-
- (19) side-to-side headshake
flip
What can I do! (3;05, #90)
-

Similarly in example (20), David is playing with the experimenter and a puzzle. He has a piece in hand that he repeatedly tries to fit in various places on the puzzle, but it is not the right puzzle for this piece. As he gives up, he holds the piece up to show the experimenter, points to the puzzle, and flips his wrist, again to express his lack of control over the situation.

-
- (20) hold-up puzzle piece – point to puzzle – flip
What to do about the piece and this puzzle! (3;10, #71)
-

5.2.3. The flip form used to mark referential expressions of location

The second way David used his non-question flips was to indicate that he knew where an object was in a referential expression of location. These uses are reminiscent of the *wh*-forms in so-called free relative structures in English; for example, “The book is *where it should be*”. English free relatives have been analyzed as referential expressions akin to definite descriptions in Jacobson (1995), which is now considered the classical analysis, and similar structures (often called *correlatives*) have been found in many other languages besides English. Consider examples (21)–(23) below. Here, David is not using the flip to request information about the location of a missing item. Rather the flip *refers* to the known location of a known entity. In (21), David is playing with the experimenter, who takes a cowboy toy and puts it behind her back. David produces the flip gesture, a gesture for the cowboy, another flip, and finally a point at the place behind the experimenter's back where the cowboy is. The final point makes it clear that David is not asking where the toy is—he and the experimenter both know it's behind her back. David is thus indicating a known location.

-
- (21) flip – COWBOY – flip – point at cowboy behind the experimenter's back
The place where the cowboy is at is there (3;00, #145)
Key: COWBOY = fists held as if holding reigns while riding a horse
-

Notice here the positioning of the flip at the beginning of the gestural sentence—contrasting with its position at the end of the sentence in the question and exclamative examples that we have presented; we return to this point in Section 5.2. Likewise, in example (22), after David and the

experimenter finish playing with a puzzle, he indicates where the puzzle belongs by producing a flip gesture and pointing to the location (the toy bag). When the experimenter puts the puzzle behind her back rather than in the bag, David shakes his head slightly in disagreement, as he knows perfectly well that the puzzle belongs in the toy bag.

-
- (22) flip – point to toy bag
The place where the puzzle goes is the toy bag. (3;10, #125)
-

We see a similar pattern in (23) when David is looking at a booklet of pictures that the experimenter drew of the toys she brings with her. He is pointing at pictures and then stops, looks to the toy bag and produces a flip gesture, looks back at the book and simultaneously points at a picture on the book and at the toy bag to signal, “*Where that (the toy displayed in the picture) is at is in the bag.*”

-
- (23) flip [look at the toy bag] – [look at book] point to picture of toy on book + point to toy bag
The place where the toy is at is in the toy bag (3;10, #126)
-

To summarize, 92% of the questions David produces are marked with the flip gesture. However, David does not use the flip gesture exclusively for questions; he uses it for two other functions as well—to express emotion (outrage, surprise, doubt) in exclamatives, and to indicate the referential expression of locations. Both of these functions are served by *wh*-forms in natural languages, as previously noted.¹¹ We turn next to an analysis of where the flip is positioned in these three types of sentences.

5.3. The positions the flip occupies in David's multi-gesture sentences

Recall that David typically produces the headshake gesture at the beginning of his negative sentences: 79% of the headshakes he produces to convey negative meaning occupy this initial slot. We look next at where David produces the flip gesture. Many of the flips that David produced for questions ($N = 55$) and for exclamatives ($N = 72$) occurred in isolation, that is, in sentences containing only the flip gesture. Fig. 1 displays the proportion of multi-gesture sentences in which flip gestures marked questions or exclamatives, categorized according to whether the gesture occurred at the beginning or end of

¹¹ The additional uses of the flip that we identify here are not to be confused with the ASL sign (“WHAT”/HUH/WELL) that Conlin, Hagstrom, and Neidle (2003) characterize as a ‘particle of indefiniteness’. This ASL sign appears in contexts other than questions (i.e., negative and affirmative sentences) and does not operate on the sentence itself. Rather, it modifies the meaning of an indefinite nominal in the sentence by making it weaker or less specific, akin to “some or other”. The ASL sign is thus a different phenomenon from the exclamative and referential locative flip that we find in David's homesign.



Fig. 3. Examples of multi-gesture sentences in which the flip occurs at the end of the sentence and marks a question (A) or an exclamation (B). In the top pictures (A), David points toward the experimenter whose bangs cover her eyebrows while moving his hand slightly upward, points at his own eyebrows, and then produces a flip gesture in order to ask where the experimenter's eyebrows are. In the bottom pictures (B), David holds up a puzzle piece that does not belong to the puzzle, points at the puzzle, and then produces a flip gesture to express his puzzlement.



Fig. 4. An example of a flip used to mark referential expressions of location. The flip refers to the known location of a known entity, a cowboy toy that David has just watched the experimenter put behind her back. David produces a flip, his cowboy gesture (two fists placed as though holding the reins of a horse), a second flip, and then a point behind the experimenter's back where the cowboy is. Note that the flip does not occur at the end of the sentence as it does in his question and exclamative sentences.

the sentence (flip gestures were never produced in the middle of sentences): 81% of the 21 flips in question

sentences occurred at the end of the gesture sentence (17 vs. 4, $\chi^2(1) = 7.22$ $p < .01$), as did 75% of the 20 flips in

exclamative sentences (15 vs. 5, $\chi^2(1) = 5.00$, $p < .02$). Fig. 3 presents examples of David's typical multi-gesture question and exclamative sentences, with the flip gesture at the end. This pattern suggests that illocutionary force is associated with right periphery in David's homesign.

Interestingly, as mentioned earlier, we find a different pattern in David's referential locative expressions. David produced only three flips in referential locative expressions. However, none of these flips occurred at the end of the sentence (see Fig. 4), significantly fewer than would be expected given David's pattern for question and exclamative flips (i.e., 32 at the end vs. 9 in other positions for questions/exclamatives, compared to 0 at the end vs. 3 in other positions for referential expressions of location, $p < .01$, Fisher Exact). These results suggest that this particular form of the flip is not functioning as an illocutionary force operator and, in this sense, is syntactically distinct from flips used to signal questions and exclamatives.

