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Typology of sign languages

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Abstract

Sign language typology is the study of languages that use the visual-gestural rather than the auditory-vocal modality, and allows typologists to consider issues of language modality alongside typological patterns. Modality effects may be absolute, where features exist only in one of the modalities, or relative, where features are more frequent in one modality than the other. Sign language typologists, while widening the scope of typological investigations, are also concerned with many of the same issues as spoken language typologists, such as areal typology, grammaticalisation, and methodological questions. Although sign language typology is one of the more recent areas to emerge in the field, several studies have examined domains of linguistic structures in over 30 sign languages, and we focus on key findings from research in the domains of interrogatives, negation, possession, and numerals. The aim of the chapter is not to give comprehensive overviews of each domain, but rather to highlight issues of general relevance. We conclude with reflections on the emerging field of cross-modal typology, where data from spoken and signed languages are systematically included. This endeavour may necessitate the redefinition of terms and concepts, and will present new challenges for spoken and sign language typologists alike.

Keywords

cross-modal typology, iconicity, interrogatives, modality effects, negation, numerals, possession, rural sign languages, sign language linguistics

10.1 The context and aims of sign language typology

Sign language typology lies at the confluence of sign language linguistics and linguistic typology. Drawing on theoretical and methodological resources from its two source disciplines, it has a double orientation, broadening linguistic typology to include sign languages, while examining linguistic diversity within sign languages from a typological perspective. Ultimately, typological studies of sign languages will lead to a theory of variation which accounts for the patterns of differences and similarities that we find both across sign languages and between signed languages on the one hand and spoken languages on the other, and such reasoning sometimes offers the potential for a deep re-thinking of linguistic theories.

The onset of modern research on sign languages is often associated with the first linguistic publications on Sign Language of the Netherlands and American Sign Language (Tervoort 1953; Stokoe 1960). Since then, sign language research has come a long way, branching into many adjacent disciplines from psycholinguistics to gesture studies, and the wider linguistic community has become increasingly aware of the significance of sign language data for other areas of linguistics. For sign linguists, it is clear that ‘[t]he finding that sign and speech are both vehicles for language is one of the most crucial empirical discoveries of the last decades of research in any area of linguistics. It is crucial because it alters our very definition of what language is’ (Meier 2002:4).

Typological comparisons between spoken and signed languages can be framed in terms of ‘modality effects’ – differences between signed and spoken languages due to the way they are produced and perceived. In section 10.8, we discuss both absolute modality effects, where features exist only in one of the modalities, and relative modality effects, where features are more frequent in one modality than in the other. Depending on the domain of investigation, we also find cases where modality has little impact on language structures.

Sign language research has always been closely linked to the communities in which these languages are the primary means of communication. An important consideration is the application of the findings in the service of these communities, which are usually disadvantaged minority communities that have faced a history of active linguistic oppression (Lane 1992; Padden and Humphries 2006). Sign language typology can serve to intensify and expand a positive impact because it aims to engage systematically with a much wider range of languages than other sub-fields of sign language linguistics. Moreover, in the attempt to bring sign language linguistics and spoken language linguistics closer together, linguistic typology is an obvious link discipline because by definition, typologists are interested in all kinds of human languages.

Most typological surveys and studies to date have omitted sign languages from their consideration, regardless of how robust they may be in other respects. Historically, many linguists have been unaware or uncertain of the linguistic status of sign languages, though this is generally no longer the case. For most linguists, the problem seems to have been the inaccessibility of sign language research, perhaps compounded by a lack of personal experience of such languages (see e.g. Haspelmath 1997:17). However, there are reasons to be optimistic, and it is becoming more commonplace to see chapters on sign language research in edited volumes and surveys on different aspects of linguistics (e.g. Haspelmath et al. 2001; Dixon and Aikhenvald 2002; Dryer and Haspelmath 2013).

In this chapter we draw attention to key findings from several grammatical domains. In doing so, the aim is not to give a comprehensive overview of each domain, but to highlight issues that demonstrate the relevance of sign languages for the field of typology as a whole. With respect to interrogatives (section 10.4), we discuss the ways in which sign language typology accounts for patterns across sign languages, including the issue of adjusting or redefining terms and concepts from spoken language research. The sections on negation (10.5) and possession (10.6) illustrate that the extent to which sign languages either share common traits or exhibit typological diversity is a matter of separate empirical investigation for each grammatical domain.

The overview of research on numerals in section 10.7 highlights the importance of small-scale rural sign languages and includes considerations of iconicity, motivation, and language-internal variation. This leads on

to the final section which considers the effects of language modality on linguistic structure and discusses the emerging field of cross-modal typology, where data from both spoken and signed languages are systematically included. Before turning to the first grammatical domain, we briefly discuss important methodological challenges facing those who wish to pursue sign language typology (10.2) and structural issues and central concepts related to sign language linguistics (10.3).

10.2 Methodological concerns

In principle, many methodological concerns facing spoken language typologists are equally valid for studies involving sign languages, such as the quality of sources for linguistic data and the selection of parameters of cross-linguistic investigation. In practice, however, there are differences between the two modalities. Firstly, the number of sign languages in the world seems to be substantially smaller than the number of spoken languages, and the number of comprehensively documented sign languages is very small indeed.¹ The latest edition of the Ethnologue (Lewis, Simons and Fennig 2015) lists 138 sign languages, of which several are extinct. Although this coverage is far from complete or accurate, the total number of sign languages around the world is, for all we know at present, unlikely to be larger than several hundred languages. For the short term, and even for the medium term, it seems unrealistic to hope for new data from hundreds of entirely undocumented sign languages in a format that can be used for cross-linguistic studies.

The scarcity of data has a direct impact on the areal balance of a sign language data base, and leads to a second quandary. In theory, avoiding areal bias is rather straightforward: one would simply include substantial numbers of sign languages that have not been in close contact with one another, from as many different geographical areas as possible. Unfortunately it is impossible to do this at present because so little is known about so many sign languages in regions including large parts of Africa, Eastern Europe, South and Central America, and Asia. For practical purposes, while these gaps remain unfilled we can choose only between a sign language data base that is areally heavily skewed in favour of regions with a greater density of sign language research such as Western Europe, and one that is more balanced areally but too small to be typologically meaningful.

The issue of genetic bias in typological studies is another problem that sign language typologists face, and this is compounded by the fact that genetic relationships between sign languages are poorly understood. Unlike in spoken language typology, the issue in sign language research concerns the notion of language family as such. For sign languages, not only do we not know in most cases which languages are genetically related, but the very notions of ‘language family’ and ‘genetic relationship’ are not well-defined (Zeshan 2005; Palfreyman 2015).² Thus far, no theoretically sound method has been determined for discovering genetic relationships between sign languages. The familiar historical-comparative method of careful comparison of

¹ We would argue that more limited gestural communication systems should be excluded when counting the number of sign languages. This applies, in particular, to thousands of so-called home sign systems, ad hoc improvised gestural communication in use by isolated deaf individuals and their immediate contacts, particularly in rural areas with little educational infrastructure in developing countries. Although such systems can be communicatively quite effective (cf. Yau 1991), they do not meet all criteria commonly associated with full-fledged human languages.

² The details of possible relationships between sign languages lie beyond the scope of this chapter, and there has been little systematic research in this area. Because of the unique sociolinguistic situation of sign languages, we may well find entirely novel types of relationships that do not accord with pre-existing categories.

linguistic forms and reconstruction of parent languages (e.g. Trask 1996) has never been applied to sign languages, and with good reason. There are, of course, processes of historical change in sign languages (cf. Pfau and Steinbach 2011), but these do not have the same characteristics as regular sound correspondences in spoken languages. Moreover, grammatical paradigms such as pronouns and verb agreement affixes, which can provide crucial clues for genetic relationships in spoken languages, are often iconically motivated in sign languages, making them unsuitable for determining genetic relationships. Trying to measure the level of lexical similarity between languages such as by lexicostatistics is not a sound method for spoken languages, and is even more doubtful for sign languages (Palfreyman 2015).

The consequence of the above considerations is that any approach to balanced sampling of sign languages for typological purposes is questionable. Given these difficulties, the most comprehensive studies in sign language typology so far have aimed to include any and all available information on as many languages as possible. Unlike in spoken language typology, the dearth of comprehensive documentation and the absence of reference grammars for sign languages means that, in order for a cross-linguistic study on sign languages to be at all viable, most of the primary data for the foreseeable future must be generated in the course of the project itself. This approach has been adopted by studies undertaken by Zeshan (2006) on interrogatives and negatives, Zeshan and Perniss (2008) on possession and existentials, and Zeshan and Sagara (forthcoming) on the semantic fields of colour, kinship, and quantification.

In addition to large-scale typological studies, comparative research is increasingly being undertaken on smaller sets of sign languages (e.g. Perniss, Pfau and Steinbach 2007). Although less inclusive of typological diversity across sign languages, such work is very valuable in shaping the domains of inquiry in sign language typology. Additional work has focused on issues of theoretical relevance such as grammaticalisation of auxiliaries and negatives (Pfau and Steinbach 2006a; Steinbach and Pfau 2007), and on methodological concerns such as comparing basic constituent order across sign languages (Johnston, Vermeerbergen, Schembri and Leeson 2007).

Over the past decade, sign language typology has undergone a considerable evolution in the methodologies for collecting cross-linguistic sign language data. While Zeshan (2006) is based mainly on responses to typological questionnaires contributed by a network of co-researchers around the world, Zeshan and Perniss (2008) and Zeshan and Sagara (forthcoming) have used more sophisticated data collection methods, including extensive sets of stimulus materials for primary data collection by co-researchers, in conjunction with typological questionnaires. The latter study also included signed translations of all these materials in order to facilitate the inclusion of sign language users with low literacy levels. Moreover, the findings in Zeshan and de Vos (2012) on sign languages in rural communities are based not only on the collection of linguistic data, but also on a common sociolinguistic and anthropological research protocol which aimed at comparing the socio-cultural setting of these languages.

10.3 General features of sign languages

In this section we introduce some important linguistic features common to sign languages as well as the associated terminology used by sign language linguists, which provides some background information to the remaining sections.

The sign languages discussed in this chapter are the primary languages of communication in deaf communities where they are used. Sign languages have emerged around the world wherever deaf people have gathered together and formed communities, often in the context of a nascent education system for deaf children. Although these sign languages exist in a situation of more or less intensive language contact with their surrounding spoken languages, they are in no way derived from spoken languages, and are not a representation of spoken languages ‘on the hands’. Instead, sign languages have a linguistic structure of their own which can be and often is very different from surrounding spoken language(s). Sign languages are now considered to be the legitimate primary languages of deaf communities, the linguistic and cultural minorities that use them.

