WHAT COMES FIRST IN LANGUAGE EMERGENCE?

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There has been much speculation about what came first in the evolution of human language -- repetitive syllables that took on meaning (MacNeilage 1998) or that provided a structural basis for syntax (Carstairs-McCarthy 1999); words (Bickerton 1990, Jackendoff 1999); undecomposable holophrases (e.g., Arbib 2012), or musical protolanguage (Darwin 1871, Fitch 2010; see Newmeyer 2002 and Fitch 2005 for informative overviews).[1] Others have argued that the defining property at the evolutionary core of the human language faculty is syntactic recursion (Hauser et al 2002), a computational operation combining and recombining linguistic units (Bolhuis et al 2014). Whatever one takes to have been fundamental, it is reasonable to assume that language must have evolved in stages, with each step dependent on others that preceded it.

It is difficult to support, refute, or flesh out hypotheses about these stages of evolution with evidence from spoken languages alone, because they are all thousands of years old, or descended from old languages, with their full linguistic structure intact. However, sign languages can arise anew at any time, and linguists look to them for clues to the course of language emergence.

The fact that the development of sign languages can be observed in real time does not guarantee that they will provide clues to the course of evolution of the human language capacity, however. If these young sign languages were to make their appearance replete with complex linguistic structure -- a possibility countenanced by strong nativist theories – they would be of little help in determining how such structure emerged in evolution. It is only if they develop gradually, and if the stages

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[1] Some theorists have proposed that spoken language emerged from gesture (Corballis 2002; Armstrong et al 1995; Arbib 2012). I do not deal with that issue here, but see also e.g., MacNeilage 2008; Sandler 2013; Emmorey 2013; and other papers in Kemmerer (Ed.) 2013 for discussion.

in this process can be identified, that they might offer concrete contemporary evidence of the path of language emergence.

Here I will identify such evidence in a new sign language that arose in relative isolation, to show that modest linguistic machinery – holistic words and prosodic organization of semantically related words – are the first things to emerge, and that they are enough to support fully functional language. Other, more computational, aspects of linguistic form, such as phonological, morphological[2], and syntactic structuring, are later arrivals, apparently dependent on the scaffolding provided by simplex words and by prosodic constituents that temporally organize semantically related units and characterize them with intonation[3].

Of course, it cannot be assumed that the development of new sign languages in biologically modern humans faithfully replicates the evolution of language in our species. But the modernity of these languages does not nullify their significance in the context of evolution, and it would be a mistake to dismiss them. Emerging sign languages offer an exciting opportunity to identify two central facets of language emergence that no other naturally occurring system can provide. One is the nature of the communicative elements that are required minimally in order for a system to function as language. The other facet, relevant for the theme of this volume, is the path along which one kind of structure follows another over time before arriving at the kind of rule governed complexity in language that we often take for granted. In this sense, new sign languages can offer a uniquely empirical and plausible reference point for models of language evolution.

New sign languages have a heuristic advantage over spoken languages in another way as well. The nature of the physical system, in which movements of different parts of the body (the two hands, the head, the face, the torso) visually manifest different

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[2] Sign languages in general have certain types of modality-typical complex morphology (e.g., Aronoff et al 2005). We were surprised not to have found this complexity at the morphological level in Al Sayyid Bedouin Sign Language, although the beginnings of a system can be discerned in compounds. See Meir et al (2010) and Padden et al (2011) for treatments of the development of morphology in ABSL.

[3] I am assuming here that prosody includes intonation as well as rhythm (timing) and stress.

linguistic functions, makes it possible for linguists to match form to function more directly than they can for spoken languages, and literally to see it unfold (Sandler 2012a). I refer to this correspondence between articulator recruitment and linguistic form as the Grammar of the Body.

Investigation of Al-Sayyid Bedouin Sign Language (ABSL), a young sign language that arose in relative isolation, has shown that a language does not spring forth fully formed, but rather evolves gradually across generations (see Aronoff et al 2008; Sandler et al 2014 for overviews). Studying this language in different age groups, and tracing the step-by-step recruitment of different articulators to create a linguistic system (Sandler 2012a), allows us to observe the gradual emergence of linguistic form over time.

Our data suggest that language develops very efficiently, first, by creating holistic units to signify concepts -- words with no phonology. This is followed by combining words into short propositions and later into larger discourse units, and organizing them prosodically into a fully functional linguistic system. Word order comes in early as well (Sandler et al 2005), although we now have reason to believe that it is determined by semantics/cognition and not by syntax per se (Meir et al, under review).

