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Dedicated gestures and the emergence of sign language

Wendy Sandler

University of Haifa, Israel

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 in signers of four age groups or strata reveals that recruitment of gesture for language is a gradual process. Starting with only the hands in Stratum I, each additional articulator is recruited 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 the emergence of linguistic complexity in human language generally.

Keywords: sign language, Al-Sayyid Bedouin Sign Language, language emergence, language complexity, prosody, gesture

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, with Klima and Bellugi's (1979) overview of research at the Salk Institute constituting a major landmark, 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 (see Sandler & Lillo-Martin, 2006). A wealth of research on the explicitly linguistic patterning of sign languages has led to deep understanding of the nature of sign language and of language generally (see Pfau, Steinbach, & Woll, 2012). This body of work led to a sea change in the attitude toward sign languages in the scientific community.

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 they are passed down 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 established sign languages, linguists have demonstrated many structural similarities between them and spoken languages at most levels of structure — phonology, prosody, morphology, and syntax.

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, Meir, Padden, & Aronoff, 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 (see Kendon, 2008, for a discussion of the historical development of these issues).

The present study takes an approach that would have been anathema to many earlier investigators of sign language, myself included — one that explicitly acknowledges the relation between sign language and gesture. I introduce the concept of the **dedicated gesture**, and trace the ways in which such gestures, produced 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. This means that gestures of the body, which convey meaning or organize information, occur unsystematically at first, and eventually become conventionalized and systematic. 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

gestures of additional parts of the body are recruited incrementally for systematic linguistic functions at each successive stage.

In earlier work, my colleagues and I have shown that grammar emerges gradually at all levels of structure — morphological (Padden, Meir, Sandler, & Aronoff, 2010; Meir, Aronoff, Padden, & Sandler, 2010a), prosodic and syntactic (Sandler, Meir, Dachkovsky, Padden, & Aronoff, 2011b), and phonological (Sandler, Aronoff, Meir, & Padden, 2011a). Those works focused on the grammatical functions themselves, and the forms they took were characterized in syntactic, morphological, phonological, or prosodic terms. Here, I approach the data from the point of view of their physical form, and find that increased linguistic complexity correlates with the addition of articulators dedicated to convey grammatical information at each stratum.

The grammatical functions attributed to gestures of various articulators are similar to those described for more established sign languages, which shows that they are linguistic: they systematically represent aspects of linguistic structure. However, two characteristics of these gestures have previously been overlooked. The first is the direct relation between the number of articulators recruited, the articulations (or gestures) they manifest, and the linguistic complexity of the utterance. The second is the incremental emergence of these forms and functions in a new sign language.

In order to approach the notion of gesture used here, I begin by distinguishing the physical signal systems of spoken and signed languages. I then go on to narrow down the object of this study, the dedicated gesture. The next main section 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, together with a sketch of the nature of the data on which the present analysis is based. The heart of the article comes next, 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 the signers observed in each of the four age groups, S I–S IV, as more articulators are added to convey grammatical information, more grammatical functions appear, to make both the signal and the grammar increasingly complex.

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 topic continuity), emerge before any overt morphosyntactic marking (e.g., inflections). Implications of these characteristics for language in general are considered in the summary and conclusion.

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

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
I	Signs		
II	Signs	– Unsystematic clause linking	
III	Signs	– Complex sentences – Embedding	– Illocutionary force – Parentheticals – Referential shift
IV	Signs	– Complex sentences – Two degrees of embedding	– Illocutionary force – Parentheticals – Double Referential shift – Contrasting two referents in a discourse – Discourse topic continuity

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), and the torso, shown in Figure 1. And the activity of each of them is directly perceivable, by the eyes.

It is the actions of 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 other 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).

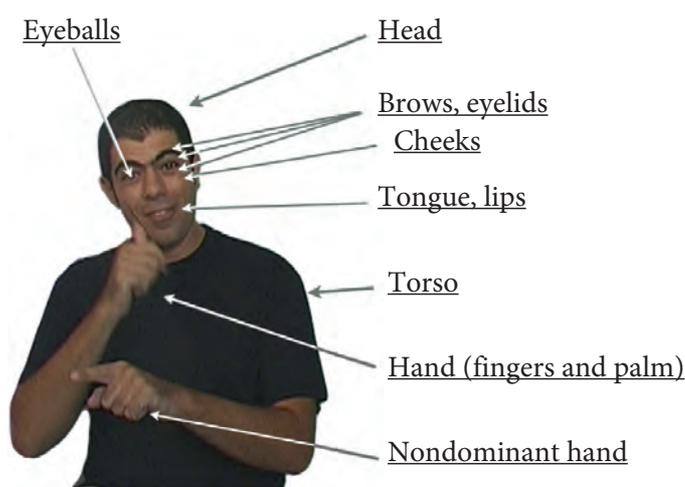


Figure 1. Visible articulators of signed languages

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 they may create phonological contrast. Sign languages also have meaningless phonological elements¹; however, a phonological system has not yet fully crystallized in ABSL (Sandler, Aronoff, Meir, & Padden, 2011a), and we exclude this level of structure from consideration here.

Second, apart from a brief discussion below in the subsection on co-sign gesture in established sign languages, we do not deal with the sign equivalent of co-speech gestures — the idiosyncratic visible gestures that accompany and augment the linguistically structured utterance, but which are themselves not systematically organized in this way (Kendon, 1980; McNeill, 1992; Goldin-Meadow, 2003).²

We turn our attention here to what I will term ‘**dedicated gestures**’, that is, **visible actions of any part of the body that perform a linguistic/grammatical function**. Only in sign languages do linguistic gestures so defined predominate — a crucial difference between sign languages and their spoken counterparts.³

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, Sandler, Padden, & Aronoff, 2010b). Meir and 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 languages⁴: 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.

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. Here, I am using the terms ‘sign’ and ‘word’ interchangeably (excluding the category of classifier constructions from the discussion — see note 5). Phonologically, the word (or sign) is created by combining different handshapes, locations, and movements selected from a finite list (Stokoe 1960). Signs may be one-handed or two-handed, but if two-handed, the hands are not morphologically independent within a lexical sign.⁵ Instead, 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 Figure 2b (Battison, 1978).