All sign languages use manual signs and non-manual features – facial expressions, and head and body postures – and are usually perceived with the eyes (though deaf-blind signers use tactile ‘hands-on’ signing). The sub-lexical make-up of a sign comprises the parameters of handshape, hand orientation, location, movement, and potentially any non-manual features with which it is conventionally associated. Changing a single parameter of a sign may create a different sign with a very different meaning, resulting in a minimal pair. Sign languages linguists refer to this level of structure as “phonology” despite the absence of any sounds, because of the equivalence of the formational parameters of signs with phonemes in speech. Although items at the sub-morphemic level of spoken languages are typically meaningless, Zeshan (2002) argues that sign languages regularly allow for meaningful elements at the sub-morphemic level of linguistic organization and that, therefore, the traditional distinction between phonemes and morphemes should be reconsidered in the light of sign language data. This exemplifies how sign language data can have particularly far-reaching consequences for reframing established linguistic theories.

One main reason for ambiguities in the phoneme-morpheme distinction in sign languages is iconicity. For the purpose of this chapter, we talk about iconicity in the sense of any non-arbitrary relationship between a sign and its meaning. As visual-gestural languages talking about a visually perceived world, there are many ways for sign languages to be iconic. This can range from very direct visual iconicity (e.g. a sign for ‘house’ with two open hands touching at the finger tips, as if shaping the roof of a house) to more abstract iconicity in grammatical systems. In Figure 1 from South Korean Sign Language, the movement direction iconically represents the transitive relationship, with the scolding directed at an addressee, in this case a female addressee represented by the little finger which is the female gender marker (the male gender marker is the thumb). In sign languages, sub-lexical components without morpheme status can nevertheless be “meaningful” because of an iconic relationship with their referent.

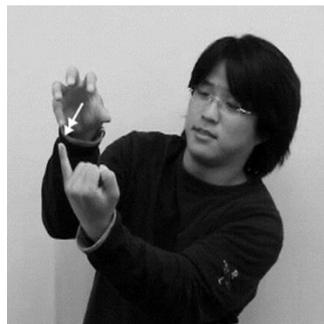


Figure 1. South Korean Sign Language sign for ‘scold a female person’.

The observation that non-manual behaviours in sign languages have grammatical functions rather than adding merely expressive and emotional nuances was confirmed early on in the development of sign language linguistics (e.g. Klima and Bellugi 1979). It can be argued that non-manual markers in sign languages are equivalent to intonation in spoken languages (cf. Sandler 1999) because both are suprasegmental phenomena that co-occur with and spread over segmental material. Referring to a modality-independent category of ‘suprasegmentals’ enables a direct comparison between sign languages and spoken languages; for example, in polar questions there is a parallel between (typically rising) intonation in spoken languages and the canonical non-manual configuration (brow raise, forward head position, eye contact) in sign languages (cf. Dixon, 2012:394-5).

Although the co-speech gestures of hearing speakers entail the use of hands, head and face for communicative purposes, gestures are distinct from signs used in primary signed languages (McNeill 2000). However, we often find historical relationships between gestures and signs, so that conventional gestures used in a particular region are incorporated into a sign language used in that region. When a gesture becomes a sign, its properties change: as a sign, it becomes part of the linguistic structure of the sign language, and is then subject to the grammatical constraints of that language.

The articulation of linguistic information via several channels (the movements of two hands which may function independently, along with facial expressions, head positions, body postures) enables the transmission of this information simultaneously, for example using a manual sign and a coextensive facial expression. Sign language structures also permit both sequential and simultaneous morphology (see examples of simultaneous morphology in sections 10.4.1 and 10.5.3). Moreover, some of this simultaneous morphology uses the signing space for grammatical processes. Many sign languages have a spatial morphological process used for inflecting transitive verbs, whereby the verb is directed in space away from the source of the action and towards the goal of the action, as in Figure 1 above. This is known as “directionality” or “spatial verb agreement” (Padden 1988; Meir 1998). Inflectional processes are summarised in some detail for American Sign Language by Sandler and Lillo-Martin (2006).

The sequential morphology found across several sign languages includes lexical compounds, affixes and cliticisation. Clitics have been identified in several sign languages to date, notably as pronominal indexical locative forms (Sandler & Lillo-Martin, 2006:7), completives (Palfreyman 2015) and negatives (10.5.3 below, which also discusses negative affixes). The distinction between clitics and affixes draws upon similar characteristics as spoken languages. For example, clitics have a co-existing free form, whereas affixes do not; clitics are comparatively more productive (see Zeshan 2004:49 for a list of characteristics). However, the ways in which a particle changes from being a full-fledged phonological sign to being attached or bounded to a host is in some cases modality-dependent. By way of example, Palfreyman (2015) uses four guiding criteria to identify clitics in Indonesian Sign Language: elision of a phonological segment, assimilation with the location of the host, a ‘hold’ in the non-dominant hand, and the spread of a mouthing which binds the clitic and its host. The first of these has a parallel with spoken languages, but the other three criteria are particular to sign languages.

Research on constituent order for sign languages has lacked a coherent approach in the description and analysis of data, and because of this, it is not possible to make any clear claims regarding a typology of constituent order in sign languages (Leeson and Saeed 2012:260). For sign languages, the key issues are further confounded by simultaneity, iconicity at the lexical and syntactic level of linguistic organisation, and the extent to which the dichotomy between fixed and pragmatically determined constituent orders is applicable (ibid: 248). Napoli and Sutton-Spence (2014) suggest that it is necessary to consider pressure exerted by the visual modality.

Sign languages do not usually exist in isolation from spoken and written forms of language, and regular contact with spoken languages may be manifest in several ways, such as mouthings (mouth patterns that imitate the articulatory movements of spoken words) and fingerspelling (where signs for written letters or characters are produced sequentially to represent a written form). In some sign languages, mouthings are used to differentiate between meanings, for example a single manual form is used in British Sign Language for both ‘uncle’ and ‘aunt’, with mouthings used to make the distinction. Fingerspelling has also become part of the lexicon of some sign languages in the form of so-called initialised signs, which are based upon the first letter of the corresponding word. However, the extent of these phenomena may vary from language to language, and even from signer to signer, in accordance with a vast range of sociolinguistic factors. For example, deaf signers who use Kata Kolok, a rural sign language in Bali, have had little contact with written forms and most use neither mouthings nor fingerspelling (de Vos 2012).

10.4 Interrogative constructions

The first ever large-scale comparative study of sign languages was concerned with clause types, in particular interrogative and negative constructions. Data from 37 sign languages contributed to these findings (Zeshan 2006). As hinted above, this sample is skewed towards European sign languages, while some regions of the world such as Africa are barely represented. Additional data have since become available, but the main typological categorisations applied to interrogatives and negatives have not been challenged in any major way.

An example of the kind of conclusions that can be drawn on the basis of this inductive analysis relates to the role of manual and non-manual features in various types of questions. Zeshan (2004a:32) argues for a redefinition of terms with respect to question particles as “signs whose main function it is to indicate that an utterance is a question”, without assuming that question particles should be obligatory in all polar questions, or pragmatically neutral. Under this definition, it is found that between a fourth and the third of the sign languages in the data set have question particles, mostly used in polar questions, but in some sign languages in content questions too. Question particles often have additional pragmatic functions, such as being used in confirmation questions, or to signal the urgency of a question. To date, there is no documented case of any sign language where a question particle could be considered obligatory in all polar questions. The remainder of this section summarises the patterning of question word paradigms across sign languages (10.4.1), and clause-level observations (10.4.2).

10.4.1 Question word paradigms

In the absence of previous established categorisations, the value of sign language typologists working “close to the data”, as mentioned in section 10.2, is particularly pertinent. With respect to question words, such an empirical survey reveals several factors that are relevant in understanding patterns across sign languages (Zeshan 2004a, 2006). One factor is the relationship between interrogative and related non-interrogative signs. This includes cases where the same sign has indefinite and interrogative functions, as is also found in some spoken languages (cf. Bhat 2000; Dixon 2012:401-404). For example, New Zealand Sign Language has a generic interrogative that is also a generic indefinite sign, as well as a specific interrogative ‘who’ that is also used as indefinite ‘someone’ (McKee 2006). It is currently an open question to what extent this interrogative/indefinite polysemy in sign languages parallels the same polysemy in surrounding spoken languages. Another aspect concerns the morphological derivation of interrogatives from non-interrogatives. For instance, in Turkish Sign Language some question words are derived by adding movement repetition to a non-interrogative sign (Zeshan 2006; see Figure 2). All such sign pairs also differ in their accompanying non-manual expressions, as the interrogative signs co-occur with interrogative non-manuals such as facial expressions and head positions (Figure 2).



Figure 2. ‘When/what day’ in Turkish Sign Language (the sign DAY has only a single short forward movement and a neutral facial expression). Reprinted with permission from Zeshan (2006).

The size and internal structure of question word paradigms is a dimension of great variability across sign languages, ranging from a minimal option with only a single interrogative to paradigms of a dozen and more interrogatives (Zeshan 2004a). In the more complex paradigms, it is particularly interesting to observe that question words may fall into sub-types with differential properties. These may be based on morphological properties, as in Hong Kong Sign Language (HKSL), where there are several sets based on two different generic interrogatives, one for entities (‘what?’, glossed WH1) and one for quantities with an open handshape and finger wiggling (‘how many?’, glossed WH2).³ These interrogatives, mentioned in Tang (2006), can be divided into sequential compounding with the entity interrogative (FACE+WH1 ‘who’ and PLACE+WH1 ‘where’); sequential compounds with the quantity interrogative (TIME+WH2 ‘when/what time’); and simultaneous compounds with WH2 for asking about duration (‘how long’) and dates (‘what day of the week’, ‘what date’). The generic interrogative of quantity occurs in similar form in morphologically complex signs in

³ Finger wiggling involving all fingers is a recurring formational component of interrogatives of quantity in many sign languages and is iconically motivated.

Japanese Sign Language, where the interrogative handshape occurs at different places of articulation to convey interrogatives of quantification (see Figure 3). American Sign Language has a sub-set of interrogatives that are derived from fingerspelling English question words using the one-handed manual alphabet (Fischer 2006), so the distinctiveness of this sub-set is based on the language contact situation with English.



