Glossa a journal of general linguistics

Tkachman, Oksana and Irit Meir. 2018. Novel compounding and the emergence of structure in two young sign languages. *Glossa: a journal of general linguistics* 3(1): 136. 1–40, DOI: https://doi.org/10.5334/gjgl.632

RESEARCH

Novel compounding and the emergence of structure in two young sign languages

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This paper investigates how structure emerges in a young language, focusing on compounding in two young sign languages, Israeli Sign Language (ISL) and Al-Sayyid Bedouin Sign Language (ABSL). We focus on novel compounds (tokens invented on the spot) to ensure that we are studying a productive process and to avoid issues contingent with lexicalization. We found that both languages make use both of compounding and size-and-shape classifier constructions (SASS-constructions), but ISL and ABSL have conventionalized different structures and the structures they do use are conventionalized to different degrees. We discuss the similarities and differences of those constructions in ISL and ABSL in the context of structure emergence and language evolution.

Keywords: compounding; novel compounds; size-and-shape specifiers; language emergence; Israeli Sign Language; Al-Sayyid Bedouin Sign Language

1 Introduction

All human languages have structure; words in sentences exhibit certain regularities that are shared between speakers. But where does the particular structure in any language come from? Most human languages are thousands of years old or developed from older languages, which exhibit structures of all kinds. The study of these languages can inform us on how new structures develop from already existing ones. There are cross-linguistic similarities in the kind of changes that structures can undergo, and researchers have proposed a variety of mechanisms to explain these changes (as in processes such as grammaticalization, see Bybee 2000; Hopper & Traugott 2003), which leads many of them to believe that such mechanisms are all that was needed in the inception of linguistic communication (Beckner et al. 2009 and references therein). Others assume that a shared language module will give rise to structure given the principles of universal grammar (Chomsky 2013; Yang et al. 2017).

The limited evidence we have from actual young languages, however, paints a picture of rather slow and thorny emergence of structure, as opposed to a rapid and efficient one. For example, traditionally creole languages are viewed as an example of universal grammar at work when there is a break in normal transmission of languages from parents to children. When children are exposed to impoverished and structurally reduced pidgins, it is argued, they impose innately-specified grammars on the pidgin, leading to creole languages that share structural properties with each other but do not share genealogical affiliations with their prior languages (see Hall 1962; Bickerton 1981; 1999; 2008; Thomason & Kaufman 1988; among others). This view, however, has been contested both with evidence from

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individual creoles (DeGraff 2003) and from large cross-linguistic studies on creoles (Blasi et al. 2017). This evidence suggests that creole languages are, first, much more different from each other than previously thought, and second, demonstrate structural continuation of their substrate and superstrate languages and thus cannot be considered languages with newly emerged grammars.[1] Likewise, evidence from sign languages challenges the idea of fast and cross-linguistically universal grammar emergence. Studies on young sign languages show that no matter what the social circumstances of sign language emergence are, it takes time for grammar to develop (Sandler et al. 2014; Sandler 2017; Brentari & Goldin-Meadow 2017), be it grammatical use of space (Senghas 2003; Padden et al. 2010a; b), syntactic structures (Aronoff et al. 2008; Sandler et al. 2011; Meir et al. 2017), prosodic marking (Sandler et al. 2011), or phonological structure (Aronoff et al. 2008; Sandler et al. 2011; Brentari et al. 2016).

How, then, does structure emerge in a new language, one that has no older structure to rely on? The arguments we make in this paper, based both on previous research and on the findings of the study we report here, are as follows. First, structure emerges gradually; second, different languages show different paths of emerging structures; third, even within a language, different domains may have different courses of emergence; and lastly, conventionalization in one domain does not necessarily influence conventionalization in other domains. We support these claims with data from two young sign languages, Israeli Sign Language (ISL) and Al-Sayyid Bedouin Sign Language (ABSL). Both languages are young, having emerged about 85 years ago in what is now Israel; however, they are unrelated to each other and they differ in their number of signers and the sociocultural situations in which they exist. Testing how forms with the same function emerge in these two very different sign languages is a good way to test claims regarding the development of grammar in language evolution.

What kind of structure do we expect to develop early in language emergence? Compounding is a word formation process that can give rise to such early structures. Compounding exists in all known human languages (Bauer 1988);[2] it is an easy means to increase the lexicon because it combines lexical items that already exist in the language; it usually exhibits a minimal hierarchical relationship between its constituents, namely a head and a modifier; it is often semantically motivated; and, unlike constituents of phrases or clauses, the possible relations between the constituents of a compound are limited (see Booij 2009; Guevara & Scalise 2009; Scalise & Vogel 2010). In many languages compounding is not only frequent, it is the dominant process of word formation. In Mandarin Chinese, for instance, between 70% and 80% of all words and 95% of neologisms are compounds (see Ceccagno & Basciano 2007 and references therein). Compounds are very frequent in sign languages as well (see Section 2). And compounding has been argued to be one of the earliest linguistic processes to emerge in language evolution (Jackendoff 1999; 2002; Heine & Kuteva 2008). Therefore, compounding is a good place to start if we are interested in the question of structure emergence.

How do we know that a structure has emerged in a language? A good indication is the degree of conventionalization of the structure in question across the community of language users. If different signers rely on the same structure to coin new labels, we can say

[1] This debate is still ongoing, but due to the limited scope of the present paper we cannot do justice to this intriguing issue. We refer an interested reader to Aboh & DeGraff (2017) and Blasi et al. (2017), cf. McWhorter (2001; 2005).

[2] Though see Štekauer, Valera, & Kőrtvélyessy (2012) in whose corpus of 55 languages at least five (East Dangla, Karao, West Greenland, Diola Fogny, and Kwak'wala) did not have any compounds. It should be kept in mind, though, that in many cases such claims are made for languages where the very definition of wordhood is still debated (Lieber & Štekauer 2009).

that this structure has been internalized and is productive. Most studies on compounding in sign languages, however, have been done on lexicalized compounds (see Section 2.1), which has important implications for what is ascribed to this process. For example, as Lepic (2015: 78) emphasizes, the term *lexicalized* is often used by sign language linguists for compounds that have been conventionalized and are typically "formally reduced." As a result, the "compounds" investigated often no longer have two identifiable signs as constituents (see, for instance, Klima & Bellugi 1979; Liddell & Johnson 1986; Sandler 1989; Brentari 1998; Johnston & Schembri 1999). Many of the features ascribed to such compounds (e.g., reduction of the movement in the first constituent, non-dominant hand anticipation, etc., see Section 2.1) are in fact found in other types of lexicalized or prosodic units, such as collocations, derived words, and phonological phrases, and are not defining properties of compounding per se (Nespor & Sandler 1999; Loos 2009; Lepic 2015; see also Brentari & Crossley 2002).

We argue that if we want to investigate a productive pattern that signers can rely on when coining a new label, we need to focus on novel compounds and not on lexicalized ones. Lexicalized forms show that the compounding process was active in the past, but cannot speak to the process' synchronic productivity. For instance, Zeshan (2003) claims that even though Indo-Pakistani Sign Language has a few conventionalized compounds, this process is no longer productive. In spoken language linguistics, the novel compounding approach has been used for decades (e.g., in Downing 1977; Plag 1998; 2003); in sign languages, however, the idea of studying novel compounds is fairly recent (Lepic 2015). Thus, in our investigation into the emergence of structure, we focus here on novel compounds, that is, compounds invented on the spot by signers of the two unrelated young sign languages, ISL and ABSL.

We investigate both how structurally conventionalized and how formationally conventionalized those novel compounds are. Conventionalization refers to a reliable association between the symbol and its meaning that is motivated solely by the agreement of language users (and not, for instance, by some intrinsic association, Clark 1996; Scott-Philipps 2015). We estimate structural conventionalization based on consistency of the sign order in compounds, and we estimate formational conventionalization based on consistency of formational features such as handedness, hand height and the behavior of the non-dominant hand. By studying novel compounds in ISL and ABSL, we hope to gain better understanding of how structure arises anew in a language, with no previously developed structures to rely on, as well as add to our understanding of this word-formation process in the visual-manual modality.

The article is organized as follows. Section 2 addresses previous research on compounding in signed languages, including the two languages under investigation, together with potential confounds of earlier studies. Section 3 describes the methodology adopted for the study and its motivations. Section 4 presents the results of the study. We conclude in Section 5 with a discussion of the main results.

2 Compounding in sign languages

2.1 Properties of lexicalized compounds in sign languages

Like compounds in spoken languages, sign language compounds are lexical units and thus have properties that are characteristic of lexemes and not phrases. The following properties of compounds are based on work on American Sign Language (ASL) by Klima & Bellugi (1979) and Liddell & Johnson (1986; 1989). Some are modality-independent, and some are characteristic of sign language only. Syntactically, such a construction must behave as one lexical unit, that is, no other lexical item can be inserted to modify the

construction. For example, in the compound BLUE + SPOT 'bruise', no word can come between BLUE and SPOT:[3]

(1) Klima & Bellugi (1979: 207)
*TED HAVE BLUE[m: 'dark'] SPOT.
TED HAVE BLUE + SPOT, BLUE[m: 'dark'].
'Ted has a dark bruise.'

In terms of grammatical operations, a compound is subject only to those that apply to a single lexical unit. For example, when applying reduplication for meaning 'a series of', the compound as a whole is reduplicated:

(2) Klima & Bellugi (1979: 209)
SISTER PROUD SHOW [x: 'me'] [SLEEP + DRESS][n: 'a series of'].
'My sister was proud to show me her collection of pajamas.'

Semantically, the meaning of a compound should differ from the meaning of the same signs in a phrase or clause. So, for instance, the compound BLUE + SPOT 'bruise' applies to all bruises, no matter what their actual color is:

(3) Klima & Bellugi (1979: 210)
BLUE + SPOT GREEN, VAGUE YELLOW[+].
'That bruise is green and yellowish.'

In addition, the meaning of individual components of the compound is not accessible:

(4) Klima & Bellugi (1979; cited in Sandler & Lillo-Martin 2006: 74)
I LOVE APPLES + ORANGES + BANANAS + ETC, BUT NOT ORANGES.
'I love fruit, but I don't like oranges.'

Rhythmically, the first sign in a compound is reduced (fewer repetitions, shorter movement) and the last sign can gain additional stress (such as tension of the muscles and rapid movement), but overall the compound duration is shorter than that of the corresponding phrase (see also Börstell et al. 2016).

The modality-specific features of sign compounds are mostly phonological. Sign compounds often exhibit unification of manual arrangement: in a two-handed sign, the non-dominant hand of the second sign is often already present as the first sign is articulated (non-dominant hand anticipation).[4] There is also a smoothing of the transition between the components: the two signs are articulated closer together in the signing space and

[3] Throughout the paper, we follow the standard convention of the field to represent sign glosses with small caps (SIGN), and fingerspelled sequences with small caps separated by dashes (S-I-G-N). In addition, when talking about classifiers we either employ the notation SASS-CL when we talk about size-and-shape classifiers in general, or a more specific notation of "CL-specification" for individual classifiers (e.g., CL-long-thin for the classifier employed for long and thin objects, see Figure 10).

[4] Here and throughout the paper the terms *dominant hand, non-dominant hand,* and *handedness* go beyond the issue of the handedness of signers, but refer to the effect of handedness on signs. Handedness here mostly refers to whether one hand or two hands are involved in the sign's production. Signs can belong to one of three major types: *one-handed signs*, articulated with just one hand, *two-handed balanced signs*, where both hands act as equal articulators and usually have the same handshape, movement and location, and *two-handed unbalanced signs*, where the dominant hand acts on the non-dominant hand, the latter in this case is employed as a passive ground rather than an active articulator (Battison 1974). Most of the time the dominant hand acts as the active articulator in signing, but in some cases the dominance can be reversed. No cases of reversed dominance occurred in our data, and we will not refer to this issue further.

the transitional movement between the components becomes part of the phonological structure of the compound (Liddell & Johnson 1986; Sandler 1987; 1989).

The previously-mentioned properties are found in compounds in other sign languages, though not necessarily in all of them. Properties that are claimed to be universal are unification of arrangement and shorter duration than that of a corresponding phrase; they are claimed to exist even in languages where compounds do not exhibit any of the other compound-specific properties (see such claims in Zeshan 2003 on Indo-Pakistani Sign Language compounds, and in Schmaling 2000 on Hausa Sign Language compounds). Other properties can be mandatory in some sign languages but optional in others. For example, both ASL and Swedish Sign Language (SSL) have a strong tendency for the sign that is articulated higher in signing space to be the first component in a compound (see Johnson & Liddell 1986; Svaib 1992; Loos 2009 for ASL; and Wallin 1993 for SSL). However, whereas counterexamples exist in ASL (see Loos 2009), in SSL this structural constraint is so strong that even compounds borrowed from spoken Swedish into SSL change the order of components to obey the higher-sign-first order. This change of the sign order happens even if the signer mouths the original Swedish compound simultaneously in the opposite order, i.e. creating a mismatch between what is being signed and what is being mouthed. For example, in the compound NOSE + BALL (NÄSA + BOLL) 'Bollnäs' (a Swedish town), the mouthing follows the Swedish word order, whereas the order of the signs is reversed to articulate the higher sign NOSE first (Wallin 1982: 18).[5] Similarly, whereas in ASL the first sign can be either one- or two-handed (Liddell & Johnson 1986), in SSL the first sign must be one-handed (Wallin 1983).[6]

Other phonological changes, characteristic of compounds in many sign languages, might not be compound-specific, but rather can be found in other lexicalized multi-sign constructions as well. In particular, two features often reported for compounding have been argued to occur in lexicalized collocations and derived signs as well: regressive assimilation, where the handshape of the first sign assimilates to the handshape of the second (see Wallin 1983; Sandler 1989; 1993; 1999), and the previously-mentioned non-dominant hand anticipation (Nespor & Sandler 1999; see Lepic 2015 and references therein).

A central notion in classifying compounds and describing their structure is the notion of headedness. In traditional approaches, the head of the compound can be determined by three different means: syntactically, it is the component that percolates its features (e.g., its part-of-speech) to the resulting compound; phonologically, the component can bear a specific stress pattern; or semantically, the head is the constituent that shares with and percolates to the whole compound all of its lexical-conceptual information, making the whole compound a hyponym of its semantic head (Jackendoff 1990; Lieber 2004). On the basis of headedness it is possible to identify three major types of compounds: endocentric, exocentric and coordinate (dvandva) compounds. *Endocentric* compounds have a head and express some semantic relationship between the head and its modifying element(s) (e.g., 'greenhouse', a type of a building used for growing plants). *Exocentric* compounds do not have a semantic head (that is, an exocentric compound is not a hyponym of one of its components) and the relationship between their constituents is often metaphoric or metonymic, as in English *redneck* 'a working-class white person'. In *dvandva* compounds all the components are heads, and together they constitute a superordinate term, as in 'singer-songwriter'. Endocendric compounds are classified as left- or right-headed depending on

[5] We are thankful to Carl Börstell for providing us with this example.