6. Discussion

6.1. Headshake and flip forms

6.1.1. The headshake gesture form

David's use of the headshake form for negation is by no means unexpected. Speakers around the globe use head movements to signify or amplify the negative meanings they express in speech (Kendon, 2003). Even young children shake their heads to indicate negation before they express negative meanings in speech (Pea, 1980; Volterra & Antinucci, 1979). What differs from culture to culture is the direction in which the head is moved to express negation. Lateral or side-to-side headshakes are found in the vast majority of cultures. However, the front-back head movement is also found to signal negation in, for example, Greece, Turkey, and Lebanon (Zeshan, 2004a, 2004b). Interestingly, sign languages of the deaf often co-opt the particular headshake direction found in speakers' gestures in the surrounding hearing culture and use it as their non-manual form for negation (Veinburg & Wilbur, 1990), although there are constraints in on/offsets and sentence position found in sign that are not found in hearing speakers' gestures. It is therefore not surprising that David's has co-opted his culture's lateral side-to-side headshake to use as his negative marker.¹²

Headshakes have been identified in all signed languages studied thus far. In addition to headshake direction, the grammatical status of the head movement and the constraints placed on its use also differ across sign languages (Zeshan, 2006). Negative head movements occur in two different types of systems—in one type, headshakes are the dominant and obligatory marker of negation; in the other, manual signs for the negative (e.g., signs for *no*, *not*, *can't*) are the dominant marker and the headshake is tied to its use.

In a sign language such as ASL, which has both manual and non-manual markers for negation, the headshake emerges first in development at around 12 months, but is replaced by manual markers for negation at 18 months. The headshake begins to be used grammatically along with manual signs after 2 years of age (Anderson & Reilly, 1997; see also Ellenberger et al., 1975.) Like deaf children acquiring ASL from their deaf parents, David used the headshake as his initial marker of negation. However, unlike ASL-acquiring children, David did not replace the headshake with manual signs for negation: 84% of the negative utterances David produced were marked by a headshake, with no change over the eight sessions (44% in his early sessions, and 40% in his later sessions).¹³ David did use the manual flip in many of his negative utterances, but most of the flips he produced in negative utterances were conjoined with a headshake and conveyed non-existence/non-occurrence, with the headshake conveying the negative meaning and the flip conveying surprise at the violation of expectations. David did, however, have one manual form—a palm swipe away from the body—that he used exclusively for negation, but this form was used only three times during our 8 observation sessions. Thus, for the most part, David used headshakes as a specific, and unique, marker for negation in his homesign system. In this sense, his system resembled the earliest stages that deaf children go through as they acquire ASL from their deaf parents.

6.1.2. The flip gesture form

David is likely to have borrowed the flip form from the hearing culture that surrounds him, just as he recruited the side-to-side headshake. Like the headshake, the flip assumes a number of different forms cross-culturally, but all variations include at least one hand extended with the palm up. In Iran (Sparhawk, 1978), Kenya (Creider, 1977), and the United States (Johnson et al., 1975), the hands rotate from palm down to palm up, often accompanied by a shoulder shrug or head tilt (Barakat, 1973; Brookes, 2004; Calbris, 1990). The flip gesture is typically understood as a signal of uncertainty (i.e., 'I don't know'), ignorance, or as an exclamation of "what do I know about it!" (de Jorio, 2000; Payrató, 1993; Rector, 1986).

Interestingly, the flip form is also found in conventional sign languages of the deaf, although there is variation in whether one or two hands are used and in whether and which facial expression accompanies the flip.¹⁴ The ASL sign for *what/perhaps* resembles the flip form that hearing speakers in the United States use when they gesture, as does the form found in Finnish Sign Language (Savolainen, 2006), New Zealand Sign (McKee, 2006), and Providence Island Sign Language (Washabaugh, Woodward & DeSantis, 1978). However, the flip form in ASL is used for a particular *wh*-meaning (*what*), whereas the flip form serves as a general interrogative marker in Finnish Sign Language and conveys the narrow meaning "I don't know" in New Zealand Sign.

¹² Franklin et al. (in preparation) explore the use of headshakes to convey negation in home signing children and their hearing mothers, and in hearing children learning English and their hearing mothers. As would be predicted by Veinburg and Wilbur (1990), all three groups use a lateral headshake for negation.

¹³ Unlike the children in Anderson and Reilly (1997), David has not yet moved (and may not move) beyond the headshake stage into co-articulated headshake and manual negation.

¹⁴ Sign systems such as Indo-Pakistani Sign Language (Zeshan, 2003) vary not only in movement but also handshape. IPSL includes a curl of the pinkie and ring finger over open palm.

Flips, like headshakes, are produced by children as well as adults. Although there is little research on the flip gesture form in hearing children, there is evidence that deaf children acquiring sign from their deaf parents use the flip form early in development. Fischer (1974) found that deaf children acquiring ASL first used the sign WELL (two palms down rotate to palms up, reminiscent of ASL *what*) as a generalized *wh*-sign and only later acquired the more differentiated forms (*where, who, why, etc.*).¹⁵ Note that David's use of the flip form is here again reminiscent of the earliest stages that deaf children go through as they acquire ASL from their deaf parents.

6.2. Negative and questions meanings

David seemed to co-opt the headshake and flip forms used by hearing gesturers in his culture, and use those forms to convey negative and question meanings, as do hearing gesturers. Thus, the impetus for David's use of negative and question forms may have come from the hearing culture surrounding him. Interestingly, however, the developmental trajectory that David followed in his acquisition of particular gesture meanings resembled the spoken language trajectory that hearing children acquiring language from their hearing parents follow. David used his headshakes to convey rejection throughout the 8 sessions, but his production of headshakes conveying non-existence/non-occurrence waned over time and was replaced by headshakes conveying denial. This developmental pattern—rejection, non-existence, denial—has been found in hearing children learning English (Bloom, 1970) and Japanese (McNeill & McNeill, 1968). Pea (1980) argues that this developmental trajectory depends on both the social environment and children's developing cognitive representations. The fact that David, who has not been exposed to a usable model of a conventional language, follows the same developmental trajectory as children who are learning language from a conventional model suggests that a shared language model is not responsible for this developmental trajectory.