Figure 3. Generic interrogative of quantity and its simultaneous compounds in Japanese Sign Language (in all signs, fingers are opened and closed repeatedly). Credit: Keiko Sagara.

The role of generic interrogatives within the question word paradigm varies cross-linguistically and falls into one of three types (Zeshan 2004a:23): “(i) the general interrogative covers the whole question-word paradigm, (ii) the general interrogative covers part of the question-word paradigm, and (iii) the general interrogative exists alongside an extensive question-word paradigm.” Excepting the generic interrogatives of quantity (as mentioned above for Hong Kong Sign Language), an implicational universal can be formulated as follows across the available data:

If a generic content interrogative sign expresses one or several non-quantitative interrogative meanings other than ‘what’, the sign will also encompass ‘what’ in its range of meanings, but not vice versa.

That is, cases where a generic content interrogative word would cover, for instance, the meanings ‘how’, ‘why’ and ‘where’, but exclude the meaning ‘what’, are not attested. Moreover, while many spoken languages make a distinction in interrogatives of entity between ‘who’ and ‘what’ (Dixon 2012:411–413), sign languages seem to privilege a distinction between interrogatives of entity and interrogatives of quantity, as is evident in the above HKSL data. In Kata Kolok, a rural sign language from Bali, there are two content interrogatives, one meaning ‘how many’ and a generic one covering all other question words.

10.4.2 *Interrogative clauses*

Across sign languages, the three main syntactic structures in content questions are for the interrogative to be clause-initial, clause-final, or repeated in both these positions. Clause-medial in-situ placement of interrogatives is only rarely attested.⁴ Several sign languages only allow clause-final question words. This is

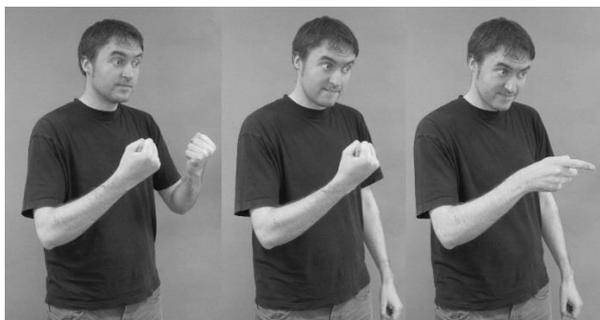
⁴ In the literature on American Sign Language, there has been a debate about the placement of content interrogatives and the significance of such data, especially with respect to formal syntax (see Petronio and Lillo-Martin 1997; Neidle et al. 1998; Fischer 2006).

the case, for instance, in Indo-Pakistani Sign Language (Zeshan 2006c) and in Italian Sign Language (Lingua de Segnas Italiana, LIS), as in these examples (LIS, from Cecchetto, Geraci and Zucchi 2009:283)⁵:

(1) low-br Italian Sign Language (LIS)
 ARRIVE IN-TIME WHO
 ‘Who arrived in time?’

(2) low-br Italian Sign Language (LIS)
 HOUSE BUILD DONE WHO
 ‘Who built the house?’

In the formation of polar questions, changes in constituent order equivalent to phenomena such as Subject-Verb inversion are not attested in sign languages, with the exception of the syntactic position of pronominal pointing. All known sign languages use index finger pointing for person reference, although the internal structures and constraints of the entire pronominal paradigms, including non-singular pronouns and other pronoun series in addition to personal pronouns, vary widely across sign languages (cf. McBurney 2002; Lutalo-Kiingi 2014). In fact, the availability of index finger pointing, sometimes as one of several options, for first and non-first person singular reference is a good candidate for a substantive universal across sign languages, until a counter-example can be found. In polar questions, the majority of sign languages are reported to exhibit a non-obligatory shift of pronominal pointing to the end of the clause, or a clause-final repetition of pronominal pointing. This often coincides with a lengthened hold of the clause-final pointing sign and the canonical non-manual expression for polar questions, as in example (3) from British Sign Language.



(3) brow-raise British Sign Language (BSL)
 CAR HAVE IX₂-----
 Do you have a car?

One lesson that can be drawn from the study of clause types in sign languages is the importance of suprasegmental aspects of clause structure. From the beginning, sign language linguistics has taken this issue

⁵ Glossing conventions in this article follow those commonly used in the sign language literature. In each example, meaning-based glosses in capital letters stand for the manual signs; the top tier (in lower case) shows non-manual features, such as head and eyebrow movement, and co-occurrence with the manual signs is shown by the length of the line. For abbreviations used, see the appendix.

seriously, and considering non-manual marking when discussing clause types is standard in sign linguistics even where manual marking also plays a role. Secondly, the domain of clause types particularly highlights the fact that spoken languages are also multimodal, a fact now often acknowledged explicitly by linguists (e.g. Enfield and Levinson 2006; Streeck et al. 2011) but generally not reflected in linguistic typology. Indeed, questioning facial expressions and interrogative gestures are common across spoken languages and, unsurprisingly, often formationally identical in deaf signers and hearing gesturers in a given region. For instance, the generic interrogative in IPSL, which is related to the general indefinite sign, is identical to a pan-Indian hand gesture, and facial expressions are also parallel (Zeshan 2000b). In sign languages, however, the elements co-opted from the surrounding manual and facial gestures of the non-signing majority culture become part of the grammar of the language. Non-manual behaviours are relevant to the grammar of most clause types across sign languages including negation, which is discussed in the next section.

10.5 Negation

This section explores in more detail some of the themes already touched upon, notably the relationship between manual and non-manual marking of clause types and between iconicity and cross-linguistic similarities in sign languages. The main markers of negation in sign languages are non-manuals (primarily negative head movement), negative particles, and bound negative morphemes.

10.5.1 Manual and non-manual negation

The fact that negation in sign languages can involve both negative signs and non-manual marking has led to a typological categorisation of negation systems based on the relationship between manual and non-manual negation. The main grammatical non-manuals used in negative clauses are head movements, specifically a side-to-side headshake (sometimes reduced to a sideways head turn), and a backwards head movement with raised chin (often accompanied by raised eyebrows). The latter configuration is restricted to the Eastern Mediterranean region and overlaps mostly, but not completely, with the cultural area where the same configuration occurs as a general gesture (cf. Antzakas 2006 on Greek Sign Language). Non-manual markers, in particular the side-to-side headshake, often spread over the clause and can be considered suprasegmental in the same way as interrogative non-manuals.

Zeshan (2006) posits a typological distinction between manual dominant and non-manual dominant systems of negation. Table 1 summarises the characteristics of both. Examples (4) and (5) illustrate both types of negation. The crucial observation is that in manual dominant systems, a negative clause without a manual negator is ungrammatical, so leaving out NOT in example (4) is ungrammatical.

- | | | |
|-----|--|-----------------------------|
| (4) | <u>neg-tilt</u>
INDEX1 SPEAK NOT
‘I am not a speaking (person).’ | Turkish Sign Language (TİD) |
| (5) | <u>headshake</u>
INDEX1 UNDERSTAND
‘I don’t understand.’ | British Sign Language (BSL) |

Table 1. Characteristics of manual dominant and non-manual dominant systems of negation (from Zeshan 2006:43).

characteristics of non-manual dominant systems of negation	characteristics of manual dominant systems of negation
non-manual negation is obligatory	non-manual negation is not obligatory
clause can be negated non-manually only, manual basic clause negator is optional	clause cannot be negated non-manually only, manual negator is required
choice of non-manual marking does not depend on manual signs	choice of non-manual marking depends on choice of manual clause negator (if there is more than one non-manual configuration)
non-manual negation spreads freely over the clause	scope of non-manual negation is over the manual negator only or is closely tied to the manual negator
examples: Deutsche Gebärdensprache (Germany), Svenska Teckenspråket (Sweden), American Sign Language	examples: Kata Kolok (Bali), Türk İsaret Dili (Turkey), Nihon Shuwa (Japan)

Across the sample in Zeshan (2006), non-manual dominant systems are more frequent (26 out of 37 sign languages). Non-manual dominant systems of negation are particularly frequent across sign languages in Europe, whereas manual dominant systems are particularly well-attested in Asia as well as in rural sign languages. However, since European sign languages were over-represented in this sample in the first place, it is not possible to make any valid conclusions about the relative prevalence and frequency of both types across all of the world's sign languages. It would be premature to argue for any areal typology with respect to negation systems, as there is not enough detailed information about a sufficient number of sign languages, and reverse cases are also attested, e.g. Italian Sign Language with a manual dominant system of negation. In more recent work, additional manual dominant sign languages have been found, and Pfau (2015) lists the sign languages of Italy, Turkey, Hong Kong, Japan, and Jordan, as well as those rural sign languages for which negation has been described, namely Kata Kolok (Bali) and Inuit Sign Language (Canada). Palfreyman (2015) provides evidence that varieties of Indonesian Sign Language have manual dominant systems of negation.

In sign languages, it seems to be difficult to make valid arguments about the scope of manually expressed negation, and sign language linguists have generally not tried to distinguish between wide-scope and narrow-scope negation. Similarly, the difference between clause negation and constituent negation is not well understood. Instead, sign language linguists talk about the scope of negation in terms of non-manuals, as most non-manual negatives can spread across several signs, in particular the side-to-side headshake. Data presented in Zeshan (2004a, 2006) and Pfau (2015) lead to the following hierarchy with respect to the scope of negative non-manuals:

- (6) manual negator < verb/predicate < other adjacent constituents < whole clause

That is, non-manual negation minimally co-occurs with a manual negator if there is one, or with the verb/predicate if there is no manual negator, or may co-occur with both but not with the verb/predicate alone if there is also a manual negator in the clause. It can further spread to additional adjacent constituents including the whole clause, but must be continuous and cannot be interrupted by constituents without negative non-

manuals. Non-manual negation can often be observed to spread from the end of the clause, as constituent orders with a clause-final negator immediately following the verb are particularly common (Pfau 2015).

10.5.2 Negative particles across sign languages

Negative particles have been observed in all sign languages documented so far, which is a correlate of the fact that other types of manual negation are restricted to specific individual lexemes rather than operating over entire sign classes. The most common syntactic position of negative particles across sign languages is clause-final (Zeshan 2004b; Pfau 2015), with pre-verbal particles occurring much more rarely. Tang (2006:221) observes that the occasional pre-verbal basic clause negator in Hong Kong Sign Language is modelled on spoken Cantonese, and that this influence from spoken language structure is stronger in younger people. On the other hand, the pervasive occurrence of clause-final negative particles in sign languages is independent of which constituent order obtains in the surrounding spoken languages.

