ACQUISITIONAL EVIDENCE FOR THE PHONOLOGICAL COMPOSITION OF HANDSHAPES

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0. Introduction

Consider the first set of three signs from Sign Language of the Netherlands in (1), all monomorphemic words:

(1) a. VEKLIKKEN TANDARTS INSTITUUT



b. ONSCHULDIG WONEN LEREN



Figure 1: minimal pairs in SLN

The examples VERKLIKKEN 'to tell tale', TANDARTS 'dentist', INSTITUUT 'institute' differ minimally in handshape, showing the same value for place and (type of) movement. The second set of examples, ONSCHULDIG 'not-guilty', WONEN 'to live (somewhere) and LEREN 'to learn', illustrate the distinctive use of place. Additional examples could be given to demonstrate the distinctive force of the type of movement.

These examples illustrate that distinct monomorphemic signs can differ with respect to their form in at least three ways:

(2) a. The shape of the hand(s)
b. The place of the hand(s) vis-a-vis the body
c. The movement of the hand(s)

For each of these three attributes, every sign language uses a fixed number of values.

This basic insight that the form of monomorphemic signs can be decomposed into a finite set of meaningless attribute-values is due to William Stokoe in a seminal work on American Sign Language published in 1960. Stokoe thus demonstrated that sign languages

~~[illegible]~~ in : Ch. Koster & F. Wynen (eds)
Proceedings of GALA 1995, 39-56

have the property of dual patterning. This means that, like spoken languages, sign languages are characterized, on the one hand, by a morpho-syntactic organization and, on the other hand, by an organization that pertains to its form. The study of the latter organization can be called **phonology** if we assume that the focus of this linguistic discipline is the study of the form of language. Form, in this view, is what is perceived by the listener and this can be an auditory or a visual signal, or any other signal that human beings are equipped to perceive.

Accepting this, all the usual questions can be asked when addressing the phonology of sign languages:

(3) a. What are the relevant attributes?
  b. What is the set of values per attribute?
  c. Do the attributes enter into some hierarchical structure?
  d. Are there limitations on combinations of attribute values?
  e. What degree of complexity is allowed in such combinations?

We cannot, of course, provide answers to such questions by studying the form of signs from a phonetic (i.e. articulatory or perceptual) perspective. As in the study of spoken language phonology, distinctions such as those in (2) must be shown to be relevant to making generalizations that reflect the way in which the form of sign is mentally represented. It is, on the other hand, quite obvious that insight into the phonetic aspects of signs is necessary as well, since we cannot determine on a priori grounds which systematic properties of signs have a cognitive basis and which are dependent on the phonetics (i.e. production and perception) of the modality.

Answers to the questions in (3) lead to the construction of theoretical models for the phonological structure of signs. To date such models are largely based on the study of systematic patterns in adult languages, and in particular on the study of American Sign Language (ASL).

We know, however, that the study of acquisitional data, as well as data from many others corners (such as aphasia, speech errors, language games, language change, dialectal and sociolinguistic variation) can also contribute significantly to linguistic theory, not just to test models that have been formed on the basis of adult languages, but also as the primary source for linguistic models. It is ultimately the case that the evidence from all corners must converge on a single model of language structure, and this means that it really does not matter where we start. The data that we use to "test" rather than derive the hypotheses simply are the data that we did not start out with. In most cases, researchers will go back and forth between the evidence from various corners, blurring the distinction between the corner that suggested the hypothesis and the corner that supplies the test material, the ultimate concern being to formulate a model that is as consistent as possible with all the relevant data.

In this article, I will discuss a case in which data from the acquisition of sign language phonology help in both confirming and fine-tuning a model of one of the attributes mentioned in (2), namely **handshape**. I believe that it is an instructive and clear example if one wants to demonstrate that the study of adult patterns and acquisitional stages go hand in hand.

I will show how data and generalizations concerning the acquisition of Handshape in ASL (taken from a study by Siedlecki & Bonvillian 1995) quite strikingly support and refine proposals for the representation of Handshape put forward in recent work on the phonological structure of signs.

To pave the way for this demonstration I will first discuss some of the current insights into the phonological structure of signs (section 1.1), homing in on proposals put forward in van der Hulst (1993, 1995b) and, more specifically, on proposals for the representation of Handshape in van der Hulst (in press a) and Brentari et al. (in prep.) (section 1.2). Then, in section 2, I discuss the acquisitional stages, proposed in Siedlecki & Bonvillian (1995) in terms of the handshape model, introduced in section 1.2. Section 3 offers concluding remarks.

1. The phonology of signs

1.1 The overall structure

In (3), we have already seen the proposal that the **monomorphemic forms** in sign language can be decomposed in various types of attribute values. Henceforth, I will refer to these units as **phonological features**.

In articulating signs, it is not linguistically relevant whether the active hand is the left or the right hand, although signers will typically use their preference hand. Many signs use both hands and there are various types of two-handed signs, depending on the extend to which the two hands perform the same action. I will ignore two-handed signs here, assuming that they have the properties of one-handed signs, that we discuss here, plus the extra property of using two hands; cf. Sandler (1993b), van der Hulst (in press b).