As in studies of negation, a developmental progression in *wh*-questions has also been reported. *What, where* and *who* questions are learned before *why, how* and *when* questions in both first (Bloom et al., 1982; Brown, 1968; Ervin-Tripp, 1970; Labov & Labov, 1977) and second (Felix, 1976; Lightbown, 1978) language acquisition. For example, *where* and *what* questions typically emerge at 26 months in hearing children learning English, followed by *who, how* and *why* questions. *Which, whose* and *when* are typically learned after 3 years (Bloom et al., 1982). Less work has been done on the acquisition of questions in deaf children acquiring sign language from their deaf parents. However, Lillo-Martin and Müller de Quadros (2004) note that children acquiring ASL or Brazilian Sign Language first use *where* and *what* questions and only later produce *why* and *how* questions. David thus appears to follow the same

developmental trajectory with respect to types of questions as children acquiring language from conventional language models. Thus, the developmental trajectory that all children, including David, follow with respect to question types does *not* appear to depend on, or be an outgrowth of, a conventional language model. Rather, the trajectory is more likely to reflect the child's need to express different question meanings over time.

At a minimum, the fact that David shows the same developmental patterns with respect to both negatives and questions as children learning language from a conventional language model suggests that David is using the headshake and flip forms that he has co-opted from the hearing culture in a language-like way.

6.3. Structure building

6.3.1. David's homesign system has sentential negation

6.3.1.1. *Sentence peripheral vs. VP peripheral negation.* In logical syntax, sentential modifiers appear in the periphery of the sentence, hence negation is represented as $\neg\phi$. In natural languages, sentential negative markers also tend to appear in the periphery: we have VP negation, which precedes the tensed verb (as in Romance languages, Greek and Slavic languages, example 24), or follows it (as in German, Dutch, example 25). VP negation can thus be thought of as VP peripheral (see Horn, 1989; Zanuttini, 1991, 1997, for extensive discussions of placement of sentential negation). Sentential negative markers can also appear at the left edge of the sentence (i.e., sentence initial) in natural languages, as in examples (24) and (25). Both the sentence peripheral and VP peripheral negations are underlined in the examples below; the tensed verb is in italics. Note that there is a distinction between the lexical markers for sentence peripheral negation and verb peripheral negation in each of the examples.

(24)	a	<u>Non, no</u> ha visto Maria.	[Italian]
		<i>no, not have.1sg seen Maria</i>	
	b	<u>Oxi, dhen</u> idha ti Maria.	[Greek]
		<i>no, not saw.1sg the Maria</i>	
		'No, I didn't see Mary.'	
(25)	a	<u>Nein</u> , Johan isst <u>nicht</u> .	[German]
	b	<u>Nee</u> , Jan eet <u>niet</u> .	[Dutch]
		<i>no, John eat.pres.3sg not</i>	

Sentence initial negation is typically thought of as *anaphoric* in the sense that it serves as a link between the sentence that it introduces and the previous discourse. It usually answers a yes/no question (with a negative response) or objects to the previous declarative sentence with the intention to correct it. Anaphoric negation on its own cannot negate the sentence; for example, in the sentence, "No, John ate", "No" does not negate the proposition "John ate" but instead negates a previous sentence (one that stated or implied that John did not eat). Verb peripheral negation, on the other hand, is what we typically think of as negation of the sentence (also called sentence internal negation). It is placed to the right or the left of the verb

¹⁵ The flip described here is similar to the flip adopted as a question marker in ASL. Note, however, that in ASL only specific *wh*-words (*why, who, where, etc.*) extend to non-question uses.

(English combines the tensed auxiliary with negation—“doesn’t”—and this form appears to the left of the verb). If the VP is the minimal propositional domain, as is commonly assumed in linguistics, then placement of negation to the right or left of the verb is consistent with the fact that the negative marker takes the proposition as its argument. This verb peripheral negation is sufficient, on its own, to characterize a sentence as negative as seen in examples (24) and (25). The additional (optional) use of sentence peripheral negation situates the locus of logical application of negation at the beginning of the string while, at the same time, linking it to the previous utterance.

Negation is also marked peripherally in sign language. Sign languages display rich typological variation in the exact sign used for negation (i.e., manual vs. non-manual dominant systems) and in the position the negative occupies within the sentence. Many signed languages, like spoken languages, place negative markers in sentence-final or postverbal position; however, other sign languages display preverbal manual negation (Zeshan, 2004a, 2004b; Zeshan, 2006; Pfau and Quer, 2002); for an overview see Quer, in press). In fact, there does not appear to be a universal pattern in the placement of negative markers in sign (e.g., Hong Kong Sign allows for a medial position headshake, Tang, 2006).

As mentioned earlier, the syntactic fact that negation is placed on the periphery is consistent with the logical syntax of sentential negation. Interestingly, at the earliest stages of language learning, children learning spoken languages tend to place their negative markers in sentence-initial position (Drozd, 1995), typically surfacing as the sentence initial “No” (“Nee” in Dutch, “Nein” in German). (26) presents examples from Drozd (1995: (1)):

-
- (26) No good
 No Leila have a turn
 No sunny outside
 No to the bathroom?
 No over
-

Importantly, the sentence initial “No” that we see in these examples is not anaphoric to the previous utterance, but appears to be used in the same way as verb peripheral negation in that it negates the sentence it occurs in—unlike the typical use of “No” at the beginning of adult sentences in English, which (as noted earlier) is anaphoric to the previous utterance (see examples 24 and 25). David’s use of the side-to-side headshake as a sentence initial negation appears to be consistent with the pattern observed in child language in terms of placement, and also in terms of meaning, since his headshakes are not generally anaphoric (although some are, see Franklin et al., in preparation).