All known sign languages have more than one clause negating particle, although Kata Kolok from Bali has as few as two, a basic clause negator and a negative completive ‘not yet’ (Marsaja 2008). The choice of particle can often result in subtle semantic changes, as in these examples from IPSL (from Zeshan 2014):

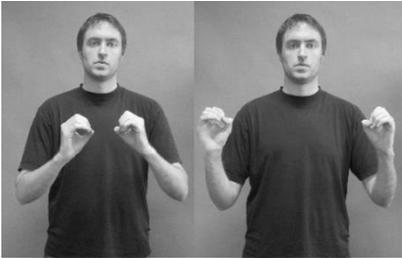
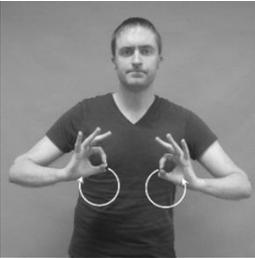
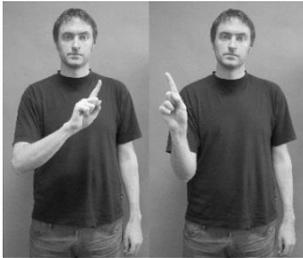
- | | | | |
|------|---|----------------------------|------------------------------|
| (7a) | PROBLEM NOT
‘It is not a problem.’
Basic clause negation, without any additional nuances of meanings. | (see picture H in Table 2) | Indo-Pakistani Sign Language |
| (7b) | PROBLEM NO-NO
‘No, there isn’t a problem. / No, this isn’t a problem.’
Contrastive negation, where either a previous utterance contains an explicit context that is being refuted, or the contrast may be implicit. | (see picture F in Table 2) | Indo-Pakistani Sign Language |
| (7c) | PROBLEM DON’T
‘There should be no problem.’
Negative imperative, implying a warning or directive not to create a problem. | (see picture D in Table 2) | Indo-Pakistani Sign Language |
| (7d) | PROBLEM NOT-EXIST
‘There is no problem.’
Negative existential to deny the existence of one or several problems. | (see picture C in Table 2) | Indo-Pakistani Sign Language |

Recurring forms are found to be used as negative particles across sign languages, including the negatives in example 7a-7d, and these forms are found in different sign languages that are not known to have had any contact. Some recurring combinations of relevant formational features are represented in Table 2 and illustrated with figures (based on Zeshan 2004b:37).

The cross-linguistic occurrence of these forms is evidence of the influence of iconicity on sign language structures. The negative particles with round handshapes are motivated by an iconic representation of writing, specifically the number zero. This is a widespread iconic motivation for clause negators, as well as for numerals (see section 10.5), and it implies that the development of literacy in the surrounding environment predates the emergence of these sign languages. This observation matches the historical records we have on the development of urban sign languages. Conversely, on this basis we would predict that the sign languages of

non-literate communities do not make use of the round handshape for negatives. Indeed, this is what we find in Kata Kolok from Bali (Marsaja 2008; de Vos 2012) and Adamorobe Sign Language from Ghana (Nyst 2007), two rural sign languages in communities where deaf people have been traditionally illiterate, although this is changing now. By contrast, negative signs that have been adopted into the sign language from surrounding co-speech gesture show no correlation with literacy, as would be expected. This includes the forward facing open palm and the upward pointing index finger, which are also found in negative gestures across various countries.

Table 2. Recurring formational components in negative particles.

	side to side movement	single sideways movement	circular movement	repeated twist of the wrist
round handshape	A 	B 	C 	
upwards extended index finger	D 	E 		
open hand with palm facing forward	F 	G 		
open hand				H 

10.5.3 Morphological negation and grammaticalisation processes

All cases of negation other than independent negative particles are summarised under the term “morphological negation” here. Morphological negation in sign languages takes several forms, some of which are familiar

form, while negative clitics may have co-occurring free forms. There is evidence across sign languages for grammaticalisation in this domain, that is, the development of independent negative particles into negative clitics and affixes. In cases such as Indonesian Sign Language (Palfreyman 2015), cliticised and non-cliticised forms exist side-by-side. Lutalo-Kiingi (2014) describes two bound negative morphemes, one of which (Figure 6a) has no current co-existing free form, while the other one (Figure 6b) has grammaticalised from an independent sign meaning ‘of low quality’.



6a. The sign LIKE and its negative counterpart with negative affix (hand moving away from the body)



6b. The sign UNDERSTAND^LOW-QUALITY meaning ‘not understand’

Figure 6. Negative affix and clitic in Ugandan Sign Language. Credit: Sam Lutalo-Kiingi, Bonnie Busingye.

Morphological negation in sign languages differs in two important ways from that of spoken languages, both of which have to do with the restricted use of this negation type in sign languages. Firstly, none of the subtypes of morphological negation applies to an entire word class in any sign language documented to date, which is why they have also been referred to as “irregular negatives” (Zeshan 2013). Instead, morphological negation is always restricted to a few items, ranging from a single item to about a dozen. There is a strong cross-linguistic tendency for these items to belong to specific semantic domains, and this generalisation also applies to negative suppletion, where the signs for positive and negative counterparts have entirely different forms. Zeshan (2004b:50) lists the following semantic domains:

- | | |
|---------------------------|-------------------------------------|
| – cognition: | not know, not understand |
| – emotional attitude: | not want, not like, not care |
| – modals: | cannot, need not, must not |
| – possession/existential: | not have, not exist, not get |
| – tense/aspect: | will not, did not, not finished |
| – evaluative judgement: | not right, not possible, not enough |

Interestingly, this semantic range is similar to the "inherently negative verbs" reported in Dixon (2012:123), and the number of these verbs in spoken languages also ranges from one or two items to about a dozen.

Secondly, virtually all cases of negative clitics and affixes occur after the stem as enclitics and suffixes, while proclitics and prefixes are rare or unattested. This is in line with the strong preference in sign languages for post-verbal and clause-final negative particles observed above and is an additional argument for positing grammaticalisation from free negative particles.

The combined effect of these two constraints is that within morphological negation, sign languages make use of fewer options in terms of structural diversity in comparison with spoken languages, and this contributes to the overall typological profile of negation across sign languages. Together with the other characteristics of negation across sign languages discussed in this section – the prominent role of suprasegmental negation, the iconic properties of negator signs, the occurrence of simultaneous morphology for negation, and the preference for negation in post-position – a cautious argument can be made in favour of a “sign language type” of negation that stands in contrast to negation systems in spoken languages.

10.6 Possession

In this section, the two main sub-topics of attributive possession and predicative possession are explored with respect to the structures found across sign languages. In addition, conceptual and linguistic links between the domains of possession, existence, and location are discussed. We argue that these conceptually-based links are a source of commonalities between signed and spoken languages in the domain of possession.

10.6.1 Attributive possession

The study of possessive and existential constructions in Zeshan and Perniss (2008) surveyed 28 sign languages from Europe, Africa, Asia, and the Americas. In the domain of attributive possession, the sign languages in this sample do not show a high degree of typological variation. Juxtaposition of possessor and possessum is pervasive across sign languages. The absence of morphological marking is related to the lack of case morphology in sign languages. So far there is no documentation of any sign language with morphological case that would operate in the same way as case morphology in spoken languages. Genitive case for marking relations between possessor and possessum is unknown in sign languages, and alternative prepositional or postpositional constructions are also missing.

In addition to juxtaposition, some sign languages use manual linker signs and/or possessive pronouns in possessive NP constructions. In the following examples from Catalan Sign Language (Quer et al. 2006:40-41), the sign glossed DE is a possessive linker, SEU is a possessive pronoun, and PROPI is an emphatic possessive pronoun (examples 8 and 9).⁶

- (8) _____ t Catalan Sign Language (LSC)
 COUNTRY DE SEU FLAG COLOUR RED
 ‘The colour of that country’s flag is red.’

⁶ The glosses DE, SEU and PROPI are based on spoken Catalan; in the absence of equivalents in English, the Catalan-based glosses are reproduced here as in the original publication.

- (9) low-br
LSC DE PROPI QUI
'Whose own language is LSC?'

Across sign languages, there is also a remarkable uniformity with respect to the form of possessive pronouns. If a sign language has a dedicated form for possessive pronouns, which is not always the case, there are just two widespread forms, a flat hand with fingers extended, and a fist with all fingers closed. As in the case of personal pronouns and all other pronominal series in sign languages, possessive pronouns are deictic and are oriented in space towards the possessor (see Figure 7a and 7b).

A third pronominal possessive form with two extended fingers (V-handshape, see Figure 7c) also occurs in some sign languages. This is neither an areal phenomenon, nor is there any clear evidence yet that this is due to historical relationships between these languages. The V-handshape has been found in possessive pronouns in the sign languages of Mexico, Brazil, France, Greece and Turkey.

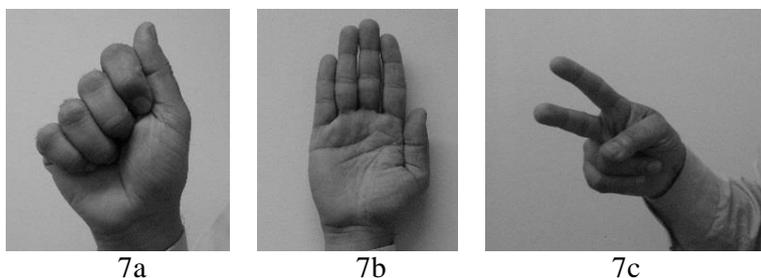


Figure 7. Handshapes in possessive pronouns. Reprinted from Zeshan (2008:16) with permission.

Having more than one type of possessive pronoun seems to be rare in sign languages. If this is the case, the distinction is between neutral possessive (with no other semantic nuances besides expressing the possessive relationship) and emphatic possessive (expressing a stronger emphasis on the possessive relationship), as in Catalan Sign Language (example 8 above) and in Ugandan Sign Language (Lutalo-Kiingi 2014). Semantically, this is similar to the difference between *my* and *my own* in English.

10.6.2 *Predicative possession*

Within possessive NPs, semantic distinctions such as alienable and inalienable possession, temporary and permanent possession, and the like, are not easily detectable in the available sign language data. By contrast, in predicative possession, we find a wide range of typological diversity across sign languages which is entirely comparable to what is found in spoken languages. Moreover, semantic distinctions and grammaticalisation paths familiar from spoken language research are readily found across sign languages.