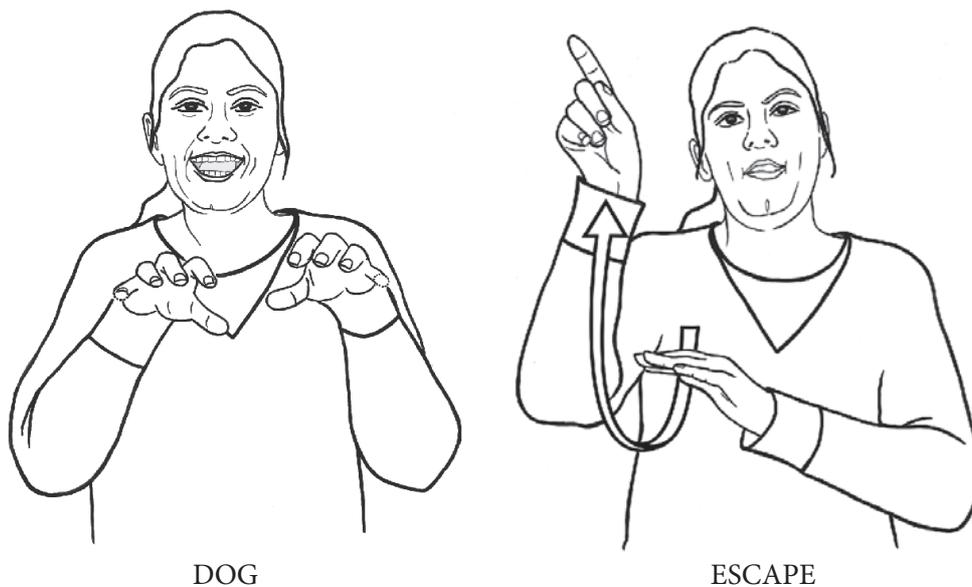


Figure 2a. The symmetrical two-handed sign DOG

Figure 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, Aronoff, Sandler, & Padden, 2010a) 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; Wilbur, 1999).

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 subsection) 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, McIntire, & Bellugi, 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 (Dachkovsky, Healy, & Sandler, to appear). 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}

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



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

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, but not easily retrievable from the immediately preceding discourse, such as the part of the following out-of-the-blue utterance shown in boldface: ***The apartment that we saw together last month** has been rented.* Squint typically appearing on topics and relative clauses in ISL (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 temporal coordination with rhythmically demarcated prosodic constituents. 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

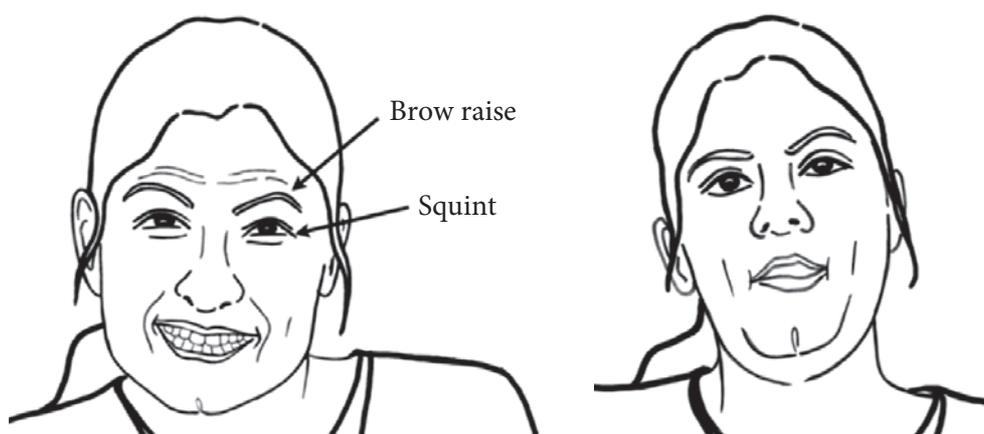


Figure 4. In the first Intonational Phrase, the sentence topic, brow raise signals continuation to the next constituent; squint signals information shared by signer and addressee. The following intonational phrase, the comment, has neutral facial expression.

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).

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 overviews of nonmanual markers in sign languages, see Wilbur (2000) and Pfau & Quer (2010).

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.

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



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

by subordination (see Sandler, 2012b, for a current 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

		TOPIC		COMMENT
		DOG SMALL-OBJ INDEX	WEEK-AGO I FIND INDEX	RUN-AWAY
Hands	Hands hold	—	—	—
	Hands repeat	—	—	
	Hands slow			
Face	Brow raise	—	—	
	Brow furrow			
	Squint	—	—	
Head	Head up			—
	Head down			
	Head forward	—	—	
	Head tilt left	—	—	
	Head tilt right			—
Body	Body tilt	—	—	

↑
Intonational phrase break

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

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 changing configurations at the intonational phrase boundary.

The nondominant hand

As explained above, 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 signal topic continuity 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