[6] Though this is true only for "native" compounds. SSL has compounds of all combination types (1 + 1, 1 + 2, 2 + 1, 2 + 2) (We are thankful to Carl Börstell for bringing this point to our attention).

whether the head constitutes the first or second element: in some languages (e.g, English, Turkish and Dutch) endocentric compounds are right-headed, while in other languages (e.g. Hebrew, Arabic and French) they are typically left-headed.

Such modality-independent properties of compounds, e.g., determining which constituent is the head in a sign language compound, are often complicated by modality-specific issues. All three types of compounds are found in sign languages: endocentric (e.g., ASL DEAF + SCHOOL 'deaf school'), exocentric (e.g., ISL FEVER + TEA 'sick') and dvandva (ASL FATHER + MOTHER 'parents').[7] However, syntactic clues, such as the lexical category of the components and the compound, are often hard to find. Even when the word class of individual signs can be determined in isolation, in a compound these signs can lose their distinguishing traits due to compound-specific reduction. For example, in ASL, nominal signs often have a repeated movement (especially when they are members of formationally similar noun-verb pairs, Supalla & Newport 1978), but this repetition is often lost in the first component of a compound. Moreover, in a young sign language there may not be reliable features distinguishing word categories (Tkachman & Sandler 2013). Thus, discussion of headedness in sign compounds is usually confined to semantic heads (e.g., in Vercellotti & Mortensen 2012).

It is not clear, though, whether headedness is relevant for describing the linear structure of sign compounds. For example, ASL compounds have been claimed to be right-headed (Klima & Bellugi 1979), left-headed (Svaib 1992), and even not positionally restricted (except for verbal compounds, see Loos 2009). It might be that some phonological factors, for example, whether the signs are one- or two-handed, as described above, play a more important role in determining the linear order of the components than headedness. Another possible factor involved in determining the linear order is spoken-language borrowings. Some sign languages have borrowed heavily from their surrounding spoken languages, and those borrowed compounds often display the opposite tendency for head position from that of compounds created within the sign language itself (a situation frequently seen in spoken languages as well, e.g., Chinese loans in Vietnamese are right-headed whereas native compounds are left-headed, Hoeksema 1992). We discuss the issue of borrowing in the following section.

2.2 Loan versus genuine compounds in sign languages

Following Wallin (1983) and throughout the paper, we refer to compounds that are native to sign languages as *genuine compounds*. Spoken language loans, that is, *loan translations* from the spoken language, are literal translations, or calques, of spoken compounds or other multiword constructions, such as HOME + WORK 'homework' in ASL (Padden 1998). Some areas of the lexicon, such as idioms, may have more loans than others (Sutton-Spence 1999 for British Sign Language), as opposed to native constructions such as verbs of motion and size-and-shape specifiers (Padden 1998). How much a signed language borrows from a spoken language is probably language-specific and depends on factors such as language prestige, oral education, and the degree of bilingualism in the community. There are also different ways to borrow from a spoken language, and all of them can participate in coining compounds. Fingerspelling is a clear case of spoken-language borrowing, but in many other cases one needs additional criteria to decide if a compound is native to the

[7] It is not clear how productive dvandva compounds are. For ASL, Vercellotti & Mortersen (2012) argue that they are no longer productive and Lepic (2015) argues they still are. In our data, a dvandva compound for 'jewelry' was used as a part of a larger compound 'jewelry box' by four of our ISL signers, but each signer used different signs and in different order (RING + BRACELET, RING + NECKLACE, NECKLACE + EARRINGS + RING, etc.), which supports the assumption that this compounding process may still be productive for superordinate terms, though the individual tokens may not be lexicalized across the community.

sign language or is a loan translation (see Section 4.1.1 for ISL-specific criteria that we use in the current study).[8]

Just as in spoken languages, loan translations can exist in a sign language for a long time, even to the point that native signers may not be aware of their origin. They also might not look formationally like loans from a spoken language, if they consist of two or more signs of the core lexicon and exhibit properties of native compounding such as temporal reduction, as opposed to other types of borrowings, such as collocations (see Section 2.3). However, such compounds may still exhibit properties that are quite different from those of compounds native to the sign language under investigation. For example, Meir et al. (2010) observe that in ISL compounds borrowed from Hebrew are always head-initial (e.g., PARTY + SURPRISE 'surprise party'), whereas genuine compounds can have heads either in initial or in final position. In SSL, genuine compounds start with a one-handed sign first, and the second sign can be either one- or two-handed. Compounds loaned from Swedish, however, do not obey this constraint and may start with either one- or two-handed signs, depending on whether the sign corresponding to the spoken word in the initial position is one- or two-handed (Wallin 1983).[9]

For our study, this distinction between genuine compounds and loan translation is important, because we are interested in the productive process of compounding. Loan translations reflect properties of their source languages, which may be very different from those of the languages under investigation. This is also why we focus on novel compounds: since novel compounds are created on the spot, they are genuine compounds. We will return to this issue in Methodology.

2.3 Special types of sign compounds and their properties

Studies of sign compounds also describe a number of modality-specific and language-specific types (for more details on those kinds of compounding see Lepic 2015; 2016). Two such types are fingerspelled and chain compounds, where both members involve fingerspelling. *Fingerspelled compounds* are calques from the surrounding spoken language, but instead of using two lexical signs with the meaning of the corresponding spoken words one of the components is fingerspelled, as in the following examples from ASL:

(5) Ryan Lepic (p.c.)
  a. AGREE F-O-R-M 'consent form'
  b. PRIVACY S-E-T-T-I-N-G 'privacy setting'
  c. S-E-X-U-A-L ACTIVITY 'sexual activity'

In addition, many borrowed English compounds are entirely fingerspelled:

(6) Padden (1998: 54)[10]
  a. W-O-R-K-O-U-T 'exercise/workout'
  b. S-K-Y-L-I-N-E 'skyline'

[8] Another type of spoken-language borrowing is mouthing, or silent mouth articulation of (part of) a spoken word while signing. Often mouthing helps to distinguish between different meanings of an ambiguous sign, such as mouthing 'brother' or 'sister' while signing SIBLING in ISL. Such cases are not considered to be compounds, however, since mouthing does not create a new lexeme, but simply clarifies which of the potential meanings of the sign is relevant (see also Sections 3.3.2.3 and 4.2.1).

[9] It should be noted, though, that a lot of the genuine compounds that Wallin discusses use specific items as the first unit, such as THINK or SEE, which happen to be one-handed. Thus, it is unclear if the constraint is really phonological or a consequence of a restricted set of items (Carl Börstell, p.c.).

[10] Examples in (6) are different from those in (5), because they do not have internal structure: even though they are compounds in their source language, in a sign language they are just a string of fingerspelled letters. One may argue that unless a fingerspelled compound is created by signers from two lexicalized fingerspelled words, and that the resulting compound does not exist in a spoken language that is the source of those fingerspelled borrowings, items in (6) should not be considered to be compounds at all.

In *chain compounds*, a fingerspelled English word is followed by an ASL lexical sign with the same or similar meaning. Such compounds are often used to establish the intended label for the referent whose sign is not widely recognized (Lepic 2016):

(7) Lepic (2016: 10)
P-R-O-S-O-D-Y WAVE-FROM-MOUTH 'prosody'

Compounds involving fingerspelled forms are language-specific, because not all sign languages use fingerspelling, and those that do use it do so to various degrees. For example, while fingerspelling is used in ISL for names and places, it is rarely used for other lexical items; ISL usually borrows from Hebrew by the way of mouthing of Hebrew words (see Footnote 8). So far, no fingerspelled compounds have been attested in ISL. However, in ASL fingerspelling is widespread (Padden 1998; Börstell et al. 2016),[11] and many concepts are expressed exclusively by fingerspelling, which gives rise to fingerspelled compounds and chain compounds.

Another type of compounds which is of more relevance to the present study is *classifier compounds*. In such compounds one of the signs, usually the final one, is a size-and-shape specifier (SASS, see Emmorey 2000 for ASL), a sign that expresses a salient visual property of the referent, as in the following examples:

(8) Klima & Bellugi (1978: 238)
a. RED + CL-rectangular - 'brick'
b. PICTURE + rectangular - 'photograph'

Such constructions are stable form-meaning pairings, but depending on context and/or the level of conventionalization, either the lexical sign or the SASS-classifier can be used on its own instead of the entire compound. For this reason, not all researchers agree that these constructions are indeed compounds (see Vercellotti & Mortersen 2012). However, SASS-classifiers are more likely to be constituents in lexicalized compounds than other kinds of classifiers (Aronoff et al. 2003), which leads some researchers to believe that such constructions should be treated as a special kind of compounding (Meir et al. 2010). In our study, we did not exclude classifier compounds from the analysis, but we call them SASS-constructions and report the results for them separately from the sign-sign compounds, to avoid any possible confusion.

2.4 Compounding in the languages under investigation

The current study focuses on novel compounding in two languages that emerged and exist in the geographical area of the current state of Israel, Israeli Sign Language (ISL) and Al-Sayyid Bedouin Sign Language (ABSL). Whereas conventionalized compounds in ABSL have been studied before (Meir et al. 2010), there are no systematic studies on ISL compounds beyond basic descriptions (Meir & Sandler 2008). In this section, we briefly review what is known about ISL and ABSL compounds.

An earlier description of ISL compounds (Meir & Sandler 2008) observed that whereas Hebrew loans are always left-headed (that is, the order of constituents is head + modifier; e.g., PARTY + SURPRISE 'surprise party'), some signers reverse the order of signs in loans to make them right-headed. Genuine compounds can be exocentric (e.g., FEVER + TEA 'sick'), and genuine verbal compounds tend to be right-headed (that is, the order is

[11] In fact, in their survey of distribution of sign categories in four different sign languages, Börstell et al. (2016) found that ASL employs more fingerspelled signs than any other sign language, 6.4% of all the signs.

modifier + head, e.g., HEART + OFFER 'volunteer', BREAD + FEED 'provide for'). As for ABSL, the language is known to have a great deal of lexical variation, but Meir and her colleagues (Meir et al. 2010) report a weak tendency for a modifier + head order in compounds (e.g., PRAY + HOUSE 'mosque').

SASS-classifiers are used in both ISL and ABSL, and ABSL especially uses them widely (see Meir et al. 2010; Sandler et al. 2011). In both languages, the preferred order for SASS-construction is SASS-final (see Meir et al. 2010 for ABSL and Tkachman & Sandler 2013 for ISL). The tendency for size-and-shape specifiers to occupy the last position is very strong in ABSL (e.g., CHICKEN + CL-oval-object 'egg', Sandler et al. 2011).

As for other types of compounds reported above, they are either unsystematic, rare or unattested. For instance, dvandva compounds have been reported to exist in both ISL and ABSL, but they appear not to be conventionalized (see below). As for fingerspelled and chain compounds, neither has been attested so far.

3 The current study

3.1 Languages under investigation and participants

The languages investigated in this study, Israeli Sign Language (ISL) and Al-Sayyid Bedouin Sign Language (ABSL), are young sign languages of approximately the same age: they both arose around 85 years ago in what is now Israel. ISL is in its fourth generation of adult signers, with about 10,000 people using it as their primary language (Meir & Sandler 2008). It has all levels of linguistic structure, and it is used in the education system and the media. There are several dictionaries of ISL, and two academic interpreters' programs. ISL has substantial contact with the surrounding spoken language, Hebrew. The first deaf schools were strictly oral, and even today deaf education in Israel is Hebrew-dominant, which results in a substantial number of Hebrew borrowings in ISL, among other influences. We return to this issue in Section 4.1.

Al-Sayyid Bedouin Sign Language (ABSL) arose in a village that now has some 4,000 people with about 130 deaf members, and it is used by the deaf and also many of the hearing members of the community (Kisch 2012b). The language is fully functional for the communicative needs of its users. Linguistic variation is quite high across different signers (Sandler et al. 2011; Meir et al. 2013). ABSL has some contact with ISL, mostly through its younger second- and third-generation signers who were educated in Hebrew schools that used ISL signs. The fourth generation of ABSL signers are educated in schools where Arabic is language of instruction, and there too, the teachers often accompany their speech with ISL signs. Nowadays the village has a deaf school of its own where the teachers use ABSL signs.

Five native signers of ISL (four deaf, one hard of hearing), and eight native signers of ABSL (all deaf) participated in the study.[12] The ISL participants were 36–55 years old (second and third generation ISL signers), and not related to each other. They had all completed high school, and three participants had Bachelor/Masters degrees. All ISL participants were female. The ABSL signers were between the ages of 14 and 45 (second and third generation ABSL signers), with four still in high school, and the rest high school graduates. Most of the ABSL participants were related to other participants: there were three siblings and an aunt from one family, two siblings from another family. The final two participants were not related to any other participant. Six of the ABSL participants were female, and two were male.

[12] Originally 8 ISL signers (seven females, one male) participated in the study, just as in the ABSL group. However, the data from two participants were damaged due to camera issues, and another participant's data had to be excluded from the analysis because the participant misunderstood the instructions.

3.2 Elicitation materials and procedure

In order to encourage our participants to create multi-sign constructions, we created a list of 32 objects that the participants were familiar with but did not have a conventionalized name for in their respective languages (as confirmed by our consultant, a native ISL signer very familiar with ABSL). The list is presented in Appendix 1. We assumed that naming such objects would encourage a *subordinate level* of description (that is, if 'chair' is a basic-level object, 'dentist chair' and 'kitchen chair' are subordinate-level objects, whereas 'furniture' is a superordinate-level term), and that that would lead participants to produce a basic-level sign plus some other sign, affix, or classifier (Newport & Bellugi 1978), thereby encouraging the production of novel compounds. We tried to avoid very unusual objects or objects with more than just one prototypical and/or obvious function, to avoid confusion and discourage lengthy descriptions. Our focus on choosing objects without established names in ISL and ABSL led us to overlook possible influences from surrounding spoken languages, however. This issue was addressed at the coding stage (see Section 3.3.2.4).

The elicitation objects were presented to the participants in the form of pictures on a computer screen using PowerPoint software. The participants were asked to name the objects they saw to another signer of the same language who did not see the pictures being named. All the responses were videotaped for future analysis.

Of the original list of 32 objects, six were excluded from the analysis. Elicitation items were excluded if they failed to elicit any multi-signed responses or if they failed to elicit any responses classified as compounds in either of the languages under investigation (see Section 3.2). Elicitation items were included if they elicited any responses classified as compounds in at least one of the languages. Thus, 26 elicitation items were included in the final analyses.