I will extrapolate from our findings on Al-Sayyid Bedouin Sign Language to propose that certain basic elements of language structure must be present before other components commonly thought of as fundamental can arise. First, the crystallization of phonology depends on conventionalization of lexical items, which in turn depends on repeated social interactions with the same social group. These factors lead to automaticity, which results in a split between form and meaning. This split paves the way for duality of patterning (Hockett 1960), meaningful and meaningless (phonological) levels of structure. The second dependency path is between prosody and syntax. We find that prosodic structure organizes semantic information in language before concrete evidence of syntax arises to mark the same functions.

The pattern of emergence we see suggests that central properties of language that are considered universal – phonology and overt syntax -- do not come ready-made in the

human brain, and that a good deal of language can be present without them. I begin with a snapshot of the Grammar of the Body in established sign languages to show how linguistic structure manifests itself in these visual languages, and then go on to emergence. [4]

    1.   The Grammar of the Body

Sign languages are sometimes described as manual languages because the hands convey words, the most essential linguistic units. But sign languages also systematically exploit the whole upper body to convey language: movements of the head, facial articulators, and the torso. Different movements of the extra-manual bodily articulators individually and in combination convey important elements of structure, including subordination, adjectival- or adverbial-type modification, contrast, intonation, and more, as shown in Figure 3 below.[5] The two levels to be discussed here are the word and prosody/intonation.

In established sign languages, words have phonological structure: different configurations of the fingers, orientations of the palm, and movements of the hand on or near different body locations are combined to create signs and to distinguish them from one another, and they are altered in phonological processes such as assimilation (Stokoe 1960; Sandler 1989; Liddell and Johnson 1989). Figure 1 shows a minimal pair in Israeli Sign Language distinguished by differences in major place of articulation alone.
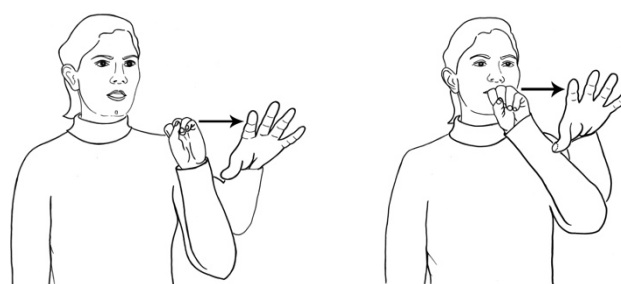

Figure 1. Minimal pair in Israeli Sign Language distinguished by place of articulation: (a) SEND (torso) and (b) TATTLE (head).

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[4] For comprehensive treatments of sign language linguistic structure at all levels, see Sandler & Lillo-Martin 2006 and Pfau et al (Eds.) 2012.
[5] There is a large literature on linguistic use of the body in sign languages; summarized in Quer and Pfau (2011) and Sandler (2012b).

A sign in sign language roughly corresponds to a word in spoken language, bearing a conventionalized form-meaning relation, and constrained in form both phonotactically (Battison 1978, Mandel 1981) and prosodically (Sandler 1999). Signs are typically monosyllabic, characterized by a single movement of the hands from one location to another (Coulter 1982 and much subsequent work). Even morphologically complex signs are usually monosyllabic, since grammatical morphemes are nonconcatenatively (simultaneously) overlaid on the base sign, by changes in locations, types of movement, and/or rhythm, and with particular conventionalized facial expressions.

At the level of phrasal prosody, manual timing establishes rhythm, and facial expression and head movement function systematically as intonation (Nespor & Sandler 1998; Dachkovsky et al 2013). To prepare for the discussion of prosody as an early feature of ABSL, a brief discussion of the way the body expresses prosody in sign languages is in order.

In an established sign language, the end of an intonational phrase is signaled by phrase final lengthening on the hands, coordinated with a change in facial expression and head position. Figure 2 shows the boundary between the two intonational phrases in the Israeli Sign Language sentence glossed roughly [[DOG SMALL THAT] [WEEK-AGO I FIND IT]] // [[ESCAPE]] meaning 'The little dog that I found last week // ran away.'[6] Figure 3 shows the grammatical functions conveyed by each articulator in the grammar of the body, and specifically at the end of the first constituent of Figure 2, [[… **IT**]].[7]

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[6] The first intonational phrase in the sentence is comprised of two lower level phonological phrases.