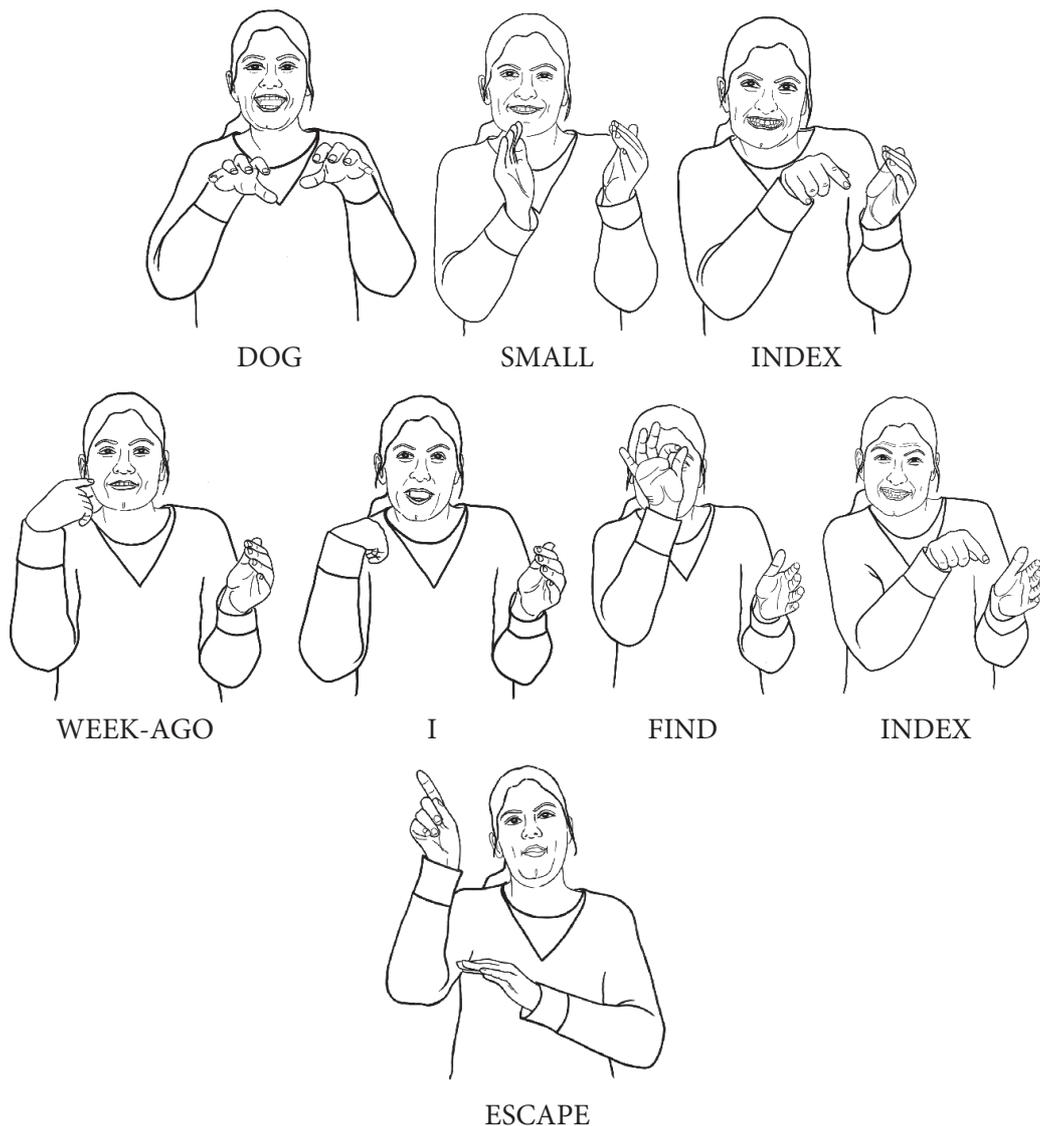


Figure 7. The ISL sentence, ‘The little dog I found last week ran away.’

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

In sum, different parts of the body perform dedicated gestures for a multitude of linguistic functions, only partially described here. A more complete but still not exhaustive indication of the panoply of dedicated gestures in sign languages is shown in Figure 8.⁹

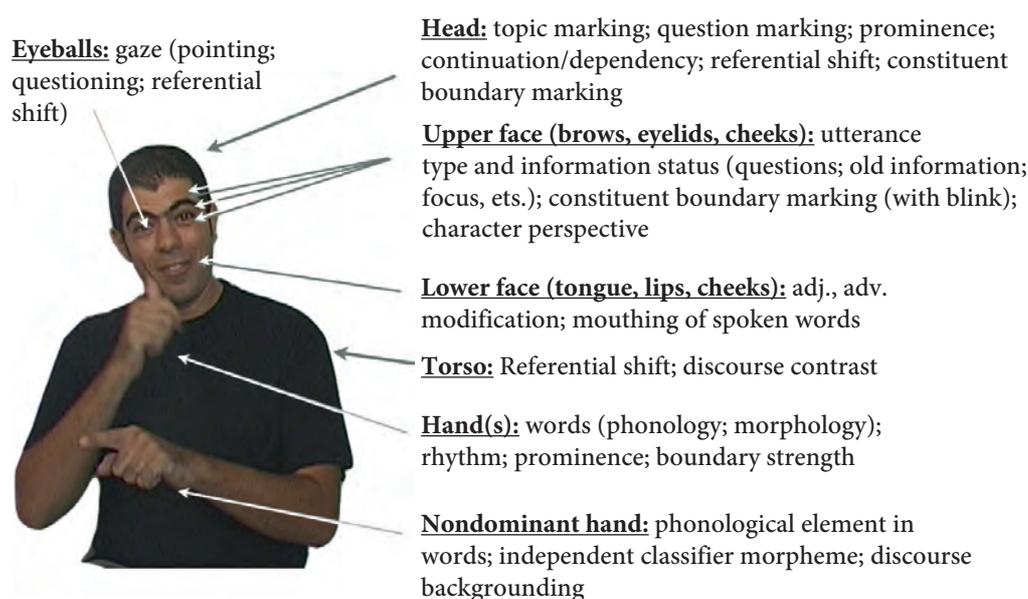


Figure 8. Dedicated gestures of sign languages (not exhaustive)

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 nonconventionalized 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 non-discrete, 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, Shield, Lenzen, Herzig, & Padden, 2012). But since these are not dedicated gestures, we will have no more to say about them here.

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 130–150 individuals with congenital deafness have been born into the community, all of them descendants of two of the founder's five sons (Scott, Carmi, Elbedour, Duyk, Stone, & Sheffield, 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, usually to a hearing person.

Households in the village, where polygamy is common, typically have large numbers of children. This means that children in a single household can easily be twenty years apart in age, with different schooling and peer group sizes, and that older deaf children can be like parental language models to small deaf children in the household. As time passed in the village, larger and larger numbers of deaf children were born, so that the younger deaf people had many more deaf interlocutors than their predecessors. For the purposes of the present this study, I divide signers into four age group or strata.

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 ABSL¹⁰ The only data we have from this group is from an amateur videotape of one of them (now deceased) telling a story in 1994. I refer to this age group as Stratum I.

Strata II and III 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 II and III are comprised of second generation ABSL signers. However, they are more like two different generations because of the large age difference between the signers in each group (20 years) and because of the nature of the input and amount and types of interaction that characterizes each, described in more detail below in the subsection on Stratum III.

We are now beginning to investigate Stratum IV, into which I group people under age 25 for the purposes of this study. The present analysis of Stratum IV is based mainly on one of them. This signer is only about eight years younger than the Stratum III signers in this study. However, his daily signing experience has

been much more intense. His mother (a Stratum II signer also in this study) is deaf, as are three of his younger siblings. His signing peers comprise a larger group as well. It is not yet known how widespread this signer's linguistic innovations are across the stratum. 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 signing of the members of the earlier strata studied.

The Stratum IV group is larger than the others. 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 an idiosyncratic kind of Signed Hebrew or Signed Arabic is the norm for teachers. Some of the boys, including the Stratum IV signer documented here, 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. Many 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 grammatical structure has affected their ABSL.

All signers in the present preliminary 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. More details will be provided about the data on which the present study is based in the next main section.

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, compartmentalizing the body in the service of language.

The data we have from the very first stratum are limited to a single videotaped story. However, the entire stratum consisted only of this man and his three siblings, so it is reasonable to assume that the data we have are representative. The analysis of Strata II and III is based on a range of data, including narratives and conversations, from several signers. There are about 100 deaf signers in Stratum IV, if we include all those under age 25. Since these signers communicate not only with members of their own stratum but also with those of older and younger strata, they benefit from massive interaction in sign language, raising the expectation that important developments will arise in the language under these circumstances. In this study, the characteristics attributed to this stratum rely on a long story told by one signer. Because of the limited corpus, the study reported here must be considered preliminary, and will be followed up in later work. However, the regular use of added articulators recruited by the Stratum IV signer, performing gestures dedicated to particular grammatical structures, has not been observed in signers of the earlier, better studied Strata II and III, and the systematic nature of their appearance at a later stage in the development of the language is seen as innovative in the language. Perhaps more interesting than the details of the order of emergence is the relation between added articulators dedicated to grammatical structure, and added complexity.

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, shortly. 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.

For this signer, 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

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

Figure 9. Segment of narrative of Stratum I signer

propositions are separated by noticeable 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 for our purposes as an expression in which the hands, face and body signify those of the same person in the event being conveyed. This definition refers to mimesis, and is not meant to include either artistic mime (e.g., the body as an olive bouncing in a martini) or body partitioning (Dudis, 2008), in which different parts of the body might represent separate entities. Nor does pantomime include role shift (see above the subsection on the body), where the body may represent a referent while the hands are signing words. In pantomime, the hands do not represent concepts symbolically; instead, together with the rest of the body, they mimic actual human action in holistic fashion.