I will also ignore that besides manual features, we need non-manual features for the phonological representation of signs. Such features, which involve mouth movement, facial expression and body posture, can be distinctive at the lexical level, but presumably play a more important role at the sentence-level.

We can refer to the attribute values in (2) as **feature classes.** For each feature class there is a finite number of features. ASL, as well as other sign languages, uses a finite set of handshape features, but not all sign languages use exactly the same set, although systematic comparative work is still lacking. Likewise, there is a limited number of ways in which the hand(s) may move, and, thirdly, a finite number of places on and in front of the body where the hand(s) may be posited.

Phonological features represent meaningless units (by definition) and this entails that their form (and the form of the constellations they enter into) cannot (in principle) be iconic. This is a point worth stressing since it is still a widespread misconception (even in linguistic circles) that sign languages are essentially composed of pantomime-like gestures. That this belief is fundamentally misguided follows from the fact that (to suppress another misconception) different sign languages can have very different signs for comparable concepts. To attribute iconicity as a necessary property of sign languages also makes no sense from the view point of acquisition because I know of no evidence showing that deaf children have a learning preference for signs that are claimed to show iconic properties by adult language users or language students, not even in cases in which it seems likely that the child could be aware of the iconic traits; cf. Bonvillian & Folven (1993: 246-249).

One cannot be blind, of course, to the iconic flavour that many (aspects of) signs have, nor to the role of iconicity in lexical innovation (see Brennan 1990), but these phenomena are analogues to what we call sound-symbolism in the case of spoken languages, which are generally not used to undermine the idea that spoken languages have a dual articulation.

That 'form-symbolism' is more pervasive in sign languages than in spoken languages follows from the simple fact that there are many objects surrounding us that have a shape without being able to produce a noise. In other words, it is apparently the case that iconicity of visible form has more opportunity in sign language than iconicity of audible form has in spoken language.

A point worth making is that single phonological features, or combinations of features, that do not form a fully specified (i.e. pronounceable) form, can be morphemes by themselves. One can think of tonal features which may represent tense morphemes in tone languages, or nasality that may mark morphological categories in some South-American languages. Thus, claiming that e.g. the handshape is a meaningless building block of the monomorphemic signs in (1), does not entail that morphemes cannot consist of a handshape alone. Like morphemic tones, such morphemes must be realized in conjunction with other morphemes to be pronounceable. Morphemes that consist of a handshape alone in fact occur and they are called classifiers.

Later work extended Stokoe's insight by enriching the set of feature classes as well as by decomposing the classes that he had proposed. Important contributions were made by Lane et al. (1976), Battison (1978), Mandel (1981), Friedman (1977), Boyes-Braem (1981), Sandler (1989), Brentari (1990) and the works brought together in Klima & Bellugi (1979), to mention just a few. Battison's (1978) proposal to add (Palm) Orientation has been generally accepted. For general overviews see Corina & Sandler (1993), Sandler (1995a), van der Hulst & Mills (in press).

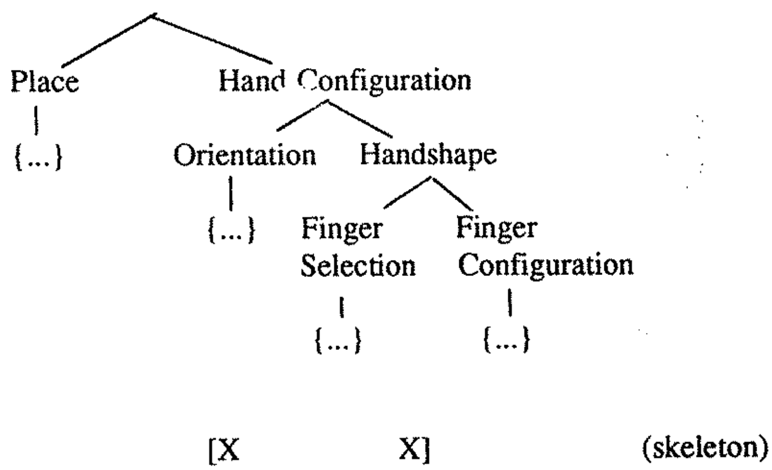
Sandler (1989) made an important further contribution by proposing that the feature classes are organized in a hierarchical structure, much like the feature classes that have been adopted in the phonology of spoken languages, as for example in the work of Sagey (1986) and a lot of subsequent work, known as feature geometry. Specifically, she proposed to combine Orientation with Handshape into a higher order unit, **Hand Configuration,** because it can be demonstrated that Orientation and Handshape form a unit in assimilatory processes, which she assumed to be phonological. She also incorporated Mandel's (1981) suggestion to decompose Handshape into **Finger Selection** and **Finger Configuration.** One of the prime motivations for this division comes from the observation that monomorphemic signs may involve a change in Finger Configuration, but not in Finger Selection. Thus many signs involve an opening of closing movement of the fingers, but only very few examples can be found in which there is a change from, for example, an all-finger handshape to a one-finger handshape. Thus the argument rests on the empirical observation that subclasses of Handshape features (in this case features bearing on finger selection and finger configuration) show independent behaviour. I will return to this point below.

