

Dedicated gestures and the emergence of sign language

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Dedicated Gestures and the Emergence of Sign Language

Abstract. Sign languages make use of the two hands, facial features, the head, and the body to produce multifaceted gestures that are dedicated for linguistic functions. In a newly emerging sign language – Al-Sayyid Bedouin Sign Language -- the appearance of dedicated gestures across four age groups or strata reveals that this remarkable gestural complexity is not available at the outset. Starting with only the hands in Stratum I, each additional articulator is liberated from the rest of the body to perform grammatical functions as the language matures, resulting in ever increasing grammatical complexity. The emergence of dedicated gesture in a new language provides a novel context for addressing questions about the relationship between the physical transmission system and grammar and about linguistic complexity in human language generally.

1. Introduction.

A scientific breakthrough in linguistics was brought about by applying standard methods of linguistic analysis to sign language, beginning with Stokoe's (1960) phonological analysis of American Sign Language (ASL). Over the half century or so that followed, linguists applied ever more theoretical models to the study of sign languages, which resulted in the discovery of many formal properties that are shared by languages in the two modalities. This body of work led to a sea change in the attitude toward sign languages in the scientific community, as evidenced by Adam Kendon's assessment, "When gesture is used routinely as the only medium of utterance, ... it rapidly takes on organizational features that are very like those found in spoken language" (Kendon, 2000:61).

The research that led to this view of sign languages was typically conducted on 'established' sign languages, languages that had been in existence for hundreds of years and used by relatively large populations of deaf people, often formed and reinforced by deaf children in residential schools. Established sign languages are also transmitted in deaf associations and other institutions and passed down from infancy to the small percentage of deaf children whose parents are also deaf, and who then join the rest of the deaf population, making their own contribution to the structure of these languages. Based mainly on investigation of these languages, linguists have demonstrated many structural similarities between them and spoken languages at most levels of structure – phonology, prosody, morphology, and syntax (see Sandler & Lillo-Martin 2006).

More recently, investigators have turned their attention to newly emerging sign languages, either in recently formed schools, as in Nicaragua, or in village settings with a high percentage of deafness, as in the Al-Sayyid Bedouin village in Israel. Our study of Al-Sayyid Bedouin Sign Language (ABSL) for the past ten years has led my colleagues and me to depart in some measure from earlier ideas about sign language and about language in general (see Sandler et al in press for a current overview).

In the first decades of research on sign language, it was important to demonstrate the linguistic properties of these languages, which previously had been considered degraded

and inferior to spoken languages. In this scientific environment, any connection to gesture was eschewed. But times have changed, and linguistics, sign language linguistics, and gesture studies have matured. Many now understand that the best way to understand any of these three natural manifestations of human communication is to explore each, and the relations among them, while keeping preconceptions at bay.

The present study takes an approach that would have been anathema to many earlier investigators of sign language, myself included – one that is explicitly gestural. I introduce the concept of the **dedicated gesture**, and trace the ways in which gestures by different parts of the body are recruited for linguistic purposes with each new age group as ABSL develops. In the process, I find that cognitive complexity precedes linguistic complexity, and that the seeds of new linguistic structuring begin to sprout at one stage and to flower at the next. The data also show that the language begins with little dedicated body involvement apart from that of the hands, and with the barest minimum of grammatical structure, and that then additional parts of the body are recruited for systematic linguistic functions at each successive stage. Analysis of this incremental development of language structure through gradual recruitment of different parts of the body brings us a step closer to understanding the connection between language and gesture more generally.

In order to approach the notion of gesture in language, I begin by distinguishing the physical signal systems of spoken and signed languages in Section 1. I then go on to narrow down the object of this study, the dedicated gesture. Section 2 provides a sketch of the way in which gestures are put to linguistic use in an established sign language, Israeli Sign Language. A brief description of the Al-Sayyid village and its deaf population follows in Section 3, together with a sketch of the nature of the data on which the present analysis is based. The heart of the article is Section 4, where the evolution of dedicated gestures and their functions across each of the four strata is presented.

The findings are represented schematically in Table 1. It shows that for each of the four age groups, S1-S4, as more articulators are added to convey grammatical information, more grammatical functions appear, to make both the signal and the grammar increasingly complex.

DESIGNATED GESTURES FIGURES

Stratum	HANDS	HEAD	FACE	BODY	NONDOMINANT HAND
I	X				
II	X	X			
III	X	X	X		
IV	X	X	X	X	X

Stratum	WORDS	COMPLEX SENTENCES	DISCOURSE REFERENCE/COHESION
S I	Signs		
S II	Signs	- Unsystematic clause linking	
S III	Signs	- Complex sentences - Embedding	- Illocutionary force - Parentheticals - Referential shift
S IV	Signs	- Complex sentences - Two degrees of embedding	- Illocutionary force - Parentheticals - Double Referential shift - Contrasting two referents in a discourse - Backgrounding

Table 1. Increase in dedicated gestures and grammatical complexity across four strata of ABSL signers.

Two characteristics of language emergence stand out from this analysis: (1) the first kind of dedicated gesture to emerge is the word, conveyed by the hands; and (2) devices for organizing information between propositions (continuation) and in discourse (e.g., for parentheticals and backgrounding), emerge before any overt morphosyntactic marking (e.g., inflections). Implications of these characteristics for language in general are considered in Section 5, the summary and conclusion.

1. The physical transmission system and the dedicated gesture

The fact that many structural linguistic similarities have been found between languages in the two modalities is doubly impressive when the physical transmission systems are taken into account, because they are radically different from one another. The active articulators of spoken languages are the vocal folds, the tongue, the lips, and, in some

languages the pharynx and the epiglottis. Except for the lips, whose action is perceived by the eyes, the actions of these articulators are difficult to perceive directly. The primary signal is the acoustic output of their activity, perceived, by the ears. In sign language, there are many active articulators: the two hands (each with its finger configuration and palm orientation), the head, all of the facial features (eyebrows, upper and lower eyelid, nose, cheeks, lips, etc.), and the torso, shown in Figure 1. And the activity of each of them is directly perceivable, by the eyes.

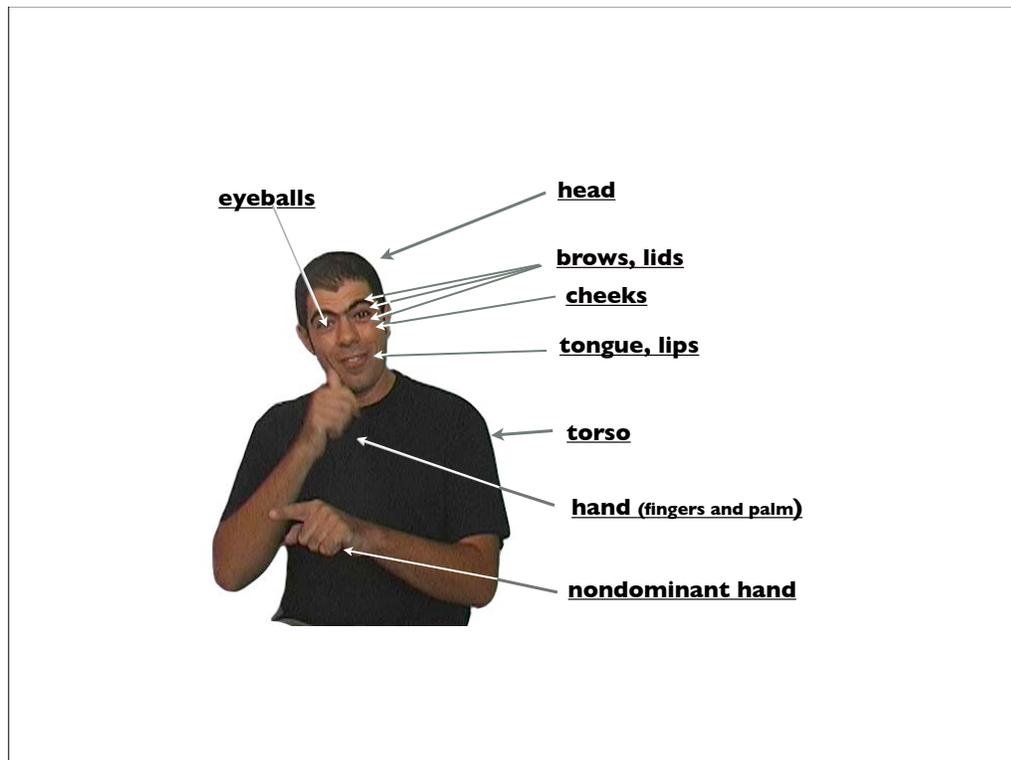


Figure 1. Visible articulators of signed languages.

It is the gestures made by these articulators that are the focus of this paper. However, humans, hearing and deaf, produce many kinds of gestures, and only one kind is the object of this investigation. Let us now narrow down the array of gestural possibilities by ruling out two prominent uses of the term 'gesture'.