In terms of the complexity of the domain, a wide range of options is found across sign languages. At one end of the spectrum, there are sign languages without any dedicated possessive constructions. This is the case for Adamorobe Sign Language in Ghana (Nyst 2008). One of the constructions used for locative, existential, and possessive meanings alike is juxtaposition with index finger pointing, where the interpretation depends on the context, as in these examples:

- (10) WOMAN THREE IX:accra Adamorobe Sign Language, Nyst 2008:240
 ‘(These) three women are there/live in Accra.’ **(locative interpretation)**
- (11) WATER IX:mountain Adamorobe Sign Language, Nyst 2008:240
 ‘There is water on the mountain there.’ **(existential interpretation)**
- (12) _____ y/n Adamorobe Sign Language, Nyst 2008:244
 MONEY IX₂
 ‘Do you have money?’ **(possessive interpretation)**

At the other end of the scale of complexity, we find a rich array of possessive constructions, such as in Catalan Sign Language (Quer et al. 2008). Table 3 illustrates the intricate patterns of the range of possessive constructions, showing the distributional and semantic properties of the three main positive polarity possessive signs, their negative counterparts, and other related possessive forms. Having more distinctions in positive polarity than under negation is consistent with the dependencies between grammatical systems for spoken languages (Aikhenvald and Dixon 2011).

Table 3. Positive and negative marking of possession in Llengua de Signes Catalane (Spain).

Positive polarity sign	Function	Negative polarity counterpart sign	Other related possessive forms
THERE-BE (inflected spatially, with accompanying tongue wiggling)	Existential/possessive predicate (alienable and inalienable, except body parts, which have zero marking)	Uninflecting suppletive existential/possessive THERE-NOT-BE (alienable and inalienable, including body parts)	Tongue wiggling can occur on its own (co-articulated with possessum)
HAVE	Possessive predicate (for alienable possession only), with possessor as subject	Possessive predicate HAVE-NOT (with cliticised negative morpheme)	
BELONG	Possessive predicate, with possessum as subject	No negative polarity counterpart sign	BELONG is formationally related to possessive NP linker DE

Across sign languages, both uninflecting particles and inflected possessives are well attested. In addition to the spatial verb agreement mentioned in section 10.1.3, possessives may also inflect for person using spatial morphology. This involves either the placement of the hand at a spatial location associated with the possessor, or a change in hand orientation with the finger tips pointing to the possessor.

Both inflected possessives and uninflecting particles across sign languages often combine existential and possessive functions (see section 10.5.3 on this issue). With uninflecting particles, we often find negative suppletion, where the negative possessive/existential is entirely different in form from the positive counterpart, and this sometimes occurs in spoken languages too (Dixon 2012). Negative possessive/existential is one of the categories where sign languages that are not known to have had any contact may have similar forms due to iconicity, in this case, a round handshape as seen in pictures A, B and C in Table 2.

If more than one possessive marker is available in the language, they express various semantic distinctions. Rather than the commonly known distinctions between alienable and inalienable possession, or

permanent and temporary possession, a number of sign languages have grammaticalised a distinction based on physical-spatial properties of the possessum. This is analogous to the systems of possessive classifiers in Oceanic languages, which include semantic distinctions based on physical-spatial characteristics, use and value of the possessum (Aikhenvald 2012:20-26). In South Korean Sign Language, the sign shown in Figure 8a can only be used for entities that can be physically owned, and preferably held in the hand, such as a pen, money, or a passport. Thus the range of possessum items that this sign occurs with is limited. The sign in Figure 8b is general in scope and can co-occur with any possessum, including inalienable ones. Both signs can also occur together.



8a

8b

Figure 8. Possessive signs in South Korean Sign Language. Credit: Kang-Suk Byun.

In Turkish Sign Language, there is a similar, but not identical distinction. In addition to a general possessive particle, the sign in Figure 9 is used for alienable possessum items that are of considerable size, value and importance. For instance, this sign can be used to say that one has a house, a car, or a factory, but not a pet dog. On the other hand, if someone had a professional dog kennel business, the sign could be used. This is different from the distinction in South Korean Sign Language, and somewhat similar to English *have* versus *be the owner of*, in the sense that one could be the owner of a house or a business, but not the owner of a sibling or the owner of intelligence. However, in English it is possible to be the owner of smaller things, pets, etc, while the Turkish Sign Language sign for “owner” cannot be used for such items.



Figure 9. A possessive sign in Turkish Sign Language. Reprinted from Zeshan (2008:27) with permission.

10.6.3 Location, existence and possession across language modalities

From the preceding sections, it is clear that sign languages do not emerge as a coherent type in any sense in the domain of possession. This underscores the point that comparison between signed and spoken languages must be undertaken separately for each domain of investigation. Whereas the domain of negation lends itself to assembling typical profiles that are characteristic of signed languages as a group in contrast with spoken languages, this is not the case for possession. Instead, a sign language such as Adamorobe Sign Language without dedicated possessive constructions is much closer in typological profile to a spoken language such as the Ghanaian languages Likpe and Ewe (see Ameka 2012) than it is to another sign language with an array of intricately organised possessive structures such as Catalan Sign Language.

This generalisation holds despite the fact that at the same time, we also observe the dispreference or even absence of certain structures in each of the two modalities. Among the structures used equally in both modalities are possessive pronouns, uninflecting particles, and inflected verbs. Sign languages have a modality-specific sub-cluster of possessive/existential verbs with spatial inflection, while case marking, comitative, and the use of prepositions are attested in spoken languages only. However, we would argue that overall typological diversity across sign languages is greater than typological differences between the two modalities.

Another factor that unifies signed and spoken languages in this domain is the cognitive basis of possession in terms of the close conceptual links between location, existence, and possession, which is clearly in evidence across both modalities. Thus grammaticalisation pathways as set out in Heine (1997), although posited with reference to spoken languages only, are also reflected in sign languages, and we have seen above how existence and possession are very often conflated both in uninflecting particles and in inflected verbs in sign languages. In addition to the link between existence and possession, the schema called “Action Pattern” in Heine (1997) is of particular interest in sign languages because the iconically motivated form of a sign is a clear indication of how a more abstract possessive meaning has evolved from a concrete meaning of “holding” or “grabbing”. The sign in Figure 11a from South Korean Sign Language illustrates this point, and similar forms occur in other sign languages including British Sign Language (example 3).

It is also notable that a number of possessive signs across different languages are articulated by making contact with the body, as seen in some of the figures above; the same is also found in Flemish Sign Language (De Weerd and Vermeerbergen 2008) and American Sign Language (Chen Pichler et al. 2006). This seems to suggest the signer’s body as the prototypical possessor location with respect to which the possessum item’s existence is predicated. Finally, an unusual grammaticalisation path is found in Kata Kolok, where a “thumb-up” sign that also means ‘good’, as in the corresponding emblematic gesture, has evolved into a marker of possession. The context of examples (13) and (14) show that the original meaning ‘good’ has been bleached and the sign is used in a purely possessive function, although the original meaning continues to be available in other contexts, and we also find contexts that are equally compatible with both meanings (Perniss and Zeshan 2008:142; there are two first person pronoun forms, one with flat handshape and one with index finger handshape).

(13) FLAT₁ HOUSE THUMB-UP | INDEX₁ HOUSE RAIN BAD

‘I have a house. My house is in bad condition; rain gets inside’

(14) FLAT₁ MARRY FEMALE THUMB-UP | FEMALE INDEX₁ CRAZY

‘I have a wife. My wife is crazy’

10.7 Numerals

The domain of numerals is one of the most documented domains across spoken languages, and there are large collections and repositories of numeral systems (Hammarström 2010), as well as typological analyses (Hanke 2010; von Mengden 2010; Comrie 2013; Gil 2013). It is therefore of particular interest to compare these available data from spoken languages with a wider range of sign language data.

Findings by Sagara and Zeshan (2013) and Zeshan et al. (2013) draw generalisations from a set of 31 sign languages; these data are part of a larger study on semantic fields, which also includes colour and kinship terms (Zeshan and Sagara, forthcoming). In this section, we discuss both language-internal variation and cross-linguistic typological variety in this domain, the role of iconicity and motivation, and the issue of modality effects. The latter topic then leads on to section 10.8 on cross-modal typology.

10.7.1 Language internal variation

In general, sign language typology has not yet taken sufficient account of language-internal variation, in particular dialectal variation. In the domain of numerals, this is particularly pertinent, as many sign languages use several numeral series alongside each other. For instance, Palfreyman (2016) documents several different ways of signing numerals in sign language varieties in Indonesia. For the purposes of typological comparison, we must pay particular attention to language-internal or dialectal variation that affects the system rather than the form of numerals. For instance, in sign language varieties across India and Pakistan we can observe regional variation for the numerals 6 to 9 (see Figure 10 for one of these sets). However, in all varieties these forms are used in the same way to construct numerals, using the "digital" system. In such a system, higher-order numerals are constructed by signing each digit in sequence, in the same way as one would do in writing; for instance, the value 275 is signed as the sequence TWO SEVEN FIVE (see Zeshan et al. 2013 on digital systems of numerals in sign languages).



Figure 10. IPSL numerals from New Delhi.

From the admittedly scarce data available so far, it seems that this type of system-preserving variation is more common in sign languages. However, we also find dialectal variation at the systemic level within numerals. For instance, one set of numerals 100 and 1,000 in Japanese Sign Language is based on an iconic representation of written Kanji; the other is based on the number of fingers used in the formation of signs (Sagara 2014).

10.7.2 Numerals in rural sign languages and the breadth of typological diversity

Until recently, and on the basis of data from the better-documented national sign languages in the Western world, the domain of numerals would have seemed rather uniform across sign languages. Predominantly, we find base-10 systems with numeral handshapes that are combined with movement patterns to form the numeral series that are multiples of 10, 100, 1,000 and so on. An example from Turkish Sign Language (TID) is shown in Figure 11 (a 2-handshape combined with a movement indicating the thousands), and this is also well-attested in other parts of the world.



Figure 11. The numeral sign TWO#THOUSAND in TID. From Zeshan et al. (2013:363); awaiting permission from de Gruyter Mouton.

