

The Morphology-Phonology Interface in Signed Languages

by

Gaurav Mathur

A.B., Linguistics (1994)
Princeton University

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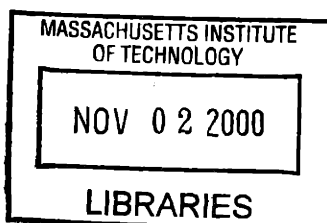
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Signature of Author Gaurav Mathur
Department of Linguistics
September 11, 2000

Certified by Kenneth Hale
Kenneth Hale, Professor of Linguistics
Thesis Supervisor

Accepted by Alec Marantz
Alec Marantz
Head, Department of Linguistics and Philosophy



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ABSTRACT

This thesis provides a novel way of looking at verb agreement in signed languages by using an interaction of several processes within the Distributed Morphology framework. At the center of the model is a phonological re-adjustment rule, ALIGN-Sphere, which handles various forms of agreement, including orientation change, path movement, hand order, and/ or a combination of these. Further evidence is taken from cross-linguistic data from American Sign Language, German Sign Language, Australian Sign Language, and Japanese Sign Language, as well as from interaction with several other morphemes. An Optimality-Theoretic analysis is sketched in which the output of the ALIGN-Sphere process is filtered by various phonetic constraints and may be replaced by an alternative form that does not otherwise violate phonetic constraints.

The model outlined above leads to a new typology of signs: first there are spatial verbs, followed by plain verbs which do not have two animate arguments, followed by aligning verbs which by definition have two animate arguments. These aligning verbs contain a subset of verbs that are in theory capable of undergoing ALIGN-Sphere without violating phonetic constraints. This subset in turn contains another subset of verbs that are listed as actually undergoing ALIGN-Sphere in a particular language.

The model rests on the assumption that the referential use of space lies outside of the grammar. By removing the referential space from the grammar removes the modality difference between spoken and signed languages with respect to 'agreement.' The remaining differences will lie in how agreement is implemented, but that is no longer a modality difference. Both spoken and signed languages make use of different processes within the morphology component to generate the agreement system (e.g. impoverishment, vocabulary insertion, and phonological re-adjustment rules), but otherwise they draw on the same set of processes made available by the grammar.

Thesis Supervisor: Kenneth Hale

Title: Professor of Linguistics

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Abstract	2
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Table of Contents	3
--------------------------------	---

Chapter One **Introduction**

1.1 Background	7
1.1.1 <i>Distributed Morphology</i>	7
1.1.2 <i>The role of space in grammar</i>	13
1.1.3 <i>Describing signs</i>	17
1.1.4 <i>Different statuses of movement</i>	20
1.2 Issues	23
1.2.1 <i>Features</i>	23
1.2.2 <i>Phonological forms</i>	25
1.2.3 <i>Typology of verbs</i>	27
1.2.4 <i>Modality differences</i>	34
1.3 Methodology	36
1.4 Overview	40

Chapter Two

ALIGN-Sphere: A New Way of Looking at 'Agreement' in Signed Languages

2.1 Alignment as the relevant conception of agreement	45
2.1.1 <i>Status of movement in agreeing verbs</i>	45
2.1.2 <i>Concept of alignment</i>	48
2.1.2.1 <i>The stem as a sphere and its endpoints</i>	49
2.1.2.2 <i>Linking AgrS and AgrO with loci in the space</i>	52
2.1.3 <i>Alignment as a phonological re-adjustment rule</i>	53
2.2 ASL data in support of alignment	57
2.2.1 <i>Change in orientation</i>	57
2.2.2 <i>Change in direction of path movement</i>	60
2.2.3 <i>Change in orientation and direction of path movement</i>	63
2.2.4 <i>Change in orientation, direction of path movement, and hand order</i>	66
2.2.5 <i>Change in orientation and hand order</i>	69
2.2.6 <i>Summary</i>	71

Chapter Two, cont'd.

2.3	Crosslinguistic data in support of alignment	73
2.3.1	<i>DGS</i>	74
2.3.2	<i>AUSLAN</i>	84
2.3.3	<i>JSL</i>	103
2.4	Interactions with other morphemes	123
2.4.1	'Multiple' morpheme	123
2.4.2	'Continuous' aspect	139
2.5	Residue	142
2.5.1	<i>FORGIVE-type verbs</i>	143
2.5.2	<i>ENCOURAGE-type verbs</i>	146
2.5.3	<i>SEE-type verbs</i>	152
2.5.4	<i>Wrap-up</i>	158

Chapter Three

Interactions between ALIGN-Sphere and Phonetic Constraints

3.1	A catalog of various phonetic constraints in signed languages	163
3.2	The linguistic status of phonetic constraints in signed languages	167
3.3	A catalog of options for aligned forms violating phonetic constraints	171
3.3.1	<i>Resolutions for any blocked alignment</i>	172
3.3.2	<i>Resolutions for blocked R-to-ME and L-to-ME forms</i>	173
3.3.3	<i>Resolutions for R-to-L and L-to-R forms</i>	174
3.3.4	<i>Resolutions for blocked 'multiple' forms</i>	175
3.3.5	<i>Resolutions for the weak hand</i>	178
3.3	Further remarks on phonetic constraints in signed languages	180

Chapter Four

Some Consequences of ALIGN-Sphere

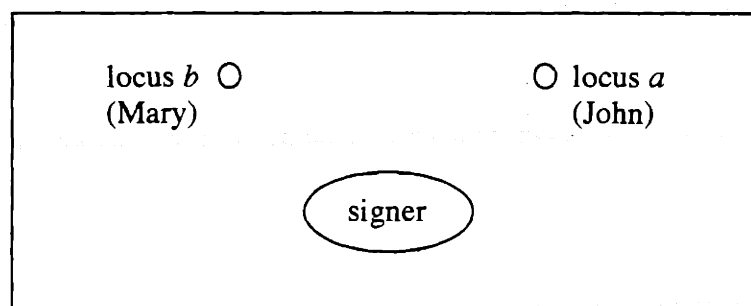
4.1	Licensing null arguments	188
4.2	Directions for future investigation	196

References	198
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Chapter One

Introduction

One property of signed languages that has been of great interest is using space in what has been called the ‘agreement’ system.¹ In a signed language, it is possible to assign points, or *loci*, within the space to particular referents. As an example, the referent of the NP *John* could be associated with a point on the right, labeled as locus *a* and the referent of the NP *Mary* with a point on the left, labeled as locus *b*.



Within this frame of reference, the verb GIVE is signed differently in the following pairs of sentences in American Sign Language (ASL).

- (1) a. aJOHN aGIVEb bMARY BOOK

‘John gave Mary a book.’

- b. bMARY bGIVEa aJOHN BOOK

‘Mary gave John a book.’

The subscripts *a* and *b* on JOHN and MARY indicate that the signs are articulated at the particular loci *a* and *b* respectively. The first subscript on the gloss GIVE indicates the starting point of the articulation of the sign, while the second subscript indicates the endpoint of the articulation. Thus, the sign aGIVE_b moves from locus *a* to locus *b*, while in the second sentence bGIVE_a moves in the opposite direction.

This phenomenon of modulating the verb so that it starts at one locus and ends at another is not as simple as the above example suggests and raises many questions, which this dissertation will address. Some of these questions have been discussed to some extent in the literature (Friedmann 1975, Edge and Herrmann 1977, Fischer and Gough 1978, Klima and Bellugi 1979, Meier 1982, Padden 1983, Shepard-Kegl 1985, Lillo-Martin 1991, Brentari 1988, Janis 1992, Engberg-Pedersen 1993, Meir 1998, Pfau and Glück 1999, Liddell 2000). However, the dissertation will depart from many of these analyses by making explicit the processes at the interface between morphology and phonology that can explain the above phenomenon as well as other ensuing issues.

To establish the context for the dissertation, I will briefly describe the Distributed Morphology framework (Halle and Marantz 1993) and outline the assumptions regarding the architecture of the grammar. In addition, I will spell out the assumptions about the role of space in the grammar of signed languages. Against this background, I will raise various questions to be addressed throughout the dissertation. I will take this opportunity to review what has been discussed so far in the literature with respect to these questions and point out further issues that remain to be resolved. To address these issues, I have gathered data from four signed languages and will explain the methodology of the

¹ The referential system and the classifier system also make use of the space. In this dissertation, I focus on the 'agreement' system.

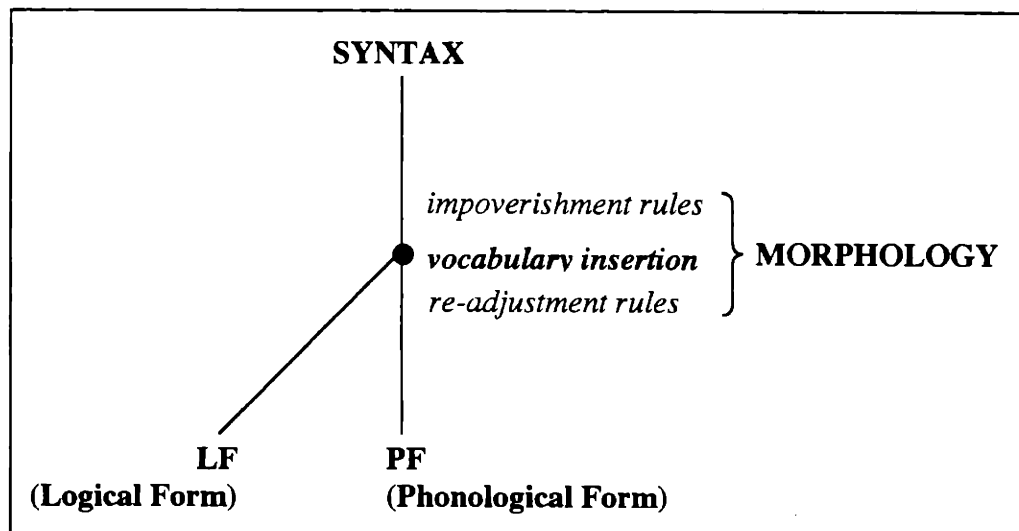
fieldwork for this dissertation. Here, I will also introduce terminology for describing the signs. Finally, I will close with an overview of the thesis.

1.1 Background

1.1.1 Distributed Morphology

This thesis adopts one particular view of the architecture of grammar promoted by the Distributed Morphology (DM) theory (e.g. Halle and Marantz 1993). Within this view, there are three main levels of grammar: syntax, logical form (LF), and phonological form (PF), organized as in the following diagram.

(2) *Distributed Morphology view of the architecture of grammar*



First is the level of syntax, where all the terminal nodes of a sentence structure are fully specified for grammatical features and may be manipulated, either through merger (combination with another part of the sentence structure) or through head-to-head

movement (e.g. from V(erb) to Agr(eement)). Logical form (LF) is the semantic level of representation, which will not concern us further. Next is the level of phonological form (PF), where the sentence structure is organized in phonological units.

The diagram shows another level of representation between syntax and phonology, namely morphology. According to the DM view, this level is actually split between the syntax and phonology components. Those processes which occur just before vocabulary insertion (or equivalently, spell-out), e.g. impoverishment rules, are considered as part of the syntax component, while processes occurring after vocabulary insertion fall into the phonology component. For the purpose of exposition, I will refer to the set of processes occurring shortly before and after 'Vocabulary Insertion' as taking place within a 'morphology' component. Now I describe vocabulary insertion, impoverishment, and re-adjustment rules in turn.

Vocabulary insertion is DM's version of 'late insertion' whereby any phonological information is not introduced until later in the derivation. This is one crucial difference between this view and others: there is no 'lexicon' preceding the level of syntax in the above diagram. Only morphosyntactic features such as tense, aspect, definiteness, person, number, etc. enter the syntax. Depending on the particular cluster of features under a terminal node, vocabulary insertion supplies the node with phonological features. As a simple example, consider a hypothetical paradigm in an imaginary language that marks subject agreement with a suffix on the verb. The phonological shape of the suffix depends on the particular person and number features.

(3) A hypothetical paradigm for subject agreement in a language

	Sin gular	Plural
1st person	- m	- m
2nd person	- k	- r
3rd person	- r	- r

If we assume that a single terminal node carries all the needed features for subject agreement, i.e. person and number features, and if we call this terminal node 'AgrS', we set up the vocabulary items for AgrS as follows:

(4) Vocabulary items for AgrS under the hypothetical paradigm:

[+2nd person, +singular]	<---->	/-k/
[+1st person]	<---->	/-m/
Else	<---->	/-r/

This example illustrates several key points of vocabulary insertion: competition, underspecification, and ordering. There are several entries (*-k*, *-m*, *-r*) which compete for insertion in the AgrS node. If the AgrS node contains, say, the features first person and plural, one must go down the list of vocabulary entries for AgrS to find the cluster of features that matches the features of AgrS as closely as possible in order to find the right suffix. Of these entries, the second and third ones match the features of AgrS. However, the second entry takes precedence over the third one in spelling out AgrS because it contains more specified features (i.e. the Elsewhere Principle).

One could set up the vocabulary items differently, like the following, where each possible cluster of features is specified.

(5) Alternative vocabulary items for AgrS under the hypothetical paradigm:

[+2nd person, +singular]	<---->	/-k/
[+1st person, singular]	<---->	/-m/
[+1st person, plural]	<---->	/-m/
[+2nd person, plural]	<---->	/-r/
[+3rd person, singular]	<---->	/-r/
[+3rd person, plural]	<---->	/-r/

This alternative misses the generalization that the suffix /-m/ is a marker for 1st person, not just for 1st person singular or 1st person plural. It also misses the generalization that the suffix /-r/ seems to be a 'default' morpheme that appears in contexts where there is no other specified morpheme. In contrast, the first list of vocabulary items captures these generalizations and is economical with just three entries. Thus, it is preferred to use the original list, which contains underspecification both in the second entry (where one does not need to specify number for 1st person) and in the third entry (where one does not need to specify any feature), as long as we also make use of the ordering principle that ranks more specified entries above less specified ones. The above example is oversimplified at best and glosses over many other issues such as allomorphy, the insertion of lexical words and the precise characterization of features. For discussion of these issues and other details, the reader is referred to the DM literature.

Within the morphology component, other operations may occur before vocabulary insertion, such as fission, fusion, and impoverishment. Since only impoverishment will be relevant in the thesis, I demonstrate only impoverishment here. For discussion of fission and fusion, one is again referred to the literature. To illustrate impoverishment, I will draw on the same example from above. Let us suppose that the paradigm in (3) applies when the verb is in the present tense. If the verb is in the past tense, the same paradigm obtains but with one difference: the suffixes for 1st person singular and plural both are /-r/.

(6) Hypothetical paradigm for subject agreement in the past tense

	Sin gular	Plural
1st person	- r	- r
2nd person	- k	- r
3rd person	- r	- r

One could set up another list of vocabulary items for AgrS when coupled with a T(ense) that carries the [+past] feature, but this would miss the generalization that it is only the 1st person feature which has been neutralized in a particular context (i.e. in the past tense) and that everything else has otherwise remained the same. On such conceptual grounds, it would be more efficient to posit an impoverishment rule that neutralizes the subject agreement for a 1st person argument in the past tense.

(7) Hypothetical impoverishment rule

$$\text{AgrS} \rightarrow \emptyset / \text{_____} [+ \text{past}]$$

[+1st person]

This rule says that when the AgrS node contains a 1st person feature (regardless of whether it is singular or plural), the AgrS features are deleted (or impoverished) when there is past tense. After the impoverishment, the AgrS node is left with no features. When vocabulary insertion takes place, the cluster of features that best matches the absence of features is the last entry, i.e. the elsewhere one, and we obtain the desired result of inserting /-r/ for 1st person singular and plural in the past tense.

In addition to these rules, there are operations which take place after vocabulary insertion, such as phonological re-adjustment rules. Re-adjustment rules are intended to handle various exceptional cases while making use of vocabulary insertion and other processes within the morphology component. They are also intended to handle stem-internal changes. For example, to mark an agreement feature, one might not use an affix but rather change the vowel quality of a word. Let us return to the same example for an illustration. Let us suppose that in the future tense, the paradigm is the same as that for the present tense, in (3), with a few exceptions. There are ten verbs in the language that, in addition to taking the suffixes as shown in the paradigm, also change the vowel to /o/ to show the future tense. The re-adjustment rule could be written as follows.

(8) Hypothetical re-adjustment rule

Rime --> /o/ / X ____ [+ future]

|

x

where X = verb1, verb2, . . . , verb10

The stem-internal change comes from changing the rime of the X to /o/ in the context of future tense, while all the exceptional cases that undergo this process are listed under X. It is this kind of rule that will be at the heart of the thesis, since I argue the 'agreement' phenomenon to be a stem-internal change that applies only to a restricted set of verbs in signed languages.

I have given examples of vocabulary insertion, impoverishment, and re-adjustment rules. It is also important to note that they must occur in a particular order: any impoverishment must occur before vocabulary insertion, and any re-adjustment rule must occur afterwards. As will be shown later in the thesis, this ordering is crucial in accounting correctly for the 'agreement' phenomena of the signed languages.

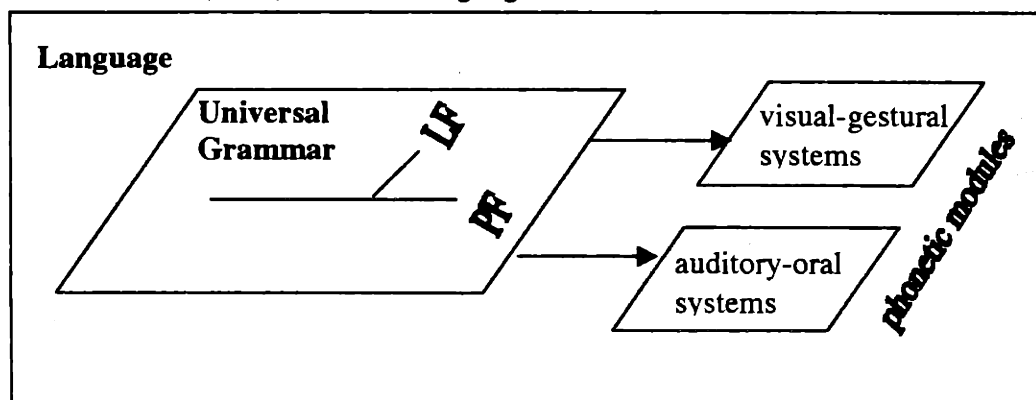
1.1.2 *The Role of Space in Grammar*

In the preceding section, we have seen one view of the architecture of grammar articulated by the DM framework. I assume that the same architecture holds for signed languages, since signed languages are natural languages on par with spoken languages and should be subject to the same Universal Grammar principles that govern spoken languages.

One may argue that since signed languages make extensive use of the space in front of the signer, the architecture of grammar may look different for signed languages. I wish argue that this is not necessarily so. First, I distinguish two different uses of space: articulatory and referential. The articulatory space means the space in which the signer articulates signs in general. For example, to articulate the ASL sign WALK, one moves the two hands, both in the B handshape and palms facing down, back and forth in the space. However, one need not make any reference to the space in the representation of WALK. It is sufficient to provide the specifications for the movement of the joints, i.e. from the perspective of the signer rather than from the perspective of the viewer. For example, the movement in the sign WALK can be described as alternating outward rotation of the arms from the elbow. Here, there is no need to refer to space as an articulatory location.

If one accepts that it is only the phonetic modules which differ for spoken and signed languages, and if these phonetic modules lie outside of Universal Grammar, as in Lillo-Martin's (1997) model of language, it is possible to maintain the assumption that spoken and signed languages share the same architecture of grammar provided by Universal Grammar.

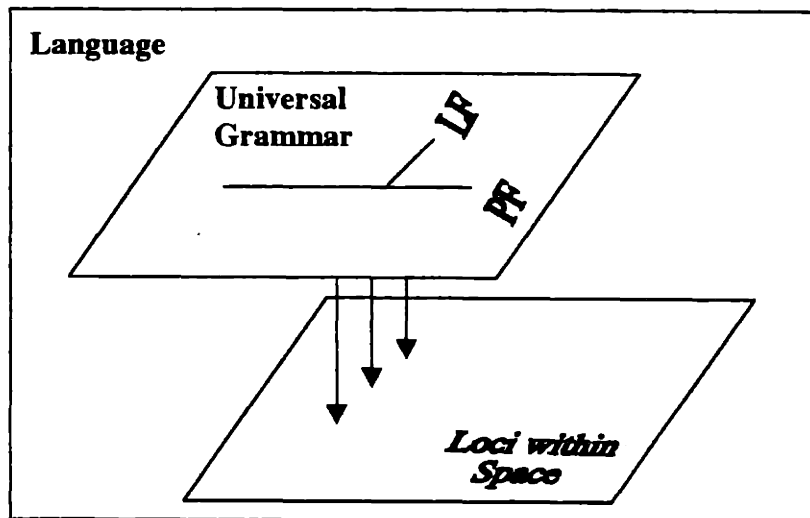
(9) Lillo-Martin's (1997) model of language



In this model, there are two phonetic modules, one for the auditory-oral system and another for the visual-gestural system. Language may be linked to either of the systems if not both. There is a choice of phonetic modules (or articulatory-perceptual systems) that language can access, but whichever phonetic module is chosen still remains outside the realm of Universal Grammar. Thus, with respect to Universal Grammar, spoken and signed languages are on par with one another.

The other use of space is referential. As mentioned at the beginning of the introduction, one may assign loci in the space to particular referents. One may then use these loci in various subsystems of the grammar, such as classifier and 'agreement' systems. I argue that even this use of space is not part of the grammar of signed languages; rather, grammar merely makes use of the space that is available. That is, the space is secondary to the grammar, contra other researchers who have taken the space to be at the heart of the sign language grammar. This conception of space's relationship with the grammar is schematized in the following figure.