We exclude first the broadest use of the term 'gesture' to describe movement of any part of the body in the course of communication. This type of gesture is relevant for theories such as Articulatory Phonology (Browman & Goldstein 1992). The actions of the tongue, lips, etc., contribute to speech sounds which in turn comprise words, and the individual gestures themselves, though meaningless, can be grammatical in the sense that

may create phonological contrast. Sign languages also have meaningless phonological elements¹; however, a phonological system has not yet fully crystallized in ABSL (Sandler et al 2011a), and we exclude this level of structure from consideration here. Second, apart from a brief discussion in Section 2.7, we do not deal with the sign equivalent of co-speech gestures -- the visible gestures that accompany and augment the linguistically structured utterance, but which are themselves not systematically organized in this way (Kendon 1980, McNeill 1994, Goldin-Meadow 2003).

Here we turn our attention to what I will term ‘**dedicated gestures**’, that is, **visible actions of any part of the body that perform a linguistic/grammatical function**. Apparently, only in sign languages do linguistic gestures so defined predominate, an interesting and scarcely recognized difference between sign languages and their spoken counterparts.²

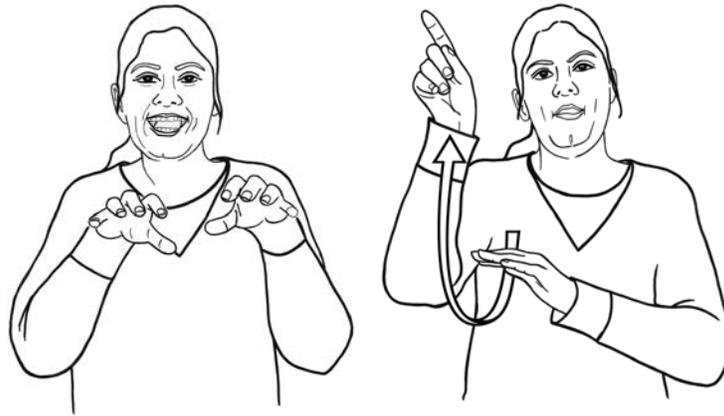
2. Dedicated gestures in an established sign language

Before exploring the emergence of dedicated gestures in Al-Sayyid Bedouin Sign Language, a few examples of their form and function in an established sign language will set the stage. The language is Israeli Sign Language (ISL), used by about 10,000 deaf people in Israel. Interestingly, ISL is about the same age as ABSL, but it has a very different developmental history and consequently differences in structure (Meir et al 2010a). Meir & Sandler (2008) describe ISL as a creole because it arose through contact among signers from many different parts of the world who met regularly in schools, at the deaf association, sporting events, and social clubs and other informal gatherings. The authors demonstrate that the language has developed grammatical structures commonly found in other established sign languages³: e.g., inflectional devices such as verb agreement and temporal aspect marking, complex classifier constructions, lexicalized compounds, as well as phonological and prosodic systems.

We will not survey all of the dedicated gesture types of this language here, as such an exhaustive treatment would take us beyond the scope of the present investigation. Instead, we restrict ourselves to those that will be relevant for the ABSL study.

2.1. *The Hands*

We begin with the articulators most closely associated with sign languages, the hands. Dedicated gestures of the hands represent the words of sign languages. Phonologically, the word (or sign) is created by combining different handshapes, locations, and movements selected from a finite list (Stokoe 1960).⁴ Signs may be one-handed or two-handed, but if two-handed, the hands are not morphologically independent within a lexical sign.⁵ Instead, typically the nondominant hand typically either mirrors the shape and action of the dominant hand, as in DOG in Figure 2a, or it functions as a passive place of articulation, as in ESCAPE in 2b (Battison 1978).



DOG

ESCAPE

Figure 2a. The symmetrical two-handed sign DOG. 2b. The two-handed sign ESCAPE in which the nondominant hand is a place of articulation.

With words come morphological complexities such as compounding, derivation, and inflection. These too are typically articulated through dedicated gestures of the hands. For example, in many sign languages, altering the shape of movement and number of iterations can convey different temporal aspects, and moving the hands between different referential points in space encodes verb agreement. With the exception of compounding, (Meir et al 2010b) we have not found such morphological processes in ABSL, and they are left outside the scope of this article.

Since the hands convey the words in sign languages, these articulators are also important in prosody, manifesting the rhythmic structure of utterances by pausing, remaining static, or reiterating a sign at prosodic constituent boundaries (Nespor & Sandler 1999).

2.2. *The head*

It has long been known that the articulations of sign languages are not restricted to the hands. Nonmanual gestures as well are responsible for encoding a number of different linguistic functions. We start here with the head – its positions and changes of position.

The position of the head (together with particular facial expressions, dealt with in the next section) can be associated with different sentence types and pragmatic meanings. For example, in ASL, the head moves forward for questions and up and back for topics (Liddell 1980) and for conditionals (Reilly et al 1990). In a study of prosody in ISL, Nespor and Sandler (1999) discovered that in that language the position of the head changes at intonational phrase boundaries. A later study showed that the same is true in ASL (Healy et al 2012). Specifically, change of head position helps to mark boundaries between constituents such as topic and comment, the ‘if’ and ‘then’ clause of conditionals, or between temporal adverbial constituents and the rest of the sentence, and

in this way to signal complex sentences. Figure 3 shows a change of head position between the topic and the comment of a sentence meaning [*The little dog that I found last week*] TOPIC [*ran away*] COMMENT.



Figure 3. Different head and body postures at an intonational phrase boundary: [DOG SMALL INDEX I FIND WEEK] [ESCAPE]

2.3. *The face*

Facial expression is a salient and versatile vehicle for expressing emotions and attitudes in all humans. Naturally, deaf people take full advantage of this endowment. But in addition to general emotional/affective facial gestures, the face is responsible for dedicated gestures whose function is akin to that of linguistic intonation in spoken language. Some of these gestures are universal across sign languages. For example, brow raise is apparently universally used for yes/no questions across sign languages (Zeshan 2004). Other facial gestures occur on a language specific basis. An example is squint, which is firmly conventionalized in ISL for information that is shared between the signer and his/her interlocutor, typically appearing on topics and relative clauses (Nespor & Sandler 1999; Dachkovsky 2005; Dachkovsky & Sandler 2009).⁶

In the same ISL sentence mentioned above, the facial expression at the end of the first intonational phrase is simultaneously characterized by raised brows, indicating continuation, and by squint, marking the shared information in the topic, *The little dog that I found last week*. Here we see an example of a complex array, in which each dedicated facial gesture contributes meaning to the whole (Nespor & Sandler 1999; Dachkovsky & Sandler 2009). These systematic gestures perform the same kinds of functions attributed to linguistic intonation in spoken languages (see Ladd 1996). Another indication that these dedicated facial and head gestures are intonational is their timing. In Figure 4 we see a closeup of the facial expression at the end of the first intonational phrase, which, as we saw in Figure 3, changes completely in the next

intonational phrase. Just as the Intonational Phrase boundary is characterized by a change in all facial gestures, this boundary is characterized by salient pitch excursions in spoken language. It is very common for a signer to blink at the Intonational Phrase boundary, much as speakers tend to take a breath at the same boundary (Wilbur 1994 for ASL; Nespor & Sandler 1999 for ISL).

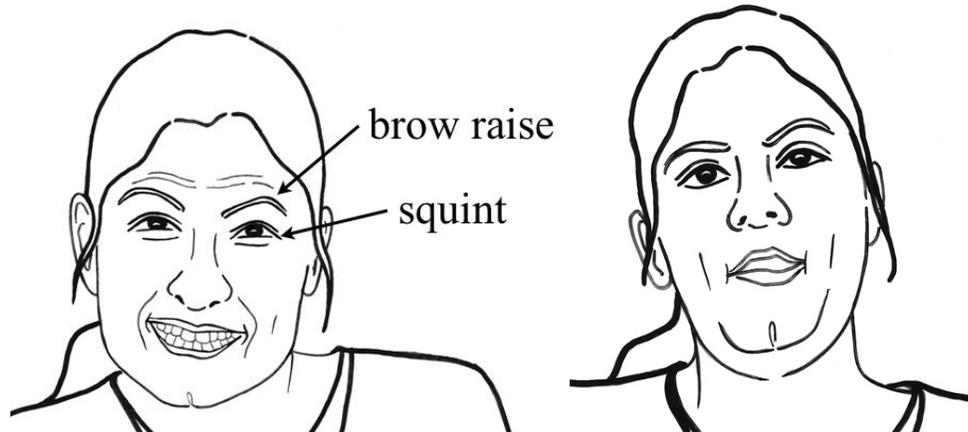


Figure 4. In the first Intonational Phrase, the sentence topic, brow raise signals continuation to the next constituent; squint signals information shared by signer and addressee. The following intonational phrase, the comment, has neutral facial expression.

The lower face produces dedicated gestures of various kinds as well in many sign languages. For example, different mouth configurations characterizing verb phrases convey adverbial or aspectual meanings such as ‘with relaxation and enjoyment’ (in ASL, Liddell 1980) ‘for a long time’ (in ISL, Meir & Sandler 2008), and ‘exactly’ (in British Sign Language, Sutton-Spence & Woll 1999). For an overview of nonmanual markers in sign languages, see Pfau & Quer (2010).