3.3 Coding and analysis

Responses were videotaped. There were only two instances of participants failing to produce any response for a picture, one in ISL data and one in ABSL data. Overall, the ISL group produced 113 compounds, 31 SASS-constructions, 14 single-sign responses, and 58 responses classified as "other". The ABSL group produced 83 compounds, 74 SASS-constructions, 29 single-sign responses, and 62 responses classified as "other" (Table 1). Sometimes participants produced multiple responses for an item. We dealt with such instances in the following way: whenever a participant produced two or more identical tokens for the same elicitation picture, we only analyzed the first token, but when the same signer produced different responses to the same picture (for example, one as a compound and one as a SASS-construction), we analyzed both variants (see Section 4.1.1 for details). The ABSL group differed from the ISL group in that repetitions of utterances occurred less frequently. This resulted in 103 productions being excluded, 71 from the ISL data and 32 from the ABSL responses. Because of the exclusion of multiple responses for some items, and some missing responses, the resulting data set includes 145 ISL forms and 216 ABSL forms.

All productions were glossed by the first author with the help of a native ISL signer who was also familiar with ABSL. Each production was classified as belonging to one of four categories: a single-sign response, a compound, a SASS-construction, or "other". A response was classified as a *single-sign response* if only one sign was used to name the object on the picture. Following Meir et al. (2010), responses were classified as *compounds* if they consisted of two or more signs, denoted one concept, were produced with ease and fluidity, and had no pauses (that is, the hands did not return to rest position between the signs) body shifts or changes in gaze. If a response met all of the above criteria for

compoundhood, but one of its signs was a size-and-shape classifier (SASS), the response was classified as a *SASS-construction*. Signs that were identified as SASSes if they depicted the shapes, outlines and/or relative sizes of the objects they described (Newport & Bellugi 1978; Supalla 1982; 1986; see Appendix 3). Two examples of SASS-classifiers, one from ISL and one from ABSL, can be seen in Figure 1: the two tokens have the same meaning and were produced for the same referent, but differed in their handshape and hand orientation. Finally, all multi-sign responses that did not meet the above criteria were classified as "other" (see Section 3.3.1 for a more detailed description of how we identified compounds). Single-sign responses and "other" responses were excluded from the final analysis. Only responses that were classified as compounds or SASS-constructions were analyzed.

3.3.1 Criteria for separating compounds from other multi-sign expressions

Identifying which responses were compounds and which were phrases or other non-compound multi-word expressions was a critical task for our study. This task was especially challenging since we were dealing with tokens that were novel and created on the spot.[13] Such a task is not easy even for conventionalized compounds: first, both compounds and phrases can label objects, and thus be indistinguishable functionally; and second, phrases and compounds can look very similar to each other, especially if their components have the same order (see Booij 2007 for discussion). In this study, we followed Meir et al. (2010) who were the first to face this dilemma while dealing with conventionalized compounds in ABSL. We decided to adopt the criteria developed by Meir et al. (2010) for the following reasons: first, it enabled us to compare our findings to the previous research on one of the languages under investigation. Additionally, the specific criteria Meir et al. (2010) developed (two or more signs denoting one concept and produced with ease and fluidity and without pauses, head shifts, etc., see above) are in line with what we know of compounds in general: semantically, compounds denote one concept, phonologically, they are reduced and behave as one unit. In fact, other researchers have claimed that phonological changes are easier to detect than other compounding properties such as semantic opacity (Zeshan 2002), and thus phonological criteria are better for identifying compounds, at least in earlier stages of the investigation. In fact, given their cross-linguistic frequency in sign language compounding, Zeshan (2002) proposes that temporal compression and movement deletion (the two features that make a compound shorter and more fluid than

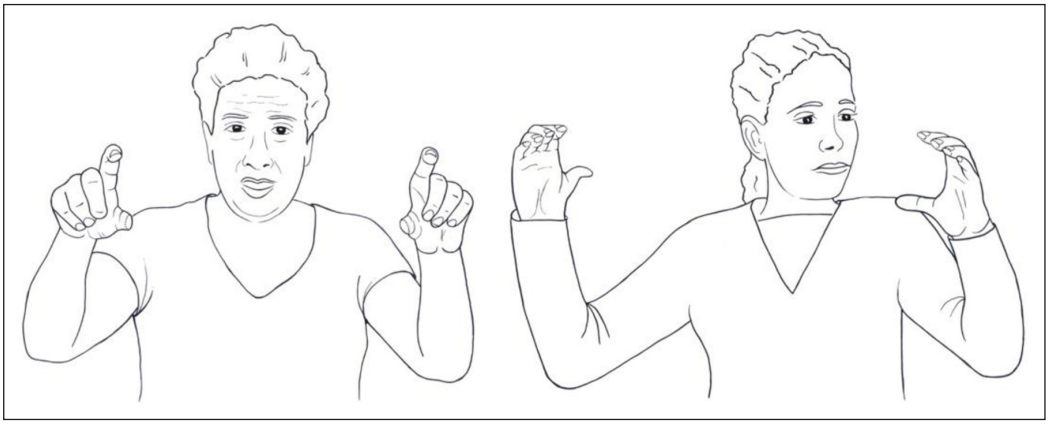

Figure 1: ISL (left) and ABSL (right) signers producing SASS-CL for a long-narrow object (ELECTRIC SPLITTER).

[13] Indeed, some researchers believe that we should not assume compounding even exists in languages that do not employ overt "compound markers" like those in Greek or German (Lepic 2016).

a corresponding phrase) should be regarded as universal phonological changes in sign language compounding. Admittedly, the syntactic criterion of indivisibility (the fact that a compound is one unit and no other elements can be inserted between its components) could not be applied to our data given the nature of the experiment design. This issue should be addressed in future research.

The effectiveness of the criteria developed by Meir et al. (2010) and adopted here can be demonstrated with an example where the same signer produced two slightly different responses for the same target, a picture of a water tap. The ISL signer produced a phrase and a compound for the same target with the same signs used in the same order, but she produced the phrase with a pronounced break between the two signs and with each sign articulated with double movement. In the first production (classified as a phrase), she produced TAP with a repeated movement, paused and her hand started to return to the rest position when she changed her mind and added WATER, again with a repeated movement and the eye gaze on her hand. It took her 3 full seconds to produce the two signs. In the second production (classified as a compound), the first sign's iteration was reduced, the movements were smaller, and there was no pause and no eye gaze change between the signs. Furthermore, the entire utterance took only 2 seconds to produce.

There were only a few such examples in our data (that is, instances where a signer produced both a compound and non-compound response, so the distinction was easily seen), as most signers produced only one response per picture, and if they produced two responses, most of them were identical to each other. However, these examples demonstrate that the criteria developed by Meir et al. (2010) are sufficient for distinguishing compounds from phrases, at least in most cases. We applied the same criteria to both languages under investigation.

3.3.2 Coding

After the data were glossed and classified, they were coded for a number of features.

3.3.2.1 Headedness and constituent order

The notion of headedness is important in compounding studies for determining a compound's hierarchical structure and its linear structure. As mentioned above, in this study headedness was identified on semantic grounds: we determined the relationship between constituents in the compounds based on the meaning of each component and the meaning of the object the participants were aiming to name. This approach was generally sufficient.

There were no exocentric compounds in our data (such as English *pickpocket* or *redneck*), and there were no coordinate compounds with both constituents behaving as a head (such as English *singer-songwriter*). In ISL we did have some examples of coordinate (dvandva) compounds (JEWELRY elicited various multi-signed responses such as RING + BRACELET, RING + NECKLACE, NECKLACE + EARRINGS + RING with simultaneous Hebrew mouthing 'jewelry' over all of the signs), but these were always constituents in a larger compound (BOX + JEWELRY for 'jewelry box'), so even in those cases determining headedness was straightforward (BOX in this example). In SASS-constructions, however, determining the head on semantic grounds was more problematic: it was not clear whether the SASS was the semantic head or the modifier. In some cases, the SASS functioned as a head (e.g., ABSL COLD + SASS-small-oval 'ice cube'), while in others it was a modifier (ABSL COMPUTER + CL-wide 'laptop'). In addition, in SASS-constructions with more than two constituents the SASS could also function as a modifier of the head (e.g., ABSL NECKLACE + BOX + CL-wide 'jewelry box') or as a modifier of the modifier (ABSL LEMON + CL-handful + TREE 'lemon tree').

Order of constituents was determined differently for compounds and SASS-constructions. In compounds, the order was determined by the position of the head (head-initial or head-final). There were only nine three-constituent compounds, and they had all possible word orders (including head-medial), which is why they were excluded from the analysis. Thus, the order of constituents for compounds was determined on the basis of two-sign compounds only. In SASS-constructions, the order of constituents was classified based on the position of the SASS-classifier (SASS-initial or SASS-final), regardless of its function or the function of the other sign in the construction. Similarly to the order in compounds, we only included two-constituent SASS-constructions.

3.3.2.2 Features of articulation

We coded the signs for three articulatory features: the number of hands used to articulate each of the signs in the compound (one- or two-handed), the spread of the non-dominant hand (either anticipation or perseveration), and the relative height of the signs in a compound. The number of hands indicated how many hands, one or two, were employed in articulation of each sign (e.g., in the ISL compound TAP + WATER, both signs were one-handed). The second feature we coded for, *non-dominant spread*, is a phenomenon commonly reported for lexicalized compounds (see Liddell & Johnson 1986; Sandler 1989; 1993; Sandler & van der Hulst 1995). The non-dominant spread occurs in compounds with one one-handed and one two-handed sign (though it can occur with two-handed balanced signs as well, e.g., ASL SLEEP + DRESS 'nightgown,' see Klima & Bellugi 1979), and can manifest itself in two ways: if the non-dominant hand of the second (two-handed) sign is already present (anticipating) during the articulation of the first (one-handed) sign, it is called *non-dominant hand anticipation*; the reverse process of the non-dominant hand of the first (two-handed) sign persisting throughout the production of the second (one-handed) sign is called the *non-dominant hand perseveration* (see Figure 11 for an example of non-dominant hand perseveration in ISL). Finally, the third feature, the relative height of the signs in a compound, refers to whether the two signs are articulated on the same level, and if not, whether the first sign is higher or lower in the signing space than the following sign.

3.3.2.3 Mouthing

Mouthing is a type of borrowing from a surrounding spoken language: the signer produces mouth articulation of (part of) a spoken word together with the manual sign. Mouthing is usually widespread in sign languages with a history of oralist education for deaf children (Boyes-Braem & Sutton-Spence 2001), and is often used to make a sign's meaning more specific (e.g., mouthing 'brother' or 'sister' for the ISL sign SIBLING; see also Padden 2001 for similar examples in ASL). Of the languages under investigation, mouthing is very rare in ABSL, whereas it is quite widespread in ISL, especially with nominal signs (Tkachman & Sandler 2013). We report only the ISL data for the mouthing feature, since no mouthing was attested in our ABSL data.

3.3.2.4 Genuine versus loan compounds

As we are interested in the word-formation processes that are part of the languages we are investigating, it was important that the forms we analysed were actually novel ABSL or ISL forms. Thus, we needed to ensure that we excluded loan words. In sign languages this is complicated by the fact that loan words come in two varieties, loans from another sign language that the signer knows, and loan words from the spoken language of the surrounding hearing community. The former are easy to find and exclude, indeed, the stimuli were created to avoid existing lexical compounds. The latter are more difficult.

When words are borrowed from a language into another language in the same modality, the forms are adjusted according to the phonology of the borrowing language. But when forms are borrowed from one modality into another, they are instead translated. Sometimes the translation is complete (using the relevant signs), other times the translation is partial, for instance, fingerspelling the word instead of using the sign. And sometimes both occur, e.g. a sign is accompanied by mouthing of the spoken word. Such borrowed forms are interesting in their own right, indeed, there is a field of study dedicated to understanding borrowing, however, the principles governing borrowings are outside the scope of the present study. We used these known properties of spoken-sign language borrowing to exclude possible borrowings.

In the case of ISL, we are aware of a substantial Hebrew influence from its inception to the present day (see Section 3.1), and therefore there was a need to distinguish between instances of actual spontaneous compound creation (genuine compounds) versus translation of a Hebrew compound that participants already know (loan translations). Though not much is known about differences between loan translations and genuine compounds in sign languages (but see Wallin 1983 on such borrowings in SSL; Padden 1998 on ASL; and Sutton-Spence 1999 on BSL), previous research indicates that the two classes of compounds can have different properties (see Section 2.3 for details).

It is not a trivial task to distinguish between Hebrew loan translations and genuine compounds in ISL, since the order of constituents in ISL compounds is not fixed; therefore, merely relying on the word order might result in an overestimate in the number of Hebrew borrowings. Another possible indicator is mouthing: mouthing is very widespread in ISL, especially on nouns (see Tkachman & Sandler 2013), and most of the elicited compounds were of the noun-noun type due to the nature of the elicitation material (pictures of concrete objects). Therefore, a compound was classified as a Hebrew loan if three conditions were met:

1) the signed compound is an *existing* compound in Hebrew;
2) all the constituents of the compound are mouthed; and
3) the mouthing is that of the Hebrew compound and not of the individual signs.

The third condition was introduced because Hebrew noun-noun compounding, called *smichut*, can be identified by certain morphological modifications on the head noun, which is always first. These modifications are apparent if the head noun is in the feminine singular or masculine plural forms, but not in the masculine singular or feminine plural forms.[14] Those latter compounds in our data, therefore, are ambiguous as to whether they are true Hebrew borrowings or genuine compounds that happen to have the same word order as Hebrew compounds (e.g., TREE + APPLE and TREE + LEMON, see Footnote 14). Only very few such ambiguously-mouthed compounds were elicited, though, and they were included in the final analysis. The issue of how to determine whether they are borrowings or genuine compounds should be investigated in more detail in future research. To sum up, in our data, we only excluded compounds as potential Hebrew loans if they met all three conditions: the compound exists in Hebrew (Condition 1),

[14] For example, if the head noun *kubiya* 'cube', which is in the feminine singular form, serves as a head of a compound, it will change its morphological form to *kubiyat* (as in *kubiyat kerach* 'ice cube'). Likewise, a noun in a masculine plural form will change its form when serving as a head of a compound (e.g., *'etzim* 'trees' will become *'etzey* in *'etzey limon* 'lemon trees'). No such changes happen to nouns in masculine singular or feminine plural forms: *'etz* 'tree' retains its form in *'etz limon* 'lemon tree', likewise *kubiyot* 'cubes' retains its form in *kubiyot kerach* 'ice cubes'. These modifications of the head noun are unique to compounding and are not present in noun phrases: for instance, in the noun phrase *kubiya shel kerach* 'a cube of ice' the head noun *kubiya* is unmodified.

both signs had a corresponding mouthing (Condition 2), and the mouthing was of the *smichut* (Hebrew compounding) form and not of the individual signs (that is, excluding productions where the signer mouthed *'etzey limon* while signing TREE + LIMON, but not if the signer mouthed *'etzim limon,* which is not the *smichut* form of a Hebrew compound, see Footnote 14) (Condition 3). The list of all Hebrew loans identified in our data can be found in Appendix 2.