[7] In the context of language typology featured in this volume, it is worth mentioning that well studied established sign languages seem to have similar articulator-to-linguistic function correspondence to that shown in Figure 3, and thus constitute a language type.
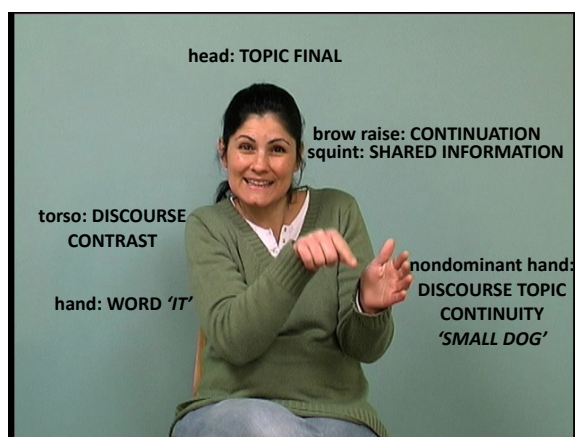
Figure 2. Complete change in facial expression and head position at intonational phrase boundary between [[...IT]] and [[ESCAPE]].

The Grammar of the Body

eyeballs: gaze (pointing; questioning; referential shift)

head: topic marking; question marking; prominence; continuation/dependency; referential shift; constituent boundary marking

upper face (brows, lids, cheeks): utterance type and information status (questions; old information; focus,etc.); constituent boundary marking (with blink); character perspective

lower face (tongue, lips, cheeks): adj., adv. modification; mouthing of spoken words

torso: referential shift; discourse contrast

hand(s): words (phonology; morphology); rhythm; prominence; boundary strength

nondominant hand: phonological element in words; independent classifier morpheme; discourse topic continuity; simultaneous words

Figure 3. Grammatical functions associated with articulators in sign language (in the margins on the figure) and their use at the end of the first constituent in Figure 3 (on the picture).

In this sentence of ISL, the dependency between the two constituents is indicated by raised brows and head forward and down at the end of the first major constituent, and by an across the board change of face and head configurations for the second. Squinted eyes indicate shared information – the little dog that the signer and addressee know about – a reliable signal for relative clauses (Nespor & Sandler 1998;

Dachkovsky & Sandler 2009). The nondominant hand retains its shape and position from 'small dog' thoughout the first constituent (through 'find it'), signaling topic continuity. This means that the anaphoric pronoun 'it' and the topic antecedent 'small dog' overlap temporally in the signal, as do the intonational and rhythmic markings of prosodic structure. This complex simultaneous layering of bodily signals systematically organizes information in sign language sentences (Wilbur 2000). We can now turn to chronological dependency in language emergence in the two pairs of structures of interest here: words and phonology, and prosody and syntax.

In the case of words, it is commonly believed that it would not be possible to amass a large vocabulary with holistic signals, and that a lower level of recombinable meaningless units (i.e., phonology) must have been a prerequisite (Hockett 1960, Pinker and Jackendoff 2005). As for prosody, two competing predictions can be put forward, either prosody and then syntax or syntax and then prosody. Specifically, it has been hypothesized that, in a young language, such as a pidgin, prosody might precede syntactic marking to indicate different sentence types and subordination (Givón 1979). On the other hand, synchronic linguistic theory typically points in the opposite direction, holding that prosodic constituents are projected from syntactic constituents (Selkirk 1984; Nespor & Vogel 1986).

It is striking that neither in the case of words/phonology nor of prosody/syntax, do these paired elements appear at the same time in ABSL. Instead, one precedes the other: the language accrues a relatively large lexicon before phonological structure crystallizes, and prosodic markers of relations such as coordination and dependency between propositions appear in advance of identifiable syntactic marking of these relations. This order indicates a dependency in the sense that one type of linguistic structuring paves the way for the other.

   2. Words first, phonology later
We have followed the development of ABSL by recording and analyzing the language of people of different ages in the village. Our earliest data consist of a videotaped story told by an elderly man who was one of the first four deaf children born into one family in the village. His utterances consist mainly of a series of one or two word-like manual signs, e.g., RIFLE, or HORSE RUN, augmented only

occasionally with pantomimic movement of the whole body, e.g., 'strike-with-sword'.[8] This is in stark contrast with the linguistic uses of the body schematized in Figure 3. Given the availability of the whole body, and the complex and systematic use of different parts of the body in established sign languages, it is striking that only the hands are used for linguistic function at the beginning of language (Sandler 2012a, 2013), to represent word-level concepts.