2.4. *The body*

The body also performs linguistic functions in sign languages. In Figure 3 above, we saw that the upper body enhances the intonational phrase boundary by changing its position. Additionally, the whole body can represent different referents in a discourse, for example, by shifting its position for reported speech, as exemplified in American Sign Language in Figure 5. This use of the body is called role shift or referential shift. Lillo-Martin (1995) analyzes this use of the body as logophoric pronouns, and Dudis (2008) incorporates body movement in his body partitioning model.



Figure 5. Change in body and head position for reported speech in the ASL sentence, ‘His wife said, “You’re fine!”’ Reprinted with permission from Sandler & Lillo-Martin 2006

2.5. *Coding prosody*

Many dedicated gestures contribute to prosodic structure, as we have seen. Prosody organizes information by signaling whether a string is interrogative, for example, and whether two propositions are connected, either by coordination or by subordination (see Sandler 2012 for an overview). Figure 6 is a partial coding of prosodic gestures of the hands, head, and body in the ISL ‘little dog’ sentence. The coding in 6 is for prosody only, and includes neither lower level information, such as phonological elements of handshape, location, and movement within signs, nor the persistence of the nondominant hand in the signal for higher level discourse cohesion, discussed below.⁷

We see in Figure 6 that at the major intonational phrase boundary, separating topic from comment, the hands set the rhythm, and gestures of the face, head, and body align themselves with the rhythmically established constituents -- crucially, changing at this major boundary. There is a smaller break (a phonological or intermediate phrase boundary) indicated by the lighter line, signaled by hand rhythm and blink, but the dedicated nonmanual gestures are the same as in the previous phrase – contrary to the configurations at the intonational phrase boundary.

		TOPIC		COMMENT
		[DOG SMALL-OBJ INDEX]	WEEK-AGO I FIND INDEX]	[RUN-AWAY]
Hands	<i>hands hold</i>	—	—	—
	<i>hands repeat</i>	—	—	
	<i>hands slow</i>			
Face	<i>brow raise</i>	—	—	
	<i>brow furrow</i>			
	<i>squint</i>	—	—	
Head	<i>head up</i>		BLINK	BLINK
	<i>head down</i>			
	<i>head forward</i>	—	—	
	<i>head tilt left</i>	—	—	
	<i>head tilt right</i>			—
Body	<i>body tilt</i>	—	—	

↑
Intonational Phrase Break

Figure 6. Prosodic coding of an ISL sentence, ‘The little dog that I found last week ran away.’

2.6. The nondominant hand

As explained in Section 2.1, some signs are two-handed, and in these, the nondominant (usually the nonpreferred) hand functions as a meaningless phonological unit. However, the nondominant hand (H2) can also assume a life of its own (see Crasborn 2011 for a current overview). In complex classifier constructions, each hand may function as a separate morpheme (see note 2). Additionally, H2 can perform a backgrounding function by holding its configuration as a sign or part of a sign in the signing space while the dominant hand completes the stretch of discourse. Liddell (2006) refers to the nondominant hand performing this function as a ‘buoy’. In the ‘little dog’ sentence, the nondominant hand is configured for the sign SMALL and remains in the signing space till the end of the topic constituent. Figure 7 shows the whole ISL sentence, DOG SMALL THAT (=point), WEEK AGO I FIND IT (=point), RUN-AWAY (ESCAPE).

We see that the nondominant hand is held in space to represent the small dog, while the dominant hand produces a pronominal pointing signs toward it.⁸



Figure 7. The ISL sentence, ‘The little dog I found last week ran away.’

In sum, different parts of the body perform dedicated gestures for a multitude of linguistic functions, which the preceding sections have only partially described. A more

complete but still not exhaustive indication of the panoply of dedicated gestures in sign languages is shown in Figure 8.

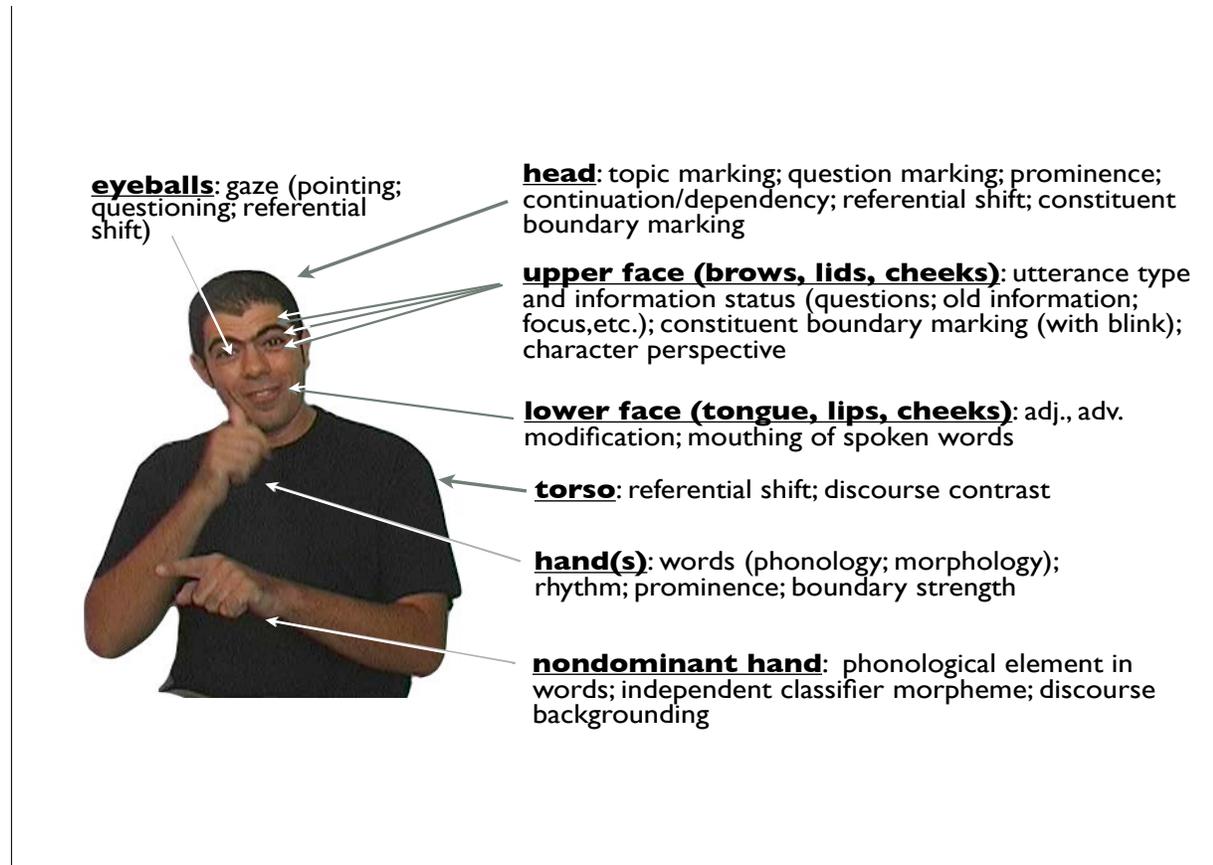


Figure 8. Dedicated gestures of sign languages (not exhaustive).

2.7. Co-sign gesture in established sign languages

The focus on linguistic gesture does not imply that there is no nonlinguistic gesture in established sign languages. As in spoken languages, there are nonlinguistic (or only partly conventionalized) gestures that accompany linguistic signing, either simultaneously with signs (like co-speech gesture), or sequentially interspersed in the sign stream.

An example of the simultaneous kind is mouth gestures. While the hands are busy transmitting the words of sign languages, the mouth performs a function that is not

linguistic, namely, co-sign gestures (Sandler 2009), akin to iconic co-speech gestures (McNeill 1992). These mouth gestures convey physical dimensions, like narrow, flat, or round, and sensations, such as vibrations associated with water spraying through a hose or two masses colliding. They are idiosyncratic and nondiscrete, and, though they augment or complement the linguistic system, they are not systematically integrated into it. Mouth gestures have been observed even in Stratum II signers of ABSL, which tells us how basic hand and mouth interaction are in human communication.

In addition, signers sometimes intersperse in their signing ordinary gestures used by the general community, like hands outward, palms up for ‘I don’t know/what to do’ (Emmorey 1999). In fact, young signers, like speakers, benefit from manual gestures when learning math (Goldin-Meadow et al 2012). But since these are not dedicated gestures, we will have no more to say about them here.

3. Al-Sayyid Bedouin Sign Language: language background and source of data for this study

The Al-Sayyid village originated about 200 years ago, when a man migrated from Egypt to a spot in the Negev desert of present-day Israel and set up his tent. The group is now in its seventh generation and contains about 4,000 members, all of whom reside together in a single community exclusive of others. Consanguineous marriage has been the norm in the group since its third generation. Such marriage patterns are common in the area and led to very strong group-internal bonds and group external exclusion. Within the past three generations, about 150 individuals with congenital deafness have been born into the community, all of them descendants of two of the founder’s five sons (Scott et al 1995). There is no stigma against signing in the Al Sayyid Village, and all villagers sign with varying degrees of expertise, depending mainly upon whether they have close family members who are deaf. Deaf people are integrated into village life, and all marry, almost always marrying hearing a person.