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 different parts of the rest of the body are not yet recruited for language.

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 in the 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



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

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.

Stratum II: Dedicated gestures of the hands and head

There are about 11 signers in Stratum II, and those we have worked with are about 50–65 years old. In their childhood, they briefly attended either a deaf education

program in the West Bank or a local school without deaf education (Kisch, 2013). In the first group, no influence from other sign languages of the area has been detected in their ABSL vocabulary (see Al Fityani, 2007). In the second, there was no sign language used. Signers from this stratum have had no useful exposure to Arabic or Hebrew. 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.

Figure 13 shows a partial coding of this string. In stark contrast with the ISL example in Figure 6, we see here that it is difficult to find constituent boundaries in Stratum II ABSL. Gestures of the hands, head, and body are rarely synchronized; they do not correspond straightforwardly to linguistic constituents; and facial expression is used only affectively.

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

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

expression, perhaps depicting intense difficulty seeing in the dark¹¹, 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.

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

Gloss	Translation
THREE DAYS // TIME 3 NIGHT / MORNING // I GO-OFF// FOUR DAYS STAY FOUR DAYS FOUR / COME-BACK...	‘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...’

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 off.’

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

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

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 nonlinguistic) 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.

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.

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 10 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. At least as important from a sociolinguistic point of view is the fact that they had more interlocutors than Stratum II signers. They interact with both Stratum II signers and other members of Stratum III, and, like signers of the other strata, with many hearing villagers of all ages as well.

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 III 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.'

In a study of short narrative stretches signed by two Stratum II signers and two Stratum III signers (Sandler et al., 2011b), we found that the two Stratum III signers consistently synchronize hand, head, and face gestures to mark dependency relations between constituents. The two Stratum II signers rarely indicate dependency and use fewer synchronized gestures. While the Stratum III signers use 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, the Stratum II signers used only affective facial expression.

By Stratum III, ABSL signers have apparently 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.

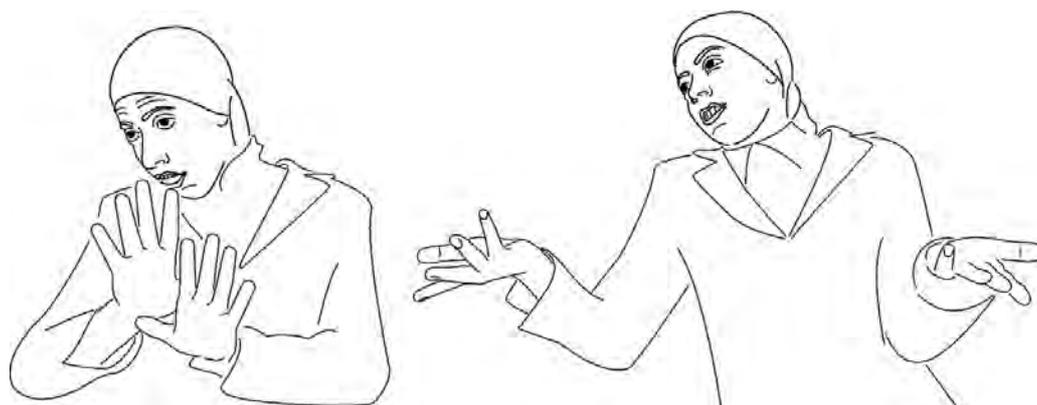


Figure 17. Head and face used intonationally for conditional sentence prosody, Stratum III. The sentence means ‘If he says no, then there is nothing I can do.’

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).

N is retelling the recounting of a dream, an impressive example of using language to embed one event (the dream) into another event (the telling about the dream) into another event (the retelling of the telling about the dream). This signer of Stratum III uses language form — dedicated gestures — in order to structure the discourse in a sophisticated way. In the segment shown in Figure 18, N

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

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

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.

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.

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 the signer of Stratum IV ABSL.



Figure 19. Dedicated gestures of head and face for reported speech. Your father said, 'Why haven't we seen you for so long?'

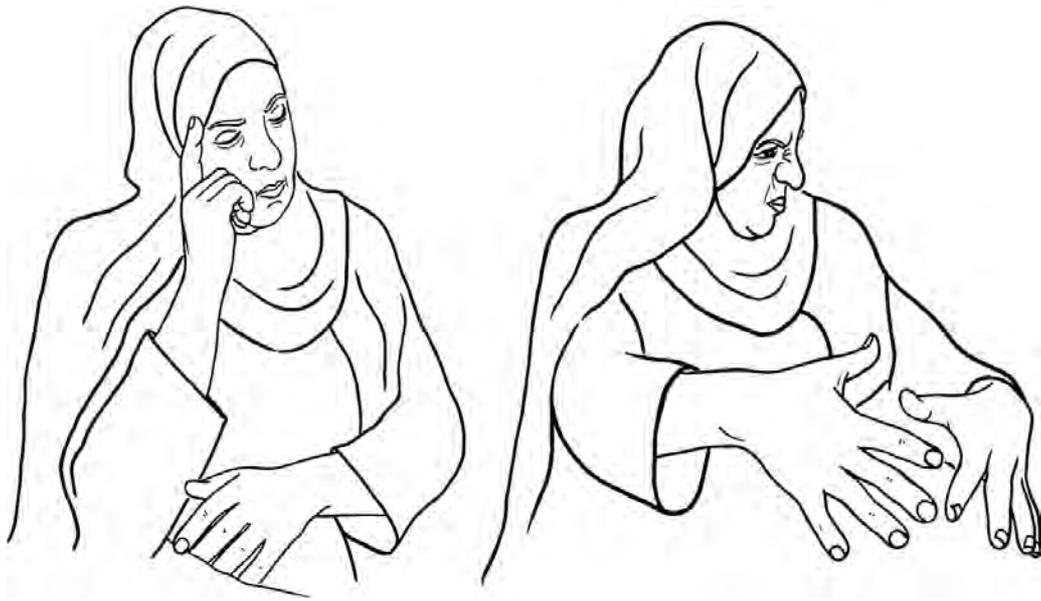


Figure 20. Use of head and face for parenthetical beginning on PREGNANT: ‘She sat thinking. She was pregnant ...’

		PARENTHETICAL			QUESTION	
		THINKING [PREGNANT SHE. SHE SHORT WIFE PREGNANT [SHE VISIT-YOU PREGNANT]] SHE				
Heads	Hands hold	—	—	—	—	—
	Hands slow					
Face	Brow raise				—	
	Brow furrow					
	Squint	—	—	—		—
	Nose wrinkle	—	—	—		—
Head	Head down	—	—	—	—	—
	Head forward			—	—	
	Head tilt	—				
	Head nod					—

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 characterizing the whole parenthetical constituent.