But in our investigation of sign production across the community, we found that the words of ABSL are unlike the words of more established sign languages because they function as iconic wholes with a surprising amount of articulatory variation (Israel and Sandler 2011), and we concluded that a phonological system has not yet crystallized across the community (Sandler et al 2011a).

Our team created a dictionary with 300 entries, presumably only a fraction of the lexicon in the language, since the signs had mostly been elicited through picture naming and the majority are thus concrete nouns. Yet, despite a relatively large vocabulary, we could not detect evidence of a systematic, meaningless level of structure. We found unexpected variation in sign production. Even broad phonological specifications in established sign languages, such as major place of articulation categories, on a par with LABIAL or DORSAL in spoken languages, varied across signers for the same sign, as exemplified in Figure 4 for the sign DOG. The two places of articulation shown here, head and torso, are major place categories and contrastive in more established sign languages (cf., SEND and TATTLE in ISL, Figure 1.).
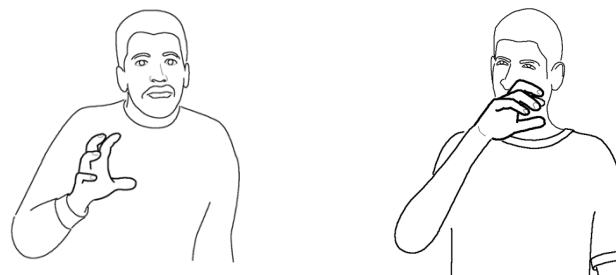
Figure 4. The ABSL sign DOG signed by different signers at two different places of articulation, the torso and the head.

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[8] Pantomimic use of the body means that the body represents a human body performing some action: the hands are hands; the head is a head; the torso is a torso.

We did discover kernels of phonology. For example, we encountered signs among younger signers whose form had been consistently altered to accommodate ease of articulation, resulting in signs that are counter-iconic. This suggests that smaller units of meaningless form are taking precedence over iconic, holistic signals. Within what we dubbed a familylect, we also found consistent form-based handshape assimilation in a frequently used compound rendering it, too, noniconic, and suggesting the beginning of a phonological level (Sandler et al 2011a; Sandler to appear). We deduce from these studies that the development of phonology, at least in a contemporary sign language, depends first on the conventionalization of words and then on frequency of use and automaticity. The answer to the empirical question of how many meaningful holistic signals humans can produce and perceive in the vocal/auditory modality is not known, and it is possible that sign languages can tolerate a larger number than spoken languages can, due to the iconicity of form and the nature of visual perception. But even if there is some difference between modalities in this regard, ABSL shows surprisingly that it is possible for a functioning human language to have a relatively large vocabulary without a crystallized phonological system, making phonology dependent, in the sense intended here, on a stable, conventionalized, and frequently shared lexicon.

3. Prosodic organization first, syntax later

How are these words combined into meaningful utterances? In established languages, prosodic signals – rhythm, intonation, and phrasal stress -- are typically coextensive with syntactic constituents such as the phrase or the clause. It has been argued that phrasal stress is determined by the order of heads and complements in a language (Nespor & Vogel 1986), and that children, sensitive to prosody of their native language since infancy (e.g., Mehler and Dupoux 1994; Juscyk 1997), use the prominence patterns of prosody to bootstrap the syntactic structure (e.g., Nespor et al 1996).

Because of this syntax-prosody correspondence, linguists propose that the prosody is read off the syntax, and is in this sense dependent on it (Selkirk 1984, Nespor & Vogel 1986). Given these observations, one might expect syntactic structure to be a prerequisite for prosodic structure in a new language. This prediction runs contrary to

that of Givón and others who reason that prosody is likely to precede syntax in young languages.

The difference between these two views may depend to some extent on what one calls syntax. Our approach throughout has been to refrain from attributing syntactic form to an expression in ABSL without explicit evidence for it.[9] We find word groupings by meaning and even consistencies in word order, but no evidence so far that favors syntactic over semantic/cognitive and pragmatic determinants of structure (Meir et al under review).[10] The groupings of words into constituents and the relations between them are marked by prosody, which emerges gradually over time in the community.

On the whole, evidence from a small sample of narratives in four ABSL age groups suggests that prosody – consisting of timing and intonation -- is the earliest organizing force, and that it emerges gradually. This overall picture is tempered by the fact that certain indications of syntactic relations **within** clauses begin to appear together with intonational marking of dependency **across** them. The findings are summarized in Tables 1 and 2.