No ABSL compounds have been identified as potential loans. First, ABSL seems to be less likely to borrow compounds from a spoken language, either Arabic or Hebrew, possibly because very few deaf ABSL signers know either language well and the experience of the research team indicates that hearing people do not use mouthing while signing.[15] Second, there are no additional clues to indicate if an ABSL compound was borrowed, such as mouthing or fingerspelling. Additionally, conventionalized compounds such as PRAY + HOUSE 'mosque' are not based on Arabic. For these reasons, we did not seek loan translations in the ABSL data. As for possible ISL influences on ABSL, since we used objects that did not have conventionalized ISL names, such influence on ABSL was unlikely. In a few cases ABSL signers did use ISL signs, but those ISL signs were used in novel compounds not found in ISL, and were thus not considered to be a case of borrowing (e.g., two ABSL signers used the ISL sign DOCTOR in the novel compound DOCTOR + BOX 'first aid kit', while none of the ISL signers produced such a compound). Of course, it is not impossible that at least some ABSL compounds were borrowed from either Arabic or Hebrew, but as we did not have reliable clues for their identification, we treated all elicited compounds as genuine ABSL compounds (the interested reader can find both Hebrew and Arabic (the local dialect) translations of all elicitation items in Appendix 8). We will address possible influences of other sign languages in the Discussion.

4 Results

Below we report the results of this study. The results are organized as follows: we start with a general overview of preferences for naming strategies in each language group, then continue with headedness and constituent order for both languages and both constructions. We conclude with the results for features of articulation, specifically the number of hands, hand height, and non-dominant spread.

4.1 The distribution of naming strategies

4.1.1 Israeli Sign Language

The ISL dataset consisted of 216 responses, of which 113 were compounds (52%), 31 were SASS-constructions (14%), 14 were single-sign responses (6%), and 58 were classified as "other" (27%). After excluding repetitions, single-sign responses and "other" responses, the dataset consisted of 70 compounds and 22 SASS-constructions (see Figure 3 below).

Of the 70 compounds, 24 were identified as (potential) Hebrew loan translations based on the three criteria described in Section 3.3.2.4 (see Appendix 2 for the full list of Hebrew loans).[16] Since borrowing is just another type of word-formation, we analyzed our data as having two types of compounds, borrowed and native (loan translations and genuine compounds, respectively). Both types were prominent in the ISL data: 32% of all responses were genuine compounds, and 20% were loan translations.

[15] The first two generations of ABSL signers grew up before deaf education was offered to Bedouins in the Negev, the third and fourth generations were schooled in deaf schools that mostly used ISL signs, but different spoken languages, Hebrew with the third generation, Arabic with the fourth (see Kisch 2012b for an extensive overview of the educational situation in the deaf ABSL community).

[16] Interestingly, no elicitation concept elicited Hebrew loans exclusively; even when most participants preferred a borrowed term (e.g., four out of five ISL participants used the Hebrew loan GLASSES + SUN 'sun glasses'), some signers coined their own labels.

Most of the ISL compounds consisted of two signs: 65 out of 70 (93%). Hebrew loans were almost exclusively two-signed (24 out of 25, 96%), which appears to be a coincidence, since Hebrew compounding is not restricted to two-word constructions; and in the group of genuine compounds five (out of 45) had more than two signs (11% of the genuine compounds).

Figure 2 shows the data for the ISL signers, individually for each participant. There, one can see that compounding was found to be the preferred strategy for most of them. But there was a marked difference in the preference for loan translations (from just one loan for one participant to 11 loans for another). None of the participants favored SASS-constructions or single-sign responses as a naming strategy, and the use of SASS-classifiers was between two and six per participant (mean 4.4). Overall, ten different SASS-classifiers were used by ISL participants, with most of them encoding either just one basic shape feature (e.g., SASS-round, SASS-square), or a combination of two shape features (e.g., SASS-long-thin) (see Appendix 3 for a full list of SASS-classifiers used).

4.1.2 Al-Sayyid Bedouin Sign Language

The entire ABSL dataset consisted of 247 responses: 83 compounds (34%), 74 SASS-constructions (30%), 62 utterances classified as "other" (25%) and 29 single-sign responses (11%). After repeated utterances, single-sign responses, and "other" responses were excluded, the analyzed dataset included 82 compounds and 55 SASS-constructions (Table 1).

Though compounds were coined more frequently than SASS-constructions, the overall distribution of naming strategies is different from what we saw in the ISL group (see Figure 3 for comparison). Individual participants showed varied preferences, but the majority favored compounds over SASS-constructions (see Figure 4). As in the ISL group, most of ABSL compounds consisted of two signs: 70 out of 82 (85%).

Even though the overall percentage of compound responses and SASS-construction responses in this group is similar, there is a marked difference in their distribution. ABSL signers used 15 different kinds of SASS-classifiers for 17 different concepts (see Appendix 3), which marked primarily scale features such as small size in combination with some shape feature (e.g., SASS-small-round, SASS-small-oval), and length in combination with some other shape feature (e.g., SASS-long-narrow, SASS-long-thin). Many other

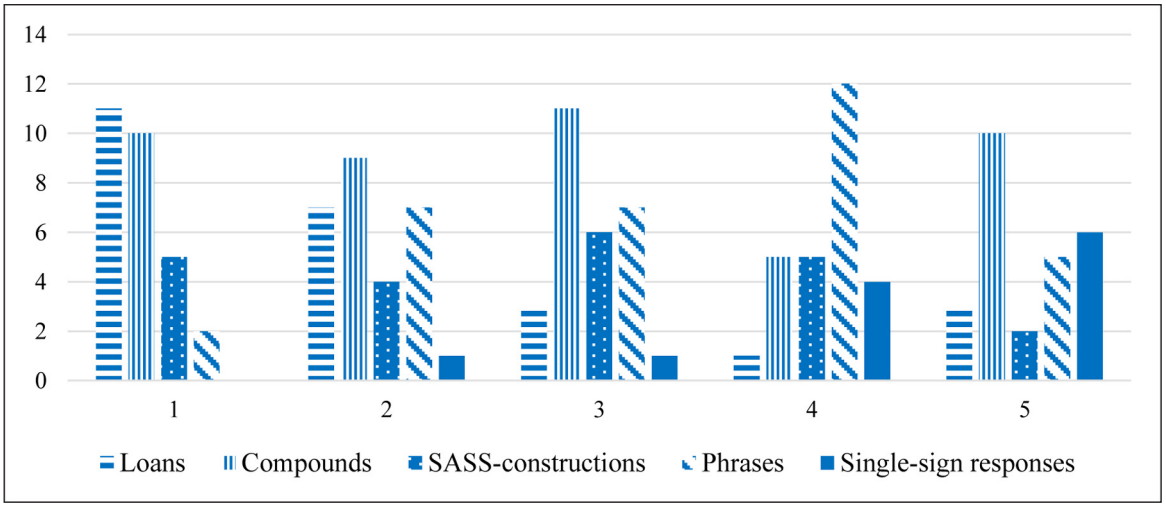

Figure 2: The distribution of naming strategies among the ISL participants.

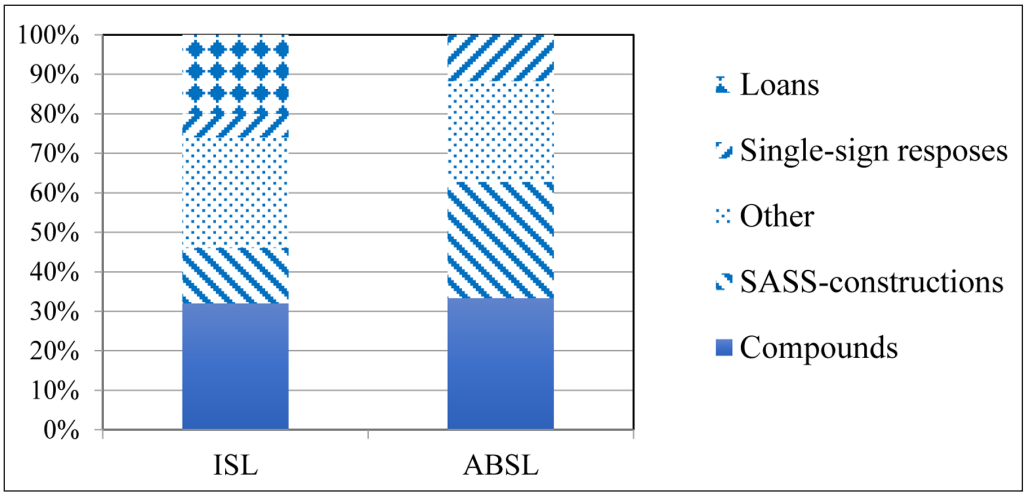

Figure 3: The distribution of naming strategies in the Israeli Sign Language (ISL) group and Al-Sayyid Bedouin Sign Language (ABSL) group.

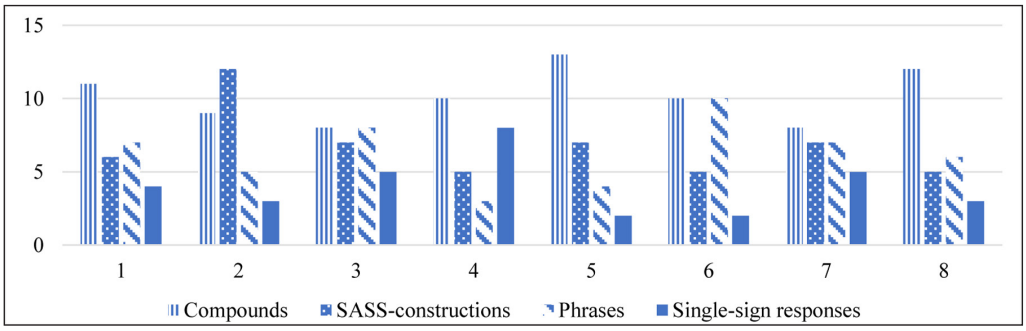

Figure 4: The distribution of naming strategies in the ABSL participants.

SASS-classifiers depicted only size (small, big) or only dimensionality (width, length). The use of SASS-classifiers was between five and twelve per participant (mean 6.6).

4.1.3 Distribution of naming strategies: Summary

Our data reveal that compounding is both a productive process and a frequent choice for coining labels for objects in both languages under investigation. SASS-constructions were also productive, though in both languages these constructions are used for a more restricted set of objects, and in ISL those constructions are not as frequent as in ABSL. A chi-squared test of independence suggests that proportions are different across the two languages (χ^2 (3, N = 355) = 9.53, p = .023). Chi-squared tests of goodness of fit further suggest that different categories are not equivalently distributed within each language (ISL: χ^2 (3, N = 137) = 56.20, p < .0001; ABSL: χ^2 (3, N = 218) = 22.55, p < .0001).

Interestingly, even though the use of SASS-classifiers was prompted by the nature of the objects used as elicitation material, when the same referents were labeled with SASS-constructions in both languages, SASS-classifiers in ISL depicted different features than SASS-classifiers in ABSL (see Figure 10). ISL signers also marked length with or without other dimensional and shape features, but not size. Thus, whereas ABSL SASS-classifiers tended to encode both size and shape features, ISL SASS-classifiers tended to focus almost exclusively on shape features (see Appendix 3). The use of SASS-classifiers was higher for ABSL signers (mean 6.6) than for ISL signers (mean 4.4).

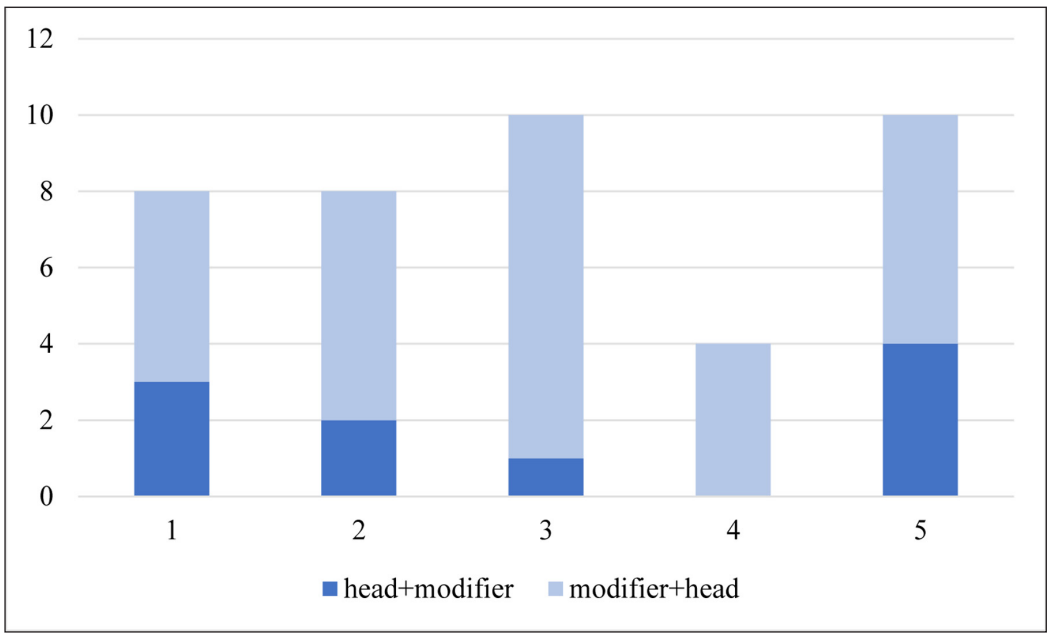

Figure 5: ISL inter- and intra-signer variation in the constituent order in genuine two-sign compounds.

4.2 Headedness and constituent order

The results for headedness and constituent order[17] were analyzed only for two-sign responses, both for compounds and SASS-constructions, because in utterances with three or more signs there could be more than one head and/or modifier which made determining their order difficult.