(10) The relationship between space and grammar

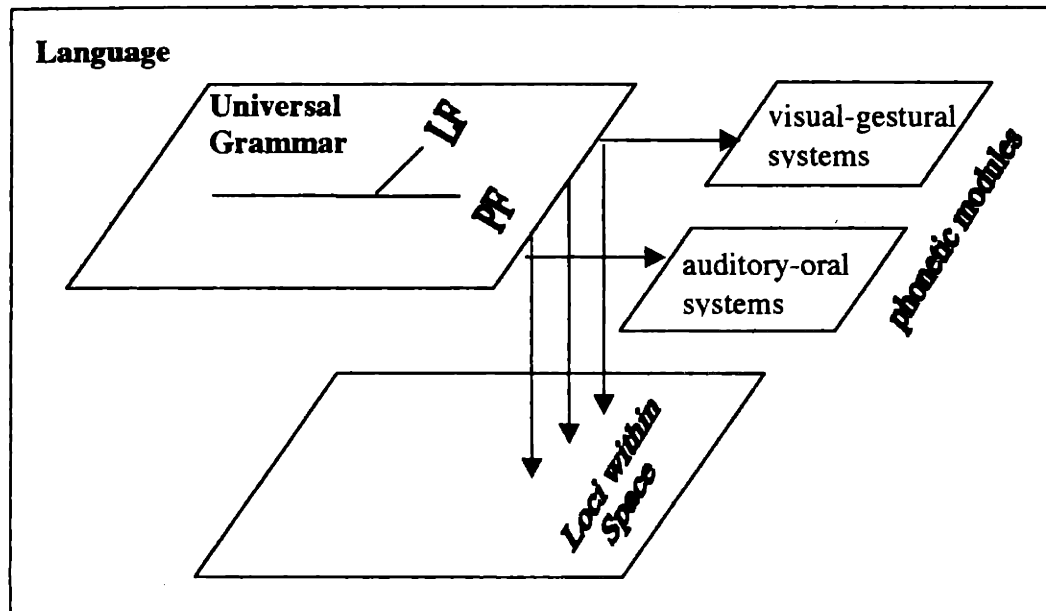


Putting the use of loci within the space out of the realm of grammar leads to several desired results. First, it is possible to extract the gestural part of sign language and assimilate it to the gestures accompanying spoken languages that also use space to show relations. Second, we can separate true linguistic universal principles from sign language universal properties stemming from the use of the space, such as the fact that every signed language uses the same system for showing 'agreement'. Finally, the issue of representing within the grammar all the infinite points in the space becomes moot. That is, the locus is not represented phonologically at all. Rather, it belongs to the space, which is then linked to the grammar, as shown in the above figure.

We turn to the next question of when the linking between the grammar and the loci occurs. I argue in the following chapters that the grammar must link to the locus somewhere around the PF edge, because of rule ordering facts. Specifically, I propose a phonological re-adjustment rule in the next chapter to account for the 'agreement' phenomena. This rule depends on the loci, and in turn various phonetic constraints outlined in the third chapter feed on the output of this re-adjustment rule. If the grammar links to the loci later in the phonetic module, followed by the re-adjustment rule, an ill-formed sign may result, since it may not be filtered out by earlier phonetic constraints. While the PF edge is the latest that the grammar can link to a locus, there is no reason why it cannot be linked before the PF edge. I assume that there is free association between the grammar module and the space component up to the edges, since the referential use of space belongs to the realm of discourse, which should be accessible to the grammar at any point in a derivation. However, this last assumption is by no means crucial, and it is sufficient that the grammar links with the loci at the PF edge. The

following figure, which combines the above two models, summarizes the above discussion.

(11) The full model of grammar, phonetic modules, and space



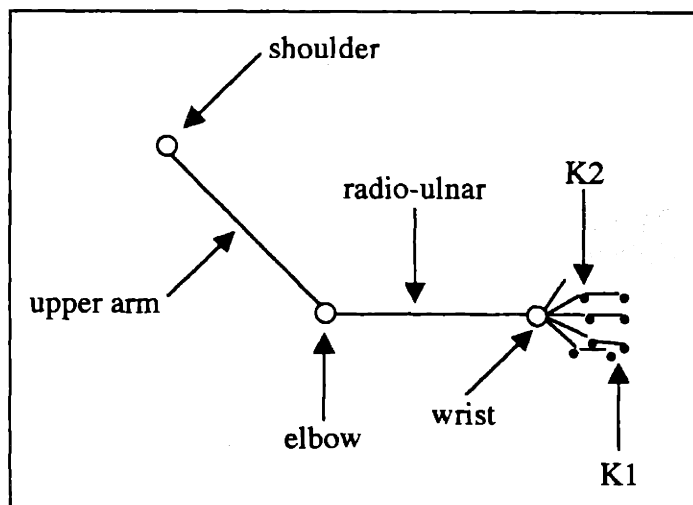
1.1.3 Describing Signs

While spoken and signed languages may share the same Universal Grammar, signed languages do not lend themselves to analysis as easily as spoken languages due to the lack of a standardized writing system, among other reasons. While the International Phonetic Alphabet (IPA) makes it possible to analyze spoken languages in a uniform way, both language-internally and cross-linguistically, the absence of such an alphabet for languages in the visual-gestural modality makes it difficult to see patterns within a morphological paradigm in a signed language. While there have been several systems developed to notate sign language (HamNoSys, Sign Writing, SignFont, SignStream), these systems do not capture the precise alternations a sign undergoes when it is inflected

for 'agreement' or even other morphology and thus do not permit one to identify the alternation that occurs across signs for a given morpheme.

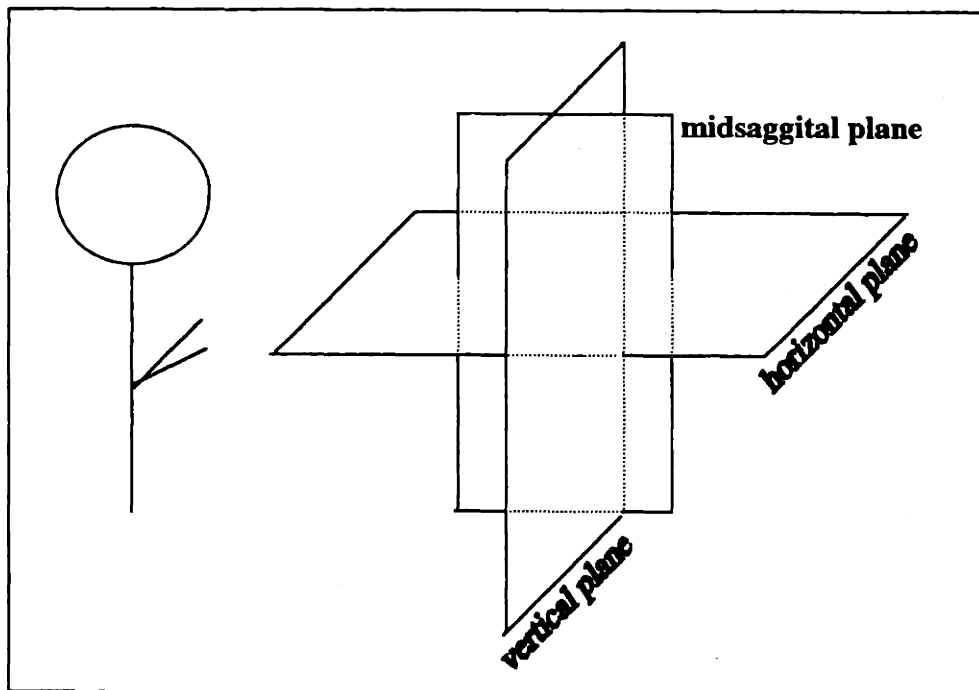
Given the absence of such an alphabet for signed language, this thesis uses a combination of prose descriptions and tables of features that will help to identify the common changes that all signs undergo under a certain morphological process. The table of features will make reference to some of the joints of the arm that are used in articulating signs. Mirus, Rathmann, and Meier (2000) and Mathur and Rathmann (2000), among others, show the importance of using the joints in making generalizations about some processes in signed languages and their acquisition. The joints that are considered important in the articulation of signs are, in order from most proximal to most distal: the shoulder, the upper forearm, the elbow, the radio-ulnar part, the wrist, the metacarpophalangeal joints (i.e. the knuckles closer to the wrist, abbreviated as K2), and proximal interphalangeal joints (i.e. the knuckles farther away from the wrist, abbreviated as K1).

(12) The joints of the arm used in the articulation of signs



Each joint has a certain number of degrees of freedom of movement. For example, the wrist has two degrees of freedom: (i) it may be bent upwards or downwards, and (ii) it may be twisted sideways to either side. One could also describe these movements in terms of the three planes of the space: the midsagittal plane which slices the body between the eyes, arms, etc.; the horizontal plane which separates the upper torso from the lower part; and the vertical plane which separates the front from the back. Thus the path traced by the fingertips when the wrist is bent upwards or downwards is within the vertical plane, whereas the path traced when the wrist is twisted sideways is within the horizontal plane. Although it is sufficient to describe the movement of the sign with the particular degree of freedom without making any reference to the planes of the space, it is helpful to know the terms for the different planes for expository purposes. The following diagram illustrates the three different planes.

(13) The three planes of the articulatory space



Another convention the thesis will follow is using glosses in capital letters to refer to signs during discussion. One may use the gloss to look up the phonological form in the appendices, which will provide HamNoSys notation for each of the signs. The HamNoSys notation system provides symbols for each of the traditional parameters of a sign first identified by Stokoe (1960) and Stokoe, Casterline, and Croneberg (1965): handshape, location, and movement. Battison 1973 proposes an additional parameter of orientation, which is accounted for by the HamNoSys system as well.²

1.1.4 Different statuses of movement

Here, I would like to discuss the different statuses that movement can have, since these distinctions will become important later on in the thesis. As will be shown, movement can be either lexical, morphological, or phonetic.

For an example of 'lexical movement,' consider the ASL sign PROPORTIONAL. The movement is a straight path from left to right and does not carry any meaning on its own, just as the handshape K does not contribute any meaning to the sign and is merely a part of the sign. If the value of a parameter is lexical, it is not possible to change the value without changing the sign into something else (either a nonsense sign or a sign with an unrelated meaning).³ That is how one can test for the lexical status of such values. Since it is not possible to change the movement nor

² While Battison (1973) argues that orientation should be an independent parameter, I assume this parameter to be under the movement parameter. Alternatively, Sandler (1989) assumes it to be under handshape.

³ One exception comes from aspectually marked forms. The value of the parameter may change as part of an aspectual inflection without changing the original meaning of the root sign, but the composite meaning of the aspectually inflected form will still be different.

the handshape of the sign PROPORTIONAL without destroying its content, the movement and the handshape are considered to be lexical. Other examples of lexical movement include twisting of the arm in the ASL sign TREE and brushing against the non-dominant hand in the ASL sign PAPER. Note that while many of the signs may seem to be iconic, the iconicity does not figure in the representation of these signs.

In contrast, the movement in an ASL sign like CARRY is morphological in the sense that it carries meaning. The movement parameter contributes the meaning of 'moving' just as the handshapes can add meaning by conveying the shape of the object being carried (even though there is usually a default handshape available, which is the B handshape in this case). One test for determining whether a parameter carries its own meaning is to modulate it in some way and check whether the modulation affects the overall meaning of the sign in the predicted way. This is different from a lexical parameter, which cannot be modulated at all.

Just the handshape of CARRY can be modulated to reflect the shape of the object, and just as the tension in the arms can be adjusted to indicate the weight of the object, so can the movement be modulated to show the manner of the action. For example, to indicate that the person is carrying the object carelessly, one uses a "th" mouth formation and swings the arms back and forth at a staccato pace.

The sign CARRY belongs to what has traditionally been called the category of "spatial verbs," which also includes the subset of classifier predicates such as PERSON-theme+MOVE. Remember that this notation does not reflect the temporal order of the morphemes; rather, they only show what is layered within the word. Again, the parameters of the sign each contribute part of the meaning: the handshape (specifically,

the index finger) expresses the PERSON-theme morpheme, while the movement expresses the MOVE morpheme.⁴ As with the sign CARRY, one can modulate the movement in PERSON-theme+MOVE to show the manner in which the action is carried out. I consider these types of movement as morphological.⁵

For an example of 'phonetic movement', consider the ASL sign VACUUM-CLEANER which resembles the action of vacuuming with fists closed around an imaginary handle and which consists of three movements in quick succession: the first movement is directed away from the body, followed by the second movement, which is directed back to the body, ending with the third movement which goes away from the body. I assume there is an underlying root, VACUUM-CLEAN (note the verbal form), which consists of just one movement, that which is directed away from the body. To derive the noun form from this root, one reduplicates the root. Translated into phonological terms, that involves repeating the movement. However, before one can repeat this movement, one must add a 'phonetic movement' to return to the starting point so that one can carry out the reduplicated movement.

This phonetic movement is neither lexical, for it is not part of the phonological form of the root, nor is it morphological, for it does not carry any meaning on its own. The movement only serves to smoothen the transition between other movements. The ASL signs HAMMER and ICE-CREAM are other similar examples which involve phonetic movement: they consist of a root with a single lexical movement which is then

⁴ This morphological analysis of classifier predicates is first due to Supalla (1986), who provides a comprehensive inventory of combinable handshapes and movements for such predicates.

⁵ I have yet to find other examples in which morphological movement means something other than 'motion.' This may be a real gap, and if so, it would show that the morphological use of movement is restricted only to showing movement within the space, whether real or abstract.

reduplicated. As with VACUUM-CLEAN, a phonetic movement is inserted between the original movement and the reduplicated one in the noun form.⁶

1.2 Issues

Having presented the necessary background, I now return to the ‘agreement’ phenomenon and discuss various issues concerning this phenomenon. I will cluster the issues into four groups, going from the finer details at the featural level to the phonological forms to the typological issues and finally to modality differences between spoken and signed languages with respect to agreement. I will discuss what the literature has reported on these issues and my own responses to them.

1.2.1 Features

If the ‘agreement’ phenomenon is like agreement in spoken languages, one question that comes to mind is what features are relevant in generating the agreement paradigm. In many spoken languages, verb agreement may mark phi-features such as person, number, gender, and/or case features of the subject and/or the object. At first sight, it seems that two features are relevant for ‘agreement’ in signed language: person and number.

For the person feature, Meier (1990) argues ASL has just two values: first person and non-first person. Neidle, Kegl, MacLaughlin, Bahan, and Lee (2000:167) consider the locus to be the manifestation of all the phi-features of a referent. While they maintain Meier’s (1990) two-way person distinction, they propose that “non-first person can be

⁶ Supalla and Newport (1978) are the first to discuss these noun-verb pairs. Liddell and Johnson (1986) call this phonetic movement “epenthetic” and provide a formal model, as others do, where it is possible to insert

further subclassified into many distinct person values." As has already been discussed by Lillo-Martin and Klima (1990) and Meier (1990), this proposal is problematic because it is not possible to encode the theoretically infinite number of distinct non-first person values within a grammar.

For the number feature, Fischer and Gough (1978), Klima and Bellugi (1979), and Padden (1983) note there are at least four possible values: singular, dual, exhaustive, and multiple. Fischer (1996) and Supalla and Osugi (1996) note that gender is marked in some subsystems of Japanese Sign Language; however verb agreement is not one of them. Smith (1990) notes the same thing for Taiwanese Sign Language.

If we take verb 'agreement' in sign language to mark person and number features for both subject and object, and if we use Meier's (1990) values for person and the three values for number (excluding the dual form, which can be considered as a subcase of the exhaustive form, both of which involve reduplication), we could generate the following agreement paradigm.

(14)

			OBJECT					
			sing		exh		mult	
			1	3	1	3	1	3
SUBJECT	sing	1						
		3						
	exh	1						
		3						
	mult	1						
		3						

It will be argued in the thesis that while the person feature is present in the grammar of the signed language, it is not relevant for the agreement paradigm. Only the number

such an epenthetic movement.

feature will be relevant. Moreover, as will be discussed in the next subsection, there are constraints on possible combinations of features, which make paradigms like the above misreading, consistent with the DM view.

1.2.2 Phonological forms

The example given at the beginning of the chapter, GIVE, involves a path movement the direction of which may be changed depending on the pair of loci that are involved in the 'agreement.' However, this is just one phonological manifestation of agreement. Fischer and Gough (1978), Janis (1992), and Meir (1998) note the importance of orientation in showing 'agreement.' For example, for a pair of loci that are either on the right or on the left, the ASL sign PITY changes only orientation so that the palm faces the locus associated with the referent of the object noun phrase (henceforth object locus). It does not involve a direct path movement between the pair of loci.

Another phonological manifestation combines the above two. For instance, the ASL sign ASK not only changes the direction of the path movement depending on the pair of loci but also changes its orientation so that the palm faces the object locus. A fourth manifestation is similar but with two hands. In this case, the two hands also change their order relative to the body. For example, in one form of the ASL sign MEET, the dominant hand moves towards the non-dominant hand which is situated at the object locus. In another form, the non-dominant hand will move so that it is situated at the object locus while the dominant hand will adjust its orientation so that the direction of its path movement is towards the non-dominant hand. Finally, a fifth manifestation involves two-handed signs in which neither hand participates in path movement. Rather, the

dominant hand contacts the non-dominant hand in some way depending on the particular verb. When one wants to adjust the verb so that it 'agrees' for a certain pair of loci, one changes the orientation of both hands so that the palm of the non-dominant faces the object locus. As will be noted throughout the thesis, it is not necessarily the palm of the hand which may face the object locus; depending on the verb, another part of the sign could face the object locus, such as the fingertips, the back of the K1 knuckles, or the back of the K2 knuckles.

Given the various phonological manifestations of the 'agreement', how does one write an 'agreement' rule so that when it applies to a verb, it leads to the right manifestation? I argue in the thesis that the particular manifestation is predictable from the underlying form of the verb and propose a formulation of the 'agreement' rule that when applied to any underlying form will generate the correct form.

There are also constraints on the possible combinations of features. Padden (1983/88) notes that it is not possible for a verb to show agreement for a subject that is multiple in number. In such cases, the subject is treated as if it were singular. Moreover, it is not possible for a verb to mark plural features on both the subject and the object. In these cases, the subject is once again treated as if it were singular, and the verb overtly marks the number feature of the object. I propose to account for these constraints within the DM framework by using a combination of an impoverishment rule and the vocabulary items for subject number.

Another property of 'agreement' in ASL and presumably other signed languages is that the 'agreement' for the subject is always optional (Padden 1983). The model to be defended here proposes to handle the optionality of subject 'agreement' by leaving the

choice of loci open: one may choose to use a specific locus associated with a subject or not. When the locus is not linked to a specific subject, a default locus is still used near the front of the signer. On the other hand, object 'agreement', when it is 'possible', is mandatory. I suggest that this is because the rule handling 'agreement' requires at least one locus linked specifically to an argument in order to be visible. However it remains a puzzle why this argument must be the object if there is just one specifically linked. This object-subject asymmetry also appears in other properties of 'agreement' which I will discuss and suggest that it is a broader phenomenon which is not restricted to 'agreement.'

If one uses two loci that are both specifically linked to arguments, the form may still not match the form predicted by the rule. Mathur and Rathmann (2000) show that there are also phonetic constraints at work which may constrain the degree to which one can show agreement for some pairs of loci. For example, it may be phonetically awkward to articulate a form that requires placing the hands in a twisted configuration, like the dominant hand moving from the left side towards the non-dominant hand which is set up on the right hand.

1.2.3 Typology of verbs

Not all verbs undergo this 'agreement' process. Padden (1983) identifies three classes of verbs which have distinct morphology: plain, inflecting, and spatial. Inflecting verbs mark for person and number; spatial verbs mark for location and position (there is a subclass, i.e. classifiers, which also mark for path and manner of movement); and plain verbs do not mark for these categories at all. Supalla (1996) refines this typology by

dividing the class of inflecting verbs into four further subclasses: verbs that agree with both subject and object in both person and number; verbs that agree with both subject and object in person but only with the object in number; verbs that agree with only the object in both person and number; and verbs that agree with the object in number. He shows that no other combination is possible in ASL and proposes to derive the set of possible forms from an implicational hierarchy that ranks the following features:

(15) Supalla's (1996) Implicational Hierarchy

object number < object person < subject person < subject number

This hierarchy says that if a verb can show subject number it can show the rest; if a verb shows subject person but not subject number, it should still be able to show object person and number; and so on.

One may wonder how to predict whether a verb is inflecting, spatial, or plain. Moreover, if the verb is inflecting, how does one know how many of the features in Supalla's (1996) hierarchy the verb will agree with? Padden (1983) suggests that the verb's class membership is a lexical property that must be learned in the course of acquisition. While Supalla (1996) does not discuss this issue for his more detailed typology, it seems that one would also have to memorize which of the features a verb may agree with.

Janis (1995) attempts to predict the class membership of verbs from a hierarchy of controller features. The controller is the nominal with which the verb agrees, and the

features are the following, ranked in a hierarchy in case there is competition for a slot between two arguments:

(16) Janis's (1995) hierarchy of controller features:

case: direct case < locative case

|

grammatical relations: subject < direct object < indirect object

semantic relations: agent, experiencer', patient", recipient

' only with a verb that is not body-anchored

"only if animate

Janis (1995) defines a nominal with locative case as being "perceived either as a location or as being at a location that affects how the action or state expressed by the verb is characterized." Otherwise, all other nominals receive direct case. The linking between direct case and the list of grammatical and semantic relations in the hierarchy indicates that any nominal with direct case must have at least one of the features from each of the two lists. The hierarchy thus predicts that if there are locative arguments within the sentence, the verb will be spatial. Otherwise, if the nominal has direct case, the verb is inflecting only if the nominal is a subject, indirect object, or direct object and if it has the role of an agent, recipient, animate patient, or experiencer (provided the verb is not body-anchored). The hierarchy predicts verbs to be plain if nominals are non-animate patients, body-anchored experiencers, or subjects/objects with instrumental/locative theta-roles.