6.3.1.2. *Metalinguistic vs. truth-functional negation.* Horn (1989) proposes that ordinary sentence internal negation, apart from its regular use as a truth functional denial (*It is not the case that S*), can also be used as metalinguistic negation. In this use, negation is “a device for objecting to a previous utterance on any grounds whatsoever includ-

ing the conventional or conversational implicata it potentially induces, its morphology, its style or register or its phonetic realization” (Horn, 1989, p. 363). (27) presents two examples:

-
- (27) a. My brother is not a crook—I don’t have a brother!
 b. Speaker A: It’s stewed bunny. (Drozd, 1995: (1))
 Speaker B: It’s not stewed bunny, it’s *civet de lapin*.
-

In the first example (27a), the “not” is negating the presupposition that the speaker has a brother. In the second example (27b), “not” is negating the appropriateness of the expression stewed bunny, and the speaker replaces it with a more appropriate expression. This contrastive and corrective use of metalinguistic negation is quite common. Horn (1989) glosses the metalinguistic use as *I object to U*, where *U* is an utterance or utterance type, and expressions like “Don’t say *U* (to me)”, or “No way”, are considered to be equivalent glosses. In some languages, the marker for sentence peripheral negation can also be used to convey metalinguistic negation. Greek “*oxi*” is one such case (Giannakidou, 1998):

-
- (28) Speaker A: O Petros exi tria pedia.
 Peter has three children
 Speaker B: **Oxi!** O Petros exi **oxi** tria pedia, ala tessera!
 No, Peter doesn’t have three children but four.
-

Horn (1989, p. 462) suggests that early negation in English-learning children is a form of metalinguistic negation. Drozd (1995) echoes this suggestion, adding that the negation can also be exclamatory. Thus, Drozd is suggesting that early child negation is not a pre-adult form of truth-functional negation but rather metalinguistic exclamatory negation, equivalent to saying something like “*No way I’ll do this!*”

Others, however, consider early child negation to be a pre-adult stage of truth-functional negation, i.e., Period I in the development of sentence negation described by Bellugi (1967); see also Bloom (1970), Bowerman (1976), Braine (1963), Déprez and Pierce (1993), Harris and Wexler (1996), Klima and Bellugi (1966), McNeill (1970), Pierce (1992), Radford (1990). Under this view, the “No’s” that we see in example (26) are equivalent to internal sentential negations (e.g., *didn’t*, *niet*, *nicht*, etc.), the expressors of logical negation. They occur in initial position because the child has not yet acquired the correct adult syntax of negation.

The question for us is whether David’s side-to-side headshake constitutes an early form of truth conditional sentential negation (that might, with more time, end up in a different position as David’s system continues to develop), or whether it is better characterized as metalinguistic

negation. The fact that David uses his side-to-side headshake for rejection and, occasionally, in other exclamative ways lends some support to the idea that his negation may be metalinguistic. However, David's data do not conform to the other requirements that Drozd (1995) establishes for metalinguistic negation. Drozd notes that early negation in English-learning children has the following properties, which suggest it is metalinguistic rather than truth functional (1995, pp. 588–589):

-
- (27) a. How pretty is she? (Question)
 b. How pretty she is! (Exclamative)
- (28) a. How quickly did he forget? (Question)
 b. How quickly he forgot! (Exclamative)
-

Importantly, none of the three properties identified by Drozd (1995) can be said to characterize David's side-to-side headshakes. First, given the absence of a shared language system, David's negation sentences cannot be echoic in the sense required by Drozd—they rarely repeat verbatim components of a preceding utterance. Second, David uses the side-to-side headshake to convey negation relatively frequently (he produced 327 negative gesture sentences, accounting for roughly 11% of his sentences). Finally, David uses the headshake to convey a variety of negative meanings, not just rejection (i.e., denials, non-existence, non-occurrence). Moreover, Drozd (1995, p. 583) claims that sentence initial negations in child language “reflect young children's competence in using grammatical negative constructions appropriately in the discourse.” Given the fact that David is profoundly deaf and not able to make use of the spoken language to which he is exposed, it is difficult to imagine how he could have acquired discourse competence of this sort. Hence we conclude that David's side-to-side headshake is developing into a truth functional form of negation consistent with analyses of early negation in English-learning children.

6.3.2. The flip functions as a *wh*-form in David's homesign system

Fig. 2 shows that David tends to produce the flip at the right periphery of his sentences in both questions and exclamatives. This placement can be taken to suggest that the right periphery is where markers of illocutionary force are located. David's homesign thus makes a neat syntactic distinction between sentential operations that affect the sentence itself—negation, placed to the left—and sentential operations that affect the illocutionary force of the utterance—*wh*-forms, placed to the right. In addition to using the flip form as a marker for questions and exclamatives, David produced a small number of flips to express referential location. Note that this particular form of the flip does not function as an illocutionary force operator. Thus, under the hypothesis that the end-position in David's sentences is reserved for illocutionary force markers, the flip form when used to mark referential expression of location should *not* occur at the end of sentences—and, indeed, it does not. Although the numbers are small, the pattern is suggestive and warrants attention.

David not only uses his flip form to ask questions but also to express emotion (outrage, surprise, doubt), as we noted, in sentences that can be understood as exclamatives. Importantly, there is a systematic connection in many languages between questions and exclamatives in that *wh*-forms are used for both purposes:

-
- (29) i. Exclamatory negation is generally echoic, often repeating verbatim the previous utterance and responding to it (e.g., an answer to a question, or a rejection of a previous statement or request)
 ii. Exclamatory negation is low in frequency
 iii. Exclamatory negation is typically used with rejection, not non-existence (e.g., sentences like “*No there is a pony*” have not been reported)
-

The same form, often the flip, is used for both questions and emotive expressions in sign languages as well. Fischer (1974) found that deaf children acquiring ASL first produced a form resembling the flip (two palms down rotated to palms up) as a generalized *wh*-sign used in both questions and exclamatives. For example, a child used the *wh*-sign in a sentence glossed as *What's this?* (INDEXa – WH-FORM?) to make a query and in a sentence glossed as *What he said yesterday!* (INDEXa – SAY – YESTERDAY – WH-FORM!) to express surprise or outrage, reflecting both a question and emotive reading for the sign.

Exclamative sentences express an emotive or evaluative (or, at any rate, subjective) stance towards a proposition. When the speaker utters “*How pretty she is!*” he is not merely asserting that she is pretty, he is making a comment that the degree to which she is pretty is an impressive one *in his view*. Similarly, in (28b), the speaker is making the claim that the amount of food he ate was impressively big, according to the speaker's standards. There is always an evaluative component in the exclamative speech act. What is important for our purposes is that this evaluative component is expressed using a *wh*-form—and, in the exclamative sentence in English, following the syntax of a declarative (i.e., no subject–verb inversion) rather than a question (with subject–verb inversion). In other words, even though a *wh*-form is used in both cases, the exclamative and the question are formally distinguished. In natural languages, it is usually the degree and amount designating *wh*-forms that are used in exclamative sentences (*how* and *what* in English), probably because these forms provide a scale for the evaluation. David has only one question form—the flip—and it is this form that he extends to the exclamative use. David's systematic extension of the flip from questions to exclamations suggests that the flip is not simply a question form in David's homesign, but is instead a broad-ranging *wh*-form.