Four children born into a single household in the 1930s were the first deaf people in Al-Sayyid. Together with their hearing family members, who reportedly were eager to communicate with them gesturally, they were the originators of ABSL. All signers of what I am calling stratum I (four siblings) are deceased, and the study of the language of that stratum, is based on the only extant videotape of one of them telling a story.

Strata two and three have been studied most widely by our group, which has analyzed the language of several signers from different perspectives in each of these two strata. Technically, strata two and three are comprised of second generation ABSL signers. However, they are more like two different generations because of the large age difference between the two groups (20 years) and because of the nature of the input and amount and types of interaction that characterizes each, described in more detail in Section 4.3.

We are now beginning to investigate stratum IV, people under age 25, and the present analysis of Stratum IV is based mainly on one of them. What is important here is that his innovations are conventionalized for him (typically more than one example of each innovation appears in a single 7-minute narrative), and that they are not found in earlier strata. The group is much larger than the others, numbering about 100 young signers. They have all been to school in special classes for deaf children, some of the older ones in the Jewish sector and the rest in the Arab/Bedouin sector. In both sectors, teachers use signs from ISL. However, they rarely know ISL well and cannot be considered a model for that language. Instead, the teachers speak either Hebrew or Arabic to the children, and typically accompany their speech with signs. Since the word order and grammar of ISL differ radically from those of Hebrew or Arabic, it is not possible to sign real ISL while speaking those languages, and instead a kind of Signed Hebrew or Signed Arabic is the norm for teachers. Some of the boys were sent as teenagers to a residential vocational school for deaf children (now closed down), where they were exposed to real ISL, and some of the teenaged girls have attended meetings of a social group set up for Bedouin girls by the Institute for the Advancement of Deaf Persons, where ISL is used by those implementing the program. Vocabulary items from ISL have thus entered the language of this stratum (with a characteristic ‘accent’). However, this exposure was after the critical period for language acquisition, and analyses of narratives have so far not found evidence that ISL grammar has affected their ABSL. For example, phenomena such as verb agreement and classifier constructions, so common in ISL, do not characterize their signing, nor do certain language-specific aspects of intonation that are well documented in the sign language of the ambient community.

All signers in the present study are deaf. All of our data were collected under conditions in which the signer signs to another deaf ABSL signer, usually of the same stratum. The data for this study consist of conversations, narratives and narrative segments, and were not elicited in a targeted way. No census of the deaf population has been undertaken in the village, and numbers of signers in each stratum reported here are estimates. More details will be provided about the data on which the present study is based in Section 4.

4. The emergence of structure

The subsections that follow partially characterize the language across strata of ABSL signers. Space does not permit an exhaustive description, but references to other studies of our team are interspersed where relevant. Here, I will show how recruiting each additional part of the body adds complexity in linguistic structure from one stratum to the next, liberating the body in the service of language.

4.1. Stratum I: The hands create dedicated gestures

Someone in Al-Sayyid had the good presence of mind to videotape one of the first four signers of ABSL when he was in his late 60s, telling a story from the history of the tribe to a group of hearing villagers in a tent. This is the only record of the first appearance of the language. The man’s son, today the principal of a school in the village, gave us some

background and helped to translate the story, first with a voiceover in Hebrew, and then by working with me on a sign by sign gloss.

It is a story about a blood feud, imparted to the man by his father. It is clear from watching the narrative that it is not an instance of rote memorization, that the signer is recreating the story in his own natural language.

Figure 9 presents a segment of the story. In the gloss, on the left, words joined by hyphens are conveyed by a single sign. Each new line is a new utterance, and the utterances are separated by pauses. Bold underlined glosses represent a pantomimed form, to be defined in Section 4.2. On the right is a translation. Words in italics and parentheses are not present in the narrative; they are filled in to tie the signs together.

<u>Gloss</u>	<u>Translation</u>
TAKE-OFF	
RUN	
RUN	‘(The man from Al-Sayyid) took off at a gallop.
SWORD	Sword and gun (<i>were at the ready</i>).
GUN	<i>(Someone)</i> struck with a sword.
<u>STRIKE</u>	<i>(He)</i> blocked with his gun.
GUN <u>BLOCK</u>	<i>(He got)</i> hit.
HIT	<i>(He)</i> fired, fired.
SHOOT	The horse fell down.
SHOOT	An eye fell out.
HORSE FALL	<i>(He)</i> waved a cloth (<i>for reinforcement</i>).’
EYE FALL-OUT	
<u>CLOTH WAVE</u>	

Figure 9. Segment of narrative of Stratum I signer

In this stratum, only the hands implement dedicated gestures, conveying the most central element in language, the word. Since most propositions consist of only one word, it is not useful to talk about constituents here. However, the propositions are separated by marked pauses, during which the hands relax down and often drop out of the signing space.

The rest of the body is sometimes engaged, but not linguistically. This is pantomime, defined here as an expression in which the hands signify the hands and the body signifies the body in an event being depicted. A good example of the difference between pantomime and a dedicated gesture, taken from this narrative, is shown in Figure 10, in which ‘strike’ is pantomime and HIT is a sign. Like the other signs in this narrative – RUN, HORSE, etc. -- HIT is still part of current ABSL vocabulary. At Stratum I, then,

the two hands function as a unit to produce words, and the rest of the body is not yet liberated for language.



‘strike’



HIT

Figure 10. Stratum I Pantomime, ‘strike’; and dedicated gesture, the sign HIT.

The language of Stratum I is simple in structure. This simplicity contrasts strikingly with the complex concepts in the mind of the signer. The most complex utterance in the narrative occurs later story. Someone from the other feuding tribe is encouraged to participate in a *sulha* – a traditional mediation process for dispute resolution– but he refuses. He says, TENT ROLL-UP ALL ROLL-UP GO-OFF // SULHA, where the double slash indicates an intonation break conveyed by a pause. The string is translated as, ‘(Only) when all Al-Sayyid roll up their tents and move off the land, then we’ll have a *sulha*.’ Like many other parts of the story, this string can only be understood if one knows the context well, as does the man’s son, who provided the translation. The complex nature of this utterance may be gleaned from the fact that there is a pause between the constituents and a raising of the head before the sign SULHA and lowering of the head during the sign, apparently lending emphasis to the word. Such prosodic markers are rare in his signing, which typically does not include dedicated head movement. But the seeds have been planted.

4.2. *Stratum II: Dedicated gestures of the hands and head*

There are about 20 signers in Stratum II, who are about 50-65 years old. No deaf education programs were available to them in their childhood, and they are consequently illiterate. Most of our research has focused on Stratum II signers who grew up with several deaf siblings. The examples provided here are from a narrative by a woman with three deaf siblings, two older and one younger.

Like the Stratum I signer, Stratum II signers mix signs with pantomime. However, the language is richer and more complex. Instances of reported speech are introduced by naming the speaker, e.g., MOTHER NO, meaning, “My mother said, ‘No’”. There are also more coordinated propositions, indicated by head bobs, with longer pauses at the end of coordinated structures than between the coordinated elements.

For example, a woman, D, describes her dismay when, after her wedding, she came back to the rough, one-room tin hut that was to be her home. A segment of her narrative is shown in Figure 11. As in Figure 8, each line in the gloss represents a separate intonational phrase, separated by pauses. The last element is a pantomime, illustrated in Figure 12.

Gloss	Translation
I COME-BACK THERE TIN HUT TIN HUT LOOK THERE NO ONE HOUSE FLOOR SO-SO WEEDS-COME-UP I PULL-OVER-COVER-BODY	I came back, there (<i>pointing to the current bedroom which was the whole house at the time</i>). A tin hut. A tin hut. I looked in (<i>and thought</i>), ‘No!’ A one-room house, with a rough floor and weeds coming through. I covered myself (<i>with my coat</i>).

Figure 11. String from a Stratum II narrative.

Forward head bobs or leans separate coordinated constituents, such as lists of actions. Occasionally, the same kind of head movement separates adverbial phrases from the rest of the proposition, making the head bob found rarely and erratically in Stratum I more systematic in the slightly longer and more connected utterances of Stratum II. For example, in the same wedding story, D tells about running away for several days before her wedding. She uses an affective facial expression to indicate extreme darkness for ‘...in the wee hours of the night’ and a head nod at the end of the phrase before going on to sign ‘I went away...’ The segment is shown in Figure 14, and the head postures on either side of the intonational phrase illustrated in Figure 15. Single slash marks in the gloss indicate less salient prosodic breaks, and double marks more salient breaks, where greater salience is signaled by a longer pause and a change in head position.

<p>THREE DAYS // TIME 3 NIGHT / MORNING // I GO-OFF// FOUR DAYS STAY FOUR DAYS FOUR / COME-BACK...</p>	<p>‘Three days (<i>later</i>), at 3:00 in the middle of the night, I went away. I stayed for four days (<i>then</i>) came back...’</p>
--	--

Figure 14. Narrative string from Stratum II with an adverbial phrase meaning ‘Three days later, at 3:00 in the morning’ separated by a pause and head bob from the main clause, ‘I went away.’