Stratum IV: Recruiting the body and the nondominant hand

Our work on Stratum IV is just begun. There are about 100 deaf signers in this stratum, assuming for our purposes that it includes all deaf people under age 25. As explained in the section on Al-Sayyid Bedouin Sign Language, Stratum IV has had more exposure to ISL than other strata, and many ISL vocabulary items have been incorporated (often produced differently) 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 an adult model of systematic ISL **grammar** is much less widespread. Where it has occurred, it's been mostly 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 on the measures we have used. Common ISL grammatical structures such as verb agreement (Padden et al., 2010), complex classifier constructions, or language-particular facial expressions (Sandler et al., 2011b)¹² have not been identified in our data for this stratum. Compounds that Al-Sayyid signers use for everyday items are idiosyncratic, and not borrowed from ISL (Meir et al., 2010a).

The Stratum IV signer documented here, J., is only about eight years younger than the Stratum III signers in this study. However, his daily signing experience has been more intense and diversified throughout his life. His mother (Stratum II signer D, also in this study) is deaf, as are four of his younger siblings. His signing peers are a larger group as well, and, as a man, he has more freedom to associate with them more often than is the case for women. It is not yet known how widespread across his stratum his language innovations are. What is important here is that the 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 signers of the earlier strata studied.

Although J knows much ISL vocabulary, he uses the strictly ABSL vocabulary of his family in the narrative studied here. Neither of his parents understands 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 [in ISL], he says, 'No, the local language.' Then J goes on to exemplify, 'FATHER, MOTHER [in 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 observed in the earlier strata, which have been studied much more extensively by our team. They have not. More interesting still, for our understanding of the way in which sign language recruits gestures for grammar, is the relationship between dedicated gestures of articulators and linguistic complexity.

Stratum IV signers benefit from a much larger pool of interlocutors in all aspects of life. There are about 30 signers in earlier strata and 100 in their own, and conversations abound 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 in later strata, 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,



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?’

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.

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

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 Figure 23.

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.

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 two-handed sign in which the hands are stacked one atop the other, with closing finger movement and 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.

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.

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, Meir, Padden, & Sandler, 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 signers of other

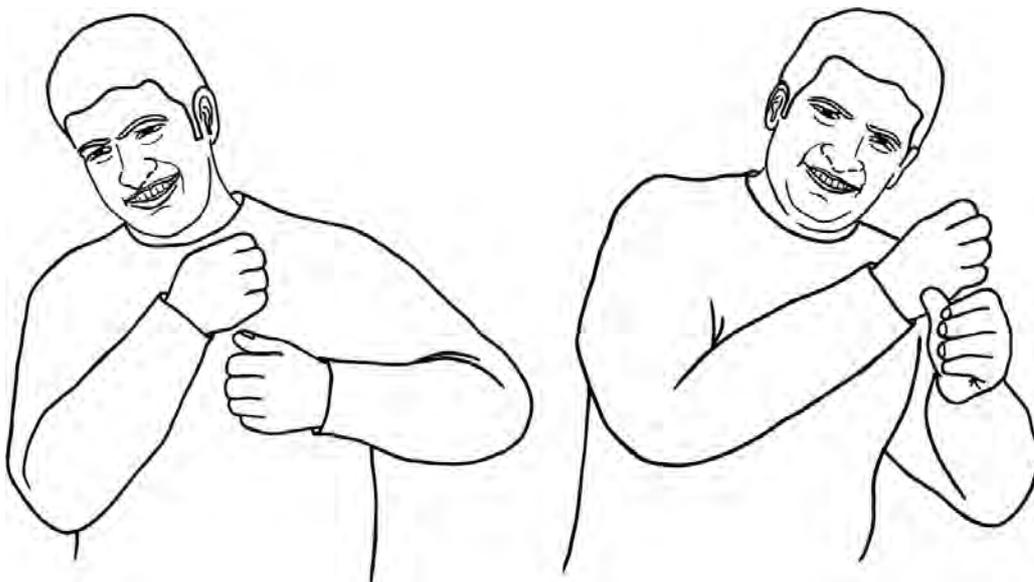


Figure 24. Different body positions for different referents: 'He took care of me, I take care of him'

strata, and it adds grammatical complexity to ABSL formally, by denoting different referents via dedicated gesture.

The nondominant hand

It may come as a surprise to learn that the two hands are not independent in lexical signs. As explained in the subsection on the nondominant hand, 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 signing hands in a discourse stretch so that each hand refers to a different referent. The other holds relevant information in the signing space throughout a stretch of discourse.

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.

The nondominant hand for topic continuity. In the previous subsection, 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 signaling topic continuity.

One instance of this phenomenon 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 being gazed at by the father. It is held out in front of the signer throughout the stretch of discourse, signed by the dominant hand.

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 a topic continuity signal. 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

Gloss	Translation
DIPLOMA FINISH. FATHER "GOOD, THIS DIPLOMA EXCELLENT, GOOD, YOU DEAF, GOOD-FOR-YOU. ALL HEARING WORTHLESS. YOU GOOD THIS, GREAT, WELL DONE."	"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."

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

Gloss	Translation
ONE COOKING TWO MECHANICS THREE WELDING [I LONG-AGO I SMALL FATHER ME HE WELD REMEMBER WELL NOT, REJECT] FOUR COMPUTERS ALL PROFESSIONS ME MECHANICS.	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.

Figure 26. Stretch of signing with dedicated gestures to convey a temporal expression, parenthetical, and backgrounding. The scope of the topic continuity signaled by the non-dominant hand is indicated with a vertical line.

third profession (welding) in the discourse throughout the parenthetical segment. In the Conclusion, I suggest that the independent use of the nondominant hand becomes possible only when its use in basic sign formation has become automatic, at 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 in a sense released to participate systematically 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 appearance of dedicated bodily gesture and linguistic structure is charted in Table 1, repeated here for convenience.

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 some current generative grammar

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

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
I	Signs		
II	Signs	– Unsystematic clause linking	
II	Signs	– Complex sentences – Embedding	– Illocutionary force – Parentheticals – Referential shift
IV	Signs	– Complex sentences – Two degrees of embedding	– Illocutionary force – Parentheticals – Double Referential shift – Contrasting two referents in a discourse – Discourse topic continuity

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, at the phonological level, the formational elements are meaningless, and often arbitrary, constituting an independent level of structure.¹³ 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.¹⁴

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 human hands 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, events, or structures that they represent is more abstract.