4.2.1 Headedness and constituent order in Israeli Sign Language

We analyzed genuine and loan compounds separately. The genuine group showed a marked preference for modifier + head order: 30 out of 40 two-sign compounds (75%). There was considerable inter-signer variation: whereas some signers always used the modifier + head order in genuine compounds, others used it in only five out of eight (62.5%) of their genuine compounds. As for the loan compounds, 22 out of 24 two-sign compounds (92%) had head + modifier order, the same order as in Hebrew noun + noun compounds; the remaining tokens of Hebrew loans were from a lexicalized noun phrase *'ezra rishona* 'first

[17] Although the structural analysis of utterances classified as "other" was outside of the scope of this project, we did evaluate ordering consistency of *concepts* in those utterances (following Osugi et al. 1999; see also Napoli & Sutton-Spence 2014 and references therein). The ISL data did not reveal any noteworthy group-wide tendencies of concept ordering (such ISL utterances tended to be lists, e.g., all the objects found in a first-aid kit, or followed the same order as compounds, but used additional signs in varied order). The ABSL data, on the other hand, showed four major patterns of description: introduction of two objects (e.g., a bottle and a cork) or an object and a substance (e.g., a meat grinder and meat) and specification of their locational relationship to each other; human interaction with one of the objects (e.g., grinding coffee with a coffee mill); description of one of the objects (with size and shape); and description of the final state, result or product of the described scene (e.g., grinded meat, melted ice, killed insects). The objects, however, tended to be ordered by their function in the utterance (a non-head object preceded a head object) and not size (27/39, 69% of the utterances with two objects used), contrary to the tendency reported in Napoli & Sutton-Spence (2014: 5): "When two [manual NPs] occur in a locational expression that forms a single clause, larger more immobile objects tend to precede smaller more mobile ones, regardless of theta role or grammatical function." The overall preferred ordering across all utterances (where signers did not necessarily use a sign for each slot, but the signs used generally followed this order) was as follows: non-head object > non-head description/SASS-CL > location > interaction > head object > head description/SASS-CL > final state/final product. We wish to emphasize, however, that this observation was made on a small sample (62 utterances), which was not elicited for this specific purpose, and further research is needed to answer the question of the order of major constituents in ABSL.

Table 1: Distribution of naming strategies: Results summary (Note that elicited numbers include repeated tokens).

		ISL 216 responses		ABSL 248 responses	
Elicited		**Number**	**Percent**	**Number**	**Percent**
	compounds	113	52%	87	34%
	SASS-construction	31	14%	74	30%
	phrases	58	27%	62	25%
	single-sign responses	14	6%	29	11%
Analyzed	compounds	70 (25 loans)		82	
	Two-sign compounds	64 out of 70 (40 genuine)	91%	70 out of 82	85%
	SASS-constructions	22		55	
	SASS-classifiers	10 different types		15 different types	

aid', which is also head-initial. Thus, in all Hebrew loans the head always occupied the initial position in the construction. We used chi-squared tests to determine whether the proportion of modifier-head and head-modifier constructions significantly differs within each language. The tests suggest that in ISL the modifier + head order was significant (χ^2 (1) = 12.1, p < .0001).

An interesting feature relevant to the discussion of headedness is *mouthing*. Nominal ISL signs tend to be mouthed often (Tkachman & Sandler 2013). Given the nature of our elicitation material (i.e., pictures of concrete objects), we expected to find widespread mouthing. It turned out, however, that not all nominal signs in our data were mouthed. In fact, whether the sign in a compound was mouthed or not depended on whether this sign was a head or a modifier. In the group of two-sign compounds, both first and last constituents tended to be mouthed, as expected of nominal signs, but initial signs were mouthed more frequently than last signs: 34 out of 40 (85%) versus 20 out of 40 (50%), respectively. The crucial factors affecting the chances of the sign being mouthed turned out to be its function: 50.5% (21 out of 40) of heads versus 82.5% (33 out of 40) of modifiers were mouthed, regardless of position. There was no difference in position of the head for its chances to be mouthed: five out of ten head-initial compounds (50%) and 15 out of 30 head-final compounds (50%) had mouthing on their heads. For modifiers, 28 out of 30 (93%) of compound-initial modifiers were mouthed, as opposed to 6 out of 10 (60%) of compound-final modifiers.

For SASS-constructions, 16 out of 23 (70%) had only two constituents, with only 9 out of 16 (56%) following the SASS-final order (52% for all SASS-constructions). The range of individual preferences for the SASS-final order was 50%–75%. We used chi-squared tests to determine whether the proportion of SASS-final and SASS-initial constructions significantly differs within each language. The tests suggest that in ISL, the difference between SASS-final versus SASS-initial was not significant (χ^2 (1) = 0.682, p = 0.41).

We also looked at the semantic relations of components in classifier constructions. In two-component SASS-constructions, there were three possibilities: the SASS-classifier could serve as a head (e.g., ISL MILK + CL-rectangular 'milk carton'), as a modifier (e.g., ISL CL-small + BOX 'candy box'), or just provide additional size-and-shape information about the sign (e.g., ABSL CORK + CL-small 'plastic cork'). Of 15 two-constituent SASS-constructions in ISL, 12 displayed a modifier + head relationship, with the majority (8/12) having a SASS-classifier fulfilling the head function (see Table 2). Across all SASS-constructions, regardless of the number of constituents, 12 (52%) served as heads,

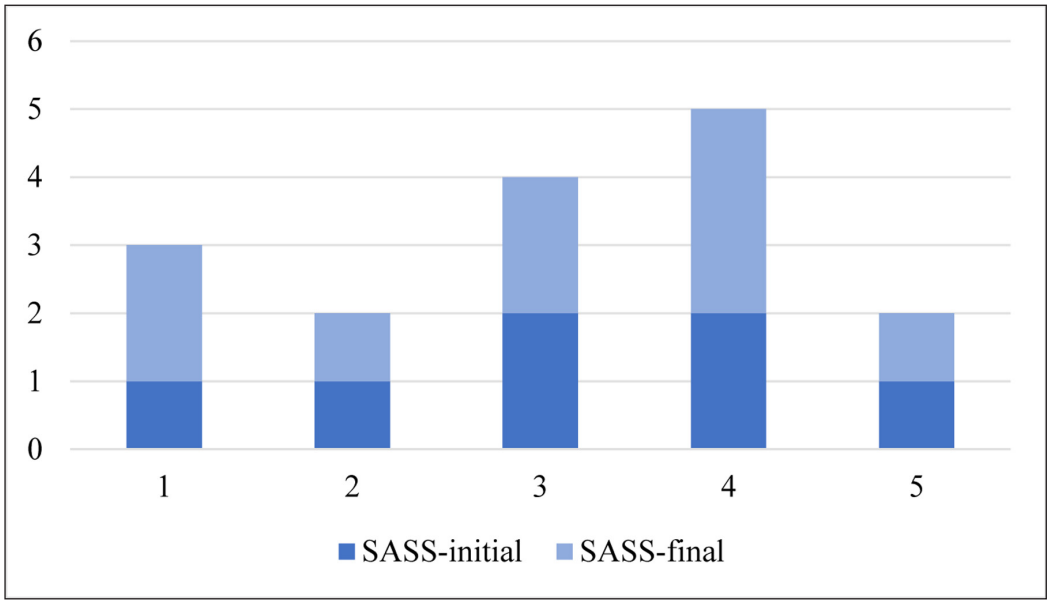

Figure 6: ISL inter- and intra-signer variation in the constituent order in two-sign SASS-constructions.

Table 2: The function of SASS-classifiers in two-constituent SASS-constructions in ISL.

	modifier+head	head+modifier
sign+SASS	8	1
SASS+sign	4	2

4 (17%) served as modifiers, 5 (22%) modified a head, and 2 (9%) modified a modifier. Additionally, ISL SASS-classifiers were almost never mouthed, regardless of the mouthing status of the other sign.

4.2.2 Headedness and constituent order in Al-Sayyid Bedouin Sign Language

Of ABSL compounds, 70 out of 82 (84%) consisted of two constituents and thus met the criteria for analysis. Compounds showed no tendency for either constituent order: 36 (51%) followed the head + modifier order. Inter-signer variation ranged from as low as 30% to as high as 70%. A 2-sample test for equality of proportions with continuity correction suggests that the proportion of modifier + head structures is significantly greater in ISL than in ABSL (χ^2 (1) = 7.45, p = 0.006). We used follow-up chi-squared tests to determine whether the proportion of modifier + head and head + modifier constructions significantly differs within each language. In ABSL, the order was not significant (χ^2 (1) = 0.058, p = 0.81).

Of ABSL SASS-constructions, 26 out of 55 (47%) consisted of two constituents. SASS-constructions demonstrated a much clearer structural tendency than ABSL compounds: most of SASS-constructions favored SASS-final order, 20 out of 23 (87%) two-constituent SASS-constructions, 39 out of 53 (73.5%) for all. Inter-signer variation was 50%–100%. We used chi-squared tests to determine whether the proportion of SASS-final and SASS-initial constructions significantly differs within each language. The tests suggest that in ABSL, the difference was significant (χ^2 (1) = 12.76, p = 0.0003); that is, in ABSL, there was a preference for SASS-final as compared to SASS-initial constructions.

Semantically, two-constituent SASS-constructions tended to express modifier + head order, with the majority of SASS-classifiers fulfilling the head function (20 out of 26

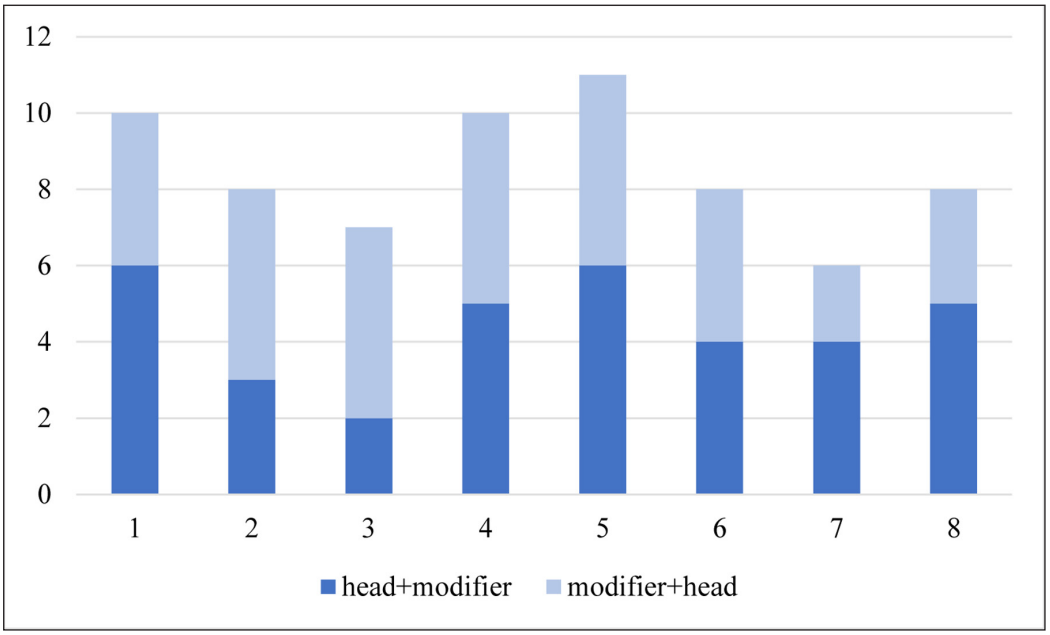

Figure 7: ABSL inter-signer variation in the constituent order in two-sign compounds.

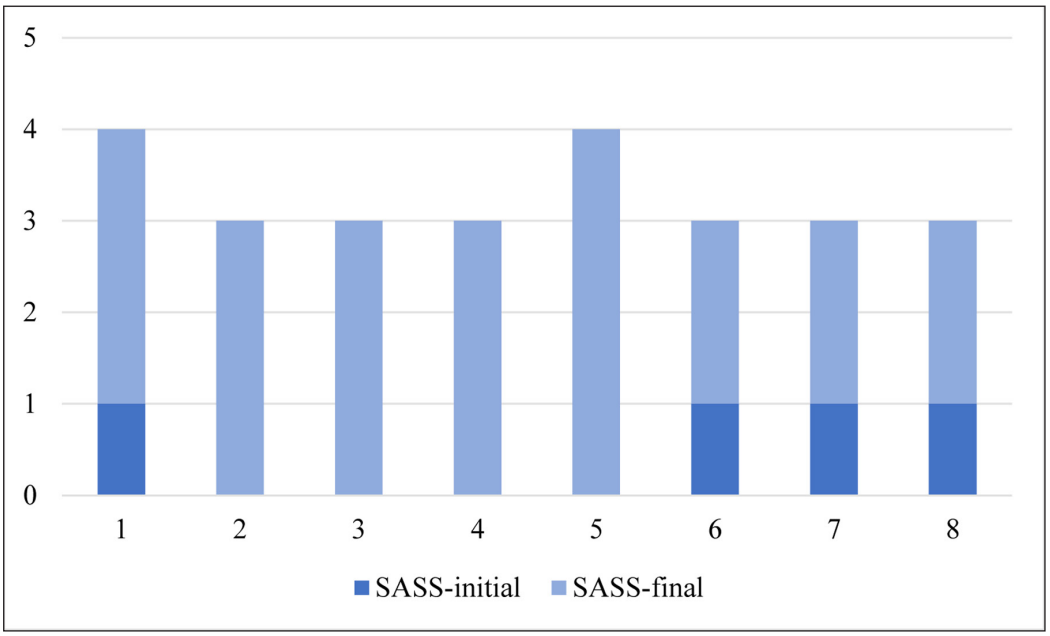

Figure 8: ABSL inter-signer variation in the constituent order in two-sign SASS-constructions.

(77%), see Table 3). Across all SASS-constructions regardless of the number of constituents, 28 out of 55 (51%) of SASS-classifiers served as the head of the construction, 4 (7%) served as a modifier, 15 (27%) modified a head, and 8 (15%) modified a modifier.

4.2.3 Headedness and constituent order: Summary

Each language group showed a preferred constituent order for one construction but not the other: modifier + head order in compounds in the ISL group and SASS-final order in SASS-constructions in the ABSL group (Table 4).

We also found that mouthing in ISL compounds is sensitive to the function of the sign: modifiers are mouthed more often than heads.

Table 3: The function of SASS-classifiers in two-constituent SASS-constructions in ABSL.

	modifier+head	head+modifier
sign+SASS	16	5
SASS+sign	4	1

Table 4: Headedness and constituent order: Results summary.

		ISL	ABSL
Headedness			
	Compounds		
	Modifier+head	75%	49%
	SASS-final	56%	73.5%
	SASS as head	53%	51%
		21% modified heads	27% modified heads
Mouthing			
	Compounds		N/A
	1st sign	85%;	
	last sign	50%	
	head	50%	
	modifier	93% initial,	
		60% final	
	SASS-constructions	never	N/A

Another interesting difference is found in the use of SASS-classifiers: the two languages used SASS-classifiers to a different extent and to mark different properties of objects. Interestingly, the choice of different properties encoded by SASS-classifiers was not due to different objects being named with SASS-constructions: of 12 objects that were labeled with SASS-constructions by ISL participants, 10 were also labeled with SASS-classifiers by ABSL participants (see Figure 9; also see Appendix 3 for the list of SASS-classifiers used for each elicitation item). It appears, therefore, that ISL and ABSL have different repertoires of SASS-classifiers which mark different size and shape properties (see Figure 10(a)). As has been noted in Section 4.1.2, ABSL SASS-classifiers tended to encode both size and shape features, whereas ISL SASS-classifiers tended to focus mostly on shape features (see Appendices 3, 6, and 7). Moreover, ISL- and ABSL-classifiers employed different strategies to represent size and shape features: ISL-classifiers tended to trace or delineate the shape of the object named, whereas ABSL-classifiers never used tracing, but employed a range of handshapes and arm lengths to represent the size and shape of the object named (see Figure 10(b)).