Figure 15. Different head positions in adverbial phrase ‘At 3:00 in the morning’, and main clause, ‘I went away.’

In the coding of this sentence in Figure 16, we can see the beginnings of synchronization of dedicated gestures to delineate constituent boundaries. On THREE in DAY THREE ('three days later'), the hands are held static and the head moves down and forward, changing to an upward position for the next constituent beginning with TIME. This is a prosodic constituent boundary for the first adverbial phrase. Between MORNING in TIME THREE NIGHT MORNING ('At three o'clock in the middle of the night') and I GO-OFF, there are a blink and changes in facial expression (though affective) and in head position, separating the complex adverbial phrase from the main clause. The hands do not produce a rhythmic change, expected at a prosodic boundary, since the full prosodic system is still in the process of self organizing in this stratum. But the impression of a boundary after MORNING is conveyed by the synchronization of facial expression, head movement, and blink. For this signer, the body often accompanies the head in the bobbing motion, and this can be discerned in the illustration (Figure 15). However, the body is not independent of the head, and body movement does not function as a dedicated gesture.

		DAY THREE	TIME THREE NIGHT	MORNING	I GO-OFF
Hands	<i>hands hold</i>	—	—		—
	<i>hands slow</i>		—		
Face	<i>affective</i>		—	—	
Head	<i>head up</i>		—		—
	<i>head down</i>	—			—
	<i>head forward</i>	—	—	—	
	<i>head tilt</i>		—		
				BLINK	

Figure 16. Dedicated gestures of the head in partial coding of gestures of D, Stratum II.

The signer then goes on to tell about her return to home and normalcy by listing all the household chores she embraced right away, KNEAD, MAKE-BREAD, CHICKENS, MEAT BRING, SHEEP MILK, GO-OUT, COME-BACK, COWS, SHEEP, CHURN,

MILK, MAKE-BREAD, GRIND-WHEAT, ALL. GOOD. 'I kneaded the dough, made bread, tended the chickens, milked the sheep, took them out to graze and back, cared for the cows, the sheep, churned cheese, milked the animals, made bread, ground the wheat, and everything else. It was good.' Each comma in the gloss stands for a head bob on the word before it with only minimal pause, in effect listing or chaining the events together in a single discourse unit. The head has been added to the hands as an articulator of dedicated gestures.

Despite the apparently limited grammatical structure available to Stratum II, ABSL signers of this stratum have no trouble conversing in real time, with no apparent interpretation difficulties, about matters as abstract and complex as folk remedies no longer in use, wedding arrangements, employment, social security, married life, deafness, and language, in addition to practical everyday matters.

4.3. Stratum III: Dedicated gestures of the face and the head aligned with those of the hands

The people in Stratum III are in their late twenties and early thirties and are about 15-20 in number. It is likely, and, in some cases, confirmed, that Stratum III signers had the language of Stratum II as input from earliest childhood, sometimes within the same household. Unlike the deaf people in Stratum II, signers of Stratum III have benefited from schooling in a deaf education setting, where they were exposed to Hebrew and to signs from Israeli Sign Language, but apparently had little if any exposure to the grammar of ISL. At least as important from a sociolinguistic point of view is the fact that they had more interlocutors. They interact with both Stratum II signers and other members of Stratum III, and, as explained, with many hearing villagers of all ages as well. As a result of increased interaction, the language has matured.

In Stratum III, dedicated gestures begin to be coordinated and to structure and organize the discourse systematically. The rhythm of the hands and the positioning of the head are more controlled. A big difference between Strata II and II is the use of the face for dedicated gesture. We see brow raise together with eye contact and forward head position at the end of dependent clauses, aligned temporally with phrase final lengthening and changing at the boundary before the dependent clause. Figure 17 illustrates signs on either side of a conditional sentence meaning, 'If he says 'no', there's nothing I can do.'



Figure 17. Head and face used intonationally for conditional sentence prosody, Stratum III.

In a study of short narrative stretches signed by two Stratum II signers and two Stratum III signers (Sandler et al 2011a), we found that Stratum III signers consistently synchronize hand, head, and face gestures to mark dependency relations between constituents. Stratum II signers rarely indicate dependency and use fewer synchronized gestures. While Stratum III uses conventionalized facial expressions for intonation in ways that are comparable (but not identical) to ISL shown in Figure 4 and illustrated for ABSL in Figure 17, Stratum II signers used only affective facial expression.

By Stratum III, ABSL signers have conventionalized and gained control of the timing of dedicated gestures of the hand and the use of dedicated gestures of the head that were beginning to take form in Stratum II, and have added dedicated gestures of the face. This enables them to convey dependency between clauses in a sentence through prosody, and to give structure to larger stretches of discourse, as we will see.

We now turn to a narrative of Stratum III signer N. She is the sister of Stratum II signer D, and about 20 years her junior. N has two other deaf siblings older than D, and several older hearing siblings who also sign very fluently. The sequence shown in Figure 18 is the story of a dream told to N by the second wife of N's husband (N is the third wife).

Gloss	Translation
WIFE TWO SHE COME YOU COME- THERE TELL // SHE TELL // WIFE SHE SHORT / SHE SLEEP // SHE NIGHT SLEEP // DREAM // SHE DREAM // DREAM // FATHER YOU(R) / THERE // LOOK-AT HER // FATHER SAY “WHY SHE LONG-TIME SEE NOT-AT-ALL? / WHY?” SHE MORNING REMEMBER // MORNING / SHE SIT THINK // [PREGNANT SHE // SHE SHORT WIFE PREGNANT // SHE COME-TO-YOU PREGNANT?] // SHE UH HUH // SHE GIVE-BIRTH...	‘The second wife came to you(<i>r house</i>), she told me. The short wife, she slept; at night she slept. She dreamed; she had a dream. She dreamed that your father looked at her and said, ‘Why haven’t we seen her (<i>you</i>) at all for so long, why?’ In the morning she remembered. In the morning, she sat thinking. [She was pregnant. The short wife was (<i>very</i>) pregnant, (<i>remember</i>) she came to you pregnant?] She (<i>thought she could</i>) give birth (<i>any time</i>)

Figure 18. Narrative segment from Stratum III with dedicated gestures signaling reported speech (“ ”) and a parenthetical stretch of signing ([]).

N is retelling the recounting of a dream, an impressive example of displacement, i.e., referring to events that are not of the here and now. However, even Stratum I was capable of this feat, which is far from trivial, and is posited as a basic design feature of human language by Hockett (1960). The difference is in the ability of Stratum III to use language form — dedicated gestures -- in order to structure the discourse in a sophisticated way. In the segment shown in Figure 18, N adopts character perspective for reported speech, changing her facial expression, gaze, and head position when quoting the father, similarly to the ASL example in Figure 5 above. The array of dedicated gestures for this example of reported speech is illustrated in Figure 19. For the parenthetical, once again, N recruits a change in head position for the entire stretch, setting it apart from the main thrust of the discourse. In Figure 20 the change to a parenthetical downward head position is illustrated. In the parenthetical, the signer also uses a nose wrinkle, her characteristic signal for shared information.



Figure 19. Dedicated gestures of head and face for reported speech.

>



THINK

PREGNANT

Figure 20. Use of head and face for parenthetical beginning on PREGNANT.

To get a sense of the difference in use and synchronization of dedicated gestures in Strata II and III, compare the coding of the D's tin hut string (Figure 13) with that of a portion of N's dream string in Figure 21 below, which includes a question inside a parenthetical, inside a larger discourse stretch, all signaled by dedicated gestures. Stratum II D's manual and nonmanual gestures do not correspond to linguistic constituents and are not temporally synchronized. There are no dedicated facial gestures, only affective expressions, and some gestures are pantomimic. Stratum III N's production is markedly different.

PARENTHETICAL QUESTION

THINKING [[PREGNANT SHE. SHE SHORT WIFE PREGNANT [SHE VISIT-YOU PREGNANT]]]SHE

Hands	<i>hands hold</i>	—	—	—	—	—
	<i>hands slow</i>					
Face	<i>brow raise</i>				—	
	<i>brow furrow</i>					
	<i>squint</i>		—	—		—
	<i>nose wrinkle</i>		—	—		—
Head	<i>head down</i>		==	==	==	
	<i>head forward</i>			—	—	
	<i>head tilt</i>	—				
	<i>head nod</i>					—

Figure 21. Dedicated gestures signal a question within a parenthetical within a larger discourse stretch in the narrative of N, Stratum III. A double line is used to draw attention to the head gesture (pictured for the sign PREGNANT in Figure 19) characterizing the whole parenthetical constituent.

In Stratum III, we see skillful use of gestures of the hands, head, and face to give structure and richness of expression to sentences and discourse, signaling subordination, reported speech, and parentheticals. Yet some corporeal articulators are not exploited at this stratum, namely, the body and the nondominant hand. Recruiting these articulators for dedicated gesture creates still more layers of linguistic organization in Stratum IV of ABSL.