Before we summarize these distinctions in a diagram, I must mention one further enrichment of the Stokoe model that many researchers have accepted. Movement is a dynamic notion and movements have a beginning and an end point. In Liddell & Johnson (1989), arguments have been provided for recognizing beginning and end points of movements as phonologically significant. Both phonological and morphological rules may make reference to these points and this requires them to be represented in the structure of signs. One morphological argument involved the marking of subject and object on certain kinds of verbs, like those expressing the meaning 'give'. Subject and object marking is done by choosing different beginning and end points in the signing space.

To accommodate reference to such points, Liddell & Johnson (1989) propose the addition of a **skeleton** or **timing tier** on which two types of units are sequentially arranged: L's (for locations) and M's (for movements). Features of handshape, location and movement associate to these units. Many researchers, including Sandler (in press b) and Perlmutter (1992), have accepted this LML model and thus the distinction between units for the static beginning and end point and for the intervening movement. Others, however, accepting the argument that reference to beginning and end point must be made, have rejected the conclusion that the intervening movement also deserves a representation on the timing tier, using the argument that two different specifications for beginning and end point necessarily imply a transitional movement (see Wilbur 1990, 1993, Hayes 1993, van der Hulst 1993, Uyechi 1994)[1].

A consequence of this proposal is that the skeleton contains units of one type only, which can be represented by a neutral symbol 'X'. This leads to the model in (4):

(4)



By directly associating features rather than organizational nodes to the skeletal points, I deviate from the actual model that Sandler (1989) has proposed and developed in subsequent work. Reasons for this are given in van der Hulst (1993, 1995b).

Contrary to van der Hulst (1993) and following Van der Kooij (1994), (4) is meant to express that a skeleton is minimally bi-positional. This encodes the empirical observation that all signs have movement in their surface realization (cf. Perlmutter 1992). The bi-positionality of the skeleton can be regarded as a prosodic minimality constraint.

Before continuing, let us briefly explicitly address the question how the units in (4) compare with units known from the phonology of spoken languages, such as feature, feature class, segment and syllable.

Stokoe compared the values of his attributes to 'phonemes', although he avoided using this particular spoken language term, coining the term 'chereme'. He stressed that the 'phonemes' in (2) are co-temporal and he concluded that signed languages have a largely co-temporal (or "simultaneous") organization, whereas spoken languages are more linear.

It will be clear that I adopt another view, namely that the values of the attributes in (2) are analogous to the units we call phonological features. Once we say this, we realize that co-temporality is not a special property of sign languages. In both language modalities, the

[1] Sandler (in press b) discusses data from ASL as well as from Israeli Sign Language that bear on this issue, and provides evidence that cannot be ignored for recognizing the M unit as a phonological prime. One important argument is that the hand(s) can move from beginning to end location in different contrasting ways (e.g. straight and arced movement), but she also provides important new morphological evidence for M.

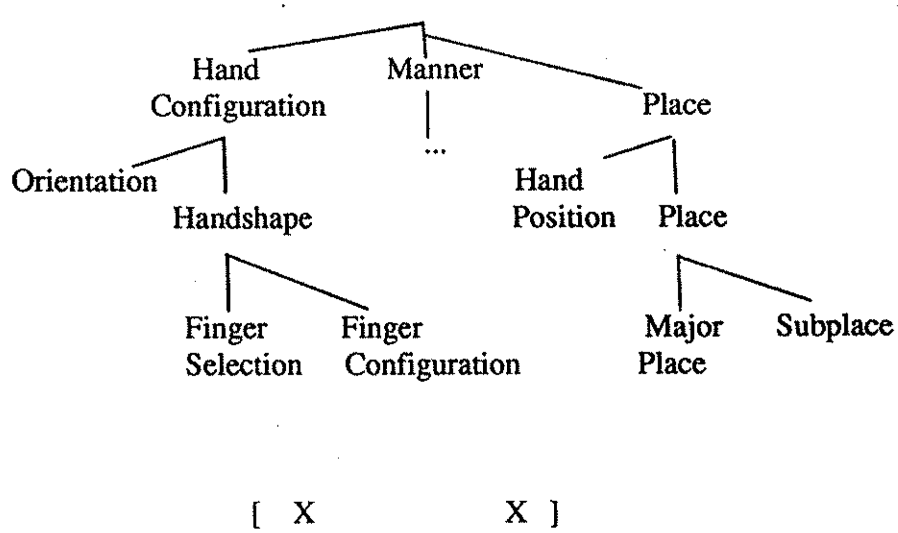
smallest units, the atoms or features are co-temporal.