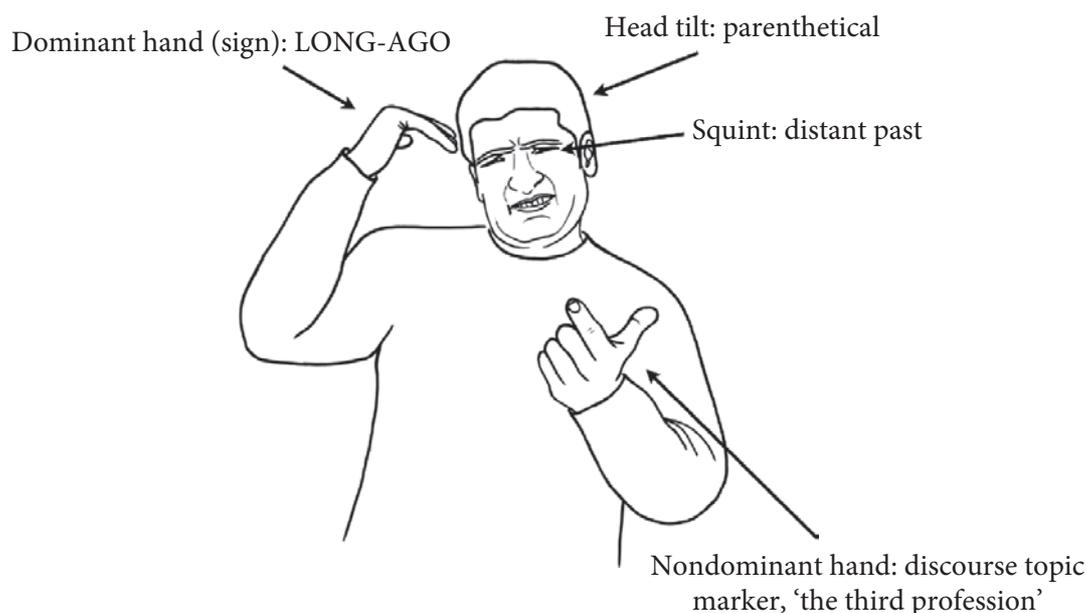


Figure 27. Simultaneous dedicated gestures of the dominant hand, head, face, and non-dominant hand in Stratum IV

That the nondominant hand is not free to perform independent linguistic functions until Stratum IV is especially interesting because it is unexpected. Nonlinguistic co-speech gesture allows such independence (Enfield, 2009), and in established sign languages like ISL, the two hands can act independently as well, as shown above. In established sign languages, however, and not in co-speech gesture, the nondominant hand also functions as a meaningless phonological element within two-handed signs (Stokoe, 1960), as explained briefly in the subsection on the hands. Why then does it take until Stratum IV for the nondominant hand to function as an independent articulator? The answer may be linked to the degree of automaticity achieved in the production of signs. Only when the coordinated use of the two hands becomes automatic in sign formation is the way paved for using them independently at meaningful levels of structure within a linguistic system.

My colleagues and I have applied similar reasoning to our analysis of the emergence of phonology in ABSL (Sandler et al., 2011a), which may in fact be directly related to this question. There we argue that ABSL has not yet developed a full-fledged phonological system across the community. Instead of recruiting meaningless handshapes, locations, and movements to form meaningful signs, signers seem to aim for more holistic (and iconic) forms, and there is more variation in their production than is the case in more established sign languages (Israel, 2009; Israel & Sandler, 2011). Yet in Stratum IV signers in deaf families in particular, the beginnings of phonology can be detected, for example, in systematically substituting a particular hand position for a more iconic one in order to accommodate

ease of articulation. When a meaningless part of a sign (e.g., hand position) is systematically changed in this way, it enters into an abstract system of meaningless components, a system that will presumably develop into full-fledged phonology. This and other examples suggest to us that the separate parts of a sign can function independently at the meaningless phonological level once signs become more conventionalized, and their formation more automatic.

In the same way, 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 to encode higher levels of grammatical structure, such as topic continuity in discourse. Once the use of the nondominant hand becomes conventionalized and automatic, and begins to participate in a phonological system, it is free to perform other dedicated gestures independently. At that point, the nondominant hand is largely redundant phonologically (as the weak drop phenomenon attests), and the two hands can independently encode linguistic elements.¹⁵

The development of ABSL 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). Many scholars believe that sign languages rapidly develop into a system that is very similar to that of spoken languages. For example, research charting the development of Nicaraguan Sign Language (e.g., Senghas, 1995; Kegl, Senghas, & Coppola, 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, p. 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, p. 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.

In fact, Senghas and colleagues investigating Nicaraguan Sign Language actually come to a more measured conclusion, one which is quite compatible with the picture presented here. They emphasize the importance of social together with

linguistic factors in the development of grammatical structure, a process that takes place over time, and to which each succeeding cohort contributes (Senghas, Senghas, & Pyers, 2005).

Our work on the emergence of ABSL, of which the present study is a part, shows that grammatical form unfolds gradually. 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 Singleton and Newport (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, Meir, Padden, & Aronoff, 2005; Padden, Meir, Sandler, & Aronoff, 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., 2010a), 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.

The present study shows linguistic complexity increasing with each stratum: The underpinnings of new dedicated gestures appear in one stratum and become systematic in the next. Interestingly, the nature of the complexity that develops in this young language, and that is presumably 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 topic continuity, which keeps information in the discourse space for as long as it is relevant. That discourse structuring precedes overt complexities of 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 and 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 the language of the signers documented in this study, we directly observe incremental accumulation of linguistic structure through activation of the many visible articulators of the body, one by one.

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Notes

1. A current overview of phonology in sign language appears in Sandler (2012a).
2. Kendon argues that too sharp a distinction between the linguistic and the gestural is misguided (Kendon, 2004, ch. 15; Kendon 2008, 2010). He proposes instead that a comparative semiotic approach to the exploration of 'utterance uses of visible bodily action' will lead to insightful understanding of utterance production more generally. In the present study, I find that respecting the distinction between linguistic patterning and idiosyncratic, unsystematic actions helps to illuminate each, and to characterize the path of development in a new sign language.
3. 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, 2012b), but in morphology, syntax, semantics, and prosody.
4. See Aronoff et al. (2005) for a discussion of similarities across sign language grammars.
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 (Dachkovsky et al., 2013).
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 topic continuity 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 symmetrical location as the dominant hand that it can function to keep the small dog in the discourse here. The ABSL ex-

amples of Stratum IV shown in the subsection on the nondominant hand for topic continuity are more typical as buoys.

9. A large body of research on a variety of sign languages supports the linguistic status of each of the functions organized by articulator in Figure 8. A comprehensive and current guide to sign language linguistics is *Sign language: an international handbook* (Pfau et al., 2012).
10. Kisch (2013) also maps the deaf signers of Al-Sayyid into four strata, but she uses different criteria than I have here, and arrives at somewhat different groupings.
11. Thanks to Adam Kendon (p.c.) for suggesting this interpretation. As in spoken language intonation (Ladd, 1996), sign language facial expression may be either nonlinguistic or linguistic in its function and patterning. See Baker-Shenk (1983) and Dachkovsky (2005) for in-depth discussions of linguistic vs. non-linguistic facial expression in sign languages. It is sometimes difficult to draw a clear line between the two in both modalities.
12. The squint exemplified in Figure 7 is used very systematically in ISL in a way that is typical of this language and less so, for example, of American Sign Language (see Dachkovsky et al., 2013). In ISL, it signifies information that is shared by both interlocutors but is not readily accessible in the discourse (Dachkovsky, 2005; Dachkovsky & Sandler, 2009; Dachkovsky et al., 2013). In ABSL, squint is used to signal distant past.
13. See Sandler (2012b) for a recent overview of phonology in sign languages.
14. See Enfield (2009) and Kendon (2011) for demonstrations of ways in which speakers use their hands simultaneously with speech in a different kind of layering.
15. When the nondominant hand functions as a phonological element, it is largely redundant (Sandler, 1993), and it is often deleted (Padden & Perlmutter, 1987).