4.4. Stratum IV: Recruiting the body and the nondominant hand

Our work on Stratum IV is just begun. This is by far the largest stratum, with about 100 deaf signers. As explained in Section 3, they have had more exposure to ISL than other strata, and many ISL vocabulary items have crept into the signing of many signers of this stratum. As also explained, however, while exposure to ISL vocabulary items begins in the first grade, exposure to ISL **grammar** is much less widespread. Where it has occurred it's been in the teen years -- after the critical period for language acquisition -- so that effects on the grammar are less likely than if the exposure had taken place during childhood. We have not at this point found in this stratum evidence of influence from

ISL grammar. Common ISL grammatical structures such as verb agreement, complex classifier constructions, or language-particular facial expressions⁹ have not been identified in our data for this stratum. So, we believe that the language of Stratum IV signers is certainly still ABSL, with influence from ISL most noticeable in the lexicon.

The signer whose narrative forms the basis for this analysis, signer J, is an excellent exemplar of his stratum, partly because he has a deaf mother, four (younger) deaf siblings, and many other deaf family members. In fact, his mother is D, whose language is analyzed in Section 4.2. Neither of his parents understand ISL. In fact, in the narrative analyzed here, in which J's (hearing) father figures prominently, J explicitly mentions that his father doesn't understand ISL. He says, 'If I sign to him FATHER, MOTHER (ISL), he says, 'No, the local language.' Then J goes on to exemplify, 'FATHER, MOTHER (ABSL)'. Only one ISL sign appears in the entire six-minute narrative.

J's language is the ideal object of analysis for Stratum IV for the following reasons: his mother is deaf (unusual, since hereditary deafness is recessive in this population), so he is a native signer in every sense of the word; he has interacted all his life with his parents and four younger deaf siblings in ABSL; he has a large number of contemporaries in his age group with whom he signs regularly; and he has the metalinguistic awareness to distinguish between ABSL and ISL. The findings presented here are based on a comprehensive analysis of the narrative studied. The dedicated gestures and grammatical structures in J's narrative have not yet been compared systematically with those of other signers across the stratum, but that is less important than the question of whether the innovations in his signing have been found in the earlier strata, which have been studied much more extensively by our team. They have not.

Stratum IV signers benefit from a much larger pool of interlocutors in all aspects of life. There are about 40 signers in earlier strata, and 100 in their own, and conversations take place at home, around the village, on the school bus, at school. As a consequence, the grammatical structures that are found in earlier strata are more practiced and conventionalized, and can themselves be used to generate more complexity. For example, J builds on the dedicated gestures of the head and face coordinated with rhythmic structure on the hands that create embedded sentences in Stratum III. In J's story of Stratum IV, we find double embedding. Referential shift is another structure where increased complexity is found in Stratum IV, through exploitation of the same grammatical devices found in Stratum III. J's story includes an example of double referential shift. I describe these examples here before going on to demonstrate the addition of the body and the nondominant hand to the repertoire of articulators recruited for linguistic gesture.

The narrative is the story of J's life, a story in which his father figures prominently. The father sent J to a special school for deaf children in Beer Sheva and later to a residential vocational school for deaf teenagers in a different part of the country, doggedly tried to find employment for J (with success), and urged him to take a hearing wife in order to avoid having deaf children. In the context of marriage, J signs, FATHER ME "MARRY DEAF TWO MARRY, BORN DEAF ALL. NO WAY." The translation is '[My father

said, [[“If you marry a deaf (woman), two (deaf people) marry, [all your children will be deaf]]]. No way.” The conditional sentence with an embedded clause is embedded in reported speech.

Earlier in the story, J tells of his arrival with his father at the vocational school, where he must choose a profession to study. He signs, FATHER YOU MECHANICS YOU? FATHER (*makes speaking gestures with mouth*) HE MECHANICS STUDY HE. PRINCIPAL YOU YES? STAMP DOCUMENT. ‘Father asked me, “Do you want to study mechanics?”’ Father told the principal, “He will study mechanics.”’ The principal asked me, ‘Do you agree?’ and he registered me.’ J faces forward-left and down when quoting his father addressing him, to the right when his father addresses the principal, and forward and down when the principal addresses him. With these three precise head positions changing in rapid succession, illustrated in Figure 22, manifesting double referential shift, the exchange is clear and easy to interpret.

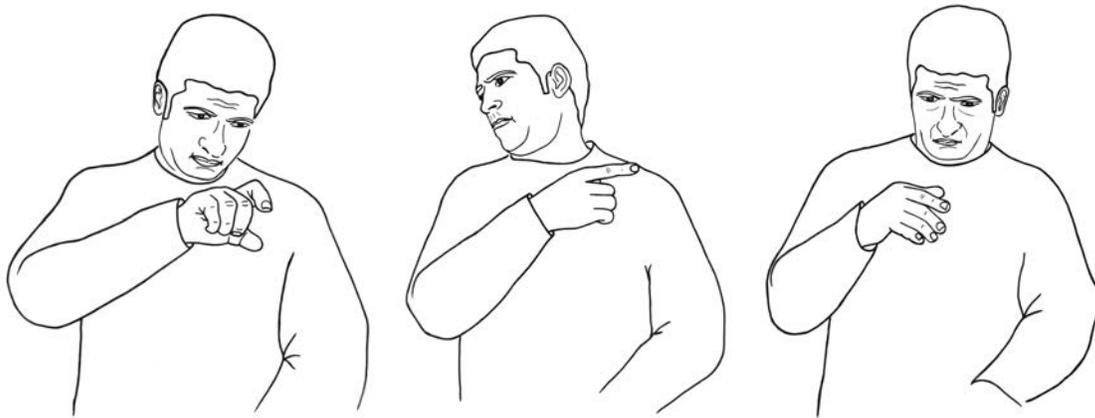


Figure 22. Three head positions for reported speech in one discourse segment. ‘Father asked me, “Do you want to study mechanics?”’ Father told the principal, “He will study mechanics.”’ The principal asked me, ‘Do you agree?’

With the liberation of two more articulatory elements, the body itself and the nondominant hand, Stratum IV’s language becomes still more complex.

4.4.1. The body. Toward the end of the story, J explains that he and his father have switched roles. He says, ‘When I was small, my father took care of me. Now I’m big and our roles are reversed. I’m big; he’s small and old. I take care of him, not the opposite’, shown in 23.

Gloss	Translation
ME PAST SMALL// FATHER <u>TAKE-CARE-OF-ME</u> // GROW UP REVERSE// I BIG, HE SMALL OLD// I <u>TAKE-CARE-OF-HIM</u> // NOT OPPOSITE	When I was small, my father took care of me. Now I'm grown up and it's the reverse. I'm big; he's small and old. I take care of him. Not the other way around.

Figure 23. String of signing of Stratum IV signer. Different referents signaled by different body positions for the signs underlined in the gloss.

The innovation here incorporates the body – more precisely the torso -- of the signer, which changes its position for each referent, the father and the son. In so doing, J signals the agent and patient of the verb TAKE-CARE-OF. The forms are illustrated in Figure 24.

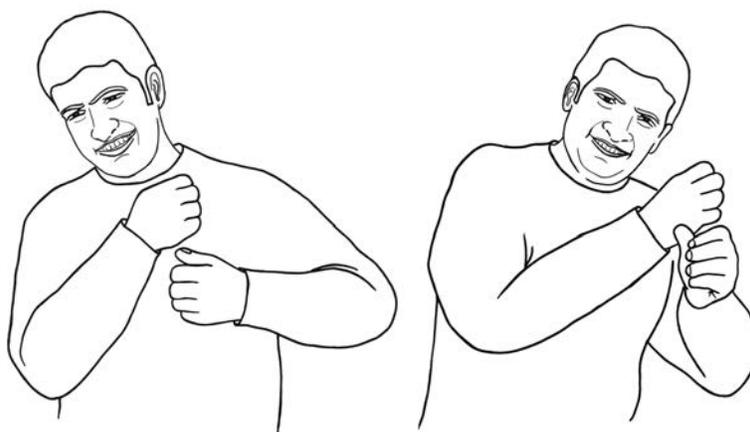


Figure 24. Different body positions for different referents: ‘He took care of me, I take care of him’.

This use of the body is not pantomime, roughly defined above as a form in which the hands are the hands and the body is the body, imitating an action. Here, the sign TAKE-CARE-OF -- a stacked, two-handed sign with closing finger movement a path movement toward the object -- is a symbol, and not an enactment. The signer, facing and making eye contact with the addressee, is narrating; he is not assuming the role of different characters. Instead, the forms of TAKE-CARE-OF behave like a sign with body involvement designating subject and object.

It is possible that dedicated gestures of the body of this sort are a precursor to the kind of verb agreement commonly found in established sign languages. Verb agreement for verbs of transfer is expressed in a large number of sign languages by moving the hands

from a locus that represents the subject to a locus that represents the object (Padden 1988). Our team conducted a study designed to elicit these structures in ABSL, and we were surprised to discover that the language does not encode agreement (Aronoff et al 2004).