This leads us to a remarkable and potentially confusing conclusion. Since most morphemes in ASL (and other sign languages as well) have just one value for each of the attributes in (2), we must conclude that most morphemes in sign languages are monosegmental. But there is no contradiction here, since there is no principled reason why morphemes should consist of more than one segment. That this is typically so in spoken languages, follows from the fact that the class of segments is many times smaller than the class of morphemes that languages seem to have. If one can demonstrate that the inventory of phonological features in sign languages is much greater than in spoken language, it follows that the class of possible segments is much greater too, and thus that the stock of morphemes calls for less segment combinations. I refer to van der Hulst (1995b) for further discussion of this point, which. I admit, is rather speculative at the moment[2,3].

In van der Hulst (1993, 1995b, in press a, b) I propose a model that builds on the idea that feature classes are organized in a tree structure as in (4), which is augmented with notions from Dependency Phonology (Anderson & Ewen 1987), in particular the basic principle that feature classes (as well as the features that they dominate) enter into a head - dependent relation. The head of a constituent is the central unit in a number of ways and graphically identified with a vertical constituent line (cf. 5).

Besides a node for Place and Hand Configuration, Van der Hulst (1995b) includes a "Manner" node in the structure of signs, which specifies how the hand relates to the place, but this proposal remains to be worked out.

(5)



[2] Commonly, the LML skeleton is compared to the CVC skeleton in spoken languages. Perlmutter (1992) is very explicit in this respect, and so is Sandler (in press b). In this view too, units like Major place and Hand Configuration are very unlike the segment-sized vowels and consonants in spoken languages, because they typically have scope over the whole "syllable". In the view that I defend in van der Hulst (1995b) there is little room for the notion 'syllable', but much depends on how we interpret the status of the skeleton.

[3] A very different but interesting analogue is presented in Kegl and Wilbur (1976), who regard the non-manual aspect of signs as analogous to vowels, while the hand or hands are compared to consonants. I will not discuss this analogue here.

Both the HandConfig and the place node are organized as specifier-head-complement structures, and so is the sign as a whole. I claim that this kind of organization qualifies as a recurrent type of linguistic structure, occurring in all modules of the grammar.

An obvious question is what motivates the representation of feature classes as heads, specifiers or complements. Syntacticians will be inclined to wonder why these terms are used in the first place. I cannot do justice to these issues here, important as they are. I merely point out that there are certain asymmetries between the smaller classes that have been grouped under Place and HandConfig and also between the classes HandConfig, Manner and Place. These asymmetries involve the possibility to be involved in assimilation (i.e. spreading) as well as the option of having a branching specification. In van der Hulst (1993, 1994a,b, 1995a, b), I propose that **stability** (non-spreading) and **invariance** (non-branching) are recurrent properties of heads in phonological structure, both in spoken and sign phonology. For an extensive examination of head-dependent asymmetries in phonology I refer to Dresher & van der Hulst (1995a, b).

Space limitations force me to leave these important issues without sufficient further discussion or motivation. I will now turn in some detail to the representation of the Handshape feature class. This is the class for which we will then consider the acquisitional stages.