The hierarchy could also be extended to predict how many of the features in Supalla's (1996) hierarchy a verb can mark.

Janis's (1995) hierarchy is a good start towards explaining the class membership of verbs, although it is weakened by three stipulations: (i) a patient must be animate; (ii) an experiencer must be with a non-body-anchored verb, and (iii) the list of semantic relations must be included. The thesis proposes to simplify Janis's analysis by requiring that 'agreement' apply only to animate arguments. If one looks at the list of semantic relations, one will notice that agents, experiencers, and recipients are usually animate. Thus one can do away with the list of semantic relations. If one allows 'agreement' to apply to any verb with two animate arguments, and lets the morphological and phonological constraints screen out any ill-formed signs, one should be able to predict whether a verb is inflecting or plain. Otherwise, I adopt Janis (1995)'s fundamental distinction between plain/inflecting and spatial verbs, and argue that they undergo different processes since they use space differently. I will discuss this more in the next chapter.

One reason Janis (1995) maintains the list of semantic relations in her hierarchy is to account for "backwards" verbs, first noted by Padden 1983/99. ASL examples include COPY, INVITE, and TAKE-ADVANTAGE. While regular signs like GIVE, ASK, and SEND start their articulation at the subject locus and land at the object locus, the backwards verbs start at the object locus and land at the subject locus. Hence the term 'backwards' verb. Padden (1983) provides various pieces of evidence that agreement must be in terms of these grammatical relations subject and object. However, one can describe the movement in terms of semantic roles, which would assimilate backwards

verbs to the class of regular verbs: the movement proceeds from the source locus to the goal locus, an analysis argued for by Shepard-Kegl 1985. Padden 1983/88, Shepard-Kegl 1985, and Brentari 1988 discuss these backwards verbs to some extent, but Meir 1995, 1998 represents the first real attempt to explain the unique behavior of backwards verbs while keeping regular and backwards verbs within the same category.

Recall in the previous section that there are several phonological manifestations of 'agreement.' One involves just changing the direction of the path movement, while another involves changing just the orientation of the hands. Meir 1998 takes the path movement to represent movement from source to goal while orientation change (or facing, in her terminology) reflects grammatical relations. Thus, both regular and backwards verbs move from source to goal, and in both types of verbs, the palm (or another relevant part of the hand) faces the syntactic object. The only difference between the two classes is the different mapping between the grammatical and the semantic relations. For regular verbs, the source maps onto the subject and the goal onto the object, while for backwards verbs, the source maps onto the object and the goal onto the subject.

In Meir's (1998) analysis, path movement and facing receive equal treatment. However, I wish to take her analysis one step further and propose that it is the broader notion of 'facing' that should be the primary property of 'agreement', with the direction of the path movement following from the orientation of the sign. Meir's (1998) analysis concerning path movement is better suited for verbs of motion, which can be argued to involve source and goal arguments, whereas the movement in verbs of 'agreement' is a secondary property following from 'facing' that marks grammatical relations, consistent with Padden 1983. As another example of the difference between the movement in verbs

of motion and the movement in verbs of 'agreement', the motion may be modulated for manner in verbs of motion but not in 'agreeing' verbs. In other words, the movement in verbs of motion is morphemic whereas it is lexical in 'agreeing' verbs.

That also goes for backwards verbs: I take the 'backward' movement in these verbs to be lexical, in line with Padden 1983, but one could adapt Meir's (1998) analysis as a diachronic explanation for the properties of backwards verbs. Otherwise, the 'agreement' rule need not say anything about the unique mapping between grammatical and semantic relations in backwards verbs. It is sufficient that the backwards verb has at least two arguments that are also animate, and the 'agreement' rule to be defended in the next chapter will derive the correct forms for both regular and backwards verbs.

One piece of evidence in favor of a lexical (as opposed to Meir's (1998) morphological) analysis of the movement in backwards verbs comes from the 'multiple' inflection. When a backward verb is inflected for multiple number, the movement in the underlying form must be reduplicated just as the underlying movement in regular verbs is reduplicated whenever there is a special lexical movement other than straight path movement. This suggests that the movement in the underlying form of backwards verbs is lexical as well. Moreover, if one looks at the list of 'agreement' verbs in Meir's (1998) Appendix A, one will see that there are 12 backwards verbs compared with 41 regular verbs. If there are not that many backwards verbs out of the whole set of verbs, one has more reason to consider the movement as lexical, and the 'backward' property could come from a broader principle of world knowledge that does not need to be encoded linguistically.

Another piece of evidence for the lexical status of the movement in backwards verbs may come from the PERSON Agreement Marker (PAM) in German Sign Language, as described by Rathmann (2000). The PAM is an auxiliary-like element which identifies the subject and object in case the verb is not able to do so, either due to discourse or phonological reasons. There are some verbs in German Sign Language where goal and source theta-roles are projected to subject and object positions respectively, like backwards verbs, but they are not able to show the 'agreement' due to discourse or phonological reasons. When the PAM is used with these verbs, the PAM moves from subject to object, not the other way around as one would expect for a backward verb. While this does not say anything directly about Meir's (1998) analysis and only shows that PAM itself behaves like a regular verb, it is still interesting how the PAM shows 'agreement' like a regular verb even when it is paired with a backwards verb. This suggests that if PAM truly carries 'agreement' for the verb, agreement must be between subject and object only, not between source and goal.

In sum, this subsection has considered various typologies of verbs in signed languages and different analyses to derive the typologies. As an alternative, this thesis puts forth the following typology of verbs: spatial verbs, verbs with two animate arguments, and all other verbs. This categorization divides the verbs in such a way that verbs in each category undergo the same processes without any exceptions: all spatial verbs use space continuously; all verbs with two animate arguments use space discretely and can show 'agreement' between subject and object; and the rest of verbs do not make use of the space except possibly in contrastive contexts, but this process is available generally, not just to these verbs but also 'agreement' and spatial verbs, as well as nouns

and adjectives. The final chapter will consider the syntactic consequences of such a typology, in particular with respect to the licensing of null arguments.

1.2.4 Modality differences

Up to now, I have been using ‘agreement’ in scare quotes for a reason. Some researchers, such as Liddell 2000, have questioned whether ‘agreement’ in signed languages is truly the same as what has been called agreement in spoken languages. One property that distinguishes ‘agreement’ in signed language from that in spoken languages is the use of the referential space.

Consider the popular example aGIVE_b from the beginning of the chapter.. Recall that the sign is modulated in such a way that the hand moves from a to b and means that the person associated with locus a is doing the giving to the person associated with locus b. One question that has remained elusive is how to represent these loci at the phonological level. There have been many analyses of verb agreement in signed languages which attempt to address this issue. Liddell 2000 notes that they all share the following assumptions⁷:

- (17) a. “some sort of spatial morpheme is somehow attached to the verb”
b. “such a spatial morpheme can be described by a set of phonological features”
c. “the space ahead of the signer is part of the grammatical representation of sentences”

(Liddell 2000: 6)

The problem is that none of the analyses provide an explicit “phonological implementation” of the “spatial morpheme,” and for a good reason: there are infinitely many points in the space which can potentially be part of verb agreement and which are thus difficult, if not impossible, to encode in a “grammatical representation.” Liddell (2000) proposes to solve this problem by doing away with the assumption in (17c) that space plays a role in the grammar of signed languages. He considers ‘agreement’ verbs as ‘indicating verbs’ which point towards a ‘token’, rather than towards a locus. A locus is a single point in the space whereas “tokens can range in size from essentially a point to something greater than a foot tall” and can “represent a standing human.” He argues that indicating verbs are not directed towards a single point but towards a particular body part of the token. For example, “GET-SAME-IDEA-SAME-TIME [or ESP] is directed towards the forehead. SAY-NO is directed towards the nose, or slightly below. GIVE is directed towards the chest, and INVITE is directed toward the abdomen.”

I too eschew the assumption in (17c), but discarding that assumption alone is not enough to provide a complete phonological implementation of verb agreement. I propose that ‘agreement’ in signed languages has linguistic status as a phonological re-adjustment rule that depends on the output of other linguistic rules and feeds other linguistic rules. As for specifying the particular heights at which one may direct the sign towards a locus, one may include that information within the lexical entry of the sign. In sum, removing the referential space from the grammar removes the modality difference between spoken and signed languages with respect to ‘agreement.’ The remaining differences will lie in

⁷ Examples of such proposals include but are not limited to those by Woodward (1970), Fischer (1975), Lacy (1974), Shepard-Kegl (1985), Lillo-Martin and Klima (1990), Klima and Bellugi (1979), Padden

how agreement is implemented, but that is no longer a modality difference. Both spoken and signed languages make use of different processes within the morphology component to generate the agreement system (e.g. impoverishment, vocabulary insertion, and phonological re-adjustment rules), but otherwise they draw on the same set of processes made available by the grammar. It is thus theoretically possible to find a spoken language that implements its agreement system in a fashion similar to that of signed language, i.e. just through impoverishment rules, vocabulary insertion of verbs, and a re-adjustment rule altering the verb stem.

1.3 Methodology

As evidence for the various positions taken in the preceding section, the thesis draws on data gathered during fieldwork on four historically unrelated signed languages: American Sign Language (ASL), German Sign Language (Deutsche Gebärdensprache, DGS), Australian Sign Language (Australian Sign Language, AUSLAN), and Japanese Sign Language (Nihon Shuwa, NS). The data collection closely follows the methodology of Mathur and Rathmann (2000), who used two dictionaries, one for AUSLAN (Johnston 1989) and the other for British Sign Language (BSL) (Brien 1992), to compile a master list of 75 transitive verbs with two animate arguments, generally with ‘agent’ and ‘patient’ theta-roles. Those two dictionaries were used in particular because they were the most comprehensive sign language dictionaries available that listed the signs according to their formational properties (in line with standard dictionaries for spoken languages)

(1988), Liddell and Johnson (1989), Janis (1995), and Bahan (1996).

rather than according to glosses in the spoken language used in the same area as the signed language.

For each signed language, two consultants were enlisted who satisfied the following criteria:

(18) Criteria for a consultant:

- i. Exposure to sign by three years of age,
- ii. Capability and comfort with judging whether a sentence is grammatical or not,
- iii. Daily contact with the signed language in the Deaf community (for 10+ years).

The first criterion generally results from being born deaf and growing up in a residential school for the deaf and/or being born into Deaf parents/having older Deaf siblings. It is sufficient that the consultant is exposed to sign by age three, because Mayberry (1993) and Neville and Lawson (1987) have found that there are hardly any significant differences between native signers and early signers with respect to memory and comprehension skills and brain structure.⁸ The motivation behind the second criterion is to seek out those informants with strong metalinguistic skills. Finally, the purpose of the third criterion is to restrict consultants to those who are up to date on the current use of the signed language. At the same time, it has been kept in mind that the consultants do not necessarily represent their signed languages for their entire nations.

With the assistance of these consultants, the master list was used to compile a list of similar verbs in the corresponding signed language. This was not always successful

because one gloss in one signed language does not always map onto another gloss in another signed language so neatly. For example, the argument structure for one verb in one language may be different than that for the corresponding verb in the other signed language.

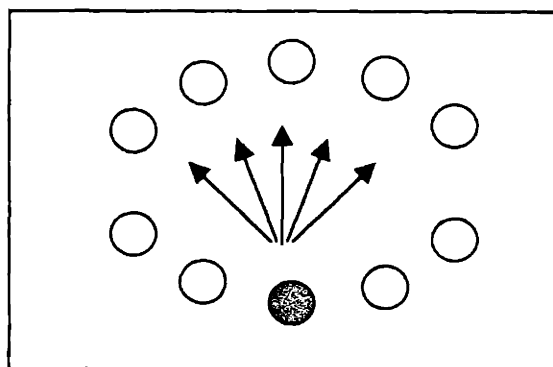
For each consultant, the following 14 forms were gathered for each verb:

(19) Forms elicited for each verb

ME to LEFT	LEFT to ME
ME to RIGHT	RIGHT to ME
LEFT to RIGHT	RIGHT to LEFT
ME to MANY(exhaustive)	MANY(exhaustive) to ME
ME to MANY(multiple)	MANY(multiple) to ME
WE(exhaustive) to YOU	YOU to US(exhaustive)
WE(multiple) to YOU	YOU to US(multiple)

To avoid influencing the data, the researcher enlisted a person fluent in the respective signed language to carry out the elicitation. The forms were elicited using visual aids like the following, which were printed on whole sheets of paper:

(20) Example of a visual aid for eliciting a form



ME to MANY(exhaustive)

⁸ Native signers are born to Deaf, signing parents and have been exposed to sign from birth, while early signers are born to hearing parents and are exposed to sign a few years later, usually in residential schools for the deaf.

The visual aids were placed in front of the consultant with the explanation that the colored circle represented the signer, while the other circles represented other imaginary people.

Note that I have not included dual forms in the above list for two reasons: (i) given the number of tokens elicited (75 verbs X 14 forms = 1050 tokens), it was desirable to minimize the number of tokens while maintaining breadth over a wide range of verbs; and (ii) I assume the dual form to be similar enough to the exhaustive form so that what holds true for the exhaustive form may apply to the dual form, with some minor exceptions.

To the best of my knowledge, never before have this many forms been gathered for so many verbs in four signed languages. Using the same methodology for each of the signed languages makes it possible to conduct an in-depth cross-linguistic study of 'agreement' phenomena in signed languages. Moreover, the changes that each verb undergoes for each form provides fertile ground for investigating phonological alternations, which is the focus of much phonology work in spoken languages but which otherwise has received little attention in sign language phonology.

All the forms were analyzed using a FileMakerPro database. A sample data entry form is enclosed in Appendix F. Each verb was entered using the HamNoSys notation, except for the movement part, which was coded using the specifications for the joints of the arm. Contact with the body and/or the non-dominant hand was also coded. For the singular forms, there were several checkboxes indicating whether there was a certain change in the articulation of the sign; a change in the orientation of the hand; a change in

the direction of the path; a change in the order of the hands if the sign is two-handed; a change in the non-dominant hand paralleling that of the dominant hand. For the exhaustive forms, there were three checkboxes: one indicating whether there was reduplication, one indicating whether there was 'alignment' (which will be explained in the next chapter), and one indicating whether the non-dominant hand participated in the same changes as the dominant hand. Finally, for the multiple forms, there were similar checkboxes as those for the exhaustive forms with one exception: the first checkbox indicated whether there was an arc 'sweep' rather than reduplication.

1.4 Overview

To explain these 'agreement' data, the thesis uses a combination of processes within the DM framework in the following order: an impoverishment rule, vocabulary insertion, a redundancy rule, a re-adjustment rule, and phonetic constraints. I will now give a brief overview of each.

I propose one impoverishment rule to account for the following data. The generalization is that a verb cannot mark two plural arguments at the same time. In such cases, the verb marks the subject as if it were singular (but still marks the number of the object).

(21)	Subject	+VERB+	Object
i. ok	[dual]		[+ singular]
ii. ok	[exhaustive]		[+ singular]
iii. *	[multiple]		[+ singular]
iv. *	[dual]		[- singular]
v. *	[exhaustive]		[- singular]

vi. * [multiple] [- singular]

- (22) Impoverishment rule:
For Agr-S, delete the feature [-singular]
in the context where Agr-O has the feature [- singular]

Next, I propose the following vocabulary items for verbs, AgrS, and AgrO:

- (23) For verbs:

Underlying form includes information about:

- handshape (including orientation)
- location
- movement if it is not a straight path away from the body

- (24) For AgrS:

[+ dual]	<---->	DUAL: two rapid reduplications across horizontal plane
[+ exhaustive]	<---->	EXH: two or three rapid reduplications across horizontal plane
Else	<---->	∅

- (25) For AgrO:

[+ dual]	<---->	DUAL: two rapid reduplications across horizontal plane
[+ exhaustive]	<---->	EXH: two or three rapid reduplications across horizontal plane
[+ multiple]	<---->	MULT: horizontal arc convex outwards
Else	<---->	∅

The one difference between AgrS and AgrO is that AgrO has a vocabulary item for the feature [+multiple] whereas AgrS does not. This accounts for the constraint noted by Padden 1983: verbs cannot mark the multiple number of a subject. In such cases, the next

closest match would be the elsewhere (default) option, i.e. a null morpheme. One will also note that these items do not make any reference to person features, since I argue that 'agreement' is a phonological re-adjustment which requires only a pair of loci for input and therefore does not make distinctions with respect to the person feature.

One will also see in the underlying form for a verb, there is no need to specify movement if it is a straight path away from the body. I assume that a redundancy rule like that below will fill in the needed information whenever movement is unspecified. The straight path away from the body seems to be the default specification, as it is the most common form of movement in verbs as well as in other signs of other lexical categories such as nouns and adjectives.

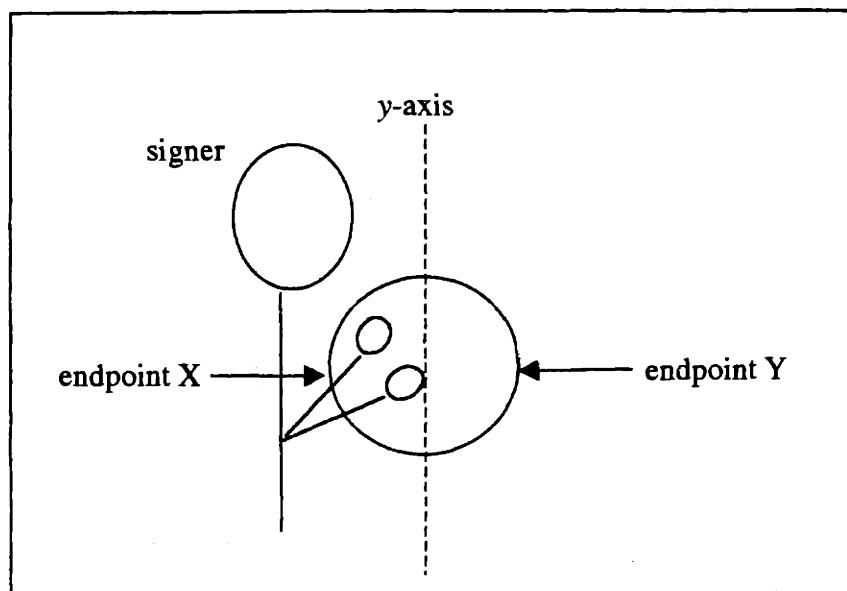
- (26) Redundancy rule:
Insert straight movement away from the body (where movement is unspecified).

Next, I propose the following phonological re-adjustment rule which generates the 'agreement' forms and which I call ALIGN-Sphere:

- (27) ALIGN-Sphere
Stem ---> Align stem / X ____

where X = (di)-transitive verb with two human arguments
where Align stem is defined as

- (i) rotating the whole sign with respect to the y-axis so that
endpoint X is aligned with the AgrS locus and
endpoint Y is aligned with the AgrO locus
- (ii) where endpoints X and Y are defined as in the following diagram:



Finally, phonetic constraints will filter any output of ALIGN-Sphere that is otherwise ill-formed. I provide two examples of such phonetic constraints here.

- | | | | | |
|------|---|----------------------------------|----------------------------------|-----------------------------|
| (28) | * | [shoulder]
inward
rotation | [elbow]
flexion | [radio-ulnar]
supination |
| (29) | * | [radio-ulnar]
pronation | [wrist]
sideways
extension | |

Through the above model, the thesis provides a new analysis that addresses many of the issues surrounding ‘agreement’ and more broadly, the use of the referential space in signed languages. By showing how this analysis works within the DM framework, the thesis also provides indirect support for the architecture of grammar endorsed by the DM view.

The rest of the thesis is devoted to justifying parts of the above model. Chapter two argues for the phonological re-adjustment rule as the relevant analysis of 'agreement' in signed languages. In addition to providing evidence in favor of the rule, the chapter discusses further issues concerning the rule, such as its application at a particular point in the grammar. Chapter three presents the other half of the model, the phonetic constraints which serve to filter the output of the re-adjustment rule. It will present arguments for the linguistic status of the phonetic constraints as well as discuss some possible substitutions or 'repairs' in the event of a violation. Then, chapter four will discuss some consequences of the model defended in the thesis. It will consider the implications that the new typology of verbs has for licensing of null arguments and will point out directions for future research.

Chapter Two

ALIGN-Sphere: A New Way of Looking at 'Agreement' in Signed Languages

This chapter provides a novel way of looking at verb agreement in signed languages that is both empirically and conceptually superior to traditional analyses. It also provides a new way of understanding verb agreement that addresses several issues raised in the previous chapter.

Section 2.1 introduces the concept of 'alignment' which I argue to be the relevant phonological implementation of verb agreement. I propose that this alignment occurs as a phonological re-adjustment rule within the Distributed Morphology framework. In section 2.2, I provide ASL data in support of the concept 'alignment'. Section 2.3 presents cross-linguistic data in support of the same concept, while section 2.4 presents further data on various other morphemes in light of alignment. Finally, section 2.5 resolves remaining data that do not fit as neatly under the concept of alignment.

2.1 Alignment as the relevant conception of agreement

2.1.1 Status of movement in agreeing verbs

Recall from the previous chapter that three types of movement are distinguished: lexical, morphological, and phonetic. Now consider the status that the movement in the ASL verb GIVE has. Let us distinguish between the citation form GIVE and the form aGIVEb, where locus a is on the right and locus b on the left.¹ In the citation form, the movement starts near the body and moves away in a slight arc in the midsagittal plane.

¹ The citation form is the form that is usually given when asked to give a sign for that word. It is also the form that usually appears in dictionaries.