However, the broader data base that is now available reveals more typological variation than we were previously aware of. One important group of sign languages that has broadened our view of typological variation in this domain is that of small-scale rural communities, often referred to collectively as “rural sign languages” or “village sign languages” (Zeshan and de Vos 2012). Zeshan et al (2013) demonstrate that several numeral system types exist in rural sign languages that were previously unattested. This includes a vigesimal sub-system in Mardin Sign Language (MarSL) from Turkey, subtractive numerals in MarSL and in Alipur Sign Language (APSL) in India, and a spatial morphological process in APSL. Figure 12 shows examples from MarSL. In APSL, the numeral sign becomes larger in the signing space the more zeros are added to the number (see Figure 14 in section 10.8.1).



Figure 12. Subtractive numeral ‘18’ (‘20 minus 2’) from Mardin Sign Language (Turkey). From Zeshan et al. (2013:378); awaiting permission from de Gruyter Mouton.

Such data have had two opposite effects on our understanding of typological patterns in this domain. On the one hand, this research has positioned sign languages closer to spoken languages in some respects. For instance, vigesimal and subtractive numerals are already well-known in spoken languages, and have now been

found to occur in sign languages too. On the other hand, these results also set sign languages apart from spoken languages in some ways, inasmuch as structures are discovered that are either unattested or impossible in spoken languages. For instance, spatial morphology is by definition unavailable in spoken languages (see section 10.8 for further discussion on modality effects).

10.7.3 Iconicity and motivation

Iconicity has already been discussed with respect to negation, as a potential driver of increased cross-linguistic similarities in sign languages. It is beyond the scope of this chapter to go into the various types of iconicity that can be found in sign languages (cf. Taub 2001; Rosenstock 2008). Suffice it to say that iconicity is by no means limited to a straightforward visually-based relationship between a sign and its meaning, such as signs for 'tree' visually resembling the overall shape, the trunk, or the crown of a tree (cf. Taub 2001). Instead, iconicity in sign languages often involves one or several levels of abstraction, and in the remainder of this chapter, we use the term "motivation" instead, which is intended to cover any type of non-arbitrary link between a sign and its meaning. In the domain of numerals, abstraction is particularly evident because the target meaning itself is abstract and does not lend itself directly to visual representation (e.g. 'five' as a concept does not visually look like anything).

In the domain of numerals, motivation is a source of both similarity and diversity across sign languages. For numerals up to 10, extending the corresponding number of fingers is a common strategy across sign languages, and seems to be virtually universal for numbers 1-4 (though the choice of which fingers are extended and which way the fingertips point is variable). It is interesting to note that even for spoken languages and in cognitive science, the role of the hands in shaping how we think and talk about numbers has been recognised (Hanke 2010: 72). Sign languages are a direct illustration of this human tendency.

However, as there are various other ways in which numerals can be iconically motivated, this also constitutes a source of diversity. For instance, Sagara (2014) proposes a typology of iconic motivation for those numerals that are related to writing, that is, where the shape of the sign mirrors the shape of the written form. This is widespread, though by no means universal across sign languages. The resulting signs then differ according to several parameters:

- a) The type of writing system that numeral signs are based on (e.g. Latin, Arabic or Chinese)
- b) The type of articulator that is used in the sign formation (e.g. 'zero' can be expressed with a round handshape, by the eyes, or by the mouth)
- c) The type of depiction used in terms of the movement trajectory (using a stationary shape vs. tracing the written shape).

Figure 13 shows some examples from sign languages that make use of writing as a source of numeral signs. This type of motivation is not found in any of the rural sign languages documented to date, as may be expected given the lack of access to education and literacy for deaf people in these communities. However, the opposite generalisation does not hold; that is, not all sign languages that have been in a language contact situation with literacy exploit writing as a source for numeral signs; this is merely one option among others.

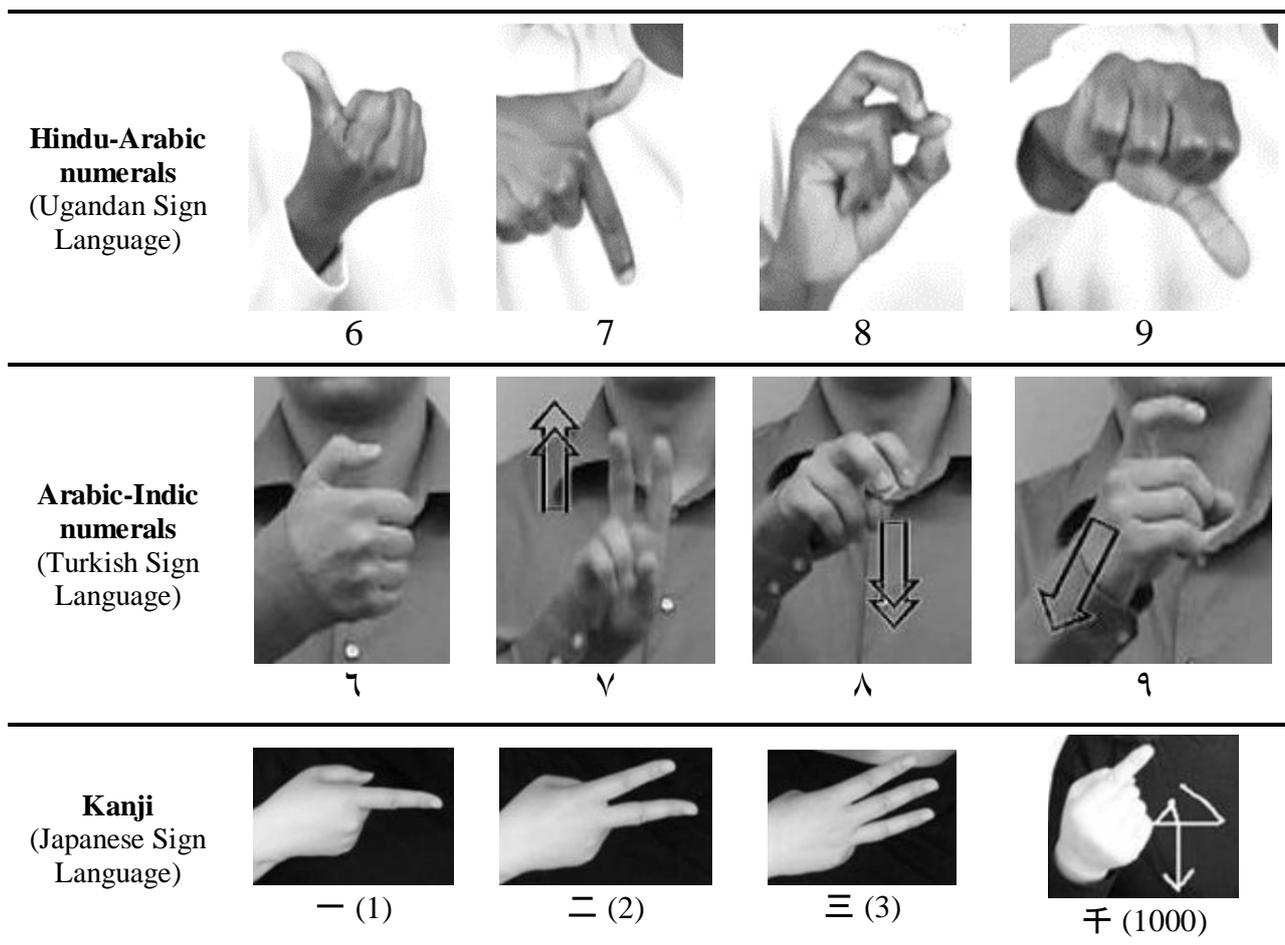


Figure 13. Numeral signs based on different writing systems (from Sagara 2014:81, used with permission).

10.8 Towards a cross-modal typology

Cross-modal typology is only just beginning to be discussed explicitly in the literature. Pfau and Steinbach (2006b) consider pluralisation strategies across signed and spoken languages. Having provided evidence from primary data for the domain of numerals, Zeshan et al (2013:391) conclude with stating two related aims of cross-modal typology: “a) An empirically substantiated recognition that sign languages show considerable cross-linguistic variation [and] b) An understanding of patterns of variation that cut across modalities, with evidence of both modality-specific and cross-modal patterns.” Throughout this chapter, we have argued for a correlation between linguistic structures and language modality in several instances, such as the absence of possessive constructions involving genitive case, comitative, and locative prepositions in sign languages, and the absence of iconically motivated negatives and numerals in spoken languages.

It has also been demonstrated in this chapter that sometimes the redefinition of terms or concepts is appropriate in order to compare like with like across modalities. For instance, talking about ‘suprasegmentals’ needs to include both intonational features in spoken languages and non-manual marking in sign languages. With respect to the non-manual dominant type of negation where a negative headshake alone is sufficient to mark negation, Pfau (2015:37) points out that “the realization of negation by only a suprasegmental feature is

rare in spoken languages ... while it is common in sign languages”, and that this reflects a modality effect.⁷ However, such redefinition is not always straightforward. Although there may seem to be a parallel, for example, between the use of locative prepositions in possessive constructions in spoken languages, and the spatial positioning of the hand in locative particles and verbs in sign languages, it is far from clear whether they should be considered equivalent for the purpose of cross-linguistic comparison.

10.8.1 Absolute and relative modality effects

In general, a modality effect is in evidence where any difference between signed languages on the one hand and spoken languages on the other can be argued to be due to the language modality.⁸ This is, however, less straightforward than it seems at first sight. When thinking about the effects of modality, one of two approaches may be taken. Either one considers that any spatial process is by definition unavailable in spoken languages, and therefore the existence of such signs is a clear effect of the language modality. Alternatively, it is possible to consider what would be the closest possible correlate in a spoken language, and then investigate whether any such equivalent form is attested in a spoken language (for examples, see 10.8.1).

Consider, for instance, the APSL numerals with spatial morphology mentioned above. In these numeral signs, making the sign bigger in space corresponds to adding zeros to the number. Figure 14 shows the signs for 100, 1,000 and 100,000 in APSL, which are successively larger in space.⁹



Figure 14. Signs for ‘100’, ‘1,000’, and ‘100,000’ in APSL. From Zeshan et al. (2013:381); awaiting permission from de Gruyter Mouton.

This process of sign formation may be regarded as an effect of the language modality because by definition, spatial processes are not applicable in spoken languages. Alternatively, it is possible to consider what would be the closest possible correlate in a spoken language, and then investigate whether any such equivalent form is attested in a spoken language. Theories in sign language phonology often compare the movement component of signs with vowels in spoken languages because both constitute the nucleus of the syllable (Brentari 1998). Therefore, an equivalent process in spoken language numerals could be one where a successive increase in a

⁷ Pfau (2015) also discusses detailed arguments about the status of the headshake, including its analysis as an affix to the verb in some sign languages, as well as discussing the applicability of Jespersen’s Cycle to sign languages.