1.2 Handshape

Handshapes are analyzed in terms of two feature classes: Finger Selection and Finger Configuration. The latter dimension bears on finger spreading (or rather its opposite: adduction), finger bending or flexion and aperture relations between fingers and the thumb. Selection is about which fingers are 'activated' or 'foregrounded'. Often 'activation' involves extension.

```
(6)    Handshape
        |‾‾‾‾‾‾‾‾\
       Finger     Finger
       Selection  Configuration
          |          |
        {...}      {...}
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The prime motivations for this division, as I have mentioned above, comes from the observation that monomorphemic signs may involve a change in Finger Configuration, but not in Finger Selection. Thus, many signs involve an opening or closing movement of the selected fingers, but only very few examples can be found in which there is a change from, for example, an all-finger handshape to a one-finger handshape. A holistic view on handshape would not allow us to formally express that Handshape change in monomorphemic signs typically does not involve a change in Finger Selection.

In the dependency model that I adopt, as pointed out above, invariance is a property of heads. Thus, as represented in (6), within Handshape, Finger Selection is the head. In the next two subsections I will discuss a specific proposal for Finger Selection and Finger Configuration, drawing on Brentari et al, (in prep) and van der Hulst (in press a), respectively.

Finger Selection

One could imagine postulating a feature corresponding to each individual finger. This approach, as we will see, would be totally inadequate because it fails to correlate the feature representation of specific handshapes with their relative markedness.

Brentari et al. (in prep), propose a new perspective on Finger Selection, building on Sandler (1995b, in press a). The central idea is to postulate three basic Finger Selection primitives that may enter into combinations to form additional distinctions[4].

Our proposal is analogous to the dependency approach to segmental representation in spoken languages. For example, in so called monovalent dependency-based feature systems, one assumes that certain segments (i.e. /a/, /i/ and /u/) are simple, consisting of just one element (represented with the symbols A, I and U), while others result from combinations:

(7) /i/ I /ü/ I->U /u/ U

/e/ I->A /o/ U->A

/E/ A->I /O/ A->U

/a/ A

The low mid vowel, here represented with /E/, is a combination of the features A and I in which the former is more salient, hence the head.

To approach Finger Selection in the same way, we need to find the basic primitives. Following Sandler (1995b, in press a), Brentari et al, (in prep.) postulate the choice of ALL fingers selected and ONE finger selected as the basic building blocks. In Sandler's model these two choices are referred to with the perceptually based labels 'broad' and 'narrow'. The 'pure' occurrence of these primitives results in all four fingers being selected or the index finger only:

(8) **The two basic handshapes**

ALL (broad)	ONE (narrow)
IIII	...I

The schematic handshape notation that I use in this article must be read as follows: the dot and the stroke represent a non-extended and extended finger, respectively. The left-most symbol represents the pinky. A list with actual handshape drawings is given in appendix A.

The new proposal differs from Sandler's original proposal in postulating **two** ONE primitives, i.e. ONE(Index) and ONE(Pinky). Henceforth, I abbreviate the three finger selection primitives as A (for ALL), I (for ONE(Index)) and P (for ONE(Pinky)). I and P stand in a bilateral opposition to A. We would like to express that I is less marked than P, like, in fact the place element I is less marked than U. Proposals to do this are discussed in Brentari et al. (in prep.).

[4] Since the work reported in Brentari et al. (in prep) is still in progress, it is likely that there will some discrepancies between the model that we will eventually release and the one presented in this section.

By allowing A, I and P to combine in the same way we allow the place primitives for vowels to combine, we generate a set of structures for which we propose the following set of handshapes:

(9) ...| I ||/| I->P |/|| P->I |... P

..|| I->A |..| U->A

|||. A->I   .||| A->U

|||| A

For the I,P combinations we propose handshapes in which the unselected fingers are in fact extended, while the selected middle or ring finger is bent forward (indicated with the slash /, as in the 8 handshapes in Appendix A). Other plausible interpretations would be ..|. and .|.., respectively. It has been claimed that sign languages do not seem to use the opposition between selecting the middle or the ring finger contrastively; cf. Ann, to appear. The interpretation of U->A is |..| (for Y) rather than ||.. which does not seem to be an attested handshape.

The three-finger handshape .||| is marked and mainly used in counting and finger spelling (for W). The other three-finger handshape |||. is used for F, but this choice is not unproblematic; cf. Brentari et al, (in prep.)[5].

The core system of handshapes can be characterized without invoking the dependency relation (if F is considered non-core), since we already mentioned that this relation is not necessary for the combination of I and P. Thus: I,A and P,A represent, in the absence of a contrast, ..|| (V) and |..| (Y), respectively.

With representations of this kind, we make certain predictions about the order of acquisition, which, as I hope to show in section 2, are born out.

Finger configuration

There is a certain consensus that at least the configurations in (10) must be recognized as being potentially distinctive. Handshapes that are made with all fingers selected show the biggest array of finger configurations, so I use these to exemplify the attested variety[6].

(10)	Closed	S-hand	: fingers folded in a fist
	Curved	C-hand	: finger base and non-base joints slightly flexed
	Curved-closed	O-hand	: like C-hand with thumb in contact with fingers
	Flat	<-hand	: finger base joints sharply flexed
	Flat-closed	>-hand	: like <-hand with thumb in contact with fingers
	Open	5-hand	: fingers fully extended, abducted
	Open	B-hand	: fingers fully extended, adducted

[5] Most of the other handshapes are used in counting or fingerspelling too, but the difference is that these also regularly occur as building blocks of normal signs. This is why often handshapes are referred to by an integer or letter even when they are used as part of normal signs; cf. appendix A.

[6] In addition to the usual integer and letter symbols, I make use of the symbols < and >. Cf. footnote 5 and Appendix A.

In van der Hulst (in press) I argue that these different handshapes require three separate Finger Configuration dimensions[7]:

(11)

```
                         Finger
                         Configuration
        Aperture
           |
{CLOSED/(OPEN)}          Finger                  Finger
                         Spread                  Flexion
                           |                       |
                    {NARROW/(WIDE)}          {FLEX/(EXT)}
                                                   |
                                                 BASE
```

The value between parentheses is considered the unmarked feature choice.

The flexion node requires some comment. Brentari et al. (in prep) distinguish flexion of all finger joints from extension (non-flexion), but in the former category they add a further option of restricting the flexion to the base joints:

(12)