Since one cannot change the movement without losing the meaning of the original sign, the movement is taken to be lexical. This is not controversial, for many other sign language researchers assume the same.

However, researchers differ on the status of the movement in the form aGIVEb. Everything about the movement, including the shape of a slight arc, is the same with one exception: the plane of the movement has been changed to the vertical plane, so that the initial point of the sign matches locus a and the final point matches locus b. Many researchers have taken the whole movement to be morphological, because it is possible to change the movement according to the different loci. In this section, I argue that only the endpoints of the movement are morphological. All other properties of the movement, including the shape of the slight arc and the direction (which goes from the first locus to the second locus), remain lexical.

If one does not distinguish the various aspects of movement, it is easy to confuse the path movement (i.e. the arc shape) for the morphological part of the sign. There are two potential sources for this confusion. The first source comes from the relative iconicity of many signs. For example, GIVE can look 'iconic' in the sense of handing one thing from one person to another and can mislead one into thinking that the movement contributes to the meaning of the sign. Meier (1982) shows the movement not to be iconic, for the signer's moving an imaginary item from one place to another does not resemble a third person giving something to yet another person. He also shows that the supposed iconicity of such signs does not aid deaf children in acquiring ASL.

Another source of confusion may come from trying to assimilate the patterns of agreeing verbs to those of classifier predicates. Classifier predicates are like agreeing

verbs in that they can involve movement between two morphological endpoints. The first endpoint can be associated with the SOURCE argument and the second endpoint, with the GOAL argument. One can modulate the movement in the classifier predicate so that endpoints match the loci. However, the similarity stops there. The endpoints are optional for classifier predicates but mandatory for agreeing verbs. In classifier predicates, the linguistic movement in classifier predicates actually denotes 'motion' and is therefore morphological, while the linguistic movement in agreeing verbs does not denote 'motion' but rather some other (abstract) action and is best treated as lexical.

The following analogy may help one to understand the distinction between agreeing verbs and classifier predicates. Think of some standard drawing software like the one that comes with MS Word. The program allows several operations. One is to rotate one of the ClipArt images that have been pre-loaded with the program. As a subcase of rotation, one can flip the image with respect to the vertical or the horizontal axis. Another operation is to draw a new image from scratch, using a 'pen.' The image need not conform to any shape in any of the pre-loaded ClipArt images. The shape can be completely novel. Naturally, drawing a new image from scratch is more 'expensive' than simply using one of the ClipArt images, given that one is not subject to any constraints.

The agreeing verbs are like the pre-loaded ClipArt images: their movement is lexical, but the movement can be subject to further (morphological) operations. The classifier predicates are analogous to the new images; one can choose from a limited repertory of handshapes and combine this with movement that is morphological. However, the 'images' that get frequently drawn can be frozen over time and be saved as new ClipArt, giving rise to new lexicalized verbs, which can be subject to the same

operations as agreeing verbs. In other words, agreeing verbs use space in a discrete way, while classifier predicates use the space in an continuous (analog) way.²

2.1.2 *Concept of alignment*

The analogy with the drawing software already illustrates ‘alignment,’ which I propose is the relevant conception of verb agreement in signed languages: there is an operation available in the grammar of signed languages called ‘Align Stem’ which entails the following:

(1) **Align Stem**

- (i) let the stem consist of the whole sign that is fixed by two endpoints, one closer to the signer (endpoint X) and the other, farther away from the signer (endpoint Y)
- (ii) link AgrS and AgrO with loci in the space
- (iii) rotate the whole sign in such a way that endpoint X is aligned with the AgrS locus and endpoint Y is aligned with the AgrO locus

I go over (i) and (ii) in turn, in which context I also discuss (iii).

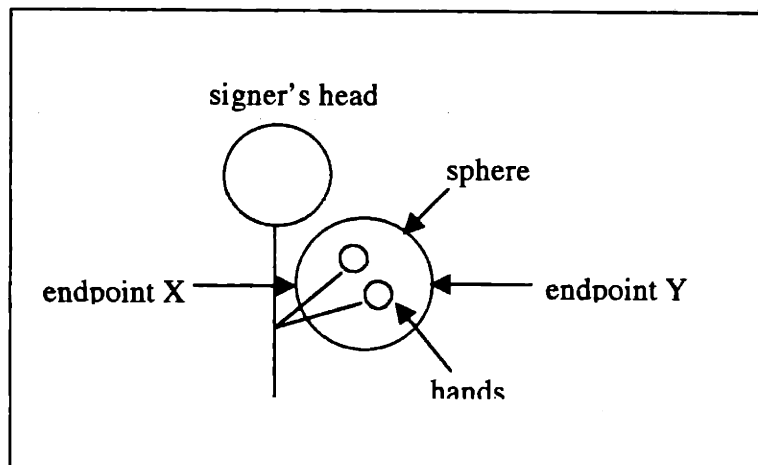
² This is consistent with what other sign language researchers (e.g. Lillo-Martin 1990, Padden 1990, Janis 1992) have observed about the different uses of space: with agreeing verbs, if one wants to use a locus that has been previously set up, it is sufficient to use a point near or around the locus; with classifier predicates, however, the distinctions are more precise and one must return to the exact locus as closely as possible.

2.1.2.1 The stem as a sphere and its endpoints

I assume that the stem/root is like a sphere encasing the entire sign. Within this sphere lexical properties of the sign such as the path movement are encoded. However, the grammar cannot 'see' the lexical properties inside the sphere until much later in the phonology component. Following the Distributed Morphology framework, the grammar can see only the sphere, i.e. the root, throughout syntax and morphology. Operations such as head movement, fission/fusion, and impoverishment rules may apply to the features that are associated with the sphere/root. Vocabulary Insertion then inserts lexical material into the sphere/root. However, I assume that the lexical material is still inaccessible to the grammar when phonological re-adjustment rules apply. That is, the re-adjustment rules still apply only to the sphere/root. Later in the phonology component, perhaps even in the phonetic component, the 'sphere' is removed and whatever material is inside the sphere can now be evaluated against phonetic constraints.

With this background in mind, I assume that the sphere has two endpoints, one that is closest to the signer and one that is farthest, as schematized in the following figure:

(2) The root as a 'sphere' with endpoints



One must fix the endpoints at the particular points shown in the above diagram, because if one fixes the endpoints at other points on the sphere, one will not derive the correct form of the sign. For example, consider the sign aGIVEb. In root form, the movement is a slight arc going from endpoint X to endpoint Y. Suppose the endpoints were fixed on the top and bottom points respectively. If one aligns the sign by aligning the sphere such the 'north pole' aligns with locus a and the 'south pole' with locus b, the orientation of the sign will be incorrect: the palm will be facing locus a rather than up.

One could fix this problem by changing the underlying representation (UR) of the sign GIVE so that rather than starting at endpoint X and ending at endpoint Y, it starts at the top point, goes in a slight arc that is concave to the left, and ends at the bottom point. Then aligning this root according to the top and bottom points will yield the correct result. We see that as long as the endpoints of the sphere are equivalent to the starting and ending points of the UR movement, it does not matter where we fix the endpoints. Two other considerations, however, argue against this alternative UR. First, there are operations other than alignment that apply to the sphere, and they do not necessarily require rotating the sphere. For example, operations which express aspect will require the correct UR to be from endpoint X to endpoint Y. The iterative aspect involves reduplication of the movement from endpoint X to endpoint Y, not from the top point to the bottom point. Similarly, the continuative aspect extends the movement between endpoint X and endpoint Y, not between the top point and the bottom point.

The other consideration which argues against the alternative UR is that it can be more 'expensive' to rotate the sphere in the sense that in some cases, one must use more

than one axis of rotation to align the endpoints with the loci. To align the top and bottom points with loci that are associated with the signer and the addressee respectively, one must rotate the sphere with respect to the axis that goes away from the body (same as for alignment with loci a and b). Then one must perform another rotation with respect to the axis that runs along the length of the body, i.e. the y-axis. With the original UR, it is sufficient to use this axis once not only for pairs of loci involving the signer and the addressee but also for any other pairs of loci within the space.³ Thus, it makes sense to fix the UR as going from endpoint X to endpoint Y in order for alignment to apply to the sphere correctly. Other data in section 2.2 will also make clear that this is a step in the right direction.

A verb should also be able to align for loci that are beyond the usual 'signing space.' Suppose that the object locus is on the right side, while the subject locus is also on the right side but much further off in the distance. One can shift and rotate the root/sphere so that the endpoints are aligned with the AgrS and AgrO loci. The preceding discussion may make it look that the sphere must stay near the body all the time, but as the previous example shows, it, or more precisely the y-axis, is movable within the space, depending on discourse factors.⁴

This brings us to another illustration of the difference between agreeing verbs and classifier predicates in their use of space: in agreeing verbs, where the loci are associated with animate arguments, they tend to be arrayed in a horizontal plane, not in the vertical

³ There are special circumstances in which locus a can be higher than locus b, i.e. the case of a mother giving something to a small child. In that case, if one uses the original UR, one would indeed need two axes of rotation, but again this form is rare and if used, is quite marked, which would be expected from the complexity of the rotation.

⁴ This observation is due to Patrick Boudreault.

or midsagittal plane. On the other hand, in classifier predicates, where one can assign loci to locative arguments, the loci need not be restricted to the horizontal plane.

2.1.2.2 Linking AgrS and AgrO with loci in the space

How does the grammar (via AgrS and AgrO) link with loci in the space? I suggest that Agr heads are associated with the loci through the referential index. Sometime during the derivation, the heads AgrS and AgrO will inherit the indices of the subject and object noun phrases respectively. Then the indices will each be linked with some locus in the space through a general process that is also available for other subsystems of signed language grammar, such as pronouns, nouns, adjectives, and even plain verbs.

Something more abstract than the referential index may actually link with the locus, because one will need a mechanism to allow different ways of associating with a plural entity: a group entity (which is indicated with a single locus), an 'exhaustive' entity (which is marked by a series of successive loci), and a 'multiple' entity (which is shown by an arc sweeping through a series of loci). I leave this aside for future research in semantics and discourse representation theory (DRT). For now, I assume that it is through the referential index that the Agr heads are linked with the locus. This is consistent with the model of language presented in (11) of the previous chapter, where the referential space is not part of the grammar of signed language.

2.1.3 *Alignment as a phonological re-adjustment rule*

In this subsection, I argue that the operation 'Align stem' takes place as a phonological re-adjustment rule within the Distributed Morphology framework, formalized as follows:

- (3) Re-adjustment Rule
Stem ---> Align stem / X ____

where X = agreeing verb

where Align stem = as defined in (1)

The arguments for the status of alignment as a phonological re-adjustment rule are two:

(i) since alignment must take place after Vocabulary Insertion but before phonetic constraints apply, the architecture of grammar provides only one place where this is possible, namely the phonology component, and (ii) alignment does not apply to all verbs but only to a select few in an unpredictable manner. This second property is characteristic of re-adjustment rules. In the course of acquisition, one must learn on the basis of positive evidence which of these verbs may align. I now elaborate on each of these arguments.

To understand why alignment must apply after Vocabulary Insertion (VI), consider the following ASL sign ASK. I assume that the underlying representation has the palm facing outward and the movement going straight away from the body. Suppose that alignment takes place before VI. Start with a root/sphere that has no lexical material in it. Now align this sphere so that endpoints X and Y align with subject and object loci respectively. Next apply VI, which has the effect of filling the sphere with lexical material. This will be the UR of the sign: the palm will face outward and the movement

will be straight away from the body. This form is correct if the subject and object loci are associated with the signer and the addressee respectively. However, if the loci are associated with other referents, the form will not be correct, because the palm will face outward and not towards the object locus. Similarly, the movement will remain straight away from the body, not towards the object locus as it should. When alignment occurs before VI, it becomes vacuous: while the sphere will rotate, the lexical material will not, since it will not have been included in the sphere at the time of its rotation.

Alignment must also take place before phonetic constraints apply. I describe the phonetic constraints in detail in Chapter 3, but for now, I introduce one for illustration. One constraint filters out forms which involve twisting the hand sideways when the palm faces downward. I call this constraint *[upper arm prone, radio-ulnar prone, wrist abduction]. Consider a sign whose underlying form has the palm facing downwards: GET-HOLD-OF. Suppose that one wants to perform alignment of this sign for two loci located on the right and the left respectively, where the right locus is associated with the object and the left locus, with the subject. To do this, one would have to twist the hand sideways to the right while keeping the palm down. This form is not possible and is instead replaced with one of the alternative forms, e.g. a form which drops the alignment. If a phonetic constraint like the above feeds on the output of the alignment, one can explain this result. However, if one were to switch the order of the application of alignment and phonetic constraints, one would incorrectly pass the form: assume that the GET-HOLD-OF has not yet been aligned. It would pass the phonetic constraint, since the sign is still in its underlying form and the hand has not been twisted sideways to the right.

If alignment then applies, we would obtain the incorrect result that the form in which the hand twists sideways to the right is well-formed.

Not only must alignment take place between Vocabulary Insertion and the phonetic constraints, but also alignment can apply only to a list of verbs that must be memorized. That is, **alignment** is a lexical property dividing agreeing verbs from plain verbs. It must be lexical, because the same verb may or may not align depending on the signer's region, age, and/or language. For instance, the ASL sign TEST can align in certain regions such as the northeastern United States, but not in the southwestern/Texas areas. Also, ASL signs such as TEACH, TEASE, and TRAIN at one time did not allow alignment, but now do.⁵ The underlying form of the signs have remained the same through time; the only difference is that they now allow alignment. Engberg-Pedersen (1993) has noticed a similar pattern for Danish Sign Language; non-aligning verbs tend to become aligning verbs in stages over time. Note that aligning verbs do not become non-aligning verbs. Supalla (1996) has also noted a similar process for ASL, that verbs may change over time so that they show more of the features in his implicational hierarchy. This one-way direction of historical change supports the lexical status of alignability. Finally, there is a sign which is the same in both ASL and DGS: ACCEPT. It can align easily in DGS. However, in ASL, ACCEPT is strictly a plain verb. Supalla (n.d.) also cites several examples, such as PHONE, which are similar across various signed languages but vary in their ability to align. Those variations are, moreover, easily learnable on the basis of positive evidence: children determine that a verb is aligning once they have seen an instance of the verb being aligned.

⁵ I thank two native Deaf ASL signers, Gene Mirus and Norma Tourangeau, for pointing out this fact.

One should keep in mind that just because a verb is not able to align does not mean that the verb is missing the abstract syntactic (and semantic) features such as person and number. Alignment is overt morphological marking and is just one way to make the features visible. There are other means to make the features visible, such as overt pronouns or context if it is clear enough. Alignment may also be partial due to phonetic reasons. I will discuss all those optional forms in Chapter 3, but the point remains that alignment is available as an agreement-marking device via a phonological re-adjustment rule for a select few of the verbs that categorize for two animate arguments.

One consequence of alignment and the role of space with respect to the grammar is that alignment does not formally distinguish between different pairs of loci. There is nothing special about the alignment for loci associated with the signer and the addressee compared with the alignment for loci associated with referents on the right and the left. This departs from Supalla's implicational hierarchy, which categorizes verbs according to whether they can mark object number, object person, subject person, and subject number. My analysis predicts that if a verb can align for a given pair of loci, then it can align for any other pair of loci. It does not matter what the pair of loci is. Thus, a verb can align for the signer as the object if and only if it is able to align for the loci on the right and left sides. On the other hand, Supalla's (1996) implicational hierarchy, which ranks subject person above object person, predicts that there may be verbs which agree with both object and subject person; verbs which agree with object person but not subject person; but no verbs which agree just with subject person and not with object person. The alignment model predicts the existence of all three types of verbs, and the only reason the

ability to align differs across these verbs (in fact, across any pair of loci) is due to phonetic constraints.

2.2 ASL data in support of alignment

The strongest argument for alignment comes from the fact that it unifies the different forms of agreement, all of which are predictable from the lexical properties of the verb. In this section, I present several kinds of underlying forms with which alignment interacts to yield the correct results. I go over each kind in consecutive subsections: (i) forms with orientation change but no path movement, (ii) forms with only path movement but no orientation change, (iii) forms with both orientation change and path movement, (iv) forms similar to (iii) but with the additional change in hand order, and (v) forms with change in hand order and orientation but not in path movement.

2.2.1 Change in orientation

In the following table are ASL signs in which only orientation changes as a result of alignment. I will pick one example from each type and describe its underlying form and the resulting alignment. There are four types of signs according to Battison (1978): type 0 signs are one-handed; type 1 signs are two-handed and symmetric; type 2 signs are two-handed and non-symmetric, with the hands having the same shape; and type 3 signs are two-handed and non-symmetric, with the hands having different shapes. By showing that there are examples from every type, I control for the factor of type. Recall also that the appendix provides the complete underlying forms of each sign in the HamNoSys font.

(4) Table of ASL signs which change only in orientation for alignment

Type 0	Type 1	Type 2	Type 3
FORCE1 IGNORE1 PICK-UP PITY1 REMIND1	ANALYZE ANSWER CONTROL CONVINCE2 FEED LOOK-UP MOCK PITY2 TEACH TEST	DEPEND-ON TAKE-CARE TEASE	FILM HIT2 PAY2

I start with one example from the Type 0 column. REMIND1 is made with the bent-B handshape, with the palm facing outward and with shaking movement from the elbow. When one aligns this sign, the fingertips must face the object locus while the back of the hand faces the subject locus. The lexical movement from the elbow remains the same, as do other lexical properties of handshape, location (in the neutral area), and palm orientation.

The sign ANALYZE involves two hands moving symmetrically. The handshapes are the bent-V, and the palm faces outward, while the location is in the neutral area. The movement involves bending the K2 knuckles as well as moving the arms down from the shoulder. Another variant has the movement distalized to the upper arm: it twists back and forth sideways. The aligned form has the palm of both hands facing the object locus, and the back of the hand facing the subject locus. Otherwise, all other lexical properties, including the movement, remain unchanged.

Now consider the sign DEPEND-ON, which also involves two hands in the same shape, G, but the dominant finger rests on top of the non-dominant finger on the K1 knuckle. The palm orientation is down, and the location is in the neutral area. The

movement is downward, either from the wrist or from the elbow. In alignment, the fingertips face the object locus. Unlike the above two signs, however, the back of the hand does not face the subject locus, because in the underlying form, the back of the hand faces up and so cannot face any loci, which are in the horizontal plane. Not only the palm orientation but also the handshape and the downward movement, all of which constitute the lexical properties, are constant in the aligned form.

Next, the sign FILM involves both hands, but the hands have different handshapes. The dominant hand is in the bent-5 handshape, while the non-dominant hand is in the G handshape. The wrist of the dominant hand rests on the tip of the non-dominant finger. In this configuration, the palm faces outward, and there is trilled movement from the wrist, i.e. the hand shakes up and down. When one aligns FILM, the fingertips and the palm face the object locus, and the back of the hand predictably faces the subject locus, but the lexical movement of waving up and down is still the same.

An additional note is in order regarding the signs REMIND1 and CONVINC2 which have special forms for 1st person object: REMIND1 contacts the shoulder, while CONVINC2 contacts the neck on both sides. If one posits that the location parameter is specified for the shoulder and for the neck respectively in their underlying form, one can derive the correct aligned forms, not only for 1st person object but also for any other pair of loci. The only difference is for the other pairs of loci, the hands will be contacting an imaginary shoulder or neck in the space. (This is similar but not identical to what Liddell 2000 argues for agreeing verbs.)

All the signs in this category have in common some special lexical movement, which usually involves some twisting movement from one of the joints (as illustrated by

all of the above examples). This lexical movement must be preserved through alignment, but the orientation can change so that the palm orientation and/or the fingertips face the object locus. Orientation change usually involves a twist of the wrist (e.g. CONTROL, FEED, DEPEND-ON, TEASE) or the radio-ulnar part (e.g. REMIND, ANALYZE, FILM, MOCK, TEACH). The underlying form of all these signs has the orientation in such a way that it is possible to apply the twist. Specifically, the orientation has the wrist in the neutral state (neither flexed nor extended sideways) and/or the radio-ulnar part in prone state. The back of the hand faces the subject locus only if the hand is up and the palm is facing outward (as in REMIND, ANALYZE, and FILM). However, there are many more signs like DEPEND-ON (e.g. CONTROL, FEED, MOCK, TEASE, TEACH) in which this is not the case. In some of these signs (e.g. FEED, MOCK, and TEACH), the fingertips face the object locus but in other signs such as CONTROL and TEASE, it is the back of the K1 knuckles which actually face the object locus. One can predict all of those forms if the underlying forms of these signs have the hands face endpoint Y in a particular configuration and if alignment applies to these forms.

2.2.2 *Change in direction of path movement*

The next set of signs mark alignment only through a change in the direction of the path movement.

(5) Table of ASL signs which change only in direction of path movement for alignment

Type 0	Type 1	Type 2	Type 3
INVITE PHONE PHONE2 VISIT3	INFORM VISIT		CALL-TTY FALL-IN-LOVE HELP SHOW

The sign PHONE is made with the Y-handshape, and the back of the middle three fingers either touch or are situated near the right ear, on the cheek. The palm orientation is towards the face, and the movement is in a straight path away from the face, made from the elbow. (Again, there is a distalized variant available, in which the movement is made from the wrist.) To align for the object locus that is associated with the signer, only the direction of the movement changes: the hand starts at the subject locus and moves back to the face. For pairs of loci that are in the space, one may delink the location on the face, and have the hand start at the subject locus and move directly to the object locus. While the initial body contact is lost and the direction of the path changes, the orientation and handshape remain constant.