Our hypothesis that the flip functions as a *wh*-form is further confirmed by the third use to which the flip form is put—the referential expression of location. This referential use of the *wh*-form is also attested in many languages. In the form of free relative or correlative structure, for example (29) through (32) in English:

-
- (29) I liked what you bought.
 (30) He goes where(ever) he pleases.¹⁶
 (31) What he cooked was potatoes (cleft)
 (32) The book is where it should be.
-

In the free relative use, the *wh*-clause is again equivalent not to a question, but to a definite description—and indeed, as mentioned earlier, the most influential analysis of free relatives argues that the *wh*-constituent (the free relative clause) corresponds semantically to a definite argument (Jacobson, 1995):

-
- (33) I liked *the thing you bought*.
 (34) He goes *to the places he wants to*.
 (35) The *food he cooked* was potatoes. (cleft)
 (36) The book is *on the place it should be*.
-

We see in these examples that the *wh*-phrase is either an argument of the verb (e.g., an object) or a locative modifier, and that there is no question or exclamative meaning involved (we return to the cleft structure below). In the free relative use, the *wh*-form, according to Jacobson's (1995) analysis, functions semantically not as a question but as a referential expression. We suggest that David's use of the flip for expressions of location is an instance of this generalization of the *wh*-form from a question meaning to a referential meaning.

The question arises, however, as to whether the transition from the question to the referential meaning in free relatives is marked syntactically; in other words, whether it involves additional structure. In Greek, for instance, the *wh*-form used for the free relative is preceded by the definite article *o* (Giannakidou & Cheng, 2006):

-
- | | | |
|------|----------|-----------------|
| (37) | [o-pjos] | the-who (Greek) |
| | [o-ti] | the-what |
| | [o-pote] | the-when |
| | [o-pu] | the where |
-

This sequence—the interrogative *wh*-phrase preceded by what appears to be the definite article *o*—is used in Greek as a referential expression of location (see non-starred items in example 38a and 38b). Note that the pure interrogative *wh*-form is not permitted in referential expressions of location (the starred items in 38a and 38b):

-
- (38) a. Pijeni **{opu/*pu}** theli.
 He goes where he likes.
 b. Efaga **{oti/*ti}** majirepse.
 I ate what he cooked.
-

¹⁶ Sometimes, a so-called free choice marker is used, in this case, "wherever", which has an effect on the interpretation. The free choice marker seems to expand the domain, which may sometimes result in a pejorative flavor. This aspect of the meaning is not inherent to the *wh*-form, but is a contribution of the free choice marker (Giannakidou, 2001). We have not found evidence for such free choice marking in David's system.

In contrast, the interrogative *wh*-form without the definite article is permitted in questions (non-starred items in 39a and 39b), while the referential *o* form is not permitted (starred items):

-
- (39) a. **{Pu/*Opu}** thelis na pas?
 Where do you want to go?
 b. **{Ti/*Oti}** majirepse?
 What did he cook?
-

The Greek facts are important for two reasons. First, they provide empirical evidence that *wh*-forms, when used as free relatives (in this case, in referential expressions of location), do not involve a question meaning since they are formally marked as definites. Second, the Greek facts show that the free relative and the question *wh*-forms can be distinguished syntactically (the free relative form involves embedding not found in the question form). Note, however, that this distinction is not found in all languages—in English, the semantic operation of becoming a referential expression has no overt syntactic counterpart; thus the free relative and the question *wh*-forms are not syntactically distinct. Crucially, though, semantically, in both English and Greek, the *wh*-form is a referential expression, not a question clause (Jacobson, 1995).

David's extension of the flip to referential expressions of location provides support for the hypothesis that he uses the flip in environments where a *wh*-marker is used in natural languages. In addition, given the absence of markings that distinguish the free relative from the question in David's homesigns, we suggest that a simpler syntactic structure (as in English), with no further syntactic embedding, is the most conservative way to analyze David's referential expressions of location.

But perhaps it would be simpler to handle the locative flips as cleft structures, e.g., *What he cooked was potatoes?* Such structures have, in fact, been described in ASL by Davidson, Caponigro, and Mayberry (2008) and Wilbur (1996). The analyses for ASL treat the *wh*-segment of this construction as a question, which merges with the segment that follows the copula and is an answer to the question. The question–answer syntactic parallelism is instrumental to getting the right meaning for the cleft so, in this analysis of David's locative flips, the flip would remain a question word.

The question–answer structure posits no embedding and thus appears to be a simpler description of David's system than the free relative description we have given. However, there are three factors that suggest caution. First, as just noted for English, a referential free relative does not necessarily involve syntactic embedding. Moreover, Jacobson's (1995) account of free relatives requires only a semantic type-shifter that need not have a syntactic reflex. As a result, by suggesting, as we do, that the locative flips are referential expressions in David's homesigns, we are not claiming that they are syntactically more complex than question flips.

Second, the cleft in English has additional presuppositions that make it a more complex structure syntactically and pragmatically than a free relative. We have no evidence

that David's referential expressions have syntactic or pragmatic constraints additional to those needed for free relatives; following Jacobson's (1995) analysis thus seems to us to be the simplest option. It must also be noted that analyzing cleft structures as involving question–answer pairing is far from uncontroversial, and there are many good arguments for choosing to analyze clefts as involving an equation relation between referential terms instead (Alexiadou & Giannakidou, 1998; Heycock & Kroch, 1998).

Third, and we believe quite importantly, the placement of the flip in the locative use is distinct from the placement of the flip in questions in David's homesigns. This distinction suggests an empirical (syntactic) contrast between the locative flip and question flip that would be unexpected under the cleft analysis (where the flip component is merely a question clause). The free relative use appears to be marked at the position of the argument, but the question flip seems to function as a sentential operator at the right periphery of the sentence. Thus, given the data we have, we conclude that the referential free relative analysis is the simplest and most plausible option for our locative flips. However, we must also emphasize that even if we chose to represent the locative flip as the question component of a *wh*-cleft, our point that the flip has generalized *wh*-uses is still valid.