⁸ How exactly this should be argued is a separate question that is not discussed here. Suffice it to say that a modality effect implies causality; that is, the observed differences are assumed to be due to the language modality. This is more specific than simply observing a correlation between the occurrence of a linguistic structure and the modality of the languages where it occurs.

⁹ This is modelled on Urdu, which has monomorphemic words for ‘1,000’ and ‘100,000’ but not for ‘million’. Urdu is the predominant surrounding spoken language in Alipur.

vowel feature such as vowel length indicates larger numbers with more zeros. A hypothetical example would be something liked *bat* '100' and *baat* '1,000'. We are not aware of any such system in spoken languages, but it is not a priori ruled out.

By contrast, iconic motivation of numerals on the basis of writing would seem to be a priori limited to sign languages because writing is a visual product that lends itself to being linked iconically with a visual-gestural language, but not with an auditory-vocal language. Logically, these two types of modality effects are different from each other. However, they can both be called instances of absolute modality effects, which means that the structure in question never occurs in one of the modalities, in this case, spoken languages.

In addition, we also find modality effects that merely concern the frequency of certain structures rather than their existence or non-existence. These patterns can be called relative modality effects. For instance, non-decimal numerals seem to be much rarer in sign languages than in spoken languages. In Comrie (2014), 42 out of 196 surveyed spoken languages include vigesimal numerals, whereas we currently have only one such case attested for sign languages. Although the amount of data from sign languages is still quite limited, the notable prevalence of decimal systems sits well with the effect that the hands and fingers have on human cognition with regard to numbers. We can expect that this effect would be much stronger in languages that actually use the hands and fingers to construct linguistic expressions. At the same time, there is nothing in the modality of signed languages that would prevent vigesimal numerals from ever arising, and indeed, a vigesimal numeral may be motivated by considering both hands and feet with a total of 20 fingers and toes. Thus there is no reason to expect that vigesimal numerals would be non-existent across all sign languages, and this is confirmed by the data.

As can be seen throughout this chapter, an investigation of cross-modal typology that embraces sign languages and spoken languages will be incomplete if one disregards the issue of the relationship between languages coexisting in the same region. Given that sign languages are always used by linguistic minorities, the influence of surrounding spoken languages can often be expected, such that some typological features of sign languages may be shared with spoken ones used in the same geographical area. For instance, it is interesting that the strategies for expressing possessive/existential/locative functions in Adamorobe Sign Language have several parallels with spoken Ghanaian languages, as mentioned in 10.6.3. Another issue is that gestures used in a particular region regularly find their way into sign languages as lexemes or grammatical markers, usually undergoing processes of grammaticalisation (as with the pan-Indian interrogative/indefinite handshapes discussed in 10.4.2). This also applies to regionally determined non-manual gestures such as the negative backwards head movement or tilt restricted to the Eastern Mediterranean area, mentioned in 10.5.1.

A logical conclusion from such considerations is that areal typology is a viable and necessary ingredient of sign language typology. There is as yet little research on specific areal typological profiles of sign languages, which may or may not share similarities with spoken languages and gestural systems of the same region. An example of areal patterns appears in Zeshan (2013) with respect to the prevalence of question particles in East and Southeast Asia. Among the sample of sign languages used for this survey, and in parallel with a common pattern among spoken languages, all sign languages except one in this region have at least one question particle, and this region is the only one with attested cases of sign languages with more than one question particle.

10.8.2 Cross-modal patterns of variation

The aim of a future cross-modal typology must be to carefully examine a much wider range of data, in particular from diverse sign languages, in order to make empirically substantiated generalisations about patterns of cross-modal variation. In addition to absolute and relative modality effects, there will also be modality-independent variables, where the language modality has no demonstrable influence on linguistic structures.

While this is clearly going to be a long-term research programme, several general observations can be made at this point. First of all, as stated above with respect to negation and possession, each semantic/grammatical domain must be examined in its own right, and we must expect quite different cross-modal patterns in different modalities. Secondly, we must expect the patterns to evolve as more and more data become available. For instance, there is as yet no evidence of any sign language using morphemes meaning ‘with’ or ‘and’ in the construction of numerals, as is common across spoken languages. At present, this looks like an absolute modality effect, but it is quite possible that the very next sign language to be described has just such a pattern, or an equivalent corollary in the signed modality.

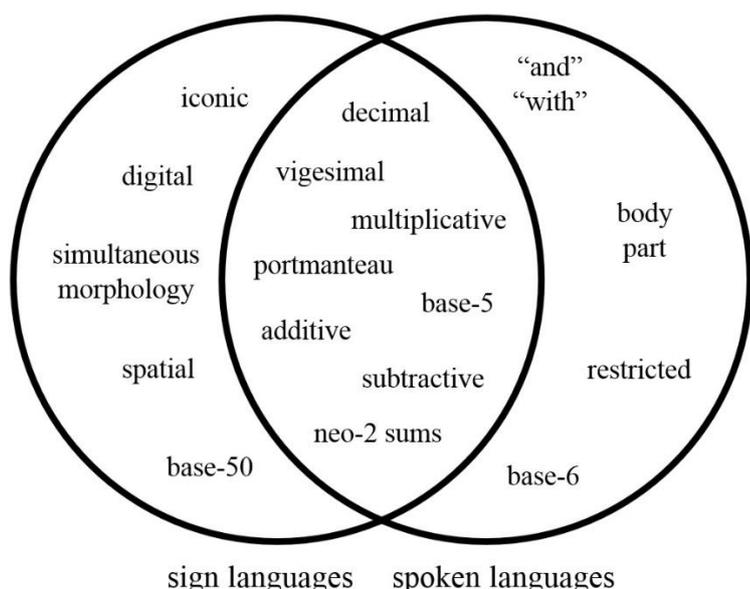


Figure 15. A cross-modal typological space for numerals.

Figure 15 shows a basic cross-modal space with sign languages on the one side and spoken languages on the other side and an overlap area in the middle, with respect to the example domain of numerals. As research progresses, we may well expect, for example, structures now in the “spoken language-only” part of the diagram to move into the middle part. Moreover, in more refined representations, the strength of relative modality effects also needs to be accounted for in terms of how frequent or infrequent a particular construction is in each modality. At the moment, cross-modal typology is still in its infancy, but with a growing data base available from sign languages, there is no doubt that this will become a viable and rewarding field of study in the not-too-distant future.

Abbreviations

SIGN	gloss for a manual sign
SIGN-SIGN	hyphenated gloss for a single sign that needs more than one word to express its meaning
SIGN-----	sign held in its final position for a length of time
IX or INDEX	pointing signs, followed by further information about the reference of the point
1, 2	subscripts indicating first and second person reference
SIGN#SIGN	simultaneous morphology
SIGN^SIGN	host-clitic combination
____t	non-manual marking for topicalisation
____y/n	no-manual marking for polar question
____low-br	lowered eyebrows
____brow-raise	raised eyebrows
____neg-tilt	backward head tilt for negation
	clause boundary

References

- Aikhenvald, Alexandra Y. 2012. 'Possession and ownership: A cross linguistic perspective', in Alexandra Y. Aikhenvald and R.M.W. Dixon (eds.), *Possession and Ownership: A Cross-Linguistic Typology*. Explorations in Linguistic Typology. Oxford University Press, pp. 1-64
- Aikhenvald, Alexandra Y. and Dixon, R. M. W. 2011. 'Dependencies between grammatical systems', in Alexandra Y. Aikhenvald and R.M.W. Dixon (eds.), *Language at Large: Essays on Syntax and Semantics*. Leiden: Brill, pp. 170-204
- Ameka, Felix K. 2012. 'Possessive constructions in Likpe (Sɛkpɛlé)', in Alexandra Y. Aikhenvald and R.M.W. Dixon (eds.), *Possession and Ownership: A Cross-Linguistic Typology*. Explorations in Linguistic Typology. Oxford University Press, pp. 224-242
- Antzakas, Klimas 2006. 'The use of negative head movements in Greek Sign Language', in Ulrike Zeshan (ed.), pp. 258–269
- Bhat, D.N.S. 2000. 'The indefinite-interrogative puzzle', *Linguistic Typology* 4(3): 365-400
- Brentari, Diane 1998. *A Prosodic Model of Sign Language Phonology*. Cambridge, MA: MIT Press.
- Cecchetto, Carlo, Geraci, Carlo, and Zucchi, Sandro 2009. 'Another way to mark syntactic dependencies: The case of right-peripheral specifiers in sign languages', *Language* 85:2, 278-320
- Chen Pichler, Deborah, Schalber, Katharina, Wilbur, Ronnie, and Hochgesang, Julie 2006. Possessives and existentials in three sign languages. Presentation at the 9th Congress on Theoretical Issues in Sign Language Research (TISLR), Florianopolis, Brazil
- Comrie, Bernard 1989. *Language Universals and Linguistic Typology*, 2nd edition. Oxford: Basil Blackwell