```
Flexion      Flexion      Flexion
   |            |            |
(EXT)         FLEX         FLEX
                             |
                           BASE

extended      curved       flat
```

Let us now consider the evidence for splitting up Finger Configuration into three subclasses.

I have mentioned that the central argument in favour of a division between Selected Fingers and Finger Configuration is that monomorphemic signs (as established for ASL and confirmed for other sign languages as well) typically do not have a change of finger selection, whereas configurational changes are common. By claiming that handshape changes can only involve a change in Finger Configuration, we significantly narrow down the set of possible changes, but, and this is the central point, the set is still too big. Although changes in aperture are extremely common, flexion- and spread-changes are not. We only find a spread change in "scissoring", arguably an iconic property. Flexion changes are limited to "hooking" and "clawing" (so called partial handshape change; cf. Corina 1993); they mainly occur in repeated form:

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[7] In Van der Hulst (in press a) and Brentari et al. (in prep) we use the label Joint Selection instead of Flexion.

(13) **Flexion changes**

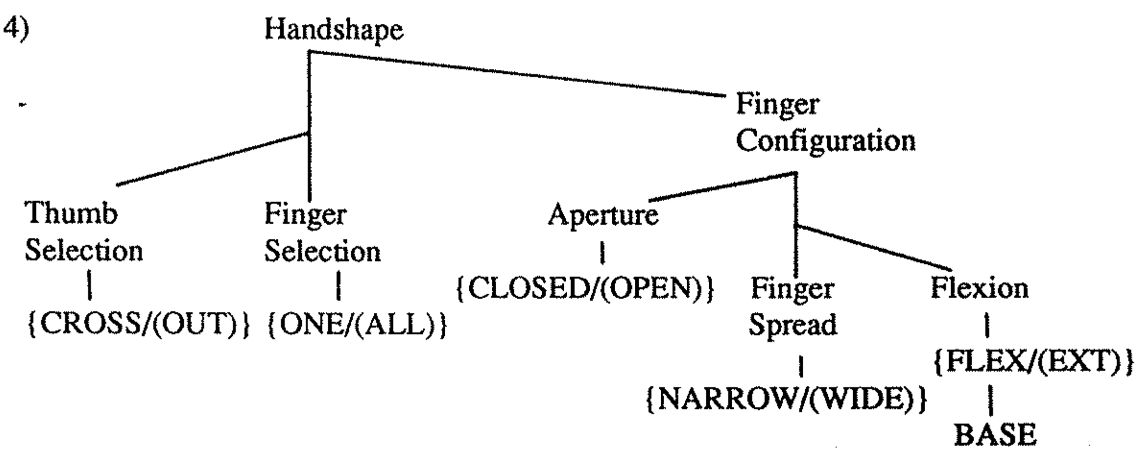
a. B > <
b. 5 > 5claw

In (11), FingSpread is the head because it is the least likely node to allow a change (only in the iconic 'scissoring'). FingFlex changes come next in line (cf. 13) and Aperture changes are the most common. Admittedly, the difference between FingSpread and FingFlex changes is not so great[8].

Residual matters such as the Thumb and summary
The position of the thumb needs, in part at least, an independent node. Simplifying matters I will assume that this node specifies that the thumb is either OUT or CROSSED.

The following diagram, then, summarizes the proposals for the Hand Configuration node[9]:

(14)



We now turn to the acquisitional evidence in favour of the structure we have proposed for the Handshape feature class and the specific organization that we have argued for.

2. The acquisition of Handshape

In a detailed study, Siedlecki & Bonvillian (1995) establish a rank order of acquisition of ASL Handshapes. The overall ranking they propose is based on three measures:

(15) a. Accuracy of production
b. Order in which handshapes are acquired
c. Production frequency

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[8] In van der Hulst (in press a), I take FingFlex (i.e. JointSel) to be the head. This is one example where the acquisition data suggest a decision where the adult data are rather indecisive.

[9] With ThumbSel as the lower dependent and FingerConfig in 'spec-position', Palm Orientation adds one layer too much; cf. (5). It is possible that ThumbSel and FingSel **together** form the head of HandConfig.

They divide the age period that was studied in 5 levels or developmental stages. The handshapes that were not observed during the observation period have been placed in stage V[10]:

(16)

Stage I:	5	1					
Stage II:	S	B					
Stage III:	C	O	c	o			
Stage IV:	V	H	K	3	X	E	
Stage V:	F	I	W	Y	8	R	T

There is the obvious growth in complexity in that more and more handshapes are being acquired, but what we are really interested in is the specific pattern of acquisition. I will now discuss each stage in terms of the handshape model proposed in the previous section.

Stage I: 5 - 1

What is acquired in this stage is the basic bilateral ALL - ONE opposition. Thus, at this stage only the head node **Finger Selection** is activated. We will assume that the phonological representation of this contrast involves the absence or presence of ONE. There is no opposition between the two ONEs. This shows that (ONE-)I(ndex) is the default or least marked choice. I is marked with respect to A(LL). Evidence that A is default is that it appears in the prelingual stage, that it ranks at the top in Siedlecki & Bonvillian's table no. 5 and that in the following stage new contrasts develop first for ALL hands[11].