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[9] Apart from overt markers, syntactic tests can identify syntactic structure. For example, early research on American Sign Language distinguished coordinate from subordinate clauses by the coreference properties of a process called final subject pronoun copy (Padden 1988). In ABSL we have not found syntactic processes of this kind.

[10] Our early work on ABSL reported a significant tendency for SOV word order, assumed there to be a syntactic phenomenon (Sandler et al 2005). However, this analysis relied in part on semantic groupings (Padden et al 2010), and closer analysis of the types of arguments involved convinced us that semantic and cognitive factors (such as animacy and reversibility) determine the order of nominal arguments with respect to the verb (Meir et al under review).

AGE GROUP	HANDS	HEAD	FACE	BODY	NONDOMINANT HAND
1	X				
2	X	X			
3	X	X	X		
4	X	X	X	X	X

Table 1. Grammar of the body: recruitment of additional articulators for grammatical functions according to age group, from oldest (earliest stage of the language) to youngest (later stage).

AGE GROUP	WORDS	COMPLEX SENTENCES (prosodically marked)	DISCOURSE/ REFERENCE COHESION
1	Signs		
2	Signs	Unsystematic clause linking (coordination); 1 NP per 2.5 predicates (vague one-word constitutents); 1st person subject pronouns only	
3	Signs	Many dependent constituents (conditionals, temporal expressions, reported speech); 1-2 NPs per predicate; 3rd person pronouns	Parentheticals, reported speech
4	Signs	Addition of modifiers, quantifiers, embedding inside reported speech (double embedding)	Addition of topic continuity marker and torso shift for different discourse referents

Table 2. Complexity added through recruitment of additional articulators for linguistic functions (adapted from Sandler 2012a).

Group 1. As I pointed out in the introduction, the story told by the oldest signer (age group 1), is characterized largely (though not exclusively) by one-word propositions, separated by pauses. Only the hands are recruited for language.

Group 2. In the second age group (short stretches of narratives of two people in the study reported in Sandler et al 2011b), movement of the head was added to the hands to separate constituents. Some separated constituents were lists, and some (e.g., temporal expressions such as DAYS THREE meaning 'for three days') were related semantically to adjacent propositions, but no special syntactic or prosodic marking distinguished these from coordinated lists. Many propositions in this age group did not associate nominal arguments with verbs in the same constituent, and no pronouns were used except occasionally first person (pointing to the chest).

Group 3. In the third age group (short stretches of narratives of two younger people), facial expression was added to show continuation/dependency between constituents such as conditionals, and, together with head position, to signal parentheticals in a discourse. Although utterances clearly involve subordination semantically, this subordination is not marked syntactically – no complementizers, time adverbials, or conditional expressions like 'if'. Instead it is marked with prosodic signals of timing of the hands and intonation of the face and head.

Together with prosodic signaling of dependency between clauses, we see richer structure within clauses: verbs are more likely to occur with nominal arguments, and third person pronouns -- abstract syntactic elements -- are common. Relations between clauses are signaled prosodically by timing and intonation, and not syntactically, but syntactic elements are emerging: a tendency toward overt arguments associated with verbs, some of them pronominal forms. We see no implicational dependency relation between these syntactic elements within clauses and the prosody connecting them, however. We conclude that the mechanism for connecting clauses and indicating dependency relations between them is prosodic, and that syntactic mechanisms serving this function have not yet arisen. In the sense of dependency in language emergence adopted here, this suggests that the appearance of syntax is dependent on semantic groupings and relations marked by prosody. For further discussion of What You Can Say Without Syntax, see Jackendoff and Wittenberg (2014).

Group 4. We are just beginning to analyze the language of age group 4. The narrative of a single signer in the fourth age group was chosen for analysis for two

reasons: he is the oldest of five deaf siblings in one household and his deaf mother and hearing father know only ABSL and no ISL, so that the young man is able to distinguish the two languages and provide a good example of 'pure', fluent ABSL in his age group.

In his signing we found refinement and coordination of the nonmanual signals for subordination/dependency (cf. ISL example in Figure 3). Even doubly embedded sentences occur. An example is an utterance translated (with the help of prosody) as, "Father said to me about marriage, 'If you marry a deaf girl, all of your children will be deaf. No way.'" The underlined section in the gloss has conditional prosody: FATHER ME MARRIAGE, <u>DEAF TWO DEAF BOTH MARRY, OFFSPRING DEAF ALL</u> – NO-WAY. As with the younger groups, this embedding is signaled by prosody only and not by overt syntactic elements.