7. Conclusions

In this paper, we identified two gestural markers in a homesign system that showed systematic and consistent enough meaning, use, and position to be analyzed as a sentential negative marker and a *wh*-form. We found that negation is marked by the side-to-side headshake and that questions are marked by the manual flip. Interestingly, the flip form is not restricted to questions and, in fact, is extended to convey the range of meanings that the *wh*-form conveys in natural languages (exclamatives and referential expressions of location). In this sense, the homesigner has re-invented a coherent linguistic category. In addition, each of the two markers occupies a systematic, and different, position at the periphery of the gesture sentence—the headshake tends to be produced at the beginning of the sentence, the flip tends to be produced at the end. The homesign system thus makes a syntactic distinction between sentential operations that affect the sentence itself (negation, on the left) and sentential operations that affect the illocutionary force of the utterance (*wh*-forms, on the right).

The fact that the homesigner displays variability in his patterns (e.g., the headshake and flip show a reliable tendency to occur in their respective positions, but are not found in those locations 100% of the time, Fig. 2) is not surprising for several reasons. First, we are describing an invented system; without an informant, we are likely to have introduced a fair amount of noise into our descriptions. Second, we are describing the communication system of a child, and children's productive language is known to be variable (see, for example, Bloom, Lightbown, & Hood, 1975). Finally, we are describing language use, which is likely to be variable (Chambers, Trudgill, & Schil-

ling-Estes, 2002). An interesting question for future work is whether the homesigner's sentences are more variable than those produced by children learning conventional language from their parents. The answer to this question bears on whether the homesigner has invented a system that contains obligatory rules.

We argue that the gestural markers we have identified function as structure building operators, i.e., they create more complex sentences out of simpler ones. Our argumentation draws from standard assumptions about the meaning of negation, questions, and *wh*-forms that are employed in current linguistic theorizing, and capitalizes on striking parallels between the side-to-side headshake and the flip, on the one hand, and the way negation and *wh*-forms are organized in natural languages, on the other.

Although we know that other American homesigners also use the side-to-side headshake and the flip forms that they presumably borrow from the surrounding hearing culture (see Goldin-Meadow & Mylander, 1984), we do not yet know whether all of these homesigners use the forms systematically. In other words, we do not yet know whether all homesigners are able to create structure building devices of the sort we have described here, or whether David is the rare exception. In future work, we will address this question by examining the homesigns of other deaf children raised in the United States and other cultures (see Franklin et al., in preparation). We expect to find that these gesture forms function as structure building operators in all homesigners. But even if they do not, the data from this study make it clear that it is possible for a child to develop a sentential negative marker and a *wh*-form even without a conventional language model to guide him. Our analysis thus implies that homesign has at least this minimal sentential syntax. If so, then what we see in homesign is a language creation process (Goldin-Meadow, 2003), and our data serve as further evidence for this position.

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References

- Alexiadou, A., & Giannakidou, A. (1998). Specificational pseudoclefts and the semantics of lists. *Published in ZAS Working Papers on Linguistics. Zentrum für Allgemeine Sprachwissenschaft, Berlin* (pp. 1–21).
- Anderson, D. S., & Reilly, J. S. (1997). The puzzle of Negation: How children move from communicative to grammatical negation in ASL. *Applied Psycholinguistics, 18*, 411–429.
- Barakat, R. (1973). Arabic gestures. *Journal of Popular Culture, 6*(4), 749–792.