4.3 Features of articulation

We coded the elicited compounds for the number of hands employed (handedness), the height of the hands, and the order of signs based on their handedness. There were four ordering options for handedness (1 + 2, 2 + 1, 2 + 2, and 1 + 1) and three ordering options for height (the first sign is higher than the second (H + L), is lower than the second sign (L + H), and both signs articulated at the same level (Same).

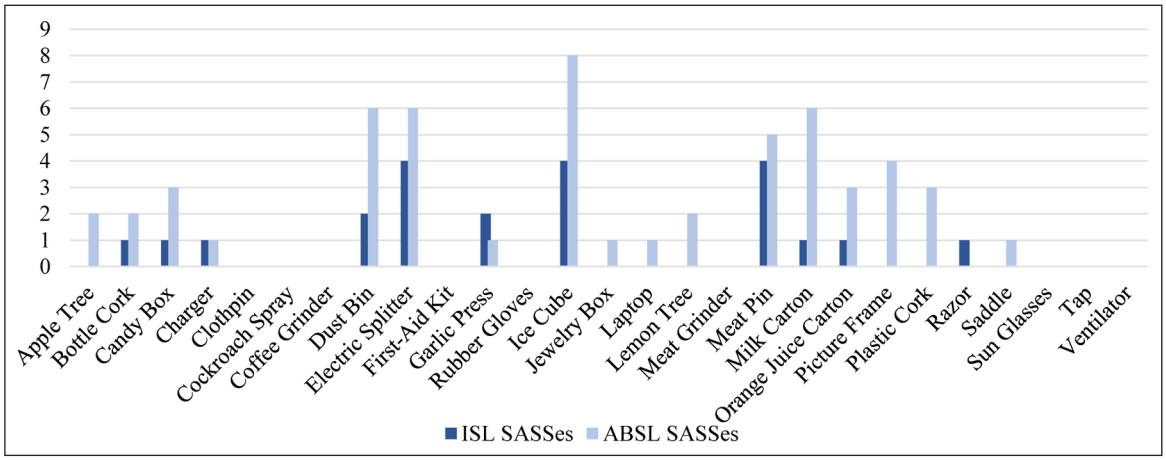

Figure 9: The distribution of SASS-constructions in ISL and ABSL.

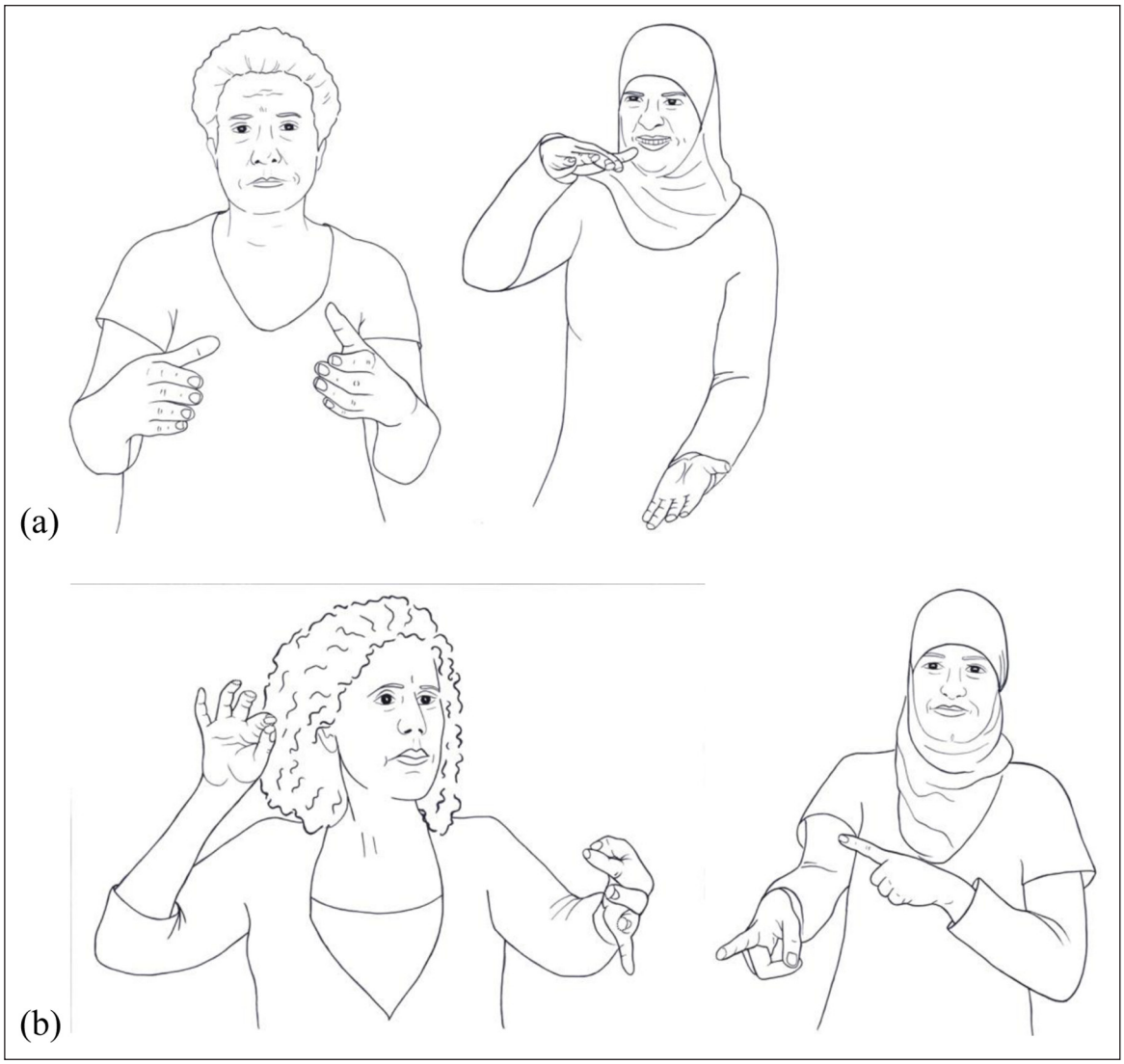

Figure 10: Semantic (a) and formational (b) differences in the choice of SASS-classifiers by ISL and ABSL signers. (a) DUST BIN: ISL signers focused on the shape of the object (left picture), ABSL signers marked the size of the object (right picture); (b) MEAT PIN: ISL signers used tracing classifiers (left picture), ABSL signers used arm as a measuring stick (right picture).

4.3.1 Israeli Sign Language

4.3.1.1 Articulation of ISL compounds

Number of hands and hand height. The results for both number of hands and hand height are summarized in Table 5. The difference between genuine and loan compound patterns is perhaps not surprising, since loan compounds have to follow the word order of Hebrew compounds, in spite of considerations such as ease of articulation that may affect genuine compounds.

Non-dominant spread. Contrary to what is frequently reported in the literature (see Section 2.1), we did not observe a lot of non-dominant anticipation in our genuine compound data. What we did observe was the opposite process of non-dominant perseveration, that is, the non-dominant hand of the first two-handed sign remained in the signing space while the second, one-handed sign was being articulated (see Figure 11). Thus, non-dominant hand perseveration is only relevant for compounds beginning with a two-handed sign. It occurred in 14 out of 24 (58%) loan translations (all the instances of 2 + 1 loans) and in all (four) instances of 2 + 1 genuine compounds. Non-dominant anticipation, on the other hand, was observed in only one out of the six (18%) 1 + 2 compounds. The remaining 30 genuine compounds and 10 loan translations were of 2 + 2 type and did not display any behavior that could be characterized as non-dominant anticipation or perseveration.

4.3.1.2 Articulation of ISL SASS-constructions

Number of hands. Of the 18 SASS constructions analyzed, seven were of 2 + 1 type (44%), four were 2 + 2 (25%), four were 1 + 2 (25%) and one was 1 + 1 (6%).

Hand height. In 19 out of 23 (83%) of SASS-constructions all the signs were articulated on the same level, with only three instances of H + L and one instance of an L + H construction.

Non-dominant spread. Non-dominant anticipation did not occur in SASS-constructions starting with an initial one-handed sign. Non-dominant perseveration, however, was prominent both in two-constituent constructions (11 out of 16, 71%) and in all three-constituent SASS-constructions ending with a one-handed sign (100%).

4.3.1.3 Additional considerations on articulation

As has been noted in Section 3.3.1, we do not have many examples in our data of the same signer producing both a compound and an equivalent phrase. Some signers, however, did sometimes repeat one of the compound's components, giving us an opportunity to see which formational features are affected in compounding. One feature that is found in our data is reduction of iterations of the first sign's movement. For example, one of the signers

Table 5: Number of hands used and hand height in genuine and loan compounds.

		Genuine	Loan
Number of hands			
	2+2	30 (75%)	10 (42%)
	1+2	6 (15%)	
	2+1	4 (10%)	14 (58%)
Hand height			
	Same	29 (72.5%)	11 (46%)
	H+L	5 (12.5%)	3 (12.5%)
	L+H	6 (15%)	10 (41.5%)

Figure 11: Non-dominant hand perseveration in ISL: the signer produces compound TREE+APPLE 'apple tree' where two-handed sign TREE is followed by one-handed APPLE. The non-dominant hand of the sign TREE persists throughout the production of the sign APPLE.

produced the compound GRIND + COFFEE with only a single circular motion on the first sign, but when she signed the sign GRIND separately, she always repeated the movement. Another signer who produced this compound in the reversed order, COFFEE + GRIND, repeated the motion in the sign COFFEE when she produced it in isolation but reduced it to a singular motion in the compound.

It must be noted here that multiple factors affect the formational features of signs; for example, many signs that were accompanied by corresponding mouthing displayed temporal alignment to the mouthing; that is, the sign was articulated for as long as the corresponding word was mouthed. One such example is ICE, which in Hebrew has two syllables. As a result, the signers produced this sign with a repetition, one iteration of the sign per one mouthed syllable, and the second iteration was not reduced even when the sign was the first constituent in the compound.

4.3.2 Al-Sayyid Bedouin Sign Language

4.3.2.1 Articulation of ABSL compounds

Just as in the ISL data, we coded ABSL compounds for the number of hands employed (handedness), the height of the hands, and their order.

Number of hands and hand height. The results are summarized in Table 6.

Non-dominant spread. As a group, two-sign 2 + 1 compounds do show a similar level of non-dominant perseveration: 9 (60%). There were only two three-sign compounds where at least one two-handed sign preceded a one-handed sign, and both had non-dominant perseveration (interestingly, in one case a two-handed sign was followed by two one-handed signs; the non-dominant perseveration occurred only with the sign immediately following the two-handed sign, but did not spread further). However, non-dominant anticipation almost never occurred: out of all two-sign 1 + 2 compounds, only 2 (9%) had non-dominant anticipation.

Table 6: Number of hands and hand height in ABSL compounds.

		Compounds
Number of hands		
	1+2	22 (32%)
	2+2	18 (26%)
	2+1	15 (22%)
	1+1	14 (20%)
Hand height		
	Same	30 (43.5%)
	H+L	22 (32%)
	L+H	17 (24.5%)

4.3.2.2 Articulation of ABSL SASS-constructions

Of 59 tokens of SASS-constructions, only 25 consisted of two components. Results below are based on these 25 tokens.

Number of hands. Two strongest tendencies were for 2 + 1 (12 tokens, 48%) and 2 + 2 types (7 tokens, 28%). Only four tokens (16%) were 1 + 2 and two tokens (8%) were 1 + 1.

Hand height. Of two-sign SASS-constructions, 16 (64%) had both signs articulated on the same level, 7 (28%) had a second sign articulated higher than the first sign, and 2 (8%) had the second sign articulated lower than the first sign.

Non-dominant spread. In two-constituent SASS-constructions, not a single case of non-dominant anticipation was found, again not surprising considering that there were only four constructions with a one-handed sign followed by a two-handed SASS-classifier. Non-dominant perseveration happened in nine out of 12 (75%) of two-constituent SASS-constructions. In three-constituent SASS-constructions, however, non-dominant perseveration was much less pronounced: only in three out of nine (33%) of constructions where at least one one-handed sign was preceded by a two-handed sign displayed non-dominant perseveration. Non-dominant anticipation occurred in four out of 17 tokens (23.5%) where at least one one-handed sign preceded a two-handed sign.

One noticeable tendency was for one-handed signs to be articulated higher in the signing space. This tendency could account for the patterns we see in our data, except for one consideration: compounds consisting of two one-handed signs had a tendency to start with a sign in a higher location (7, 50%). One possible explanation is that the data actually reveal an interaction between two tendencies: the tendency for one-handed signs to be articulated higher in the signing space, and the tendency for compounds to start with a sign in a higher location. The latter tendency, however, seems unlikely in light of the distribution of compounds: we had almost equal numbers of 1 + 2 and 2 + 1 compounds (20 and 16, respectively). Of these compounds, the former also tended to start with a sign in a higher location (13, 65%) and the latter tended to start with a sign in a lower location (11, 69%). Thus, it seems unlikely that the order of signs is motivated by articulatory considerations. All the tendencies we see in the data are due to the tendency of one-handed signs to be articulated higher in the signing space than two-handed signs (Siple 1978).

4.3.2.3 Additional considerations on articulation

There were even fewer examples of compounds and corresponding individual signs produced by the same signer in ABSL than in ISL (see Section 4.3.1.3). However, some of the observations we made for ISL compounds hold for ABSL compounds and individual signs

as well. For example, for GARLIC + PRESS one of the signers produced the sign GARLIC with a full swing of the palm and back, then waved to attract her addressee's attention and produced a compound where the first sign was reduced to a very short movement forward, and no movement backward. Another participant produced the compound PRESS + GARLIC and then repeated PRESS; while the first element in the compound was produced with only one movement, in the individual sign the movement was repeated. Thus, in ABSL, as in ISL, we see that the compounding process affects the number of repetitions.

4.3.3 Features of articulation: Summary

The two languages under investigation showed both similarities and differences in the articulation of compounding. Similarly to each other, but contrary to other sign languages reported in the literature, ISL and ABSL compounds did not show non-dominant anticipation, but instead showed non-dominant perseveration. In addition, the number of hands used for sign articulation did not appear to determine the sign's position in genuine compounds in either ISL or ABSL, again contrary to what is reported for some other sign languages. In ISL, however, there was a slight tendency to use more two-handed signs in the initial position in Hebrew loans.