References

- Al-Fityani, Kinda (2007). Arab sign languages: A lexical comparison. *Center for Research in Language Technical Reports*, 19 (1), 3–13.
- Aronoff, Mark, Irit Meir, Carol Padden, & Wendy Sandler (2004). Morphological universals and the sign language type. In Geert Booij & Jaap van Marle (Eds.), *Yearbook of morphology 2004* (pp. 19–40). Dordrecht & Boston: Kluwer Academic Publishers.
- Baker-Shenk, Charlotte (1983). A micro analysis of the nonmanual components of American sign language. Unpublished PhD thesis, University of California, Berkeley, U.S.A.
- Battison, Robbin (1978). *Lexical borrowing in American sign language*. Silver Spring, MD: Linstok Press.
- Bickerton, Derek (1984). The language bioprogram hypothesis. *Behavioral and Brain Sciences*, 7, 173–221.
- Browman, Catherine & Louis Goldstein (1992). Articulatory phonology: An overview. *Phonetica*, 49 (3/4), 155–180.
- Chomsky, Noam (2006). On minds and language. *Biolinguistics*, 1, 9–27.

- Crasborn, Onno (2011). The other hand in sign language phonology. In Marc van Oostendorp, Colin J. Ewen, Elizabeth V. Hume, & Keren Rice (Eds.), *The Blackwell companion to phonology* (pp. 223–240). Malden, MA: Wiley-Blackwell.
- Dachkovsky, Svetlana (2005). Facial expression as intonation in ISL: The case of conditionals. Unpublished MA thesis, University of Haifa, Israel.
- Dachkovsky, Svetlana & Wendy Sandler (2009). Visual intonation in the prosody of a sign language. *Language & Speech*, 52 (2/3), 287–314.
- Dachkovsky, Svetlana, Christina Healy, & Wendy Sandler (to appear). Visual intonation in two sign languages.
- Dudis, Paul (2008). Types of depiction in ASL. In Ronice Müller de Quadros (Ed.), *Sign language: Spinning and unraveling the past, present and future* (pp. 159–190). Florianópolis, SC, Brazil: Editora Arara Azul.
- Emmorey, Karen (1999). Do signers gesture? In Lynn Messing & Ruth Campbell (Eds.), *Gesture, speech, and sign* (pp. 132–159). Oxford: Oxford University Press.
- Emmorey, Karen (Ed.) (2003). *Perspectives on classifier constructions in sign languages*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Enfield, Nick (2009). *The anatomy of meaning*. Amsterdam: John Benjamins.
- Givón, Talmy (1979). From discourse to syntax: Grammar as a processing strategy. In Talmy Givón (Ed.), *Syntax and semantics XII: Discourse and syntax* (pp. 81–112). New York: Academic Press.
- Goldin-Meadow, Susan (2003). *The resilience of language: What gesture creation in deaf children can tell us about how all children learn language*. New York: Psychology Press.
- Goldin-Meadow, Susan, Aaron Shield, Daniel Lenzen, Melissa Herzig, & Carol Padden (2012). Gestures ASL signers use tell us when they are ready to learn math. *Cognition*, 123, 448–453.
- Hopper, Paul (1987). Emergent grammar. *Berkeley Linguistics Society*, 13, 139–157.
- Israel, Assaf (2009). Sublexical variation in three sign languages. MA thesis, University of Haifa.
- Israel, Assaf & Wendy Sandler (2011). Phonological category resolution in a new sign language: A comparative study of handshapes. In Rachel Channon & Harry van der Hulst (Eds.), *Formational units in sign languages* (pp. 177–202). Berlin & New York: Mouton de Gruyter.
- Kegl, Judy, Ann Senghas, & Marie Coppola (1999). Creation through contact: Sign language emergence and sign language change in Nicaragua. In Michel DeGraff (Ed.), *Language creation and language change: Creolization, diachrony, and development* (pp. 170–237). Cambridge, MA: MIT Press.
- Kendon, Adam (1980). Gesticulation and speech: Two aspects of the process of utterance. In Mary Ritchie Key (Ed.), *The relationship of verbal and nonverbal communication* (pp. 207–227). The Hague: Mouton.
- Kendon, Adam (2004). *Gesture: Visible action as utterance*. Cambridge, UK: Cambridge University Press.
- Kendon, Adam (2008). Some reflections on the relation between ‘gesture’ and ‘sign’. *Gesture*, 8 (3), 348–366.
- Kendon, Adam (2010). Pointing and the problem of ‘gesture’. Some reflections. In Maria Atonietta Pinto & Olga Capirci (Eds.), Special issue: Gesture and speech in a semiotic, developmental, and intercultural perspective. *Rivista di psicolinguistica applicata*, 10 (3), 19–30.
- Kisch, Shifra (2013). Demarcating generations of signers: The case of the Al-Sayyid Bedouin. In Ulrike Zeshan & Connie de Vos (Eds.), *Sign languages in village communities* (pp. 87–125). Berlin & New York: de Gruyter.