Stage 2: S - B

Both S and B can be seen as 'elaborations' of 5. In both cases an extra feature is added. We derive B from 5 by adding the feature Spread:NARROW while S results from adding the feature Aperture:CLOSED. Thus in stage II, 5 enters in a bilateral opposition. In their summarizing table no. 5, S&B rank B before S.

Stage 2, then, involves the activation of the FingConfig node. If, in fact, B is taken to come earlier than S, this confirms that Spread is the head of FingConfig.

The Spread parameter obviously could not apply to shape 1, since there is only one finger involved. It would be possible, however, to apply the Aperture parameter here, but we do not find the predicted handshape, i.e a closed 1 (i.e. o), at this stage yet. We interpret this as meaning that new contrasts emerge first with the unmarked members of previously acquired contrasts. I.e. the closed-open opposition is acquired first for ALL.

Stage III: C - O - c - o

The new development lies in applying the aperture distinction to B and 1, resulting in curved open version of B and 1, viz. C and c, and curved closed versions of B and 1, viz.

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[10] Due to the way I wish to interpret the stages, and for practical purposes, some of the integer or letter names differ from those in Siedlecki & Bonvillian's study. Cf. Appendix A.

[11] The fist (S) also frequently occur in the prelingual stage. This leads Boyes-Bream (1981) to assume that 5 and S must be the first contrast. That stage I shows 1 rather than S may relate to the fact that 5 and 1 perhaps are more distinct perceptually than 5 and S. In our model S is a closed 5, and in this sense resembling 5, rather than being maximally different.

O and o. We do not, then, see the emergence of C as following from activating FingFlex. The C/c shape **could** be analyzed as the flexed version of the B/1. We prefer not to do that for reasons of simplicity. The (phonetic) flexion can be the result of the open/closed relation in this stage.

Our interpretation of C/O and c/o entails that, in fact, stage III does not show a new structural possibility and only the extension of the earlier acquired aperture distinction[12].

Stáge IV: V - H - K - 3 - X - E

When we look at the handshapes that are acquired in this stage, we see that three new options have been acquired.

Firstly, there is a change in the Finger Selection possibilities; the two-finger handshape has entered the scene in no less than **four** ways. The occurrence of the two-handshape implies that I and A now enter into a combination giving ..ll (i.e. V) and variants, informally represented in (17):

(17)	I,A	I,A - NARROW	I,A - CLOSED	I,A - THUMB
	V	H	K	3

We assume that the V handshape is the unmarked form of the two-hand, i.e. WIDE for Spread and OPEN for Aperture. We see that the two marked options for these parameters apply to the two-finger handshapes. These options are already part of the system and are simply applied to a newly acquired handshape.

To regard the K shape as a closed two-hand does not seem too far fetched, since it seems simply more difficult to make contact with the middle finger keeping the index finger strictly adjacent to the middle finger.

The 3 handshape shows a variation on the two-hand that involves the thumb being selected. Thus the ThumbSel node is now active. Finally, the handshapes E and X indicate that the FingFlex node is also activated. At this stage then the almost complete structure has been acquired.

The final stage involves those handshapes that have not been attested during the period of investigation. Since these handshapes do belong to ASL, it follows that they are acquired later.

Stage V: F - I - W - Y - 8 - R - T

These handshapes are clearly the most complex and marked ones, at least from the view point of our handshape model. The F shape shows a stage in which crucial use of the dependency relation is acquired (for F as opposed to V), as well as the other ONE shape, viz. P(inky):