For a two-handed symmetric sign, consider INFORM. Both hands start in the flat-O handshape and open into a lax 5 handshape (with the K1 joint) as they move away (with the use of the elbow) from the forehead. The palm orientation is angled between towards the face and towards up. Again, for alignment, the initial contact with the forehead is lost, and the path moves from the subject locus to the object locus. The fingertips nor the palm change their orientation during alignment. There are actually several other ways in which one can align INFORM, i.e. one may tilt the fingertips slightly towards the object locus or one may preserve the initial contact with the forehead and inflect it like TELL and VISIT (which I describe in section 2.5), but one form clearly allows for change only in the direction of the path movement. It makes no difference for alignment that this is a two-handed symmetric sign: the non-dominant hand merely shadows the dominant hand in its movement.

No type 2 signs have been found for this category, but this should not be taken to be meaningful, since the sample of the data is relatively small, plus the distribution of type 2 signs is small in general compared with the other types, so it is not surprising that no such signs have been found.

There are a few type 3 signs which pattern in the same way as the above described signs, such as HELP. The dominant hand is in the A handshape, but with the thumb stretched out, and the ulnar side (i.e. the side of the pinky finger) rests on the non-dominant hand which is in the B handshape and has the palm facing up. The palm orientation of the dominant hand is similar to that for PHONE, i.e. towards the body, and the movement is a straight path away from the body. To align the sign, one changes the direction of the path movement so that it starts at the subject locus and ends at the object locus. Everything else remains the same, including the the orientation of the hands both in relation to each other and in relation to the body.

Unlike the first set of verbs described in subsection 2.2.1, the verbs described here have in common that they involve straight path movement , which changes its direction according to the pair of loci. The orientation remains the same, although it should in theory be subject to alignment. The orientation of these signs is such that it is next to impossible to change the orientation even in a slight way. For example, twisting the hand in PHONE is difficult, since it is already twisted to the max in the underlying form. The palm orientation in INVITE faces up, so that aligning it would mean raising the shoulder past the point of comfortable signing. Similarly, signs such as FALL-IN-LOVE and HELP have the non-dominant hand facing up and have the same problem as INVITE in aligning. The underlying forms of SHOW and VISIT do not have the hands facing away

from the body nor towards the body; rather, the hands must face each other in a particular relationship, and if one were to align these signs 180 degrees for an object locus associated with the signer, one would have to raise the shoulder to an awkward configuration. Finally, it is phonetically possible to align the signs INFORM and CALL-TTY, but there seems to be a preference not to. Given that it is only phonetic constraints which hinder the alignment of orientation in these signs, they should be properly classified under the following category of verbs that allow for alignment of both orientation and path movement. However, I group them separately because I want to highlight the fact that there are a significant number of verbs which cannot align orientation due to phonetic reasons.

2.2.3 *Change in orientation and direction of path movement*

The next category is by far the biggest. This is not surprising, for this seems to constitute the most prototypical situation in which both the direction of the path and the orientation undergo change during alignment.

(6) Table of ASL signs which change direction of path and orientation for alignment

Type 0		Type 1	Type 3
ASK1	KILL-fs	ABANDON	BLAME
ASK2	LOOK	BAWL-OUT	SEND2
BEAT1	LOOK+aspect	CATCH2	
FAX-fs	OVERCOME	FOLLOW	
FAX1	PAY-fs	GIFT	
FEEDBACK1	PAY1	GIVE-HARDTIME	
F-CK	PICK1	HATE2	
F-CK-fs	SAY-NO		
GIVE1	SEND1		
GIVE2	SHOOT-GUN1		
HIT1	SHOOT-GUN2		
INSULT1	STAB		
INSULT2	WOP		
JOIN1			

Apart from the high frequency in members, two other factors point to this category as the most prototypical, default one: all the signs in the table align regularly without any exceptions across all pairs of loci (contrast with REMIND1 and CONVINC2 in the first category which have "special" forms for 1st person object), and any newly formed signs arising from lexicalized fingerspelling such as FAX-fs, F-CK-fs, KILL-fs, and PAY-fs all belong to this category.

Let's now go over some of these signs. In the underlying form, ASK1 is made with the index finger which flexes at the K1 joint at the same time the arm is extended away from the elbow. The arm is upright so that the palm faces outward. Alignment requires twisting the radio-ulnar part so that the palm faces the object locus. Following that, the lexical movement of both the K1 joint and the elbow are carried out as usual.

The sign BAWL-OUT, which is of Type 1, also aligns in much the same way as ASK1. In the underlying form, BAWL-OUT is made with two hands in the S handshape, with the ulnar side of the dominant hand resting on top of the radial side of the non-dominant hand. The palm of the dominant hand faces to the left (for right-handed signers) while the palm of the non-dominant faces to the right. As with ASK1, the lexical movement consists of two simultaneous parts: the hands open into a 4-handshape through the extension of K2 knuckles at the same time that the arm is extended from the elbow. For alignment, one again twists the radio-ulnar part of the sign so that the underlying front part of the sign faces the object locus. From that configuration, the lexical movement is then carried out.

Again, as with the previous category, there are no examples of Type 2 in this category for the same reasons; Type 2 signs are relatively infrequent, plus the size of the

sample ($n = 151$) is quite small compared to the size of the entire vocabulary of verbs, which presumably runs into the thousands.

Next, consider a Type 3 sign like SEND2. In the underlying form, the dominant hand is in the bent-B handshape whose fingertips rest on the back of the non-dominant hand, which is in the lax-5 handshape. The palm orientation of both hands face downwards. After initial contact with the base hand, the dominant hand flattens into a straight B handshape through the extension of the K2 knuckles, while the arm is carried forward through an extension from the shoulder. Under alignment, the radio-ulnar part of the dominant arm twists so that the fingertips face the object locus at the time of the hand's flattening into the B handshape.

The non-dominant hand in SEND2 does not participate in alignment due to phonetic reasons. Since the ulnar side of the non-dominant hand faces the front (i.e. endpoint Y), if one were to align this hand, one would have to twist the arm inward, going beyond the threshold of optimal signing. However, there are many other instances in which the non-dominant hand can participate in alignment. For instance, in Type 1 signs like BAWL-OUT, the non-dominant hand can shadow the dominant hand in its alignment, or as will be described in the next two subsections, the non-dominant hand can align in other ways. In fact, the next two categories are actually subcases of most Type 3 signs in this category. Hence there are not too many Type 3 signs here.

All of the above examples involve two lexical movements occurring simultaneously, one either from the K2 or K1 or the wrist and the other from the elbow or the shoulder, but there are also other examples which involve just one lexical movement, e.g. GIVE1, JOIN1, LOOK, and WOP from the one-handed category and ABANDON,

FOLLOW, and GIFT from the two-handed category. All the verbs in the above table share some property in common with each of the previous two categories: (i) the verbs' underlying orientation has the wrist in the neutral position and the radio-ulnus in the prone position, both of which are easily changeable and therefore amenable to alignment, as with the verbs in the first category (subsection 2.2.1), and (ii) the verbs' underlying movement includes a straight path away from the body, with the optional addition of a finer movement from within the hand. While this finer movement must be preserved, the direction of the bigger, path movement is amenable to alignment as in the verbs in the second category (subsection 2.2.2).

2.2.4 Change in orientation, direction of path movement, and hand order

If the sign involves two hands which are different from each other, that is, if the sign is of Type 3, one would expect that alignment would affect not only the dominant hand but also the non-dominant hand, given that both hands are included within the root/sphere, and this is indeed the case. Since in Type 3 signs, it is only the dominant hand which moves, alignment accordingly affects only the movement and orientation of the dominant hand. However, the non-dominant hand still participates in alignment through a change in orientation and/or a change in its relative order to the non-dominant hand. For example, if the non-dominant hand is in front of the dominant hand in the underlying form, a alignment for 1st person object will place the non-dominant hand behind the dominant hand. I will provide specific examples, but first here is a list of signs which undergo such a process.

(7) Table of ASL signs which change direction of path, orientation, and hand order

Type 1	Type 2	Type 3
CLASH	CONTACT KISS MEET OPPOSE REVENGE1 SUPPORT USE-BORROW WIPE-OUT	ADVISE APPROVE ARREST CALL COPY FLICK FLIP FORCE2 INFLUENCE JOIN2 OPPRESS PICK-ON RECRUIT SLIDE-OFF TAKE-ADVANTAGE

Since this category involves only two-handed signs, there are no Type 0 signs. Alignment of hand order is generally visible only when there is some asymmetry between two hands with respect to orientation, movement, and point of contact. Hence most of the signs belong to Types 2 and 3. However, there is one Type 1 sign which could fit into this category: CLASH.

In the underlying form of CLASH, the two hands start in the O handshape and slightly apart from each other. They open into a 5 handshape (via extension of the K2 knuckles) and 'clash' into each other, making contact on the palms. The dominant hand is upright so that the palm orientation faces away from the body; while the non-dominant hand mirrors that orientation, i.e. it faces the body. In order to align the sign, one only need to twist the radio-ulnar part of both arms so that the back of the dominant hand faces the subject locus while the back of the non-dominant hand faces the object locus.

In a type 2 sign, both hands also have the same handshape, but the non-dominant hand stays in place while the dominant hand carries out the movement. For example, in the sign MEET, both hands have the index handshape. In the underlying form, the non-dominant hand is upright and the palm faces the body, and while the dominant hand is

also upright, it has the opposite orientation, i.e. it faces away from the body. The dominant hand moves towards final contact with the non-dominant hand on the closed fingers. If one aligns the sign, the back of the dominant hand will face the subject locus while the back of the non-dominant hand will face the object locus. Everything else will follow from the aligned form: the two hands will stand in the same relation to each other, and the dominant hand will move towards the non-dominant hand.

Now consider a type 3 sign like JOIN2, in which the two hands have different handshapes. The dominant hand is in the H handshape, is upright, and faces to the left palm-wise, while the non-dominant is in the C handshape, is at mid-level and faces to the right palm-wise. The movement consists of the dominant hand moving (via elbow extension) towards final contact on the radial side of the non-dominant thumb. What happens when one aligns this sign? The whole unit will shift such that the base of the dominant hand is towards the subject locus, while the back of the non-dominant fingers is to the object locus. Again, this can be accomplished with a twist of the wrist and/or the radio-ulna. The direction of the movement of the dominant hand will then follow correctly from the aligned form.

These signs are actually a subset of the previous category: the movement in all of the underlying forms of the dominant hand is a straight path away from the body, while the orientation is in a neutral state and easily alignable. Moreover, the non-dominant hand stands in a particular order with the dominant hand, which is also affected by alignment.

2.2.5 *Change in orientation and hand order*

There is another set of verbs which may be properly included under the first category, since all the verbs have special lexical movement which must be preserved, but their orientation can be aligned. Add to these properties the relative order of the two hands. In the first category, the hands stand in a neutral order with respect to each other such that in any aligned form, either the order remains the same from the point of view of the signer or the aligned order becomes impossible to implement phonetically that it is dropped (as will be described further in Chapter 3). In this category of signs, however, it is possible to align the hand order.

(8) Table of ASL signs which change orientation and hand order under alignment

Type 1	Type 2	Type 3	
FEEDBACK2	BOTHER CHASE PRAISE RUB-OUT	ABUSE BEAT2 CRITICIZE DISCRIMINATE FLATTER OVERCOME2 REMIND2	SPOIL STARE-AT TAKE-PICTURE TRAIN TRICK WARN

One example from the Type 1 column is FEEDBACK2. Both hands are upright and start in the F handshape, facing each other. The back of the dominant hand faces the body, while the palm of the non-dominant hand faces the dominant hand. The movement consists just of opening the F-handshape into a bent-5 handshape via extension of the index finger, with optional wrist flexion. There is no straight path away from the body, although the dominant hand does twist at the wrist away from the body. When one aligns the sign, e.g. for a 1st person object locus, the back of the non-dominant hand faces the

object locus while the back of the dominant hand faces the subject. The lexical movement then follows in this aligned form such that the dominant hand twists towards the body.

Another example is BOTHER which is of type 2. Both hands have the same B handshape, but the non-dominant hand is stationary while the ulnar side of the dominant hand repeatedly contacts the non-dominant hand in the area between the thumb and the index finger. The palm of the non-dominant hand faces the body, while the palm of the dominant hand faces to the left. When alignment applies to this underlying form, the result is that the back of the non-dominant hand and the fingertips of the dominant hand both face the object locus. Thus, if the subject locus is associated with the signer and the object locus with the addressee, the dominant hand is closer to the body. However, if the loci are aligned, it is the non-dominant hand which is closer to the body. Within this aligned context, the dominant hand continues to carry out the lexical movement of repeatedly contacting the non-dominant hand.

Next is an example of type 3: CRITICIZE. In the underlying form, the non-dominant hand is in the B-handshape and its palm faces the body while the fingertips point to the right. The dominant hand consists of an index finger; the palm faces down; and the fingertip contacts the palm of the non-dominant hand. The movement consists of the index finger criss-crossing against the palm of the base hand via the elbow's flexing sideways. This is a nice example in which the movement is not at all directed away from nor towards the body but is still preserved in the aligned form, wherein the back of the non-dominant hand faces the object locus while the base of the dominant hand is to the subject locus. Thus, as in the case of FEEDBACK2 and BOTHER, if the object locus is

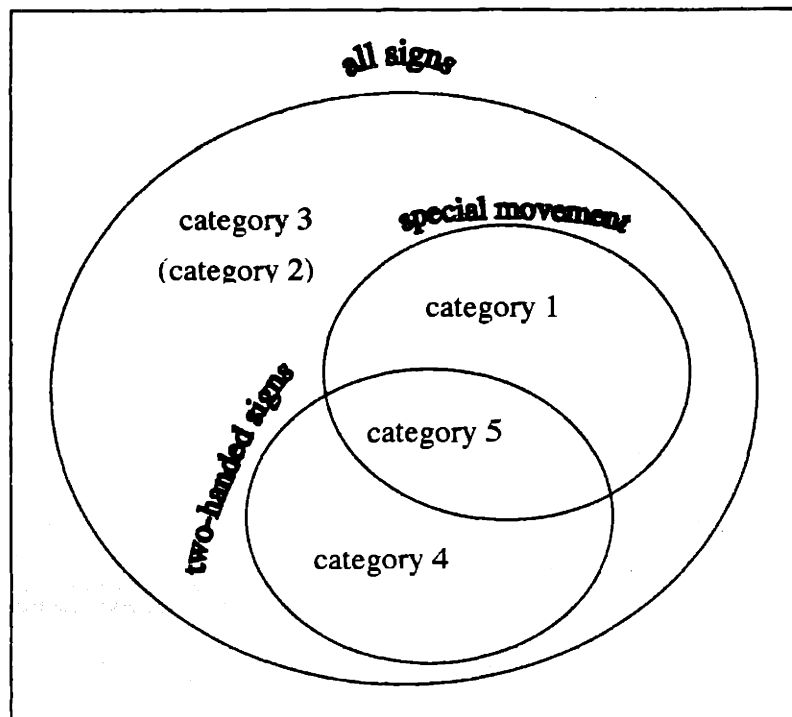
linked with the addressee, the dominant hand is closer to the signer, but if the object locus is linked with the signer, the non-dominant hand becomes the closer one.

In sum, the underlying forms of the signs in this category are similar to those for signs in the previous category with one difference: the movement is not a straight path away from the body, so that alignment affects just the relative order of the hands and consequently the orientation of the individual hands.

2.2.6 *Summary*

The general picture that emerges is that alignment affects the whole unit. This means that at the phonetic level, the orientation of the hand and the direction of the movement changes (category 3). Category 2 also fits into this same description, since it is only phonetic factors which prevent the orientation of the hand from changing. Within category 3, there is a subset of two-handed signs in which the two hands do not stand in a static relation to each other. The non-dominant hand too changes orientation to the extent that is permitted by phonetic constraints, and the relative order of the hands changes as well (category 4). There is yet another subset of signs within category 3 which have a specific lexical movement that cannot be changed. The consequence is that only the orientation changes (category 1). Category 4 and category 1 intersect to yield category 5, which consists of two-handed signs that have specialized lexical movement. In those cases, only the orientation of the hands and their relative order change.

(9) Different forms of alignment and how they relate to one another



There are examples which do not fit so neatly into one of these categories.

Consider the sign BORROW, which is formed with two K handshapes, the dominant hand's ulnar side resting atop the non-dominant hand's radial side (specifically, the area between the thumb and the index finger). The dominant hand's palm faces to the left while the other hand's faces in the opposite direction. The movement consists of twisting inward (pronating) the radio-ulnar part of the arm, so that the fingertips look as if they are tracing an arc towards the body. To align this sign, one needs to have the front of the sign face the object locus and then have the movement carried out. However, for an object locus associated with the signer, it is phonetically impossible to have the front of the sign face the signer. Instead, one drops the orientation change and aligns only the direction of the arc, which merely involves twisting outward (supinating) the radio-ulnar part, so that

the fingertips trace an arc in the opposite direction. For this reason, I would put BORROW under category 2 (and consequently under category 3). Unlike most signs in this category, the sign does not involve a straight path movement, but the direction of the movement still aligns, so it does not matter what shape the movement has but what direction it has. In other words, the shape of the movement is lexical and remains unchanged through operations such as alignment, but the direction of the movement is changeable.

Interestingly, there is a one-handed version of BORROW which drops the non-dominant hand. Free of contact with another hand, the dominant hand can easily align both in orientation and direction of the arc for most pairs of loci, including those between the signer and the addressee, so that the one-handed version would fit into category 3. This suggests that the two-handed BORROW is correctly grouped with category 3 or more precisely with category 2 due to its phonetic character.

There are more unique examples to be found from other signed languages which do not involve straight path movement, which now takes us to the next section.

2.3 Cross-linguistic data in support of alignment

In this section, I present cross-linguistic data from three signed languages different from ASL: DGS (German Sign Language), AUSLAN (Australian Sign Language) and NS (Japanese Sign Language). They provide important empirical support for the concept of alignment in three ways. First, if alignment is taken to be a operation available for signed languages in general due to emergence from the modality-specific articulatory system, one should expect to see similar data in other signed languages. As

we will see, this is indeed the case. Second, the size and variance of the sample data is substantially increased so that the data is more robust. We find even more diverse examples that can be explained by alignment.

Finally, alignment is an operation having to do with phonology/phonetics, so it should not matter what the meaning of the sign is. This predicts that signs that have similar meanings but have different phonetic forms across signed languages should pattern differently with respect to alignment. In fact, even signs that are similar both in meaning and phonetic form across signed languages may still pattern differently, given that alignment applies to an arbitrary list of words that must be memorized. Also, signs that have similar phonetic form but are otherwise unrelated in meaning across signed languages should pattern in the same way, that is, if they appear on the list of stems that alignment applies to in their signed language.

I devote one subsection to each of the three signed languages. The structure of each subsection will be similar to that for the previous section: I will group signs according to the same categories outlined above. Throughout these sections, I will draw comparisons across the signed languages and provide specific instances of what I discuss in the preceding paragraph.

2.3.1 *Deutsche Gebärdensprache (DGS)*

As described in the methodology section in the first chapter, seventy verbs with the appropriate argument structure (transitive or di-transitive with two animate arguments) were elicited from DGS in aligned forms for various pairs of loci. For one signer, most of the forms (47 to be exact) were ‘plain’; that is, they did not align for any

pair of loci. Instead, the signer used a person-agreement marker (PAM) with these verbs. PAM is an auxiliary-like element that carries morphological agreement. See Rathmann (1999) for further discussion of PAM. The other 23 verbs, however, do show alignment in some way, and they conform to the same categories that have been outlined for ASL.

One will notice that in the following categories there is an absence of type 2 or type 3 signs. There are two possible reasons for this: (i) out of the whole sample, there are not many signs of type 2 or 3 (16 compared with 24 signs of type 0 and 30 signs of type 1), and (ii) with all type 2 or 3 signs that do exist, the signer uses PAM. I will assume that these signs are all plain, that is, they do not appear on the list of stems that alignment applies to. Since there are no type 2 or 3 signs which show alignment, there are no examples of categories 4 and 5, both of which consist solely of these signs.

One may wonder if any of these signs can be potentially aligned, perhaps in another generation or in another region. I have identified one sign, VERBESSERN 'correct' which has the potential for being aligned. This sign is made with the V handshape. The hands face each other palm-wise, while the fingers point away from the body. The side of the dominant middle finger brushes against the top side of the index finger. Since the radio-ulnar part is not twisted in any way in the underlying form, it is possible to align the orientation of the fingertips by twisting the radio-ulnar part. Thus, while both informants have not elected to mark alignment on this sign I predict that the sign may be aligned by other individuals belonging to other generations or regions. Further examination of the underlying forms of type 2 and type 3 signs in the appendix may uncover more examples that have the potential of being aligned.

On the other hand, there are several other signs such as VERLETZEN 'hurt,' KONTROLLIEREN 'control', KLATSCHEN 'applaud', WÄHLEN 'elect', and BESTRAFEN 'punish' which seem not to be candidates for alignment. In these signs, the two hands stand in a specific relation to each other, such that their orientation and relative order cannot be changed by alignment. Moreover, they all have some special lexical movement on or towards the non-dominant hand, so that there is no direction of movement that can be recognizably changed under alignment. (See the appendix for the complete description of the signs.) I predict that such signs will not be aligned in any idiolect of DGS at any time. These signs, in fact, pattern like the ASL sign FORGIVE, which I will discuss in section 2.5.

Having put aside the type 2 and 3 signs, let's now consider the first category. Several DGS signs have been found which have special lexical movement that must be preserved but otherwise have some kind of orientation that can change under alignment.