4.4 Results: Summary

The overall results show that compounding is a productive word-formational process in both ISL and ABSL, and SASS-constructions are a frequent choice for a more restricted group of referents (Table 7). The preferred constituent orders are modifier + head order in ISL compounds and SASS-final order in ABSL SASS-constructions. ISL has a strong order preference for compounds and no preferred order for SASS-constructions, and ABSL has a strong order preference for SASS-constructions and no preferred order for compounds. In addition, both languages exhibit a similar articulatory feature of the non-dominant hand, where the non-dominant hand of the first two-handed sign spread to the following one-handed sign. The number of hands used for sign articulation, on the other hand, does not appear to determine the sign's position in a compound or a SASS-construction in ABSL, with only a weak tendency towards a two-handed sign articulated in the initial position in ISL. Similarly, the height of the sign articulation does not appear to motivate sign order in compounds in either language: ISL genuine compounds mostly consist of two two-handed

Table 7: Features of articulation: Results summary.

		ISL	ABSL
Two-handed signs			
	Compounds		
	Genuine	2+2: 75%	2+1: 32%, 2+2: 26%
	Loan	58%	
	SASS-constructions	2+1: 44%	60% 2-initial, 60% 2-final
Handedness	2+2, neutral space	52.5%	23.5%
and hand height	1+2, 1st is higher		19%
Non-dominant anticipation	1+2 compounds	18% (1/6)	9% (2/22)
Non-dominant	Two-sign compounds		
perseveration	Genuine	100% (4/4)	50%
	Loan	58%	
	Three-sign compounds		60%

signs articulated in the neutral signing space, and the variety of patterns found in ABSL can be explained by the tendency of one-handed signs to be articulated higher in the signing space.

Comparing compounding in the two languages revealed certain language-specific features. Mouthing is widespread in ISL and absent in ABSL. Mouthing also behaved differently with different components of compounds: the first sign was almost twice as likely to be mouthed than the second sign, and modifiers were almost twice as likely to be mouthed than heads.

5 Discussion

In this paper, we have reported on our investigation of compounding in two young sign languages, Israeli Sign Language (ISL) and Al-Sayyid Bedouin Sign Language (ABSL). In both languages, compounding is a productive process and a frequent choice for coining new labels. Below we review our results in the light of the overarching question we started with: how does structure emerge in a new language?

First, we need to ask ourselves what constitutes the structure of compounds. Numerous typologies have been suggested for compounding (see Bisetto & Scalise 2005; Bauer 2009; Lieber & Štekauer 2009 and references therein), but the most frequent proposals are based on structural criteria of phonological (e.g., stress, vowel harmony, tonal patterns, etc.), morphological (e.g., linking elements, internal inflection), and syntactic properties (headedness, the order of elements, recursion). In our study, we mainly focused on the syntactic properties of constituent order and the formational properties of the number of hands, hand height, and the non-dominant anticipation and perseveration. We found that both syntactic and formational properties of compounding emerged in both ISL and ABSL, but the extent to which they are conventionalized appears to be different for each language. Regarding sign order, ISL exhibited a strong tendency towards modifier + head order in its compounds (75% of genuine compounds), but no tendency towards SASS-final order in SASS-constructions (56% for two-constituent SASS-constructions, 52% for all). ABSL exhibited a strong tendency for SASS-final order in SASS-constructions (87% for two-constituent SASS-constructions, 73.5% for all), but no tendency for modifier + head order in compounds (49%). Noteworthy, our findings on structure in ABSL compounds and SASS-constructions are very similar to those previously reported in Meir et al. (2010) for lexicalized ABSL constructions: in their study, 90% of SASS-constructions had SASS-final order and 54% of compounds had modifier + head order.

Formationally, however, ISL and ABSL look more similar to each other – and different from what is usually reported for compounds in sign languages. We found widespread *non-dominant hand perseveration*, or spreading of the non-dominant hand of the first sign to the production of the one-handed second sign, in both ISL (83%) and ABSL compounds (52%), but not the opposite phenomenon of *non-dominant hand anticipation*. The fact that our novel productions showed perseveration rather than anticipation supports the claims of Lepic (2015) and Loos (2009) that non-dominant anticipation is not a feature of compounding per se but of lexicalized multi-sign constructions in general. In a similar vein, we cannot claim that non-dominant hand perseveration is a feature of compounding, since it has been observed in phonological phrases in several sign languages (see Nespor & Sandler 1999; Sandler 1999a; b; 2006; Brentari & Crossley 2002). This phenomenon may be one of the features indicating that the members of a compound or a SASS-construction form one unit, especially when other compounding-specific features have not yet conventionalized. Notably, in ISL loan translations from Hebrew, non-dominant hand perseveration occurred less often than in genuine compounds, which could be because loans had other features indicating they are one unit (e.g., mouthing). On the other hand, since 68%

of the loans exhibited non-dominant hand perseveration, it could simply be the case that loans obey ISL phonological properties to a lesser degree than genuine compounds. This question should be further investigated in future research. Finally, the novel compounds elicited in our study exhibit phonological reduction previously reported for lexicalized compounds. While this reduction has been claimed to be a universal feature of lexicalized compounds (Zeshan 2002), the present study is the first to demonstrate reduction in novel compounds created on the spot. This indicates that temporal reduction can be used as a diagnostic for compoundhood in future studies, both in fieldwork on underdescribed sign languages and in experimental studies like ours. The syntactic and formational properties of compounds and SASS-constructions we observed in our data, though some of them are very robust, are neither entirely consistent in either language nor are they the same in both, which leads us to conclude that structure does not appear instantaneously as soon as the language is born. It may be that the languages in this study are still very young, the participants belong to only the third and fourth generations of signers in their respective languages, and even though some individual signers conventionalized the structures in question, the communities at large are still in the process of conventionalization. Or it may be the case that these patterns, once emerged, will not change even as the languages continue to develop. Future research will show whether these patterns undergo further conventionalization.

When, then, can we say that a structure has emerged? An important aspect of structure emergence is conventionalization: a specific structure/property has to be conventionalized within a language community. And the evidence for conventionalization is consistency among language users: not only should different members of the same linguistic community use a specific construction, but they have to do so consistently, and be able to apply it to novel productions. This last point is crucial for our study: when a structure is productively applied to coin novel labels, it is a sign that the structure has indeed been internalized by language users. Focusing on novel compounds allowed us to show that in both ISL and ABSL speakers have stable knowledge of compounding that allows them to coin new forms in systematic ways, i.e., they have an emerging shared structural knowledge, an indication that this word-formation process is productive synchronically. The compounds and SASS-constructions that our participants coined for the study are not actual words (i.e., they are not conventionalized across their signing communities). However, they are *possible words* (Aronoff 1976; 1983): not only did native signers coin them when in need of a new name, but different participants often coined the same labels for the same elicitation objects. Crucially, even when participants coined different labels for the same referents, they often used the same order, thus relying on the same construction.

The structures are the same in both languages (modifier + head for compounds and SASS-final order for SASS-constructions), but each language conventionalized only one of those structures: compounding in ISL and SASS-constructions in ABSL, as measured by systematicity of structures coined by our participants. The fact that only one of these structures is conventionalized in each of the languages may reflect the different preferences of those languages: ABSL uses a wider variety of SASS-classifiers and uses these for a wider range of referents (see Section 4.1 and Appendix 3), so ABSL signers may have conventionalized the SASS-construction type faster simply because they use SASS-constructions more frequently. Indeed, our ABSL participants produced more SASS-constructions than our ISL participants, both individually and as a group. ISL signers, on the other hand, seem to have a preference for compounds. It is possible that this preference is due to ISL signers' contact with Hebrew, a language with widespread and productive compounding; however, if this were the case, then we would expect elicited compounds to look

like borrowed ones (that is, to follow Hebrew compounding order of head + modifier), and this was not the case. It is also possible that, given the young age of the languages in question, they cannot conventionalize all the emerging structures at the same time and at the same rate, and in the future both constructions will be conventionalized to the same degree and in both languages. Alternatively, the fact that in both languages one of the constructions showed no clear tendency for conventionalization could be indicative of instability of these constructions, and in the future they could give way to other means of word formation.

An issue related to the extent of conventionalization is the question of formational similarities between the two constructions we investigated. The fact that ISL and ABSL both demonstrated non-dominant hand perseveration raises the question of whether this is indeed a sign of conventionalization, or is the result of some other factor, such as motoric ease of articulation of multi-sign constructions. However, ISL showed a higher degree of non-dominant hand perseveration than ABSL suggesting this feature is indeed conventional. ISL has a robust prosodic structure (Nespor & Sandler 1999; Sandler 1999), and non-dominant hand perseveration plays a role in its prosodic and phonological units (Nespor & Sandler 1999; Sandler 1999a; b; 2006). It appears that the non-dominant hand's function as a prosodic/phonological marker is more conventionalized in ISL in general, something that surfaces in compounding as well.

How does conventionalization actually take place? Does it start at the individual level or at the community level? That is, are individuals consistent within themselves and the variation is due to inter-subject variation, or are individuals inconsistent even within themselves? In our data, we see evidence for the latter: when individual signers are inconsistent, group-wide conventionalization is also not very high. For example, constituent order in compounds shows a higher level of conventionalization in ISL. And indeed the ISL participants were quite consistent individually: with two of them always using the same constituent order, and even the one participant who showed the lowest level of within-subject conventionalization was still above chance, using modifier + head order 64% of the time (see Figure 5). ABSL participants, on the other hand, were individually variable, and also demonstrated no group-level consistency (see Figure 7). Likewise, we see that SASS-constructions show both inter- and intra-signer consistency in the ABSL group (see Figure 8), but neither inter- nor intra-signer consistency in the ISL group (see Figure 6). While individual ISL signers showed variability in their compound use, and individual ABSL signers showed variability in their SASS-construction use, the group-level consistency for each of these was high enough to reveal strong constituent order tendencies. These observations strongly suggest to us that within-signer consistency is not enough to prompt conventionalization at a group level. That is, conventionalization is a group act of the entire language community.

Another interesting issue regarding conventionalization is whether there is a difference between the conventionalization of articulatory features and syntactic features? One might predict that articulatory features would conventionalize more quickly: they are less abstract, rooted in the motoric system of the body, and do not rely on the developing syntactic/semantic categories. At first glance, we do see some evidence for this: ISL compounds showed a strong preference for two two-handed signs articulated on the same level, but in ABSL, all sign combinations were frequent. So, it may seem as if ISL is conventionalizing handedness and hand height faster than ABSL. The ISL tendency for compounds with two-handed signs, however, may be just the reflection of the overall distribution of two-handed signs in the language, which has not been studied so far. For instance, the distribution of two-handed signs in the first Dictionary of American Sign Language (Stokoe et al. 1965) is 60% of all the signs listed (Klima & Bellugi 1978: 58);

similarly, the lexicon of the Sign Language of the Netherlands (NGT) has more two-handed than one-handed signs (~55%, see Crasborn & Sáfár 2016). If their distribution is similar in ISL, this could explain the tendency we found without referring to compounding-specific properties. Likewise, SASS-constructions in both languages showed a preference to consist of a two-handed sign followed by a one-handed sign, with both signs articulated on the same level. This, however, could be due to many SASS-classifiers being one-handed. It is not clear at this stage whether there is indeed any conventionalization of articulatory features for SASS-constructions. However, in terms of articulatory *processes*, both ISL and ABSL demonstrated a tendency for non-dominant hand perseveration, in both compounds and SASS-constructions. In our data, ISL signers had a higher rate of conventionalization of the non-dominant hand perseveration than ABSL participants. Thus, from our data we can only conclude that neither articulatory nor syntactic features conventionalize faster than the other ones. These results support our fourth claim, conventionalization in one domain does not necessarily influence conventionalization in another domain. One possibility with regard to non-dominant perseveration is that it emerged in only one of the languages and was borrowed by the other through contact. Though such borrowing was indeed possible due to the prolonged contact between ISL and ABSL, a few considerations make such borrowing unlikely. While it is true that ABSL signers have been exposed to some varieties of ISL and many of them are bilingual in both languages, the opposite is not true of ISL signers: most of them never met any ABSL signers, and those who did are very rarely familiar with ABSL. Thus, the possibility of borrowing non-dominant perseveration is only plausible if it emerged in ISL and was borrowed by ABSL. We do not have any evidence, however, that this was indeed the case, though future studies with older signers in both languages could shed some light on this possibility. In addition, it seems unlikely that signers of one language would borrow one articulatory feature of compounding but not the ordering pattern or any other features. Finally, since in both ISL and ABSL non-dominant perseveration occurred with both compounds and SASS-constructions, it seems more of a feature of multi-sign constructions in general than of one specific construction. Thus, at least at this point, the articulatory explanation appears to be more convincing.

A few additional remarks on our findings are due. Mouthing showed an interesting pattern sensitive to the function of the sign: modifiers were mouthed more than heads. It might be the case that heads are more semantically salient and do not require the additional clarification provided by mouthing. We leave this question for future research.