- Bellugi, U. (1967). The acquisition of negation. Unpublished doctoral dissertation, Harvard University.
- Bernini, G., & Ramat, P. (1996). *Negative sentences in the languages of Europe: A typological approach*. Berlin: Mouton de Gruyter.
- Bloom, L. (1970). *Language development: Form and function in emerging grammars. Research monograph, no. 59*. Cambridge, MA: MIT Press.
- Bloom, L., Lightbown, P., & Hood, L. (1975). Structure and variation in child language. *Monographs of the society for research in child development, 40*, serial no. 160.
- Bloom, L., Merkin, S., & Wootton, J. (1982). Wh-questions: Linguistic factors that contribute to the sequence of acquisition. *Child Development, 53*, 1084–1092.
- Bowerman, M. (1976). *Early semantic development: A cross-linguistic study with special reference to Finnish*. Cambridge: CUP.
- Braine, M. (1963). The ontogeny of English phrase structure: The first phase. *Language, 39*, 1–15.
- Brookes, H. (2004). A repertoire of South African quotable gestures. *Journal of Linguistic Anthropology, 14*(2), 186–224.
- Brown, R. (1968). The development of wh-question in child speech. *Journal of Verbal Language and Verbal Behavior, 7*, 279–290.
- Calbris, G. (1990). *The semiotics of French gestures*. Bloomington: Indiana University Press.
- Chambers, J., Trudgill, P., & Schilling-Estes, N. (Eds.). (2002). *The handbook of language variation and change*. Malden, MA: Blackwell.
- Cheng, L., Cheng, C. T., & Tang, J. (1996). Negative particle questions: A dialectal comparison. In James R. Black & Virginia Motapanyane (Eds.), *Microparametric syntax and dialect variation*. Amsterdam: John Benjamins.
- Chomsky, N. (1995). *The minimalist program*. Cambridge, MA: MIT Press.
- Chomsky, N., Hauser, M., & Fitch, T. (2002). The faculty of language: What is it, who has it, and how did it evolve? *Science, 298*(5598), 1569–1579.
- Conlin, F., Hagstrom, P., & Neidle, C. (2003). A particle of indefiniteness in American Sign Language. *Linguistic Discovery, 2*(1), 1–21.
- Conrad, R. (1979). *The deaf schoolchild: Language and cognitive function*. London: Harper & Row.
- Creider, C. A. (1977). Toward a description of East African gestures. *Sign Language Studies, 14*, 1–20.
- Davidson, K., Caponigro, I., & Mayberry, R. (2008). Clausal Question-Answer Pairs: Evidence from ASL Proceedings of the 27th West Coast Conference on Formal Linguistics. In Natasha Abner & Jason Bishop (Eds.), (pp. 108–115). Somerville, MA: Cascadia Proceedings Project.
- De Jorio, A. (2000). *Gesture in Naples and gesture in classical antiquity*. (A. Kendon, Trans.). Bloomington: Indiana University Press [Original work published in 1832].
- Déprez, V., & Pierce, A. (1993). Negation and functional projections in early grammar. *Linguistic Inquiry, 24*(1), 25–67.
- Drozd, K. (1995). Child English presentational negation as metalinguistic exclamatory negation. *Journal of Child Language, 22*, 583–610.
- Ellenberger, R., Moores, D., & Hoffmeister, R. (1975). Early stages in the acquisition of negation by a deaf child of deaf parents. Unpublished research report 94, University of Minnesota.
- Ervin-Tripp, S. (1970). Discourse agreement: How children answer questions. In J. R. Hayes (Ed.), *Cognition and the development of language*. New York: Wiley.
- Feldman, H., Goldin-Meadow, S., & Gleitman, L. (1978). Beyond Herodotus: The creation of language by linguistically deprived deaf children. In A. Lock (Ed.), *Action, symbol, and gesture: The emergence of language*. New York: Academic Press.
- Felix, S. (1976). Wh-pronouns and second language acquisition. *Linguistische Berichte, 44*, 52–64.
- Fischer, S. (1974). The ontogenetic development of language. In E. Straus (Ed.), *Language and language disturbance: Fifth lexington conference on phenomenology*. Pittsburgh: Duquesne University Press.
- Franklin, A., Copeland Johnson, M., & Goldin-Meadow, S. (in preparation). Getting ahead in negation: Headshakes, input and the development of negation in deaf homesigning and hearing children.
- Giannakidou, A. (1998). *Polarity sensitivity as (non)veridical dependency*. Amsterdam: John Benjamins.
- Giannakidou, A. (1999). Affective dependencies. *Linguistics & Philosophy, 22*, 367–421.
- Giannakidou, A. (2001). The meaning of free choice. *Linguistics & Philosophy, 24*, 659–735.
- Giannakidou, A., & Cheng, L. (2006). (In)definiteness, polarity, and the role of wh-morphology in free choice. *Journal of Semantics, 23*, 135–183.
- Goldin-Meadow, S. (1982). The resilience of recursion: A study of a communication system developed without a conventional language model. In E. Wanner & L. R. Gleitman (Eds.), *Language acquisition: The state of the art*. New York: Cambridge University Press.
- Goldin-Meadow, S. (2003). *The resilience of language: What gesture creation in deaf children can tell us about language-learning in general*. NY: Psychology Press.
- Goldin-Meadow, S., & Mylander, C. (1984). Gestural communication in deaf children: The effects and non-effects of parental input on early language development. *Monographs of the society for research in child development 49* (3), no. 207.
- Goldin-Meadow, S., & Mylander, C. (1998). Spontaneous sign systems created by deaf children in two cultures. *Nature, 91*, 279–281.
- Goldin-Meadow, S., Mylander, C., & Butcher, C. (1995). The resilience of combinatorial structure at the word level: Morphology in self-styled gesture systems. *Cognition, 56*, 195–262.
- Goldin-Meadow, S., Butcher, C., Mylander, C., & Dodge, M. (1994). Nouns and verbs in a self-styled gesture system: What's in a name? *Cognitive Psychology, 27*, 259–319.
- Goldin-Meadow, S., Mylander, C., & Franklin, A. (2007). How children make language out of gesture: Morphological structure in gesture systems developed by American and Chinese deaf children. *Cognitive Psychology, 55*, 87–135.
- Harris, T., & Wexler, K. (1996). The optional infinitive stage in child English: Evidence from negation. In H. Clahsen (Ed.), *Generative perspectives in language acquisition*. Amsterdam: John Benjamins.
- Heycock, Caroline, & Kroch, Anthony. (1998). Pseudocleft connectedness: Implications for the LF interface level. *Linguistic Inquiry, 30*, 365–397.
- Hoffmeister, R., & Wilbur, R. (1980). Developmental: The acquisition of sign language. In H. Lane & F. Grosjean (Eds.), *Recent perspectives on American Sign Language*. Hillsdale, NJ: Erlbaum.
- Horn, L. (1989). *A natural history of negation*. Chicago: University of Chicago Press.
- Hummer, P., Wimmer, H., & Antes, G. (1993). On the origins of denial negation. *Journal of Child Language, 20*(3), 607–618.
- Hunsicker, D., & Goldin-Meadow, S. (submitted for publication) Hierarchical structure in a self-created gesture system: Are there noun phrases in homesign?
- Jacobson, P. (1995). The quantificational force of the English free relative. In E. Bach et al. (Eds.), *Quantification across languages* (pp. 451–486). Dordrecht: Kluwer.
- Johnson, H. G., Ekman, P., & Friesen, W. V. (1975). Communicative body movements: American emblems. *Semiotica, 15*(4), 335–353.
- Kendon, A. (2003). Some uses of the head shake. *Gesture, 2*(2), 147–182.
- Kegl, J., Senghas, A., & Coppola, M. (1999). Creation through contact: Sign language emergence and sign language change in Nicaragua. In M. DeGraff (Ed.), *Comparative grammatical change: The intersection of language acquisition, creole genesis, and diachronic syntax* (pp. 179–237). Cambridge, MA: MIT Press.
- Klima, E., & Bellugi, U. (1966). Syntactic regularities in the speech of children. In J. Lyons & R. J. Wales (Eds.), *Psycholinguistic paper*. Edinburgh: Edinburgh University Press.
- Labov, W., & Labov, T. (1977). Learning the syntax of questions. In R. Campbell & P. Smith (Eds.), *Recent advances in the psychology of language: Formal and experimental approaches*. New York: Plenum.
- Lightbown, P. M. (1978). Question form and question function in the speech of young French L2 learners. In M. Paradis (Ed.), *Aspects of bilingualism*. Columbia, SC: Hornbeam.
- Lillo-Martin, D. (1999). Modality effects and modularity in language acquisition: The acquisition of American Sign Language. In T. Bhatia & W. Ritchie (Eds.), *Handbook of language acquisition*. Academic Press.
- Lillo-Martin, D., & Müller de Quadros, R. (2004). The position of early wh-elements in American Sign Language and Brazilian Sign Language. In *Generative approaches to language acquisition North America conference*.
- Mayberry, R. I. (1992). The cognitive development of deaf children: Recent insights. In S. Segalowitz & I. Rapin (Eds.), *Child neuropsychology. Handbook of neuropsychology* (Vol. 7, pp. 51–68). Amsterdam: Elsevier.
- McClave, E. (2000). Linguistic functions of head movements in the context of speech. *Journal of Pragmatics, 32*, 855–878.
- McClave, E. (2001). The relationship between spontaneous gestures of the hearing and American Sign Language. *Gesture, 1*(1), 52–71.
- McKee, R. (2006). Aspects of interrogatives and negation in New Zealand Sign Language. In U. Zeshan (Ed.), *Interrogative and negative constructions in sign languages*. Nijmegen: Ishara Press.
- McNeill, D., & McNeill, N. (1968). What does a child mean when he says 'no'? In E. Zale (Ed.), *Proceedings of the conference on language and language behavior*. New York: Appleton-Century.
- McNeill, D. (1970). *The acquisition of language*. New York: Harper & Row.
- Meadow, K. (1968). Early manual communication in relation to the deaf child's intellectual, social, and communicative functioning. *American Annals of the Deaf, 113*, 29–41.
- Mountage, R. (1969). On the nature of certain philosophical entities. *The Monist, 53*, 159–194.