(10) Table of DGS signs which change only in orientation for alignment

Type 0	Type 1
ANSCHAUEN 'look at'	BEINFLUSSEN 'influence'
BEOBACHTEN 'look over'	EHREN 'honor'
BESCHIED-SAGEN 'inform'	LEHREN 'teach'
KRITISIEREN 'criticise'	VERSPOTTEN 'tease'
SCHIMPFEN 'bawl-out'	
TÄUSCHEN 'deceive'	

The signs ANSCHAUEN, BEOBACHTEN, and EHREN all involve the same V handshape, with the palm facing down and the fingertips pointing away from the body. The hand remains static in ANSCHAUEN, moves up and down (by flexing the wrist) in BEOBACHTEN, and moves downward and away from the other hand (by extending the

elbow and extending the shoulder sideways) in EHREN.⁶ Under alignment, the fingertips are re-oriented so that they point at the object locus. This is easily accomplished by twisting the radio-ulnar part. Otherwise, the lexical movement remains unchanged.

The signs BESCHEID-SAGEN (bent B), KRITISIEREN (crooked index finger), LEHREN (flat O), SCHIMPFEN (curved 5), and VERSPOTTEN (lax V) all have the same lexical movement: they shake the hand back and forth, first away from the body and then back, which is done by trilling the extension of the elbow. The fingertips and the palm in all of the signs also face away from the body, except in VERSPOTTEN the palm orientation of the two hands face each other. The major difference across the signs is in handshape, which I have identified in parentheses next to each sign. When one aligns these signs, the lexical movement cannot change, but the orientation can, since the radio-ulnar part is in twistable state in the underlying form.

Finally, the sign TÄUSCHEN involves moving the S handshape, palm facing outward, around in a small, clockwise circle, as if rubbing against an imaginary face. Since the arm is upright and the radio-ulnar part is in neutral state, the sign easily aligns through orientation change by twisting the radio-ulnar part so that the palm of the hand faces the object locus. The lexical, clockwise movement is preserved in the meantime.

I should point out here that BESCHEID-SAGEN and LEHREN are similar to their ASL counterparts, both in meaning and phonetic form. I gloss the ASL counterpart to BESCHEID-SAGEN as REMIND, and the ASL counterpart to LEHREN is the same as the English gloss, TEACH. There is one slight phonetic difference between LEHREN and TEACH: in the underlying form, the fingertips of LEHREN face away from the

⁶ ASL LOOK is similar to DGS ANSCHAUEN and may also remain static so that it falls under the same category as DGS ANSCHAUEN, e.g. category 1. However, the ASL signers who were interviewed for the

body, while in TEACH, the fingertips of the two hands face each other. However, remember that this is the older version of TEACH. There is a newer version of TEACH which allows alignment and whose underlying form is the same as that of LEHREN. In fact, there may be a mix of the two forms: the older form for object loci out in the space, and the newer form for loci closer to the signer. If one puts those differences aside, the pairs BESCHIED-SAGEN/REMIND and LEHREN/TEACH constitute pairs (or cognates if ASL and DGS can be reliably traced to a common source) where the signs are similar in meaning and phonetic form across the languages and are correctly predicted to fall into the same categories.

The DGS sign VERSPOTTEN and its ASL counterpart MOCK may be another similar example. Not only is their meaning similar, but also their phonetic form is sufficiently similar to land them into the same category, in spite of the different handshapes and palm orientations (in MOCK, the handshape is a hooked Y, and palm orientation is down).

Now we consider the next category of signs that change only in the direction of the path movement for alignment.

(11) Table of DGS signs which change only in direction of path movement for alignment

Type 0	Type 1
FRAGEN 'ask'	HELFEN 'help'
GEBEN 'give'	

FRAGEN is made with the F handshape, with the free fingertips pointing to the left and the palm facing the body. Starting at the chin, it bounces away in a slight arc. Since the

dissertation use path movement for the sign LOOK, so that it falls under category 3.

radio-ulnar part is already supinated to a high degree in order to have the palm face the body, it is difficult to change the orientation for alignment. Instead, it is sufficient to mark alignment through a change in the direction of the path, so that the sign starts at the subject locus and ends at the object locus. For an object locus associated with the signer, the hand is situated at the subject locus and moves towards contact with the signer's chest, so that contact with the chin need not be part of the underlying form. For a subject locus on the left and an object locus on the right, the sign does change orientation so that the palm faces the subject locus and then moves from there to the object locus. This is the one exception proving the rule, for it shows that orientation in these signs can be aligned to the extent that is phonetically possible. For a subject locus on the right and an object locus on the left, it is no longer phonetically possible to have the palm face the subject locus, so the palm just faces the left locus and undergoes the aligned path movement.

The sign GEBEN shares the same movement as FRAGEN: it bounces away in a slight arc. The handshape and orientation are different, though, which are the flat B hand and palm facing up respectively (and fingertips pointing away from the body). The orientation requires the wrist to be extended to the max and the radio-ulnar part to be supinated to the max, so that the orientation is even less flexible than that of FRAGEN. Consequently, changing orientation for a subject locus on the left side is not even possible, unlike FRAGEN. For all pairs of loci, the orientation remains as it is in the underlying form, and alignment is manifested just through the bouncing movement from subject locus to object locus.

HELFEN is similar to the ASL sign SET-UP but in a two-handed symmetric version. The hands are in the A handshape, with the thumbs extended, and the palms of

both hands face each other. Initially pointing towards the face, the thumbs end up pointing upward after the hands move away in a slight arc via a twist of the radio-ulnar part and an extension of the arm from the elbow. One cannot change their orientation for a 1st person object locus for two reasons: (i) it is difficult to do so from a phonetic standpoint, since the wrist is already extended and the radio-ulnar part also ends up being supinated to a high degree in the underlying form (similar to the case of GEBEN), and (ii) the orientation of the two hands with respect to each other must be preserved.

However, for pairs of loci on the right and the left, one can align the whole unit so that the back of the closed fingers face the object locus. In all cases, the path movement continues to proceed from subject to object locus.

Now we turn to the last category of signs that involve a change in both orientation and direction of path movement for alignment.

(12) Table of DGS signs which change direction of path and orientation for alignment

Type 0	Type 1
ABHOLEN 'pick up'	AKZEPTIEREN 'accept'
ANTWORTEN 'answer'	EINLADEN 'invite'
BESUCHEN 'visit'	SCHÜTZEN 'defend'
ENTLASSEN 'fire'	ÜBERFALLEN 'attack'
IGNORIEREN 'ignore'	UNTERDRÜCKEN 'oppress'
SENDEN-SCHICKEN 'send'	

I will pick four signs for their interesting properties and describe them here. First is ENTLASSEN, which is similar to the one-handed version of ASL HATE. The sign starts in the 8 handshape, with the palm facing to the left and the fingertips pointing out. One flicks the handshape into an open 8, while twisting the radio-ulnar part slightly and extending the arm from the elbow at the same time. Since the wrist nor the radio-ulnar

part are not too twisted, orientation changes easily during alignment so that the fingertips point at the object locus. One also easily changes the direction of the path movement so that it ends at the object locus. This is a good example of a sign that involves both finer movement within the hand (elsewhere called 'internal movement', e.g. Sandler 1989) and path movement. The pairs ENTLASSEN/HATE are also an example of signs that differ in meaning yet are similar in phonetic form so that they behave in the same way under alignment.

BESUCHEN is one sign that involves just path movement (i.e. no internal movement). This sign is actually similar, both in meaning and phonetic form, to the ASL GO-OVER. Both are made with the B handshape, palm facing to the left and fingertips pointing away (as in ENTLASSEN). The movement is a simple straight path away from the body, made by extension of the arm from the shoulder. To align the sign, one twists the radio-ulnar part so that the fingertips face the object locus; within that configuration, the lexical movement is carried out. BESUCHEN and GO-OVER are yet another pair of cross-linguistic signs that are similar in phonetic form (and in meaning as well) and thus behave similarly during alignment.

Now, I discuss AKZEPTIEREN and EINLADEN, which have the same handshape of a bent 5 closing into a flat O and the same straight movement towards the body via flexion of the arm from the elbow. Note that they are 'backwards' verbs. In addition, the fingertips point away in both signs. The only difference between the two signs is in palm orientation: the palm is down (or technically, the radio-ulnar part is prone) in AKZEPTIEREN while it is up (or equivalently, the radio-ulnar part is supine) in EINLADEN. One can twist the radio-ulnar part in both signs so that the fingertips face

the object locus, and then carry out the lexical movement. For a 1st person object locus, one can do the same thing as well. The only difference is that the original relation between the two hands will be broken. In the underlying form, the radial sides of the hands face each other, but in the aligned form for a 1st person object, it is the ulnar sides of the hands that face each other. This is apparently fine, which suggests that the relation between the hands is not important and therefore not part of the underlying form. This is different than HELFEN, in which the relation between the two hands must be preserved at all times. AKZEPTIEREN is similar in meaning and phonetic form to the ASL sign ACCEPT; however, as mentioned earlier, ACCEPT is not on the list of stems that alignment applies to, even though it could be a potential candidate for alignment as shown by the example of AKZEPTIEREN.⁷

Before I close this section on DGS, I would like to discuss three signs which I have grouped into the above category. They differ from the others in that they do not have a typical straight path, but the direction of the movement still aligns. ANTWORTEN, IGNORIEREN, and SENDEN-SCHICKEN all involve a sharp twisting movement; one can twist the arm in whatever appropriate direction will place the correct part of the sign against the object locus.

ANTWORTEN uses a lax V handshape, whose palm starts out facing to the left, with the fingertips pointing outward. One twists (pronates) the radio-ulnar part downward in such a way that the fingertips face the object locus. There is one time when this is not possible, and that is due to phonetic constraints: the object locus is on the right side and

⁷ Another way to characterize the difference between AKZEPTIEREN and ACCEPT is to say that contact with the body must be preserved in ACCEPT at all times but not necessarily in AKZEPTIEREN. Thus the contact is part of the underlying form in the American sign which must be preserved and which consequently bars any potential alignment.

the subject locus on the left side. In that case, one drops the orientation change (as in FRAGEN) but preserves the movement/twist towards the object locus.

SENDEN-SCHICKEN works similarly. This time, the 'key' handshape is used and thrown like a frisbee so that the back of the index finger's first knuckle faces the object locus. The movement is done by twisting the wrist outward (i.e. wrist extension), and like in ANTWORTEN, this movement makes it difficult to align fully for an object locus on the right and subject locus on the left. Instead, one keeps the orientation like for the R to L form, and twists the arm as usual in the direction of the object locus. For the 1st person object locus, one still twists the wrist but inward, so that the back of the finger contacts the chest. One may also add supination of the radio-ulnar part while twisting the wrist inward.

IGNORIEREN uses a C handshape, which is twisted by supinating the radio-ulnar part or by extending the arm from the elbow so that the radial side of the hand faces the object locus. If a pair of loci requires it (like L to R, or addressee to signer), one may pronate the radio-ulnar part instead while moving the arm, because it still achieves the target of having the radial part of the C handshape face the object locus. Thus IGNORIEREN can align for more pairs of loci than the other two signs.

Those three signs provide nice examples whose orientation and movement align predictably from the underlying form, even though they stand out from most other signs in having unusual orientation and/or movement.

2.3.2 Australian Sign Language (AUSLAN)

For the AUSLAN data, 75 verbs with the appropriate argument structure were elicited. Of these, 45 show some form of alignment, which have been grouped into the same categories as above. As with ASL and DGS, every verb's classification is predictable from its underlying form.

The first category consists of those signs which change only in orientation for alignment. The fact that the direction of the movement does not align follows from the presence of special lexical movement in the underlying form. Moreover, in all these signs, the underlying orientation is such that it can be easily aligned.

(13) Table of AUSLAN signs which change only in orientation for alignment

Type 0	Type 1	Type 2	Type 3
CALL-UP COPY SHOOT-WITH-GUN	FEED TEASE		FILM

For instance, CALL-UP, which uses the bent B handshape, involves lexical movement of trilling the extension of the arm from the elbow. The arm is upright and the palm orientation faces outward, so that one can easily twist the radio-ulnar part to align orientation and have the palm and the fingertips face the object locus. This sign is similar in phonetic form to ASL REMIND and DGS BESCHIED-SAGEN. Whether they have exactly the same meaning or only closely related meanings, the point remains that their similar phonetic forms correspond to similar behaviors with respect to alignment.

AUSLAN FEED is identical to ASL FEED except in handshape and orientation: the AUSLAN sign uses a 'key' handshape with middle palm orientation, while the ASL

sign uses a flat-O handshape with an upward palm orientation. There is 'shaking' movement or equivalently trilled extension of the arm from the elbow. Thus it aligns in the same manner as AUSLAN CALL-UP and ASL FEED, which is also in the same category (see table in (4)).

TEASE uses the 5 handshape and wiggles the fingers from the K2 joint. There may be also trilled movement from the elbow accompanying the hand-internal movement. While this specific movement remains constant under alignment, the orientation is changed. In the underlying form, the palm faces down and the fingers point outward. If one wants to align for a 1st person object locus, for example, it is just a matter of twisting inward (or supinating) the radio-ulnar part. In aligning the sign, the relation between the two hands also change. In the underlying form, the radial sides of both hands face each other, but in the aligned form, it is the ulnar sides which face each other. This suggests that the relation between the hands is not marked in the underlying form and can be changed, as in the case of ASL TEACH.

AUSLAN TEASE is actually similar, if not identical, to DGS BEINFLUSSEN. In spite of their different meanings, their common phonetic form lands them in the same category, as shown by the table in (10) for DGS. The underlying form of ASL FLIRT is also similar to these two signs, but with one significant difference: the relation between the hands, i.e. the radial sides of the hands facing each other, must be preserved. In some variants, the thumbs contact each other, which may be the source of the mandatory relation between the two hands. Thus alignment cannot change this relation between the hands, and to align for a 1st person object would be phonetically impossible. Hence ASL FLIRT, unlike AUSLAN TEASE and DGS BEINFLUSSEN, belongs to the set of signs

that do not align solely because of a lexical property requiring a specific relation between the hands.

AUSLAN COPY is similar in phonetic form to ASL COPY and DGS KOPIEREN, but there are some important differences which lead to their different behavior during alignment. AUSLAN COPY is a one-handed sign made with one form of the 5 handshape, wherein the thumb is bent inwards. In the underlying form, the palm faces outward and the movement consists of repeatedly closing the hand into a flat-O through flexion of the K1 joints, while flexing the arm back from the elbow at the same time. This repeated movement bars a single, direct movement from the subject locus to the object locus, but the direction of the movement is still aligned (in which case, AUSLAN COPY should be properly under category 3, but as explained in section 2.2.6, all aligning signs fall under category 3 in one way or another, and I put AUSLAN COPY under category 1 because of its special lexical movement).

ASL COPY differs from AUSLAN COPY in two ways: first, ASL COPY is a two-handed hand such that the non-dominant hand in the B handshape is added, from which the dominant hand initiates its movement, and second, the movement is single, not repeated. Since ASL COPY is a type 3 sign, and since the relation between the two hands is alignable, and since the single path movement can be aligned for the subject and object locus, it falls under category 4. DGS KOPIEREN is practically the same as ASL COPY and should also align like the ASL counterpart, but as explained in the section on DGS, one signer prefers not to align type 3 signs and instead prefers to use PAM with these signs. KOPIEREN being a type 3 sign like ASL COPY, it falls under the same pattern as

other DGS type 3 signs. Thus KOPIEREN is one of the DGS signs that could potentially align but happen not to be on the list of stems that undergo alignment for this signer.

The trio of AUSLAN SHOOT-with-GUN, ASL SHOOT-with-GUN1, and DGS SCHIEßEN parallels the situation of the above trio COPY. In AUSLAN, SHOOT-with-GUN is made with an H handshape, with the palm facing to the left and the index finger pointing outward. The movement consists of extending the arm from the elbow and rapidly 'bouncing' it back. Because of the 'bouncing' movement, I place it under category 1, but in reality, one still aligns the direction of the movement as well as the orientation so that the fingertip of the index finger points directly at the object locus. ASL SHOOT-with-GUN differs in that the 'bouncing' movement is absent and the handshape is L rather than H; instead, the movement is a straight path away from the body. Hence it is under category 3. Finally, DGS SCHIEßEN has a 'bouncing movement' like AUSLAN SHOOT-with-GUN and the same handshape as ASL SHOOT-with-GUN so it is a candidate for alignment, but one signer has chosen to use PAM with this sign; hence it belongs to the set of signs that fail to be on the list of stems undergoing alignment.

I want to stress that these forms are based on the individual signers who have been filmed for this dissertation. There may well be variation on these signs, so do not take the above comments to apply exclusively to the respective signed languages. For example, another ASL signer may sign SHOOT-with-GUN with a bouncing movement as in AUSLAN and DGS. The prediction is that it would fall under category 1, as in AUSLAN. There may also be other DGS signers who actually align the sign SCHIEßEN; in that case, it would also fall under category 1.



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HIRE uses the C handshape; the palm and fingertips are to the left so that the back of the curved fingers face outward. The movement consists of a straight path movement towards the body via flexion of the arm from the elbow (thus it is a 'backwards' verb). In order for the back of the fingers to face the object locus, one must twist the wrist as well as the radio-ulnar part into a phonetically awkward configuration. Thus alignment of orientation is blocked, and alignment just consists of changing the direction of the path movement so that it starts at the subject locus and ends at the object locus.

AUSLAN HELP is similar to ASL HELP in that the two hands stand in a specific relation to each other: the dominant hand must rest atop the non-dominant at all times. It is only handshape and orientation of the dominant hand which is different than that in ASL HELP: the dominant hand is in the B shape (same as the non-dominant hand, hence of type 2) and the palm faces and contacts the non-dominant palm the whole time. For the reason as ASL HELP, it is phonetically difficult to twist the radio-ulnar part so that the fingertips of the non-dominant hand face the object locus. Hence alignment of orientation is blocked and only alignment of the direction of the path movement remains.

ANSWER works similarly: it is formed with the dominant index finger contacting the non-dominant thumb on the fingertip; this whole unit then moves in a straight path movement away from the body. This contact must be preserved so that if one were to align the orientation, one would have to twist the non-dominant radio-ulnar part into an ill-formed position in order for the non-dominant fingertips to face the object locus. Thus one just aligns the direction of the path movement.⁸

⁸ An interesting note: the AUSLAN sign for ANSWER is made from the AUSLAN sign for A. British Sign Language (BSL) and other related signed languages, including AUSLAN, make use of a two-handed fingerspelling system, in which the signs for vowels are made by pointing to one of the five fingers, so that A is made by pointing to the thumb, E by pointing to the index finger, I to the middle finger, and so on.

It may seem that there are not many signs in this category, but there are actually many more signs which could fit into this category, if it were not for one unusual property of preserving initial contact with the face. Since they are quite pervasive in AUSLAN compared with the other signed languages, they deserve a thorough discussion, which I have reserved for the end of the section.

We turn to the next category of signs which change both direction of path and orientation for alignment. These signs have in common that in their underlying form, the movement is a straight path away from the body and the orientation is changed through a twist of the wrist and/or the radio-ulnar part.

(15) Table of AUSLAN signs changing direction of path and orientation for alignment

Type 0	Type 1	Type 2	Type 3
CHOOSE INVITE MURDER-KNIFE SAY-NO WATCH	BAWL-OUT CHASE PICK-UP	FAX FOLLOW	PAY

SAY-NO is a unique AUSLAN sign. The other signed languages do not have any sign that resembles this sign in phonetic form. This is made with the F handshape. The arm is upright and the ulnar side of the hand faces outward. The movement is a straight path away from the body. One can twist the radio-ulnar part so that the ulnar side of the hand faces an object locus on the right for a subject locus on the left or vice versa. For a 1st person locus, the alignment should be such that the ulnar side of the hand faces the chest. While this is doable, it is not as phonetically well-formed so that only a partial alignment

Similarly, the AUSLAN sign for QUESTION is made from the sign for Q: an index finger hooking into the

is achieved such that it is the palm which faces and ultimately makes contact with the chest.

Other signs present some interesting similarities and differences to signs in other signed languages. Consider AUSLAN INVITE, which starts out in the bent L handshape, with palm to the left and the back of the knuckles facing outward. The sign moves towards the body (i.e. a 'backwards' verb) through flexion of the arm from the elbow. The hand also closes into the 'key' handshape. One can twist the elbow so that the back of the knuckles faces the object locus. At the same time, one can carry out the movement from the elbow. The ASL sign which has the same meaning as AUSLAN INVITE is different in phonetic form, although it has the same 'backwards' movement. ASL INVITE is made with a flat B hand, palm up, and the radial side faces outward. Thus aligning orientation is difficult, and only the direction of path movement is aligned, putting the ASL counterpart into category 2.

Another AUSLAN sign, MURDER-KNIFE, aligns easily in both orientation and direction of movement. This sign is made with the S handshape in a 'stabbing' movement, or more technically, through extension of the arm from the elbow. The arm is at a 45° angle, and the palm is to the left, a combination which makes it possible to align orientation through twisting the radio-ulnar part. The ASL counterpart, glossed as STAB, is phonetically the same as the AUSLAN sign and accordingly behaves in the same way, for it also appears in category 3 (see table in (6)). Contrast this with a similar DGS sign, TÖTEN 'kill', which has the same meaning and phonetic form as AUSLAN MURDER-KNIFE. While the DGS counterpart should be able to align, as shown by the AUSLAN

non-dominant O-shape.

and ASL examples, one signer still prefers to use PAM with this sign, so that it does not appear on the list of stems subject to alignment.

WATCH is yet another AUSLAN sign that is similar to ASL LOOK. As in ASL LOOK, the AUSLAN sign involves a V handshape, palm down and fingertips pointing outward, and there is a straight path movement.⁹ Like ASL LOOK, AUSLAN WATCH aligns easily both in orientation (through a twist of the radio-ulnar part) and direction of movement (through extension of the arm from the elbow). DGS ANSCHAUEN 'look' is superficially different from those signs in that the hand is static and there is no movement, so that only the orientation aligns, which places it in category 1. However, this form has been attested in AUSLAN and ASL as well, and similarly, the AUSLAN and ASL form has been attested in DGS, so those variants are not necessarily language-specific, but the different phonetic forms of the variants still predictably lead to different behavior under alignment.