However, a deterministic view is ill advised. I do not wish to make specific predictions about how ABSL's grammatical roots – which we have found at every level of structure – will grow and develop. Even in sign languages with verb agreement, the device can take different forms, and, of course, different sign languages have different grammatical processes. Two things are clear: body shift of the kind produced by J constitutes a phenomenon not observed in other strata, and it adds grammatical complexity to ABSL formally, by denoting different referents via dedicated gesture.

4.4.2. The nondominant hand.

It may come as a surprise to learn that the two hands are not independent in lexical signs. As explained in Section 2.6, the nondominant (typically the nonpreferred) hand instead either mirrors the dominant hand in configuration, location, and movement, or it assumes an unmarked handshape and serves as a place of articulation (Battison 1978). It is largely redundant, and is often deleted in a process that has been called 'weak drop' (Padden & Perlmutter 1987). In a special type of structure called classifier constructions, the two hands each manifest a separate morpheme (see note 3). These are constructions in which each hand may be configured to represent a class of referents, such as humans or flat objects, which in turn combine simultaneously with motions and locations, each of which is a meaning-bearing morpheme (Supalla 1986). Classifier constructions of this kind have not been found in ABSL. In the first three strata, the nondominant hand performs only the function of a phonological element of the kind illustrated for ISL in Figures 2a,b above.

In J's Stratum IV narrative, the nondominant hand is liberated from the dominant hand and the rest of the body to perform two different kinds of dedicated gesture. One provides contrast at the level of discourse by alternating hands in a signing stretch so that each hand refers to a different referent. The other holds background information present in the signing space throughout a stretch of discourse.

4.4.2.1. Two hands, two referents

In the segment of J's narrative in which he talks about how he and his father have reversed roles, he uses his dominant hand to refer to himself and his nondominant hand to refer to his father, signing 'He's small' with the dominant hand and 'I'm big' with the nondominant hand.

The use of two hands in this way helps to structure the discourse formally by allowing each articulator to sign independently in a different part of the signing space to refer to

different referents. It is a structural device available to sign languages but not to spoken languages. However, availability alone does not a grammar make. The emergence of language exploits the affordances of its modality, but grammar takes time to develop.

4.4.2.2. *The nondominant hand for backgrounding*

In the previous section, the role of the nondominant hand was to sign independently about a different referent from the one being ‘talked about’ by the dominant hand. This sort of discourse device is by and large sequential: first one hand signs and then the other. But the physiological independence of the two hands makes it possible for each to act independently at the same time, and that is what occurs in backgrounding.

One instance of backgrounding occurs when J tells of his return home from vocational school with a graduation certificate. His father looks at the certificate and congratulates J at length. Throughout the reported speech discourse segment (Figure 25), the nondominant hand is configured flat, with the fingers together and extended and the palm facing the signer, representing the graduation certificate. It is held out in front of the signer throughout the stretch of discourse, signed by the dominant hand.

Gloss	Translation
<p>DIPLOMA FINISH. FATHER “GOOD, THIS DIPLOMA EXCELLENT, GOOD, YOU DEAF, GOOD-FOR-YOU. ALL HEARING WORTHLESS. YOU GOOD THIS, GREAT, WELL DONE.”</p>	<p>“You graduated.” Father said, “Good, you got a diploma. Excellent, good. You are deaf, good for you. All these hearing people around here, they’re worthless. You did well with this, great, well done.”</p>

Figure 25. Stretch of discourse with the nondominant held in the configuration of the graduation certificate, for backgrounding, its scope over the whole discourse stretch indicated with a vertical line.

Earlier in the discourse, dedicated gestures of the face, head, and nondominant hand produced a particularly complex structure, one that includes a temporal expression, a parenthetical and backgrounding. J tells of his arrival at vocational school. He enumerates on the fingers of the nondominant hand the various professions from which he can choose, naming them with the dominant hand: cooking, mechanics, welding, computers. When he gets to welding, he says parenthetically that he was familiar with that profession because his father had been a welder a long time ago, and that J didn’t want that. He then returns to name the fourth profession, computers. Then the nondominant hand drops out of the signing space when J says that he chose mechanics. The discourse stretch is shown in Figure 26. Throughout, the nondominant hand is present. J bends a finger down (starting with the pinky) for each new occupation, and when he gives parenthetical information about welding, the third occupation, he leaves

the hand in the signing space with the first three fingers bent down. This moment is illustrated in Figure 26. Here all major bodily articulators participate in gestures dedicated for linguistic organization and structure. The dominant hand signs LONG-AGO; the head is tilted signaling the parenthetical stretch; the eyes are squinted, conventionally signaling distant past in ABSL; and the nondominant hand is keeping the third profession (welding) in the discourse throughout the parenthetical segment.

Gloss	Translation
<p>ONE COOKING TWO MECHANICS THREE WELDING [I LONG-AGO I SMALL FATHER ME HE WELD REMEMBER WELL NOT, REJECT] FOUR COMPUTERS ALL PROFESSIONS</p> <p>ME MECHANICS.</p>	<p>One, cooking, two, mechanics, three, welding. [Long ago, when I was small, my father was a welder. I remembered it well and didn't want that, not welding.] Four, computers, all the professions. I wanted mechanics.</p>

Figure 26. Stretch of signing with dedicated gestures to convey a temporal expression, parenthetical, and backgrounding. The scope of the backgrounding by the nondominant hand is indicated with a vertical line.

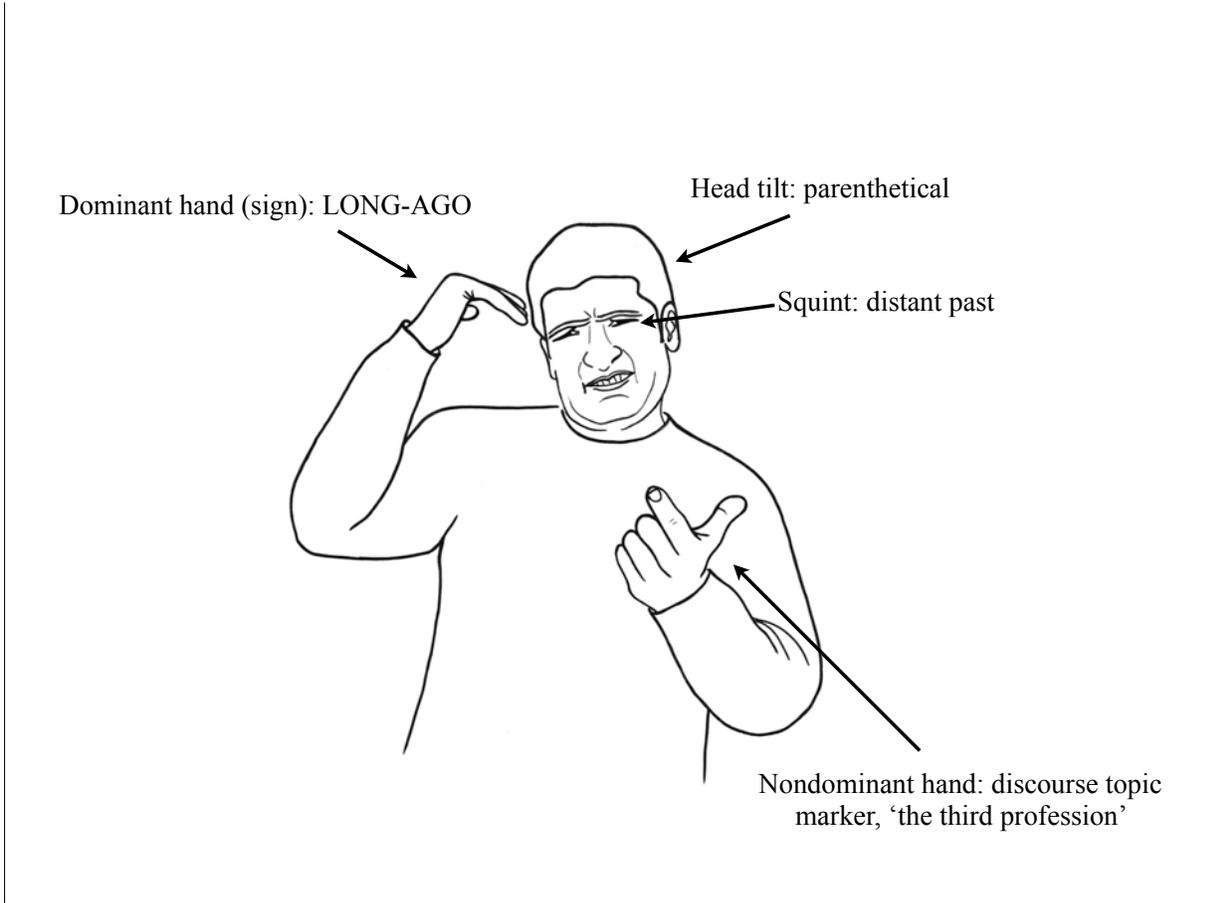


Figure 27. Simultaneous designated gestures of the dominant hand, head, face, and nondominant hand in Stratum IV.