- Nevins, A., Pesetsky, D., & Rodrigues, C. (2009). Pirahã exceptionality: A reassessment. *Language*, 85(2), 355–404.
- Newport, E. L., & Meier, R. P. (1985). The acquisition of American Sign Language. In D. I. Slobin (Ed.), *The cross-linguistic study of language acquisition. The data* (Vol. 1). Hillsdale, NJ: Erlbaum.
- Payrató, L. (1993). A pragmatic view on autonomous gestures: A first repertoire of Catalan emblems. *Journal of Pragmatics*, 20, 193–216.
- Pea, R. D. (1980). The development of negation in early child language. In D. R. Olson (Ed.), *The social foundations of language and thought: Essays in honor of Jerome S. Bruner*. New York: W.W. Norton.
- Pfau, R., & Quer, J. (2002). V-to-Neg raising and negative concord in three sign languages. *Rivista di Grammatica Generativa*, 27, 73–86.
- Pinker, S., & Jackendoff, R. (2005). The faculty of language: What's special about it? *Cognition*, 95(2), 201–236.
- Pierce, A. (1992). *Language acquisition and syntactic theory: A comparative analysis of French and English child grammars*. Dordrecht: Kluwer.
- Potts, C. (2007). The expressive dimension. *Theoretical Linguistics*, 33(2), 165–197.
- Progovac, J. (1994). *Negative and positive polarity: A binding approach*. Cambridge, MA: MIT Press.
- Quer, J. (in press). Negation. In R. Pfau, M. Steinbach, & B. Woll (Eds.), *Sign languages (handbooks of linguistics and communication science, HSK)*. Berlin: Mouton de Gruyter.
- Radford, A. (1990). *Syntactic theory and the acquisition of English syntax*. Oxford: Blackwell.
- Rector, M. (1986). Emblems in Brazilian culture. In P. Bouissac, M. Herzfeld, & R. Posner (Eds.), *Iconicity: Essays on the nature of culture* (pp. 447–462). Tübingen: Stauffenburg.
- Sandler, W., Meir, I., Padden, C., & Aronoff, M. (2005). The emergence of grammar: Systematic structure in a new language. *PNAS*, 102, 2661–2665.
- Savolainen, L. (2006). Interrogatives and negatives in Finnish Sign Language: An overview. In U. Zeshan (Ed.), *Interrogative and negative constructions in sign languages*. Nijmegen: Ishara Press.
- Searle, J. (1969). *Speech acts: An essay in the philosophy of language*. Cambridge, England: Cambridge University.
- Sparhawk, C. (1978). Contrastive-identificational features of Persian gestures. *Semiotica*, 24(1–2), 49–86.
- Tang, Gladys (2006). Questions and negation in Hong Kong Sign Language. In Ulrike Zeshan (Ed.), *Interrogative and negative constructions in sign languages* (pp. 198–224). Nijmegen: Ishara Press.
- Veinburg, S., & Wilbur, R. (1990). A linguistic analysis of the negative headshake in American Sign Language. *Sign Language Studies*, 68, 217–244.
- Vogt-Svednsen, M. (1990). Eye gaze in Norwegian Sign Language interrogatives. In W. H. Edmondson & F. Karlsson (Eds.), *SLR '87: Papers from the fourth international symposium on sign language research*. Hamburg: Signum-Press.
- Volterra, V., & Antinucci, F. (1979). Negation in child language: A pragmatic study. In E. Ochs & B. Schieffelin (Eds.), *Developmental pragmatics* (pp. 281–303). New York: Academic Press.
- Washabaugh, W., Woodward, J., & DeSantis, S. (1978). Providence Island Sign Language: A context-dependent language. *Anthropological Linguistics*, 20(3), 95–109.
- Wilbur, R. B. (1996). Evidence for the function and structure of wh-clefts in American Sign Language. In W. H. Edmondson & R. B. Wilbur (Eds.), *International review of sign linguistics* (Vol. 1, pp. 209–256). Mahwah, New Jersey: Lawrence Erlbaum.
- Yoon, S. (2010). *Not it in the mood: The syntax and semantics of evaluative negation*. PhD Thesis University of Chicago.
- Zanuttini, R. (1991). Syntactic properties of sentential negation: A comparative study of romance languages. Unpublished PhD dissertation, University of Pennsylvania.
- Zanuttini, R. (1997). *Negation and clausal structure*. Oxford: Oxford University Press.
- Zeshan, U. (2003). Indo-Pakistani Sign Language grammar: A typological outline. *Sign Language Studies*, 3(2), 157–212.
- Zeshan, U. (2004a). Hand, head and face: Negative constructions in sign languages. *Linguistic Typology*, 8(1), 1–58.
- Zeshan, U. (2004b). Interrogative constructions in signed languages: Cross-linguistic perspectives. *Language*, 80(1), 7–39.
- Zeshan, U. (2006). *Interrogative and negative constructions in sign languages*. Nijmegen: Ishara Press.
- Zwarts, F. (1995). Nonverbal contexts. *Linguistic Analysis*, 25, 286–312.