AUSLAN BAWL-OUT involves both hands in the O handshape, palms facing each other and the K1 joints facing outward, which then open into a lax 5 handshape. This movement is accompanied by an extension of the arm from the elbow. Since the radio-ulnar part is in a neutral position, one can twist this part to align orientation such that the palm and the K1 joints (at the beginning of the sign) and the fingertips (at the end of the sign) face the object locus. This is different from AUSLAN ABANDON and DGS LOSWERDEN 'get rid of', both of which are similar in phonetic form and which do not align. While these two signs involve similar handshapes and movements as AUSLAN BAWL-OUT, the orientation is different: the palms are facing down and the hands move

down (like in ASL DROP). It is not phonetically possible to align these signs because twisting the wrists sideways and then executing the downward movement both from the wrist and elbow places too great a burden on the articulatory system. AUSLAN BAWL-OUT is actually **more** like ASL BAWL-OUT with two minor differences: the hands start out in the O handshape in AUSLAN but in the S handshape in ASL, and the hands are next to each other in AUSLAN while they are on top of one another in ASL. Like AUSLAN BAWL-OUT, ASL BAWL-OUT belongs to category 3 (see table (6)), which is to be expected from their similar lexical properties.

AUSLAN FAX and DGS FAXEN are another pair which share the same story as the previous pair. Both have the same phonetic form: under a non-dominant hand in the B handshape, the dominant hand, initially in the bent B handshape, flattens into a straight B via extension of the K2 joints. The palms of both hands face downwards, while the dominant fingertips and the ulnar side of the non-dominant hand face away from the body. Since it is phonetically awkward to align this ulnar side of the non-dominant hand, only the dominant hand aligns in orientation and direction of movement. This is the case in AUSLAN and thus falls into category 3, but in DGS, two signers prefer to use PAM with the sign, so it seems to be one of the possible alignable stems which does not appear on the list under the re-adjustment rule for these signers.

I discuss one last AUSLAN sign in this category, PAY, which is identical to ASL BUY except in handshape and orientation (but otherwise distinct in meaning): AUSLAN PAY uses the 'key' handshape which has middle palm orientation, while ASL BUY uses the flat-O handshape, palm up. In both signs, the non-dominant hand is in the flat B

⁹For an ASL sign that is closer to the meaning of 'watch' as opposed to 'look', there are several forms, but one which is related to ASL LOOK, adds the non-dominant hand which shadows the dominant hand and

handshape, with the palm facing up and the fingertips pointing outward. The dominant hand moves from this base hand through an extension of the arm from both the elbow and the shoulder. In AUSLAN PAY, the upward orientation of the non-dominant hand blocks its alignment, but otherwise the orientation of the dominant hand can align through a twist of the wrist so that the back of the K1 knuckle faces the object locus, and the path movement follows from that orientation change. ASL BUY does not have the appropriate argument structure for agreeing verbs, which always involve two animate arguments. Instead, ASL BUY has one animate argument (the 'buyer') and an inanimate argument (the thing bought). Even if the thing that is bought is animate (e.g. a slave or an animal), the thing is still treated as inanimate from the semantic view of the verb. Since the argument structure of BUY does not fit that of agreeing verbs, it does not agree, but it is interesting to see an AUSLAN sign that is similar in phonetic form to ASL BUY which does agree with two animate arguments and which does align.¹⁰

Next, we turn to the set of signs that involve two hands which align their order relative to the body. The signs which qualify for this kind of change are of type 2 and type 3, in which the dominant hand moves while the non-dominant hand stays put. If one combines type 2 and type 3 signs, they constitute over one third of the sample, but as one will see from the following table, most type 2 signs do not show alignment at all and equally as many type 3 signs align (category 4 and 5) as they do not (category 0). Thus, it comes as no surprise that the signs in the next two categories are mostly type 3 and few in number.

makes the sign a two-handed, symmetric one (i.e. type 1). This ASL sign also belongs to category 3.

(16) Distribution of type 2 and type 3 signs across categories

Category	Type 2	Type 3	Total
0	10	5	15
1	0	1	1
2	1	1	2
3	1	1	2
4	1	3	4
5	0	3	3
Total	13	14	27

There are three AUSLAN signs which change three properties under alignment: the orientation of the hands, the direction of the path movement, and the order of the hands with respect to the body.

(17) Table of AUSLAN signs changing direction of path, orientation, and hand order

Type 3
ATTACK
DECEIVE
SEND-MAIL

AUSLAN ATTACK is similar to ASL OPPRESS, which belongs to the same category (see table in (7)). Given their phonetic similarity, this is to be expected. In ATTACK, the non-dominant hand consists of the index finger, with the fingertip pointing outward and the palm at mid-level. The dominant hand is in the 5 handshape facing downward, and the fingertips point outward like the non-dominant finger. The dominant hand rests on top of the radial side of the non-dominant finger and presses it down in an arc, through extension of the arm from the elbow, plus downward flexion of the wrist in both hands. It is possible to align the whole unit by twisting the radio-ulnar part and then carrying out

¹⁰ One may wonder whether the ASL sign for PAY looks like in relation to the AUSLAN sign. Three ASL

the lexical movement. As will be explained in Chapter 3, alignment for a 1st person object locus does take place, but at the phonetic level is implemented only half-way so that it is the palm of the dominant hand and the radial side of the non-dominant finger which faces the signer. However, it remains that the non-dominant hand is closer to the body than the dominant one when the sign is aligned for the 1st person object locus. A similar pattern obtains for ASL OPPRESS, with minor differences: the non-dominant hand is in the S-handshape rather than the index finger, and the phonetic form of the sign when aligned for a 1st person object locus is also done only partially, but not in exactly the same way as AUSLAN ATTACK due to the different orientation properties of the non-dominant hand and the dominant hand's interaction with it. This will be explained further in Chapter 3.

DECEIVE is identical to ASL GET-HOLD-OF, and both accordingly fit into this same category. The non-dominant hand is an upright index finger, with the ulnar side of the finger facing outward, while the dominant hand is in the V handshape and facing downward, with the fingertips pointing outward. The movement consists of placing the V hand over the index finger so that the index finger stands between the two dominant fingers. This is done through extension of the arm from the elbow, with an optional downward twist (flexion) of the wrist. When one aligns this sign, the non-dominant hand does not change orientation due to phonetic constraints, but the dominant hand does so that the fingertips face the object locus. Moreover, the dominant hand is farther away from the object locus than the non-dominant hand. The movement is then executed within that configuration.

signs were gathered for PAY, none of which resemble the AUSLAN sign.

SEND-MAIL is one unique AUSLAN sign; the other signed languages do not seem to have any sign which is similar in phonetic form to SEND-MAIL. The non-dominant hand is upright and in the I handshape; the palm faces the body. The dominant hand starts in the S handshape, palm facing to the left, and opens into a B handshape through extension of the fingers from the knuckles. At the same time the dominant hand is opened, the arm is extended from the elbow so that the dominant hand lands on the non-dominant hand, with the ulnar side of the B hand making final contact at the point between the pinky finger in the non-dominant hand and the other, closed fingers. This sign resembles placing mail in a rack. Since the orientation of both hands can be changed by twisting the radio-ulnar parts, both hands undergo change in orientation for alignment. The non-dominant hand will also be closer to the object locus, so that if the signer is associated with the object locus, the non-dominant will be closer to the body, but not when the signer is associated with the subject locus. The change in direction of the dominant hand's path movement follows from the change in the orientation of the hands.

The next category of signs is similar to the above category, except that there is no single straight path movement, so that it is just the orientation and the relative order of the hands with respect to the body which change under alignment.

(18) Table of AUSLAN signs which change orientation and hand order under alignment

Type 2	Type 3
CONTACT	BLAME FLATTER FLIRT

AUSLAN CONTACT is similar to ASL CONTACT. Both hands are in the open 8 handshape and face each other (i.e. the non-dominant hand faces the body, while the dominant hand faces away). The difference is that the AUSLAN sign involves repeated contact of the dominant hand with the non-dominant hand, while the ASL version consists of just a single straight path of the dominant hand towards final contact with the non-dominant. Hence, the AUSLAN version belongs here, while the ASL sign belongs to category 4 (see table in (7)). This reminds one of the similar contrast between AUSLAN COPY and ASL COPY, where the AUSLAN version but not the ASL one is repeated in its movement. In actuality, the AUSLAN version of CONTACT is also present in ASL and aligns in the same way as category 5 signs, but it has a slightly different meaning of 'to keep in touch with regularly' (vs. ASL CONTACT which means 'having made contact with'). A similar thing can be said for the AUSLAN version of COPY in contrast to the ASL version.

The other three signs all involve the non-dominant hand in the index handshape and the dominant hand carrying out some special lexical movement on the non-dominant hand. I discuss the first two for illustration. In BLAME, the dominant hand is in the 5 handshape with the thumb bent in and the palm facing down; the non-dominant hand faces down and points outward. The radial side of the dominant index finger brushes against the radial side of the non-dominant index finger through trilled extension of the arm from the elbow. To align this sign for a 1st person object locus, one twists the radio-ulnar part of the non-dominant arm so that the fingertip of the index finger points at the signer. The dominant hand aligns only in the direction of the movement, not in orientation, because to change orientation so that the palm faces the object locus would

break the special relation between the two hands, i.e. the radial sides of the two index fingers must be in contact at all times. The dominant hand aligns direction of movement so it should be in category 4, but I place it here because it lacks a single straight path, but otherwise, there is no real distinction between the two categories, just different manifestations of alignment which depend on the underlying form of the sign.

FLATTER involves the dominant hand in the B shape facing down; the fingertips brush upwards against the non-dominant index finger through repeated extension of the fingers from the K2 joints. This is similar to ASL SPOIL, except that the fingertips brush downwards through repeated flexion from the K2 joints. Still, the relevant properties of orientation and the relation of the two hands with respect to each other are identical so that both signs are placed in the same category (cf. table in (8)). Since it is possible to twist the radio-ulnar part of the dominant arm so that the fingertips face the object locus, the orientation of the dominant hand changes. Since in the underlying form the ulnar side of the non-dominant finger faces outward, it is not phonetically possible to align this hand for many object loci on the left side and at the signer, so that the orientation does not always change. However, the order of the hands relative to the body changes depending on the loci: for a signer-to-addressee form, the dominant hand is closer to the body, but for an addressee-to-signer form, it is the non-dominant hand which is closer. FLATTER is a particularly good example of this category, because the lexical movement of the dominant hand is not directed outward in the underlying form but rather upwards against the base hand; it is just the orientation of the fingertips which mark the object locus.

Having gone through each category of AUSLAN signs, I discuss briefly three more sets of interesting signs which do not fit as perfectly into one of the above categories but which still undergo alignment in a way predictable from their underlying forms. The first set of signs include FORCE, GIVE, IGNORE, and PROVIDE, all of which involve a twist of the radio-ulnar part as part of the lexical movement. Aligning these signs involves twisting the radio-ulnar part in a possibly different direction than that for the underlying form so that the front part of the sign faces the object locus. For example, FORCE is a one-handed sign made with the index finger flexed down at the wrist. The movement twists the radio-ulnar part (as well as the wrist) so that the fingertip moves up and points at the object locus. Sometimes this may require raising the shoulder, as in the case of a 1st person object locus: the shoulder is raised to make it easier for the down index finger twist towards the body, but even in that configuration, the finger aligns only 90°, not 180° as is usually the case. Still, the alignment is visible enough to mark the object locus distinctly. These examples work similarly as the DGS signs ANTWORTEN 'answer', IGNORIEREN 'ignore', and SENDEN-SCHICKEN 'send'.

Another set of signs has circular movement, always within the midsagittal plane, as part of their lexical entry: CRITICIZE, INFORM, and PITY. I will use the first example to illustrate these cases. CRITICIZE is a two-handed symmetric sign which uses the I handshape.¹¹ Both hands are upright and face each other palm-wise. They alternate

¹¹ In AUSLAN (as well as BSL and other related signed languages), the I handshape usually carries a negative connotation, so that it appears in many signs that have some negative meaning (cf. the location of nose which is used for many negative signs in ASL). Similarly, the A shape with the thumb pointing up has a positive connotation and appears in many signs that have some positive meaning. Thus, the AUSLAN sign for PRAISE is exactly the same as AUSLAN CRITICIZE, except that the hands are in the A

in undergoing circular motion which is executed by extending and flexing the arm repeatedly from two joints: the elbow and the shoulder. One can align this sign by twisting the radio-ulnar part so that the ulnar sides of the hands face the object locus. From that configuration, the direction of the circular movement is accordingly aligned.¹²

There are parallel examples that can be found in ASL and probably in other signed languages as well, but the examples in ASL are those which involve adding aspect, e.g. LOOK+continuous aspect, which has circular movement in the midsagittal plane. One can completely align this sign too, as I will discuss in the next section. However, it is hard to find ASL examples with the right argument structure that have circular motion as part of their lexical entry rather than coming from a morphological suffix like aspect. In that respect, AUSLAN's examples may be unique.¹³

The last set of AUSLAN signs is interesting in that all the signs involve a path movement from the subject locus to the object locus, but only after initial contact with the face is made, which is part of the underlying form. This process also has been attested in ASL (cf. the case of ASL INFORM described by Klima and Bellugi (1979)), but it is

handshape. Interestingly, even though this sign has the same movement as AUSLAN CRITICIZE, the orientation of the arm for the A shape prevents alignment for a 1st person object locus at the phonetic level.

¹² I should add one note about INFORM here. INFORM is similar to CRITICIZE except that the handshape is the index finger which points straight up and whose backside faces outward (unlike the I handshape in CRITICIZE whose palm faces to the side). While it is possible to align INFORM for a 1st person object locus so that the back of the index finger faces the body, this does not happen for two possible reasons: (i) it is awkward to align the arm, which requires pronating (twisting inward) the radio-ulnar part, as opposed to supinating it, which is sufficient for aligning the arm in CRITICIZE, and (ii) the specific relation between the hands in which the ulnar sides of the fingers must face each other may not be broken, e.g. by alignment. This relation between the hands may have its source in the original starting point on the chin.

¹³ It is not necessarily an accident that all aligning verbs which involve circular motion have it within the midsagittal plane in the underlying form. It would be interesting to find examples of verbs with the right argument structure that involve circular motion within the horizontal or the vertical planes, because there seems to be a gap in such signs. If such a sign exists, it should still be able to align if the orientation is right. For instance, consider a upright hooked index finger facing outward and rotating within the vertical plane. One can easily align this sign by twisting the radio-ulnar part so that the palm side of the finger faces the object locus and then carry out the circular movement. Some examples as ASL ANALYZE and ASL

much more pervasive in AUSLAN and is the one particular thing which seems to stand out AUSLAN from the other signed languages. The AUSLAN signs which undergo this process include ASK, CARE, EVALUATE, EXPLOIT, SHOW, and VISIT. They all involve initial contact with the face, and the orientation in the underlying form is such that it is phonetically awkward to align it for a 1st person object person, i.e. some part of the hand other than the palm or the fingertip faces outward (the ulnar side for ASK and EVALUATE and the back of the finger(s) for the rest). Also, as in the case of INFORM, for the two-handed signs (CARE, EVALUATE, SHOW, VISIT), the specific relation between the two hands cannot be broken; they must be next to each other as in the underlying form at all times, which may stem from their initial contact on the face. Thus they may change orientation for some loci but not for a 1st person object locus. I propose that those signs still undergo alignment. What is different about these signs is that the stem consists of two parts: the first part involves contact with the face, while the second part involves the movement. I argue in section 2.5.3 that it is the second part which is encased within the 'sphere' and therefore subject to alignment.

Two other AUSLAN signs, REMIND and TEACH, also work in the same way as the above signs, except that the signs can change orientation, since in the underlying form the hands are upright and the fingertips point outward. Thus it is just a matter of twisting the radio-ulnar part to have the fingertips face the object locus and then carry out the movement from there. Finally, there are two AUSLAN signs, PHONE and TELL, which involve initial contact with the face like the above signs; however in the forms for a 1st person object locus, the contact becomes medial rather than initial. I reserve these signs

EVALUATE come close, since they do involve some kind of lexical movement within the vertical plane, but none of them are circular.

for further discussion in section 2.5.3, where I argue that they are instances of pronoun assimilation.

2.4.3 *Nihon Shuwa (NS)*

Now I turn to the data from Japanese Sign Language (NS). The sample is much smaller than for the other signed languages due to technical difficulties encountered during the data collection. For this language, only 50 verbs with the appropriate argument structure were elicited. However, even with a small sample like this, a sizable portion of the verbs ($n=31$) show alignment. The following table shows the overall distribution of signs with respect to type and category, where category 0 indicates absence of alignment, i.e. the verb is plain.

(19) Distribution of signs with respect to type and category

Category	Type 0	Type 1	Type 2	Type 3	Total
0	9	5	2	3	19
1	1	2	1	2	6
2	3	3	0	1	7
3	3	5	0	0	8
4	--	--	0	6	6
5	--	--	0	4	4
Total	16	15	3	16	50

As one can see from the table, over one third of the sample is plain, half of which are one-handed. Most of these signs involve some specialized lexical movement, orientation, and/or relation between the two hands that cannot be aligned, while others may be alignable but are preferred to be signed with an auxiliary-like element. Otherwise, the rest of the signs are distributed evenly over the other categories. There are not too many type

2 signs in the sample; whether this is characteristic of NS in general or not remains to be seen with a much larger sample. Most of the type 3 signs seem to be represented in categories 4 and 5 rather than in the other categories, which is consistent with what we have seen so far with the other signed languages, since type 3 signs have more possibilities in terms of changing the relative order of the hands with respect to the body.

Before I present the NS data, three notes are in order. First, NS seems to be unique from other signed languages in that it offers distinct 'classifiers' for gender, namely, the upright I handshape for female referents and the upright A-thumb handshape for male referents. There are many lexical signs which are originally formed from the A-thumb handshape, with the dominant hand carrying out some movement on this handshape. ASL also has many signs which have similar roots (e.g. CONVINCING, PICK-UP, GET-HOLD-OF). However, even if the sign in NS is one-handed, one may use the non-dominant hand to add a classifier handshape at the object locus.¹⁴ This may explain the apparently high visibility of type 3 signs in NS, compared to other signed languages, even though the NS signs are actually distributed evenly over types 0, 1, and 3 as shown by the above table.¹⁵ While the I handshape appears in true classifier predicate constructions, it never appears in frozen lexical forms (Supalla and Osugi 1996, Fischer and Osugi 2000), thus suggesting that the A-thumb handshape is the default handshape.

¹⁴ Even this process is available in ASL but it does not seem to be as frequent as it is in NS.

¹⁵ This may also explain why the signs are spread evenly over the non-plain categories in NS, whereas category 3 is by far the largest in ASL. All of the type 3 signs in NS are made with the A-thumb classifier, and barring the classifier, they are equivalent in alignment behavior to one-handed signs in categories 1 and 2. Hence the even distribution across all the categories.

This handshake is also used in classifier predicate constructions when the gender is either unknown or not important.¹⁶

Second, the signers seem to allow the option of switching dominance to the other hand when it becomes phonetically awkward to do the alignment with the dominant hand. This option is not necessarily characteristic of all NS signers, for I have double-checked some forms with several other NS signers, some of whom reject that option. Moreover, this option is present not only in some NS signers but also in some ASL, AUSLAN, and DGS signers. What this tells us is that this option is not language-specific but rather is available generally. Each signer varies to the degree that one uses this option for aligning verbs.

The last note, as mentioned in the introductory background, is that NS makes use of several 'auxiliary'-like elements which are similar to PAM in DGS. These elements represent another option for showing agreement in case the verb is not able to align due to phonetic reasons.

We now look at the first category of signs that change only in orientation for alignment due to having a specialized lexical movement.

(20) Table of NS signs which change only in orientation for alignment

Type 0	Type 1	Type 2	Type 3
OKORU2 'be angry at'	BUNSEKI-SURU 'analyze' CONTOROORU-SURU 'control'	SETTOKU-SURU 'persuade'	MITOMERU 'approve' SATSUEI-SURU(VCR) 'film'

¹⁶ For the default handshake, the signers actually alternate between the A-thumb handshake and the index finger handshake that is standardly used in the other three signed languages. It remains to be investigated

OKORU2 is similar, if not phonetically identical, to DGS SCHIMPFEN 'bawl out', and as expected, they belong to the same category (cf. table in (10)). This sign is made with an upright curved 5 handshape and the palm faces outward. The movement consists of shaking or trilling the extension of the arm from the elbow. One simply twists the radio-ulnar part so that the palm faces the object locus and then carries out the shaking movement.

BUNSEKI-SURU is similar to ASL ANALYZE, except that the handshape is a curved 5 (or a clawed 5) whereas it is a bent V in the ASL version. Otherwise, the palm orientation faces outward as in the ASL sign, and both appear in the same category (cf. table in (4)). The movement consists of three components which occur at the same time: (i) wiggling of the fingers at the K1 joints, (ii) pulling the two hands apart repeatedly via sideways extension of the arm from the elbow, and (iii) moving them down in the vertical plane via downward extension of the arm from the shoulder. To align the sign, one again twists the radio-ulnar part such that the palm faces the object locus and then carries out the three lexical movements, none of which involve a straight path.

The next three signs are unique to NS, the likes of which have yet to be found in the other signed languages. CONTOROORU-SURU resembles manipulating a marionette. Both hands are in the F handshape, are held in front of the forehead, and face outward palm-wise so that they resemble holding strings. They alternate between moving up and down in the vertical plane through extension of the arm from elbow and the shoulder. It is possible to twist the radio-ulnar part so that the palm faces the object locus

what kinds of contexts (e.g. lexical, syntactic, or pragmatic) determine the choice of the handshape. Based on the little data that I have here, it looks like pragmatic factors determine the choice of handshape.

and then carry out the lexicalized vertical movement, which is again not a straight path that can be aligned in its direction.