- Comrie, Bernard 2013. 'Numeral Bases', in Haspelmath, Martin, Dryer, Matthew S., Gil, David, and Comrie, Bernard (eds.), *The World Atlas of Language Structures Online*. Leipzig: Max Planck Institute for Evolutionary Anthropology. Available at: <http://wals.info/chapter/131> [Accessed on 8 March 2015]
- de Vos, Connie 2012. Sign-spatiality in Kata Kolok: How a village sign language inscribes its signing space. PhD thesis, Max Planck Institute for Psycholinguistics, Nijmegen, the Netherlands.
- de Weerdt, Danny and Vermeerbergen, Myriam 2008. Observations on possessive and existential constructions in Flemish Sign Language. In Zeshan and Perniss (eds.), pp. 195-212
- Dixon, R.M.W. 2012. *Basic Linguistic Theory, Volume 3: Further Grammatical Topics*. Oxford University Press
- Dixon, R.M.W. and Aikhenwald, Alexandra, eds. 2002. *Word: A Cross-Linguistic Typology*. Cambridge University Press
- Dryer, Matthew S. and Haspelmath, Martin, eds. 2013. *The World Atlas of Language Structures Online*. Leipzig: Max Planck Institute for Evolutionary Anthropology. Available online at <http://wals.info>. [Accessed on 8 March 2015.]
- Gil, David 2013. 'Distributive Numerals', in Haspelmath, Martin, Dryer, Matthew S., Gil, David, and Comrie, Bernard (eds.), *The World Atlas of Language Structures Online*. Leipzig: Max Planck Institute for Evolutionary Anthropology. Available at: <http://wals.info/chapter/54> [Accessed on 8 March 2015]
- Hammarström, Harald 2010. 'Rarities in numeral systems', in Jan Wohlgemuth and Michael Cysouw (eds.), *Rethinking Universals: How Rarities Affect Linguistic Theory*. Berlin: De Gruyter Mouton, pp. 11-60
- Hanke, Thomas 2010. Additional rarities in the typology of numerals. In Jan Wohlgemuth and Michael Cysouw (eds.) *Empirical Approaches to Language Typology: Rethinking Universals: How Rarities Affect Linguistic Theory*. Berlin: De Gruyter, pp. 61-89.
- Haspelmath, Martin 1997. *Indefinite Pronouns*. Oxford University Press
- Haspelmath, Martin, König, Ekkehard, Oesterreicher, Wulf, and Raible, Wolfgang, eds. 2001. *Language Typology and Language Universals. An International Handbook*. Berlin / New York: Walter de Gruyter
- Heine, Bernd 1997. *Possession: Cognitive Forces, Sources, and Grammaticalisation*. Cambridge University Press
- Enfield, Nicholas and Levinson, Stephen C., eds. 2006. *Roots of Human Sociality: Culture, Cognition and Interaction*. Oxford: Berg
- Fischer, Susan D. 2006. 'Questions and negation in American Sign Language', in Zeshan (ed.), pp. 165-197
- Johnston, Trevor, Vermeerbergen, Myriam, Schembri, Adam, and Leeson, Loraine 2007. 'Real data are messy: Considering the cross-linguistic analysis of constituent ordering in Australian Sign Language, Vlaamse Gebarentaal and Irish Sign Language', in Perniss, Pfau and Steinbach (eds.), pp. 163-206
- Klima, Edward S. and Bellugi, Ursula 1979. *The Signs of Language*. Cambridge, MA: Harvard University Press
- Lane, Harlan 1992. *The Mask of Benevolence*. New York: Alfred Knopf
- Lewis, M. Paul, Simons, Gary F., and Fennig, Charles D., eds. 2015. *Ethnologue: Languages of the World, 18th edition*. Dallas, Texas: SIL International. Online version: <http://www.ethnologue.com>

- Lutalo-Kiingi, Sam 2014. A descriptive grammar of morphosyntactic constructions in Ugandan Sign Language (UgSL). PhD thesis, University of Central Lancashire, Preston, UK
- Marsaja, I Gede 2008. *Desa Kolok: A Deaf Village and its Sign Language in Bali, Indonesia*. Nijmegen: Ishara Press
- McBurney, Susan Lloyd. 2002. 'Pronominal reference in signed and spoken languages. Are grammatical categories modality-dependent?', in Meier, Cormier and Quinto-Pozos (eds.), pp. 329-369
- Meier, Richard, Cormier, Kearsley and Quinto-Pozos, David, eds. 2002. *Modality and Structure in Signed and Spoken Languages*. Cambridge University Press
- Meir, Irit 1998. Thematic structure and verb agreement in Israeli Sign Language. PhD dissertation, Hebrew University of Jerusalem
- Neidle, Carol, Lee, Robert, MacLaughlin, Dawn, Bahan, Ben and Kegl, Judy 1998. 'The rightward analysis of WH-movement in ASL: A reply to Petronio and Lillo-Martin', *Language* 74(4): 819-831
- Nyst, Victoria 2007. *A Descriptive Analysis of Adamorobe Sign Language (Ghana)*. Utrecht: LOT
- Nyst, Victoria 2008. 'Pointing out possession and existence in Adamorobe Sign Language', in Zeshan and Perniss (eds.), pp. 235-252
- Padden, Carol 1988. *Interaction of Morphology and Syntax in American Sign Language*. New York: Garland Publishing
- Padden, Carol and Humphries, Tom 2006. *Inside Deaf Culture*. Harvard University Press
- Palfreyman, Nick 2015. Sign language varieties of Indonesia: A linguistic and sociolinguistic investigation. PhD thesis, University of Central Lancashire, Preston, UK
- Palfreyman, Nick 2016. 'Variation and change in the numeral system and colour terms of Indonesian sign language varieties', submitted.
- Perniss, Pamela, Pfau, Roland and Steinbach, Markus 2007. *Visible Variation: Comparative Studies on Sign Language Structure*. Berlin: De Gruyter Mouton
- Perniss, Pamela and Zeshan, Ulrike 2008. 'Possessive and existential constructions in Kata Kolok (Bali)', in Zeshan and Perniss (eds.), pp. 125-149
- Petronio, Karen and Lillo-Martin, Diane 1997. 'WH-movement and the position of Spec-CP: Evidence from American Sign Language', *Language* 73(1): 18-57
- Pfau, Roland 2012. 'Manual communication systems: Evolution and variation', in Roland Pfau, Markus Steinbach and Bencie Woll (eds.), *Sign Language: An International Handbook*. Berlin: De Gruyter Mouton, pp. 513-551
- Pfau, Roland 2015. 'The grammaticalization of headshakes: From head movement to negative head', in Smith, Andrew, Trousdale, Graeme and Waltereit, Richard (eds.) *New directions in grammaticalization research*. Amsterdam: John Benjamins, pp. 9-50.
- Pfau, Roland and Steinbach, Markus 2006a. 'Modality-independent and modality-specific aspects of grammaticalization in sign languages', *Linguistics in Potsdam* 24: 5-98
- Pfau, Roland, and Steinbach, Markus 2006b. 'Pluralization in sign and speech: A cross-modal typological study', *Linguistic Typology* 10: 135-182

- Quer, Josep and GRIN. 2008. 'Structures of possession and existence in Catalan Sign Language', in Zeshan and Perniss (eds.), pp. 33-53
- Rosenstock, Rachel 2008. 'The role of iconicity in International Sign Language', *Sign Language Studies* 8(2): 131-159
- Sagara, Keiko 2014. The numeral system of Japanese Sign Language from a cross-linguistic perspective. MPhil dissertation, University of Central Lancashire, Preston, UK
- Sagara, Keiko and Zeshan, Ulrike 2013. 'Typology of cardinal numerals and numeral incorporation in sign languages', poster presented at the 11th Theoretical Issues in Sign Language Research (TISLR) Conference. University College London, July
- Sandler, Wendy 1999. 'The medium and the message: Prosodic interpretation of linguistic content in sign language', *Sign Language and Linguistics* 2(2): 187-216
- Sandler, Wendy and Lillo-Martin, Diane 2006. *Sign language and linguistic universals*. Cambridge University Press.
- Stokoe, William C. 1960. 'Sign language structure: An outline of the visual communication systems of the American deaf', *Studies in Linguistics: Occasional papers (No. 8)*. Department of Anthropology and Linguistics, University of Buffalo
- Steinbach, Markus and Pfau, Roland 2007 'Grammaticalization of auxiliaries in sign languages', in Perniss, Pfau and Steinbach (eds.), pp. 303–339
- Streeck, Jürgen, Goodwin, Charles and LeBaron, Curtis, eds. 2011. *Embodied Interaction: Language and Body in the Material World*. Cambridge University Press
- Tang, Gladys 2006. 'Questions and negatives in Hong Kong Sign Language', in Zeshan (ed.), pp. 198-224
- Taub, Sarah F. 2001. *Language from the Body: Iconicity and Metaphor in American Sign Language*. Cambridge University Press
- Tervoort, Bernard Th. M. 1953. *Structurele Analyse van Visueel Taalgebruik binnen een Groep Dove Kinderen [Structural analysis of visual language use in a group of deaf children]*. Amsterdam: Noord-Hollandse Uitgevers Maatschappij
- Trask, Robert L. 1996. *Historical Linguistics*. London: Hodder Arnold
- von Mengden, Ferdinand 2010. *Cardinal Numerals: Old English from a Cross-Linguistic Perspective*. Topics in English Linguistics 67. Berlin and New York: De Gruyter Mouton
- Yang, Junhui and Fischer, Susan D. 2002. 'Expressing negation in Chinese Sign Language', *Sign Language and Linguistics* 5(2): 167–202
- Zeshan, Ulrike 2000. *Sign Language in Indopakistan: A Description of a Signed Language*. Amsterdam: John Benjamins
- Zeshan, Ulrike 2002. 'Towards a notion of 'word' in sign languages', in Dixon and Aikhenvald (eds.), pp. 153-179
- Zeshan, Ulrike 2004a. 'Hand, head and face: negative constructions in sign languages', *Linguistic Typology* 8(1): 1-58

- Zeshan, Ulrike 2004b. 'Interrogative constructions in signed languages: Cross-linguistic perspectives', *Language* 80(1): 7-39
- Zeshan, Ulrike 2013. 'Sign Languages', in Haspelmath, Martin, Dryer, Matthew S., Gil, David, and Comrie, Bernard (eds.), *The World Atlas of Language Structures Online*. Leipzig: Max Planck Institute for Evolutionary Anthropology. Available at: <http://wals.info/chapter/54> [Accessed on 8 March 2015]
- Zeshan, Ulrike, ed. 2006. *Interrogative and Negative Constructions in Sign Languages*. Sign Language Typology Series No. 1. Nijmegen: Ishara Press
- Zeshan, Ulrike and Perniss, Pamela, eds. 2008. *Possessive and Existential Constructions in Sign Languages*. Sign Language Typology Series No. 2. Nijmegen: Ishara Press
- Zeshan, Ulrike and de Vos, Connie, eds. 2012. *Sign Languages in Village Communities: Anthropological and Linguistic Insights*. Sign Language Typology Series No. 4. Berlin: De Gruyter Mouton and Nijmegen: Ishara Press
- Zeshan Ulrike, Escobedo Delgado, Cesar Ernesto, Dikyuva, Hasan, Panda, Sibaji and de Vos, Connie 2013. 'Cardinal numerals in village sign languages: Approaching cross-modal typology', *Linguistic Typology* 17(3): 357-396
- Zeshan, Ulrike and Sagara, Keiko, eds. Forthcoming. *Semantic Fields in Sign Languages: Colour, kinship and quantification*. Sign Language Typology Series No.6. Berlin: De Gruyter Mouton and Nijmegen: Ishara Press