(18)	P	A->I	A->P	P->A	P,I
	I	F	W	Y	8

[12] o is regarded as the closed version of 1. We interpret S&B's L in stage III as c. Cf. Brentari et al. (in prep) for discussion.

Finally, we see that two other marked options, which involve a special thumb position, are also acquired late. A two-handshape with the middle finger placed over the index finger (R) and the fist with the thumb placed in between the index and middle finger (T). For R we introduce a feature CROSSED that can only be relevant for two-finger handshapes involving index and middle finger. For T we use a marked thumb selection that we also call CROSSED, although it is not clear that this is really the same feature.

3. Concluding remarks

Perhaps phonology is the least likely area to reveal parallels between spoken and signed languages because the phonetic dimensions involved are completely different, and one might expect that this must lead to different phonological categories and organization. It seems to be true, in fact, that with respect to the actual list of features, the two modalities differ quite obviously.

Therefore, if sign languages are taken seriously, no modern textbook or article ought to state that there is a universal set of phonological features out of which specific languages make a choice -- where this 'universal set' contains features such as [voice], [coronal], [nasal], and so on. If this set were the one made available by universal grammar, deaf children would be pretty much on their own when they have to figure out the abstract phonological structure of their language and the relation between this structure and its phonetic exponents.

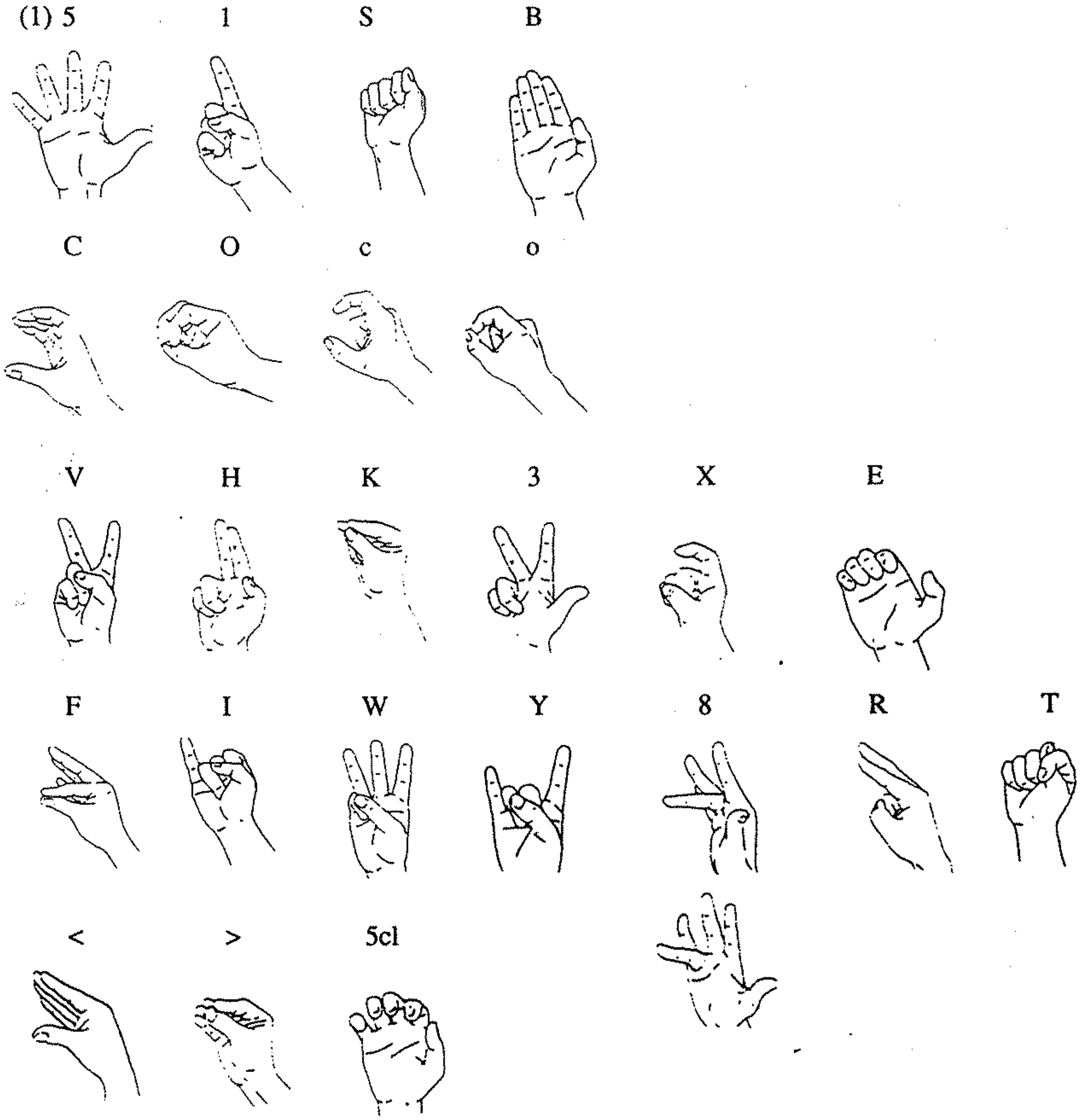
The example is, I think, very instructive because it is so simple. It illustrates quite straightforwardly that by studying languages in a different modality we are immediately confronted with candidate 'universals of human language' (in this case a set of phonological features) that turn out to be valid for spoken languages only.

But there is, of course, an essential difference between proposing an actual list of distinctive features that is supposedly universal (an enterprise that is doomed to fail as long as phonologists attribute clearly modality-dependent entities to the list) and proposing, as a universal of human language, that forms having the status of morphemes (i.e. atoms of morphosyntactic structure) can be decomposed in building blocks that have no meaning, in other words pure building blocks of the form of language that we refer to as features.

Thus, to find that the features are different does not entail that there are no phonological universals that are valid for both modalities. The analogue between the phonological organization in spoken and signed languages lies at a level of abstraction at which universals transcend the number and 'names' of features as well as their phonetic exponents. In this particular case, it seems likely that the universal abilities lie in being able to categorize phonetic scales into discrete categories, presumably in some systematic way.

One could plausibly argue that a different view on what the phonological universals are, entails a different view on how phonological acquisition works. What we seem to be saying is that acquisition of phonology (at the segmental level, at least) does not involve picking out features from an innate set or the setting of parameter values, but rather a systematic growth of structure in order to accommodate an increasingly detailed system of contrasts needed to stay in line with the expansion of the lexicon. In the preceding section we have seen, I believe, that studying stages in sign language acquisition can contribute to our models of phonological representations, just like the study of stages in the acquisition of spoken languages have done since the original and influential work in Jakobson (1941/1968).

Appendix A: Handshapes referred to in this article



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