One prediction of ours was not borne out: the prediction that ISL SASS-classifiers would always have SASS-final word order. This prediction was made based on a previous study (Tkachman & Sandler 2013), in which all ISL SASS-classifiers appeared in the final position. The difference between the previous report and our finding probably comes from the difference in elicitation materials and tasks between that earlier study and ours. Whereas Tkachman & Sandler used pictures of objects that had established names, and their participants were using SASS-classifiers as nominal markers, namely as a means to distinguish between nominal and verbal instances of similarly looking signs (see Figure 12). In our study, we used pictures of objects with no established names, and our participants used SASS-classifiers to add aspects of meaning about the referents. At this stage, however, we can only speculate as to what caused the difference in rates of SASS-final order between the two studies. A more general study on the use of SASS-classifiers in ISL is needed to answer this question definitively. It is noteworthy, however, that both ABSL SASS-constructions in our study and ISL SASS-constructions in Tkachman & Sandler's (2013) study display the SASS-final order, similar to other unrelated sign languages such as ASL

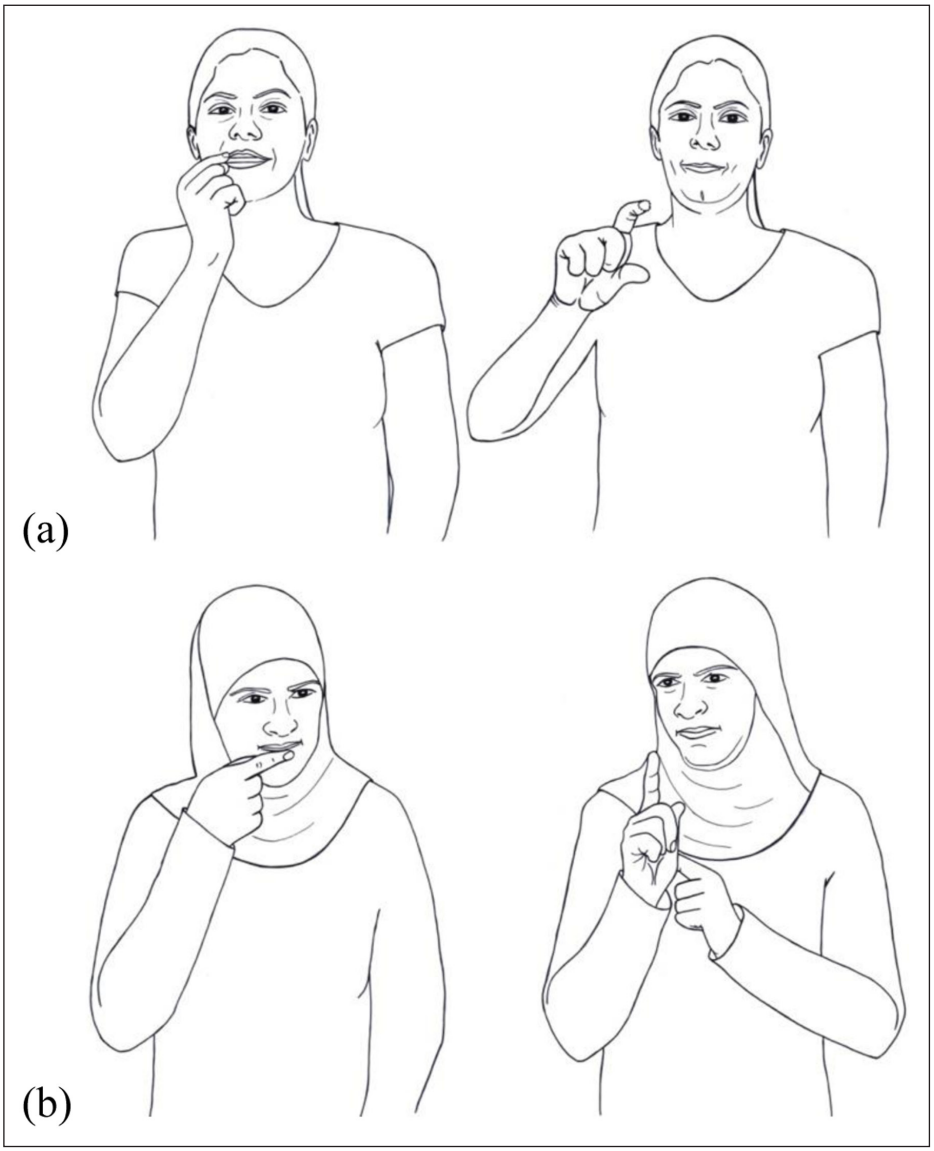

Figure 12: SASS-classifiers used as nominal markers to distinguish between the nominal and the verbal signs with similar formational properties, (a) in Israeli Sign Language, LIPSTICK+SASS-small and (b) in Al-Sayyid Bedouin Sign Language, LIPSTICK+SASS-straight (adopted from Tkachman & Sandler 2013: 270).

(see Section 2.3). It is possible that there is a cross-linguistic tendency for the SASS-final order in SASS-constructions, but this possibility needs further testing on a wider sample of sign languages.

Lastly, we need to address the issue of possible influences of other sign languages in ISL and ABSL compounding. To date, no one has conducted a systematic study on possible influences of substrate languages on ISL. Though we know that deaf immigrants to Israel came mostly from Europe, North America and the Middle East, no information is available on which sign languages (if any) they were using (Meir & Sandler 2008). One exception is German Sign Language (Deutsche Gebärdensprache, DGS): many of the original deaf leaders either immigrated from Germany or studied there, and the teachers of the first school for the deaf (established in Jerusalem in 1932), though they employed the oral method of teaching, were DGS signers (Meir & Sandler 2008). Research on similarity of DGS and ISL, however, only suggests that they are related but cannot be considered dialects: they share only about 27.5% of their lexicons (unpublished study by Brockmann, cited in Meir

& Sandler 2008), whereas even unrelated sign languages often have 20% overlap in their lexicon (Al-Fityani & Padden 2000; McKee & Kennedy 2000; Guerra Currie et al. 2002; Kasten et al. 2014).[18]

Likewise, it is unclear if any individual compounds and/or the compounding pattern have been borrowed from DGS (and even if some compounds were borrowed, it does not necessarily mean the pattern was also borrowed). General descriptions of DGS compounding indicate a pattern similar to that of ASL and other sign languages: the order of constituents in a compound is fixed, the first sign often loses repetition and the compound is shorter than the execution of the free morphemes (e.g., in GOD + WAIT 'advent', the first sign loses a stopping point and the second becomes monosyllabic), the sign articulated higher in the signing space is signed first (e.g., 'congruency' THINK + SAME, where THINK is higher than SAME), and 1 + 2 compounds exhibit non-dominant anticipation (e.g., in THINK + SAME 'congruency', the nondominant hand of the second sign is present with the same handshape at the beginning of the sign, Keller & Leuninger 2004). In addition, it has been claimed that compounding is both rare and unproductive in DGS. In her extensive study of DGS compounding, Becker (2000) found that most compounds were loans from spoken German, and that genuine compounds were both very rare and tended to lose their second constituent in spontaneous signing (e.g., genuine compounds with the sign PERSON as their second element (mostly in professions, e.g., BAKE + PERSON (BACHEN + PERSON) 'baker') tended to drop PERSON in spontaneous signing). These observations and consultations with native signers lead Becker (2000) to conclude that DGS signers rely on borrowing from spoken German instead of using compounding productively.

As for other potential substratal language influences, Meir & Sandler (2008: 223) list some signs (but no compounds) that are identified as 'Algerian', 'Moroccan', and 'Egyptian' within the Israeli Deaf Community, but to date no comparison with the corresponding sign languages has ever been conducted to verify those claims. And such signs are not necessarily borrowed from other sign languages: for example, 10-SHEKELS is said to be coined by Egyptian Jewish deaf population (some signers liked to play cards and needed to show numbers with one hand) rather than being borrowed from Egyptian Sign Language. Considering that Jewish communities have often been segregated from the general population of the countries they resided in, we cannot simply assume that deaf Jewish immigrants from a certain country were exposed to the established sign language of that country; isolation could lead to emergence of their own sign languages (e.g., Algerian Jewish Sign Language (AJSL) developed in a Jewish community in the Algerian city of Ghardaia, see Lanesman & Meir 2012). If such sign languages of Jewish

[18] It is not clear what lexical overlap is indicative of dialectal relatedness and what should be taken to mean the two sign varieties are separate though related languages. Different claims have been made by different researchers. For instance, Woodward (1993) found that the sign languages of India, Pakistan and Nepal share 62–71% of their lexicons, which he claims shows they are separate languages of the same language family. In his earlier work on ASL, however, Woodward (1978) showed that this language shares 58–61% of its lexicon with French Sign Language (LSF) and concluded that ASL did not directly descend from LSF but was influenced by other sign languages. Al-Fityani & Padden (2000) compared Jordanian Sign Language (LIU), Kuwaiti Sign Language (KSL), Lybian Sign Language (LSL), Palestinian Sign Language (PSL), and ABSL and found 24–58% overlap. They concluded that LIU and PSL (shared 58%) and LIU and KSL (shared 40%) are related but not dialects of the same language, and that the other languages are unrelated. More recently, Hurlbut (2012) adopted the criteria set up by Parkhurst & Parkhurst (2007), in line with the spoken language assessment scheme adopted by SIL International (formerly known as the Summer Institute of Linguistics). According to her criteria, 80%–95% is taken to show that two sign varieties are dialects of the same sign language, 70%–80% requires further intelligibility testing to determine whether they are dialects of the same sign language or separate sign languages, and 60%–70% means the two varieties are likely to be two separate sign languages, and the overlap of 40% or less implies that the two sign languages belong to different language families. On these grounds, 27.5% overlap in ISL and DGS appears to be quite modest.

communities have been brought to Israel, they are in all likelihood lost by now (e.g., AJSL is a dying language with only a handful signers left, Lanesman & Meir 2012) and their potential influence on ISL and its compounding pattern will remain unknown.

As for ABSL, beside its contact with ISL, it is hard to evaluate influences of other sign languages. In one known case, in 1967, four deaf siblings spent a year in a deaf school in Halhul, where the signing used was probably some variety of Jordanian Sign Language (LIU, Kisch 2012a). It is unclear how much influence we can reasonably attribute to LIU, however. Al-Fityani & Padden (2000; see also Footnote 18) compared lexical cognates in LIU and ABSL and found 24% overlap, which they took to mean that the two are distinct languages. They attribute the overlap to iconicity and cultural similarity. Similar observations were made of the ISL influence on ABSL in Kastner et al. (2014) who showed that in ISL and ABSL 23% of compared signs are similar, but in ABSL and unrelated Kfar-Qasem Sign Language (KQSL, another village sign language that emerged in Israel) 36% of signs are similar, which they also attribute to their shared cultural background.

Even if we consider the possibility that LIU could influence ABSL compounding without influencing its lexicon, it would be hard to make a meaningful comparison of this process in the two languages. The limited information available on LIU compounding reports features that are common to compounding in most sign languages (see Section 2.1): the movement of one or both signs can be shortened, repetitions may be deleted, and the transition between the two signs may be reduced via location and handshape assimilation (Hendriks & Baker 2008: 53). Hendriks & Baker (2008: 57), however, also report that LIU has a very productive simultaneous compounding, where two signs produced simultaneously by the two hands are combined.[19] This pattern is unattested in ABSL. On these grounds, we take the possibility of substratal influence of LIU on ABSL compounding pattern to be negligible.

6 Conclusion

What did we learn from novel compounding in young languages about the emergence of structure? The most obvious take-home message is perhaps this: structure is not given a priori (even in very simple structures such as compounding) (Meir et al. 2010b; Sandler et al. 2011). Even though the languages under investigation are in their third or fourth generations of users, compounding is not entirely conventionalized in either one of them, with variation both within and across signers. Neither constituent order nor articulatory features have been fully conventionalized across all the signers in either of the languages. Second, structure may develop at different rates in different language domains (Meir et al. 2010a; b; 2013; Sandler et al. 2014). Compounds and SASS-constructions are similar to each other in many respects (to the point that some researchers treat the latter as a subtype of the former), and yet each language under investigation has conventionalized one of those structures to a higher degree than the other. Further, constituent order and articulatory features conventionalize independently from each other and show different rates of conventionalization (ISL appears to conventionalize articulatory features faster, but in ABSL it is the constituent order that is in the lead). Third, structure may develop at different rates in different languages (Aronoff et al. 2003; Meir et al. 2010a). Even though ISL and ABSL are of the same age and used both kinds

[19] Simultaneous compounding is fairly limited in sign languages, so it is interesting that according to Hendriks & Baker (2008) it is both common and productive in LIU. Some of the examples, however, appear more like what other authors take to be frozen classifier constructions: e.g., ADDRESS is made with the nondominant hand producing a classifier for a flat object and the dominant hand making the sign STREET (which is usually two-handed, Hendrinks & Baker 2008: 57). We do not argue with Hendrinks and Baker's (2008) interpretation but merely wish to point out this possible difference in terminology.

of structures extensively, those structures looked different in ISL and in ABSL, with ISL conventionalizing compounds and articulatory features faster than SASS-constructions, and ABSL conventionalizing SASS-constructions faster than compounds and articulatory features. Finally, conventionalization in one domain does not necessarily influence its emergence in other domains (Meir et al. 2010a; b). For instance, loan Hebrew compounds in ISL, which are conventionalized in Hebrew, did not cause ISL compounds to become more Hebrew-like. Likewise, a strong tendency for modifier + head order in ISL compounds did not cause faster conventionalization in SASS-constructions. In sum, structure emerges gradually, independently of other structures and domains, and at its own speed.

Abbreviations

ABSL = Al-Sayyid Bedouin Sign Language, AJSL = Algerian Jewish Sign Language, ASL = American Sign Language, BSL = British Sign Language, CL = classifier, DGS = German Sign Language (Deutsche Gebärdensprache), ISL = Israeli Sign Language, KSL = Kuwaiti Sign Language, KQSL = Kfar Qasem Sign Language, LIU = Jordanian Sign Language (Lughat al-Ishāra al-Urdunia), LSF = French Sign Language (langue des signes française), LSL = Lybian Sign Language, NGT = the Sign Language of the Netherlands (Nederlandse Gebarentaal), SASS = size-and-shape specifier, SSL = Swedish Sign Language

Additional Files

The additional files for this article can be found as follows:

- **Appendix 1.** The list of concepts used for eliciting data. DOI: https://doi.org/10.5334/gjgl.632.s1
- **Appendix 2.** The list of ISL compounds identified as potential loan translations from Hebrew. DOI: https://doi.org/10.5334/gjgl.632.s1
- **Appendix 3.** The list of various classifiers used for each referent. DOI: https://doi.org/10.5334/gjgl.632.s1
- **Appendix 4.** Genuine compounds in ISL. DOI: https://doi.org/10.5334/gjgl.632.s1
- **Appendix 5.** Genuine compounds in ABSL. DOI: https://doi.org/10.5334/gjgl.632.s1
- **Appendix 6.** SASS-constructions in ISL. DOI: https://doi.org/10.5334/gjgl.632.s1
- **Appendix 7.** SASS-constructions in ABSL. DOI: https://doi.org/10.5334/gjgl.632.s1
- **Appendix 8.** Elicitation items in Modern Hebrew and the local dialect of spoken Arabic (Note: both Hebrew and Arabic script is written from right to left. The English gloss follows the word order, left to right. That is, the English translation is not of the word above it, but is in the order it is spoken). DOI: https://doi.org/10.5334/gjgl.632.s1

Acknowledgements

We are grateful to Wendy Sandler, Carl Börstell and Ryan Lepic for feedback on the earlier draft of this paper and Carla L. Hudson Kam, Alexis Black and Emily Sadlier-Brown for feedback on the later draft, as well as our anonymous reviewers for their many helpful suggestions.

Funding Information

Support for this research was provided by U.S. National Institutes of Health grant No. R01DC006473.

Competing Interests

The authors have no competing interests to declare.

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How to cite this article: Tkachman, Oksana and Irit Meir. 2018. Novel compounding and the emergence of structure in two young sign languages. *Glossa: a journal of general linguistics* 3(1): 136.1–40, DOI: https://doi.org/10.5334/gjgl.632

Submitted: 13 February 2018 **Accepted:** 22 August 2018 **Published:** 19 December 2018

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