This complexity of gesture and grammar is in stark contrast with the limited possibilities of Stratum I, in which only the hands produce dedicated gestures, as illustrated in Figure 10 above. Stratum I exploits only the two hands acting together to convey concepts. The rest of the body has not been engaged by grammar, and participates in communication only through pantomime. By Stratum IV, the head, face, body, and nondominant hand are released from whole-body conglomerate in the service of language. The emergence of body/grammar coordination is not immediate, but gradual, forged through increased communicative contact across larger and larger groups of interlocutors. This gradual materialization of bodily gesture and linguistic structure is charted in Table 1, repeated here for convenience.

DESIGNATED GESTURES FIGURES

Stratum	HANDS	HEAD	FACE	BODY	NONDOMINANT HAND
I	X				
II	X	X			
III	X	X	X		
IV	X	X	X	X	X

Stratum	WORDS	COMPLEX SENTENCES	DISCOURSE REFERENCE/COHESION
S I	Signs		
S II	Signs	- Unsystematic clause linking	
S III	Signs	- Complex sentences - Embedding	- Illocutionary force - Parentheticals - Referential shift
S IV	Signs	- Complex sentences - Two degrees of embedding	- Illocutionary force - Parentheticals - Double Referential shift - Contrasting two referents in a discourse - Backgrounding

Table 1. Increase in dedicated gestures and grammatical complexity across four strata of ABSL signers.

5. Conclusion

ABSL offers us a rare opportunity to observe in real time the ways in which language structure and language form come to find each other. In the process, it uncovers essential properties of language in general.

Tracing the emergence of grammatical structure in this young sign language reveals a critical role for the transmission system in grammatical form, a role that is quite different from what is often assumed. In current generative grammar models, the system that transmits language – so-called ‘externalization’ -- is thought of as secondary (e.g., Chomsky 2006), distant from the grammatical core. And, like spoken languages, sign languages have a meaningless level of structure alongside the meaningful words and sentences.¹⁰ However, as shown in Figures 8 and 27, gestures of the articulators also

shape higher levels of grammatical structure directly. This raises the possibility that the physical transmission system of the oral modality as well may shape some aspects of grammar. Linearity at all levels of structure -- seen most clearly when contrasted with the simultaneous layering of sign languages -- is an example.

The complex simultaneous layering characteristic of sign languages does not emerge overnight. Language form in sign language begins with the hands. Figure 8 shows that we should not take this for granted, since every visible articulator is recruited for linguistic structure in established sign languages. Why the hands then? Two possible explanations come to mind. First, the hands have far more degrees of freedom than other articulators, making them versatile enough to convey a large number of lexical items. Second, they facilitate iconicity -- both by assuming the forms of objects, and through mimicking actual actions of humans in the world. It may be that dedicated gestures of the rest of the articulators come later because they are not iconic in any strict sense, so that the relation between their actions and the meanings or structures that they represent is more abstract.

That the nondominant hand is not liberated until Stratum IV is especially interesting because it is unexpected. Even co-speech gesture allows such independence (Enfield 2009). Here use of the term 'liberated' may be most appropriate. Unlike gesture, sign languages exploit the hands as meaningless phonological elements (Stokoe 1960), as explained briefly in Section 2.1. It is reasonable to propose that a certain degree of automaticity in sign formation had to be reached before the two hands could be exploited independently. Variation and irregularity in sign formation across the ABSL community suggest that the language has not achieved such automaticity, which is only beginning to be observed in Stratum IV (Sandler et al 2011b). At that point, the nondominant hand is largely redundant phonologically, and the two hands can independently encode linguistic gestures.

The development of ASBSL charted here shows how complexity develops: as the use of an articulator is dedicated for linguistic gesture in one stratum, its use is extended to create more complexity in the next stratum. For example, Stratum III has conventionalized dedicated gestures of the head and face to signal embedded sentences, and by Stratum IV, use of the same gestures is extended to create double embedding.

While the articulator by articulator emergence of linguistic structure in ABSL is surprising in a sign language, the course of its emergence may have still more surprising implications for our understanding of language in general.

A body of linguistics literature argues that sign languages are much like spoken languages in organization and structure, despite the different modalities (e.g., Klima & Bellugi 1989; Sandler & Lillo-Martin 2006). Like Kendon, cited in the introduction, many believe that sign languages rapidly develop into a system that is very similar to that of spoken languages. Research charting the development of Nicaraguan Sign Language (e.g., Senghas 1995; Kegl et al 1999), which arose in a school beginning in the late 1970s, has convinced some linguists, such as Steven Pinker, that the language was

“created in one leap when the younger children were exposed to the pidgin signing of the older children...” (Pinker 1994:36). This is not surprising if, as Chomsky believes, “...language evolved, and is designed, primarily as an instrument of thought, with externalization a secondary process.” (Chomsky 2006: 22). The grammatical structure is somehow ‘there’, just waiting to be expressed. Bickerton’s Language Bioprogram Hypothesis (1984) based on creoles is compatible with this way of looking at language.

Our work on ABSL, of which the present study is a part, suggests that those of us who contributed to this general picture may have overstated our case. The findings presented here show that the emergence of grammatical form is gradual and not abrupt, that language can be fully functional yet not grammatically complex. The complexity of the message, even in Stratum I, compared with the simplicity of linguistic structure, suggests that we must disentangle the two. The grammatical complexity of familiar languages, all very old, can be misleading -- complex thought is possible with simple language. As Newport and Singleton (2004) found in their study of Simon, a deaf child who regularized imperfect input from deaf parents who were late learners of American Sign Language, complex structure is derived from less structured input, and not somehow predetermined by the structure of thought.

Apart from basic word order regularities (Sandler et al 2005; Padden et al 2009), the language lacks overt syntactic cues. There are no complementizers and no function words except for two negators. And apart from compounding, whose tendencies toward regularity are slowly beginning to emerge (Meir et al 2010b), there is no morphological complexity – no agreement, no case marking or other inflections. And yet, the language works and is fully functional for its users. The types of grammatical structuring that accumulate stratum by stratum tell us what a language needs in order to work.

As we have seen, complexity increases with each stratum: The very beginnings of new dedicated gestures appear in one stratum and become systematic in the next. The nature of the complexity that is first to develop, that is most important in order for language to work, is related to the organization of information in discourse: intonational cues to sentence type and relations between propositions, signals for parenthetical information, signals for backgrounding, which keeps information in the discourse space for as long as it is relevant. That discourse structuring precedes overt syntactic structure in a new language would come as no surprise to those researchers of spoken languages who have claimed that discourse is prior to or the basis for syntax, e.g., Sankoff & Brown (1976), Givón (1979), and Hopper (1987).

ABSL allows us to see that even the cognitive ability for complex thought, the affordances of the human body, and the potential for iconically enacting events do not yield linguistic complexity immediately. Instead, the body organizes grammar gradually. In this new language we directly observe incremental accumulation of linguistic structure through activation of the many visible articulators of the body, one by one.

¹ A current overview of phonology in sign language appears in Sandler (2012).

² One might say that a gesture of an oral articulator, such as tongue height, also has a linguistic function, by distinguishing words from one another, e.g., *beet*, *bat*. What is unique to sign languages is the use of directly visible gestures to mark linguistic functions at all levels of structure, not only in phonology (see e.g., Sandler 2012), but in morphology, syntax, semantics, and prosody.

³ See Aronoff et al (2005) for a discussion of similarities across sign language grammars.

⁴ I am using ‘the sign’ and ‘the word’ interchangeably here, but note that some researchers label classifier constructions as signs as well, although the latter structures may be better understood as belonging to a higher level of structure than the word. See note 3.

⁵ In classifier constructions of ISL, as in ASL (Supalla 1986; Emmorey 2003), each hand may articulate a separate morpheme. It has been argued that these structures are not lexical words, but are formed postlexically by combining morphemes manifested by handshapes, locations, and movements (Sandler & Lillo-Martin 2006).

⁶ A comparative study of ISL and ASL facial intonation revealed that certain facial gestures, such as squint and brow raise, occur in both languages, but with different distribution (Healy et al 2012).

⁷ Coding of prosody is often done using ELAN software, which aligns the coding tiers with the time code of the video, rendering precise measurements. Here a more idealized and impressionistic version of the alignment is presented to make comparison between Strata II and III more accessible.

⁸ This example of using the nondominant hand for backgrounding is somewhat atypical, since the nondominant hand here is part of a sign meaning SMALL, and is not interpretable as a morpheme in its own right. Perhaps it is because SMALL is a symmetrical sign in which the nondominant hand is specified for exactly the same shape and location as the dominant hand that it can function to background the small dog here. The ABSL examples of Stratum IV shown in section 4.4.2.2. are more typical as buoys.

⁹ The squint exemplified in Figure 7 is used very systematically in ISL in a way that is typical of this language and not, for example, of ASL (see Healy et al 2012). In ISL, it signifies information that is shared by both interlocutors but is not readily accessible in the discourse (Dachkovsky 2005, Dachkovsky & Sandler 2009).

¹⁰ See Sandler (2012b) for a recent overview of phonology in sign languages. References

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