In his narrative, the signer added the nondominant hand for topic continuity (essentially, discourse level coreference) and shifts in body posture to identify referents in a discourse. All of these phenomena are structural advances over the narratives of the earlier stages of the language of the older people studied. Figure 5 is a gloss and translation to English of an excerpt in which he describes the vocations he had had to choose from at vocational school. A parenthetical segment is set off in the gloss by square brackets. The line along the side indicates the stretch of signing during which the nondominant hand is held in the signal to mark continuity of the topic -- 'the third profession' (vocation: welding) -- dropping to his side at the end of the discourse segment relating to the topic. Figure 6 illustrates the physical manifestation of linguistic properties of the utterance. The signer's budding Grammar of the Body is not yet as systematic and complex as that of more established sign languages, but it has the scaffolding in place.

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.

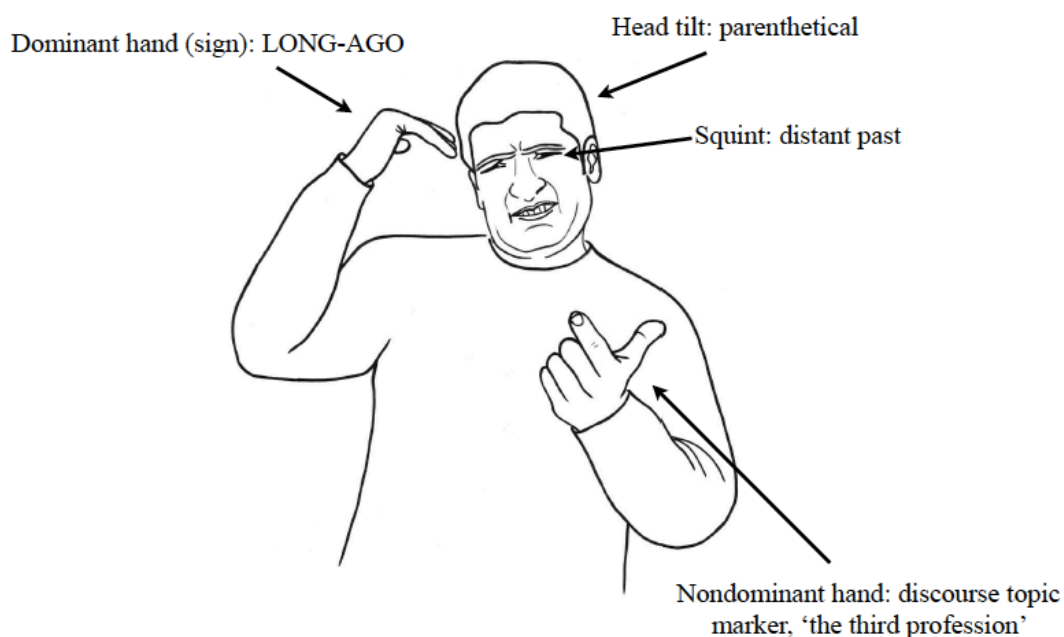Figure 5. Excerpt from 4th age group signer's narrative (from Sandler 2012).

Figure 6. Use of the body for grammatical functions in the segment glossed in Figure 5 (from Sandler 2012).

3. Conclusion

From a grammatical point of view, ABSL is relatively simple. Nevertheless, it

functions as a full language. Its users talk about life histories, folk remedies, dreams,

fertility, deafness, national insurance, wedding preparations, suspicions, personal relations – all fluently, without hesitation or pantomimic 'acting out', and without noticeable communication failures. While further linguistic structures may develop over time, it seems that fully functional language is possible with relatively simple structure (see Klein and Perdue 1997, Gil 2005, and Jackendoff & Wittenberg 2014 for more support for this claim).

The overview presented here suggests that a crystallized phonological system is dependent on the existence of a sizable, conventionalized lexicon, and that the emergence of overt syntactic complexity is dependent on semantic relations organized by prosody. Language needs this basic scaffolding of words and prosody, which emerges gradually within a few generations, and it seems that it is all you need for a perfectly good human language.

In the context of evolution, let's take a step back and consider what is entailed by this basic scaffolding: symbolic words, semantically related word groupings, intonational linking of propositions. Simple maybe, compared to millennia-old languages. But no other species even comes close.

Submitted July 2015

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