- Klima, Edward & Ursula Bellugi (1979). *The signs of language*. Cambridge, MA: Harvard University Press.
- Ladd, Robert (1996). *Intonational phonology*. Cambridge: Cambridge University Press.
- Liddell, Scott K. (1980). *American sign language syntax*. The Hague: Mouton.
- Liddell, Scott K. (2003). *Grammar, gesture, and meaning in American sign language*. Cambridge: Cambridge University Press.
- Lillo-Martin, Diane (1995). The point of view predicate in American sign language. In Karen Emmorey & Judy Reilly (Eds.), *Language, gesture, and space* (pp. 155–170). Hillsdale, NJ: Lawrence Erlbaum Associates.
- McNeill, David (1992). *Hand and mind: What gestures reveal about thought*. Chicago: University of Chicago Press.
- Meir, Irit & Wendy Sandler (2008). *A language in space: The story of Israeli sign language*. New York: Lawrence Erlbaum Associates.
- Meir, Irit, Mark Aronoff, Wendy Sandler, & Carol Padden (2010a). Sign languages and compounding. In Sergio Scalise & Irene Vogel (Eds.), *Compounding* (pp. 301–322). Amsterdam: John Benjamins.
- Meir, Irit, Wendy Sandler, Carol Padden, & Mark Aronoff (2010b). Emerging sign languages. In Marc Marschark & Patricia E. Spencer (Eds.), *The Oxford handbook of deaf studies, language and education*, vol. 2 (pp. 267–280). Oxford: Oxford University Press.
- Nespor, Marina & Wendy Sandler (1999). Prosody in Israeli sign language. *Language and Speech*, 42 (2/3), 143–176.
- Padden, Carol A. (1988). *Interaction of morphology and syntax in American sign language*. New York: Garland.
- Padden, Carol & David Perlmutter (1987). American sign language and the architecture of phonological theory. *Natural Language and Linguistic Theory*, 5, 335–375.
- Padden, Carol, Irit Meir, Wendy Sandler, & Mark Aronoff (2009). Against all expectations: Encoding subjects and objects in a new language. In Donna B. Gerdts, John C. Moore, & Maria Polinsky (Eds.), *Hypothesis A/Hypothesis B: Linguistic explorations in honor of David M. Perlmutter* (pp. 383–400). Cambridge, MA: MIT Press.
- Padden, Carol, Irit Meir, Mark Aronoff, & Wendy Sandler (2010). The grammar of space in two new sign languages. In Diane Brentari (Ed.), *Sign languages: A Cambridge survey* (pp. 573–595). New York: Cambridge University Press.
- Pfau, Roland & Josep Quer (2010). Nonmanuals: Their prosodic and grammatical roles. In Diane Brentari (Ed.), *Sign languages: A Cambridge survey* (pp. 381–402). Cambridge: Cambridge University Press.
- Pfau, Roland, Markus Steinbach, & Bencie Woll (Eds.) (2012). *Sign language: An international handbook*. Berlin & New York: de Gruyter.
- Pinker, Steven (1994). *The language instinct: How the mind creates language*. New York: Harper Perennial Modern Classics.
- Reilly, Judy, Marina McIntire, & Ursula Bellugi (1990). The acquisition of conditionals in American sign language: Grammaticized facial expressions. *Applied Psycholinguistics*, 11, 369–392.
- Sandler, Wendy (1993). Hand in hand: The roles of the nondominant hand in sign language phonology. *The Linguistic Review*, 10, 337–390.
- Sandler, Wendy (2009). Symbiotic symbolization by hand and mouth in sign language, *Semiotica*, 174, 241–275.

- Sandler, Wendy (2012a). The phonological organization of sign languages. *Language and Linguistics Compass*, 6 (3), 162–182.
- Sandler, Wendy (2012b). Visual prosody. In Roland Pfau, Markus Steinbach, & Bencie Woll (Eds.), *Sign language: An international handbook* (pp.55–76). Berlin & New York: de Gruyter.
- Sandler, Wendy, Irit Meir, Carol Padden, & Mark Aronoff (2005). The emergence of grammar: Systematic structure in a new language. *Proceedings of the National Academy of Science USA*, 102 (7), 2661–2665.
- Sandler, Wendy & Diane Lillo-Martin (2006). *Sign language and linguistic universals*. Cambridge: Cambridge University Press.
- Sandler, Wendy, Mark Aronoff, Irit Meir, & Carol Padden (2011a). The gradual emergence of phonological form in a new language. *Natural Language and Linguistic Theory*, 29, 503–543.
- Sandler, Wendy, Irit Meir, Svetlana Dachkovsky, Carol Padden, & Mark Aronoff (2011b). The emergence of complexity in prosody and syntax. *Lingua*, 121 (13), 2014–2033.
- Sandler, Wendy, Irit Meir, Carol Padden, & Mark Aronoff (to appear). Language emergence: Al-Sayyid Bedouin sign language. In Nick Enfield, Paul Kockelman, & Jack Sidnell (Eds.), *Cambridge handbook of linguistic anthropology*. Cambridge: Cambridge University Press.
- Sankoff, Gillian & Penelope Brown (1976). The origins of syntax in discourse: A case study of Tok Pisin relatives. *Language*, 52 (3), 631–666.
- Scott, Daryl A., Rivka Carmi, Khalil Elbedour, Shoshi Yosefsberg, Edwin M. Stone, & Val C. Sheffield (1996). An autosomal recessive nonsyndromic-hearing-loss locus identified by DNA pooling using two inbred Bedouin kindreds. *American Journal of Human Genetics*, 59 (2), 385–391.
- Senghas, Ann (1995). Children's contribution to the birth of Nicaraguan sign language. Unpublished PhD dissertation, Massachusetts Institute of Technology.
- Senghas, Richard J., Ann Senghas, & Jennie E. Pyers (2005). The emergence of Nicaraguan sign language: Questions of development, acquisition, and evolution. In Jonas Langer, Sue Taylor Parker, & Constance Milbrath (Eds.), *Biology and knowledge revisited: From neurogenesis to psychogenesis* (pp.287–306). Mahwah, NJ: Lawrence Erlbaum Associates.
- Singleton, Jenny & Elissa Newport (2004). When learners surpass their models: The acquisition of American sign language from inconsistent input. *Cognitive Psychology*, 49, 370–407.
- Stokoe, William (1960). Sign language structure: An outline of the visual communications systems. *Studies in Linguistics. Occasional Papers*, 8. Buffalo, NY: University of Buffalo.
- Supalla, Ted (1986). The classifier system in American sign language. In Collette Craig (Ed.), *Noun classes and categorization* (pp.181–214). Amsterdam: John Benjamins.
- Sutton-Spence, Rachel & Bencie Woll (1999). *The linguistics of British sign language*. Cambridge, UK: Cambridge University Press.
- Wilbur, Ronnie (1994). Eyeblinks and ASL phrase structure. *Sign Language Studies*, 84, 221–240.
- Wilbur, Ronnie (1999). Stress in ASL: Empirical evidence and linguistic issues. *Language and Speech*, 42 (2/3), 229–250.
- Wilbur, Ronnie (2000). Phonological and prosodic layering of non-manuals in American sign language. In Karen Emmorey & Harlan Lane (Eds.), *The signs of language revisited* (pp.215–247). Mahwah, NJ: Lawrence Erlbaum Associates.
- Zeshan, Ulrike (2004). Interrogative constructions in sign languages: Crosslinguistic perspectives. *Language*, 80 (1), 7–39.

Author's address

Professor Wendy Sandler
Sign Language Research Lab
University of Haifa
31905 Haifa
Israel
wendy.sandler@research.haifa.ac.il

About the author

Wendy Sandler is professor of linguistics in the Department of English Language and Literature at The University of Haifa, and Founding Director of the Sign Language Research Laboratory there. She received her PhD degree in theoretical linguistics from The University of Texas, Austin. Wendy Sandler's research on phonology, morphology, and prosody in American and Israeli Sign Languages has been fueled by her interest in the relationship between the grammatical form of natural languages and the physical modality of its transmission. Over the past decade, she and her colleagues have had the privilege of investigating the emergence of this relationship in a very young sign language in a Bedouin village in Israel.