SETTOKU-SURU uses the B handshape for both hands. The palm of the non-dominant faces up, while fingertips point slightly to the right so that it is the radial side which faces outward. The palm of the dominant hand faces to the left, and the fingertips more or less point outward. The movement consists of tapping the fingertips of the dominant hand against the palm of the non-dominant hand through trilled supination of the radio-ulnar part. To align the non-dominant hand for a 1st person locus so that the radial side faces the signer is not phonetically possible (cf ASL INVITE, DGS GEBEN); hence this is dropped and the non-dominant hand stays put. However, the dominant hand shows alignment for most pairs of loci by twisting at the wrist so that the fingertips face the object locus. The lexical movement of trilled supination of the radio-ulnar part continues to be carried out within the aligned form.

MITOMERU might be more properly placed under Type 0, since the non-dominant hand (in the C handshape) serves only to hold the dominant arm near the elbow or may be even dropped, while the dominant hand, in the upright S handshape and facing outward palm-wise, twists down (flexes) at the wrist. One aligns this sign by twisting the radio-ulnar part so that the palm of the dominant hand faces the object locus. For a L-to-R form in which it would be phonetically awkward to have the palm face the object locus, two signers solve this problem by switching dominance to the other hand. Otherwise, the lexical movement of twisting down at the wrist is preserved in all reserved forms.

The last sign in this category, SATSUEI-SURU, is so similar to AUSLAN FILM that one is referred to the description of AUSLAN FILM (just before the table in (18)). The handshape and lexical movement are slightly different in the NS version: the hand is in the 5 handshape with the pinky finger folded in, and the movement consists of shaking this hand back and forth (via trilled sideways extension of the arm from the elbow) over a non-dominant in the B handshape, palm up. Otherwise, the orientation properties are the same as in the AUSLAN example, which affect alignment in the same way, i.e. the NS sign aligns through a change in orientation but not in the lexical movement.

Next is the category of NS signs which change only in the direction of the movement and not in orientation. In the underlying form, these signs usually move in a straight path away from the body, and some part of the hand faces outward (endpoint Y) such that it is difficult to align for many pairs of loci. I go over each of these signs in turn, most of which are close or similar to signs in the other signed languages we have discussed.

(21) Table of NS signs which change only in direction of path movement for alignment

Type 0	Type 1	Type 2	Type 3
CHUUI-SURU 'advise'	ATAERU 'give'		OKURU 'send by post'
DENWA-SURU 'phone'	KOTAERU 'answer'		
KIRAI 'dislike'	RENRAKU-SURU 'contact'		

CHUUI-SURU is made with the F handshape, palm facing the body and fingertips pointing to the left. Starting from contact with the chin on the junction of the index finger and the thumb, the arm is extended from the elbow, in a straight path away from the

body. Thus, this is similar to DGS FRAGEN 'ask', which is otherwise unrelated in meaning. While both signs basically follow the same patterns of alignment and fall into the same category (cf. table in (11)), NS provides additional markers of agreement, which I now describe for different pairs of loci.

For both ME-to-R and ME-to-L forms, the sign is executed as in the underlying form except that the movement is directed towards the object locus. For the R-to-ME and L-to-ME forms, it is difficult to align the orientation (by twisting the radio-ulnar part) such that the back of the hand faces the signer. Thus, one drops the orientation change but aligns the path movement so that it starts at the subject locus and ends at the 1st person locus. Actually, the sign may start with optional contact at the chin and then proceed to move from the subject locus to the object locus.¹⁷ In this respect, this is similar to what has been described for AUSLAN signs like ASK, CARE, and EVALUATE, and this is also different from DGS FRAGEN, which need not preserve the contact at the chin.

Next, for the R-to-L form, if the right arm is the dominant one, it is difficult to align orientation such that the back of the hand faces the object locus on the left, as in the forms for a 1st person object locus. Instead, it is the palm which faces the object locus, and the direction of the path movement is aligned, with optional initial contact with the chin.¹⁸ Optionally, one may position the left hand in a A-shape classifier at the object

¹⁷ There is a perceptible break between the contact with the chin and the path movement between loci. In parallel examples from AUSLAN and ASL, there is no break, so that the movement is in one smooth flow. It remains to be seen whether the break is peculiar to NS, and whether this break is in fact a precursor to the smooth flow seen in the varieties of AUSLAN and ASL that were gathered.

¹⁸ The fact that the initial contact with the chin may be dropped supports the analysis of the parallel examples in ASL and AUSLAN, which I describe briefly at the end of the AUSLAN subsection. The stem in these examples consists of two parts, one outside the 'sphere' (i.e. contact with the face) which is not subject to alignment and which may be deleted as shown by the NS examples, and one inside the sphere which undergoes alignment. This process is available even for L-to-ME and R-to-ME forms.

locus for the right hand to direct its movement towards. Another alternative is to switch dominance to the left hand, in which case the back of the hand faces the object locus, and the hand moves in the correct direction from right to left. Note that in this alternative, it is not preferred to place the right hand in the form of an A-shape classifier at the object locus for the left hand to direct its movement to, since this would cross the arms. The situation for the L-to-R mirrors exactly that of the R-to-L form. In sum, the NS sign may preserve its initial contact, and the orientation of the hand may align such that the back of the hand faces the object locus, as long as this is phonetically permissible by whichever arm is used.

DENWA-SURU 'phone' is similar to the corresponding signs in all the other signed languages: it uses a Y-handshape starting with contact near the ear. The NS sign aligns like the above sign CHUUI-SURU. It must start with initial contact near the ear, and then proceed in a path movement from the subject locus to the object locus.¹⁹ No orientation change takes place, given that the radio-ulnar part is already twisted. This is different from AUSLAN and ASL, where the hand involves medial contact near the ear for a 1st person object locus, and from DGS, where the hand does not move at all.

KIRAI is similar to CHUUI-SURU in that it involves the F-handshape, palm facing the body and fingertips pointing to the left. However, there is no contact on the chin, and the hand opens into a 5 handshape while being extended away from the body via the elbow. This is somewhat similar to ASL HATE1, but the ASL sign does not involve path movement, and the palm faces outward in the underlying form, so that it belongs in category 1 (cf. table in (4)). Since it is the back of the hand which faces

¹⁹ Again, as in the case of CHUUI-SURU, there is a perceptible break between the point of contact and the path movement from one locus to another.

outward in the underlying form, one must align the sign by twisting the radio-ulnar part in such a way that the back of the hand faces the object locus. This is not possible for a 1st person object locus; if the right arm is the dominant hand, the aligned form for R-to-L is also not possible. In such cases, one drops the orientation change and just changes the direction of the path movement. One may put the left hand in the A-thumb classifier shape at the left locus to clarify its object status.²⁰ For the L-to-R form, one may continue to use the right arm as the dominant one and align as usual, since it is possible for the back of the hand to face the object locus on the right side. Alternatively, the signers have chosen to switch dominance to the other arm and do the same thing as described for the R-to-L form.

The next sign, ATAERU 'give', is identical to DGS GEBEN, except that the non-dominant hand is added which shadows the dominant hand in its handshape, orientation, and movement. Otherwise, it aligns in exactly the same way as DGS GEBEN, and one is referred to a description of this sign (after the table in (11)) for details.

KOTAERU is one unique NS sign; similar signs have yet to be found in the other signed languages. This sign uses both hands in the L handshape, palms facing outward and the index fingertips pointing upward. They start near the chin, the location of which mandates a specific relation between the two hands: the thumbs must point at each other the whole time. From the elbow, the arms are extended so that the hands move in a straight path away from the body. Since it is not possible to align the orientation of the

²⁰ Two further observations about the A-thumb classifier: (i) this classifier may be associated only with the object locus, not with the subject locus, and (ii) if the object locus is on the left side, the NS signers prefer to use the left hand for the A-thumb classifier; similarly, if the object locus is on the right side, the signers prefer to use the right hand for the classifier. Whichever hand is used to place the classifier, this has the effect of pushing dominance to the other hand. These observations follow from avoidance of crossing the arms, but other (e.g. ASL) signers prefer to cross the arms rather than switch dominance to the other arm.

hands for a 1st person object locus without breaking the relation between the two hands, one merely aligns the direction of the path movement so that the hands start at the subject locus and move towards the signer. For pairs of loci on either side, it is possible to align the orientation so that the palms face the object locus; one then carries out the movement from that position.

For the last sign in this category, OKURU, there are two variants. One is similar to ASL HELP, which also falls into the same category. NS OKURU resembles stamping a letter and moving the whole unit towards the object locus. The non-dominant hand is in the B handshape, palm up and radial side facing outward, while the dominant hand is in the S handshape, palm facing the body. While the whole unit moves in a straight path away from the body (via extension of the arms from the shoulders), the dominant hand's ulnar side makes contact with (stamps into) the palm of the non-dominant hand in the middle of the sign and bounces away at the end through an extension from the elbow. It is difficult to change the orientation of both hands so that the radial side of the non-dominant hand and the knuckles of the dominant hand face a 1st person object locus or an object locus on the right side. In such cases, orientation change is dropped, and only the direction of the path movement aligns, while maintaining the dominant hand's lexical movement of stamping on the base hand.

Another variant of OKURU is more analogous to AUSLAN ANSWER in the sense that the relation between the hands is fixed due to a borrowing from the written orthography of the surrounding environment. Thus the second variant of OKURU resembles the Japanese symbol for the post office, which is like a T but with a double bar at the top, and not surprisingly there are no similar signs in the other signed languages.

The sign is made with a non-dominant V hand, palm facing the body and fingertips pointing to the right, and a dominant index finger, palm facing the body and fingertip contacting the ulnar side of the non-dominant middle finger. The whole unit then moves in a straight path away from the body through extension of the arms from the elbows. Since it is not easy to align the orientation of the hands without breaking their specific relation to each other (especially for object loci on the right side and for 1st person), one does not bother to change the orientation and just aligns the direction of the movement.

Another sign, RENRAKU-SURU 'contact', resembles ASL RELATE: both hands hook into each other in the F handshape so that their palms face each other ; the back of the non-dominant hand would face outward. The movement is in a single straight path away from the body, achieved through an extension of the arms from the elbow. It is phonetically awkward to align the orientation without breaking the relation between the two hands in such a way that the back of the non-dominant hand faces an object locus on the right side or at the signer. Hence, only the direction of the path movement is changed in most of the aligned forms.

Next, we turn to the third category of signs that change both orientation and direction of path movement for alignment. These signs have in common that in the underlying form, the orientation is easily alignable, and the movement consists of a straight path away from the body.

(22) Table of NS signs which change direction of path and orientation for alignment

Type 0	Type 1
FAKKUSU-SURU 'fax'	EIKYOO-SURU 'influence'
IU2 'tell'	HIHAN-SURU 'criticize'
TAZUNERU 'ask'	OIKAKERU 'follow'
	TAYORU 'depend on'
	UKEIRERU2 'accept'

FAKKUSU-SURU is similar to FAX1 in ASL and AUSLAN and therefore falls into category 3 as in the other signed languages: the dominant hand in the bent B handshape, palm down and fingertips pointing away, flattens into a straight B as it moves in a straight path away from the body. One can easily align this sign by twisting the radio-ulnar part so that the fingertips point at the object locus. In the NS version, the non-dominant hand stays in the 'phone' shape near the ear, while the dominant hand carries out the movement as described above.

IU2 'tell' is similar to ASL SEND1, except that the NS sign is signed from near the chin. Otherwise, everything else remains the same, and it is not surprising that both of them are in the same third category. The sign starts in the S handshape, palm down, and opens into a lax 5 handshape while moving away in a straight path via extension of the arm from the elbow. For alignment, one simply twists the radio-ulnar part so that the fingertips of the final handshape point at the object locus when the lexical movement is complete.

TAZUNERU 'ask' is another of the signs unique to NS: the hand is in the B handshape, palm to the face, 'bounces' straight away from the cheek through a downward

twist (extension) of the wrist and extension of the arm from the elbow.²¹ In the end, the fingertips point outward. To align the sign, one may twist the wrist so that the fingertips point at the object locus at the same time the arm is flexed from the elbow, bringing the hand towards the object locus. The phonetic form is similar to DGS GEBEN, the difference being one of location and orientation: the NS sign is near the cheek, whereas the DGS sign is in the neutral space. Moreover, in the NS sign, the fingertips point outward which are alignable, while it is the radial side of the hand in the DGS sign which faces outward, which is not as alignable. It is this difference in orientation that places them in different categories: the NS sign in category 3 and the DGS sign in category 2.

Now we turn to the two-handed signs, all of which are symmetric. The type 3 signs are grouped in more specific categories below. EIKYOO-SURU 'influence' is similar to DGS BEINFLUSSEN and ASL FLIRT: the hands are in the 5 handshape, palms down and fingertips pointing away. There is no contact between the hands, unlike in ASL FLIRT, so there is no relation between the hands that needs to be preserved. The fingers wriggle while the arms move in a straight path from the elbow, unlike in DGS BEINFLUSSEN which has the hands moving back and forth. Under alignment, one can twist the radio-ulnar part so that the fingertips point at the object locus; from there, one carries out the movement from the elbow. Because of the single movement of the arms, NS EIKYOO-SURU is in this category, but DGS BEINFLUSSEN is in category 1 (cf. table in (14)) because of its repeated movement.²²

²¹ In the forms where the addressee is associated with the object locus, the wrist twist may distalize to the K1 joints, so that the form resembles more a bent B flattening into a straight B.

²² For the R-to-L and L-to-R forms, one may drop the non-dominant hand and replace it with the A-thumb classifier, but the dominant hand undergoes the same alignment as described above. Either hand may be used as the dominant one in accordance with observation (ii) in footnote 20. This is also possible for the ME-to-R and ME-to-L forms, for instance, in MANE-SURU 'imitate'.

HIHAN-SURU 'criticize' is identical to ASL HATE2, and as expected they both belong to the same third category (cf. table in (10)). Both hands are in the index finger handshape, palms facing each other and fingertips pointing outward. The movement is a simple extension of the arms from the elbows, forming a straight path away from the body. One can easily align this sign by twisting the wrists so that the fingertips point at the object locus and then carrying out the lexical movement. Note that in the form for a 1st person object locus, the relation between the two hands is changed so that it is the back of the fingers which face each other rather than the palm side; this is fine, since there is no particular relation between the hands in the underlying form which needs to be preserved.

OIKAKERU 'follow' uses the same handshape as HIHAN-SURU but in a different orientation: the index fingers are upright and point upward, while the palms face outward. Both hands shake in trilled sideways extension of the arm from the elbow while moving forward in a straight path, through extension from the elbow, so that the dominant hand, being closer to the body, resembles 'following' the non-dominant hand. For alignment, one can twist the radio-ulnar part as needed to have the palms face the object locus and then carry out the shaking movement as well as the path movement. As in HIHAN-SURU, no relation need be kept between the two hands, so for a 1st person object locus, the ulnar rather than the radial sides of the fingers face each other. However, the hands still preserve their order relative to the body, i.e. the dominant hand is always closer to the body. For pairs of loci that are on the right and the left, the hands remain on their respective sides of the space, so that the arms do not cross. Notice that when

HIHAN-SURU and OIKAKERU align for a 1st person object locus, the hands align independently of each other rather than as a unit.

The next two signs, TAYORU 'depend on' and UKEIRERU2 'accept', are backwards verbs in that the movement in the underlying form is towards the body. While they align both in orientation and direction of movement, they change orientation in different ways than the above, and in different ways for different pairs of loci as well, all owing to phonetic constraints.

Now I turn to the last two categories, in which the order of the hands relative to the body also changes under alignment. Only type 2 and type 3 signs can fit into these categories, since one must have some relation between the hands that can be alignable. All the NS signs in both categories are of type 3, since there are hardly any type 2 signs in the sample data. Moreover, as noted earlier in this subsection, all of the signs are formed with the non-dominant hand in the A-thumb classifier shape, palm facing to the right (if the non-dominant hand is the left one) and the thumb pointing up. Keep this in mind, as I will not include it in the following descriptions of the signs.

In category 4 are signs which change the following properties under alignment: direction of path, orientation, and hand order relative to the body.

(23) Table of NS signs which change direction of path, orientation, and hand order

Type 3	
KOROSU 'kill'	NAGURU 'hit'
MANE-SURU 'imitate'	SATSUEI-SURU (KAMERA) photograph'
MIRU2 'watch'	YOBU 'call'

All of these signs are similar in phonetic form and meaning to their counterparts in other signed languages. For instance, KOROSU 'kill' resembles shooting with a gun at the non-dominant hand. The dominant hand is in the L handshape, palm to the left and index fingertip pointing outward at the non-dominant hand. The dominant hand moves in a straight path towards the non-dominant hand via extension of the arm from the elbow and ultimately contacts the non-dominant hand on the fingertip. For a 1st person object locus, it is the non-dominant hand which is closer to the body, and the dominant hand aligns its orientation by twisting the wrist and the radio-ulnar part so that the fingertip points directly at the signer (and the non-dominant hand). The ASL counterpart SHOOT-with-GUN works in the same way, minus the non-dominant hand, so that it belongs to category 3. Both AUSLAN SHOOT-with-GUN and DGS SCHIEßEN involve a bouncing movement rather than a straight path movement, so I place them both in category 1 for changing only in orientation. (As mentioned, the DGS signers prefer to use PAM with SCHIEßEN so it is actually in category 0, but it has potential for aligning like the AUSLAN sign).

MANE-SURU 'imitate' and SATSUEI-SURU 'photograph' are similar to ASL COPY, AUSLAN COPY²³, and DGS KOPIEREN, which I already discussed in the section on AUSLAN under table (13). I refer the reader to that section for a detailed description of these signs. The NS version uses the A-thumb classifier as the base hand, while the ASL version uses the B hand as the base hand. Otherwise, they align in the same way, and they are both in category 4. The AUSLAN version lacks a base hand and

²³ For a 1st person subject locus, MANE-SURU drops the non-dominant hand and involves final contact with the forehead, whereas SATSUEI-SURU does not. If the object locus is 1st person, the A-thumb classifier is at the subject locus, which is an exception to the observation that the classifier is usually at the object locus. This may be due to the 'backward' nature of the verb.

trills the movement, so it falls into category 1, while DGS KOPIEREN is identical to ASL COPY and should be in category 4, but the signers choose not to align it and instead use PAM, so that it is in category 0.

MIRU2 'watch' is practically the same as ASL LOOK and AUSLAN WATCH, except that the A-thumb classifier is added as a base hand. See the discussion of AUSLAN WATCH under table (19) for the description of these signs. MIRU2 is in category 4 because of the base hand; if one removes the base hand, as is done in the ASL and AUSLAN forms, the sign would be in category 3, which is indeed the case. The form elicited from the DGS signers has static movement, so only orientation changes and the DGS sign belongs to category 1.

NAGURU 'hit' is similar to ASL HIT1: the dominant hand is in the S handshape, palm down and K1 knuckles facing outward; one moves this hand in a straight path by extending the arm from the elbow. One aligns this sign by twisting the radio-ulnar part so that the K1 knuckles face the object locus.²⁴ Then the lexical movement is carried out in that configuration. If there is no non-dominant hand involved, as in ASL HIT1, this sign would belong to category 3, but the NS sign adds an A-thumb classifier at the object locus, so that the NS version ends up being in category 4. While AUSLAN HIT is similar with respect to the dominant hand, the position of the base hand (a B handshape with the palm down and fingertips pointing to the right) with respect to the dominant hand renders the sign iralignable, i.e. category 0. Since the ulnar side of the base hand faces outward, one must align it so that the ulnar side faces the object locus, which is not phonetically possible for many object loci. As an alternative, one could drop the orientation change for

the base hand yet continue to align the dominant hand. This does not happen either, for there seems to be a strict relation between the two hands that must be preserved, which would otherwise be destroyed if one went ahead with the alternative.²⁵

YOBU 'call' is similar to ASL CALL, except that the base hand is in the A-thumb handshape rather than the lax B handshape facing down palm-wise. The dominant hand is in the B handshape, palm down and fingertips pointing outward, and moves in a straight path towards the body (thus a 'backwards' verb), while the B handshape bends by flexing the fingers at the K2 knuckles. For alignment, the non-dominant hand becomes closer to the object locus, while the radio-ulnar part of the dominant arm is twisted so that the fingertips point towards the object locus at the beginning; accordingly, the direction of the path movement is also aligned.²⁶ Thus both YOBU and ASL CALL fall into the same 4th category. The AUSLAN and DGS counterparts are different in phonetic form, so one cannot compare them.

The next set of signs involve a non-dominant hand in the A-thumb classifier and the dominant hand carrying out a specialized lexical movement on, rather than just a straight path movement towards, the non-dominant hand so that in alignment, only the orientation of the dominant hand and the order of the hands relative to the body change.²⁷

²⁴ For a 1st person object locus, the non-dominant hand may be dropped, and the dominant hand directed towards the temple, thus revealing the precise underlying location of the sign (as in CONVINCE and REMIND in ASL, which also involve contact with a specific part of the body).

²⁵ No sign was elicited for DGS that is equivalent in meaning to the above signs. SCHLAGEN 'fight' is similar in phonetic form to ASL HIT1, except that the movement is reduplicated and the dominant hand faces the non-dominant hand, which is added and alternates with the dominant hand in its movement. This is in fact similar to ASL FIGHT, and given their reduplicated movement plus the specific relation between the two hands, they are both plain. However, one cannot really compare these signs with the signs discussed above, since they do not exactly have the same meaning.

²⁶ As with NAGURU 'hit', the non-dominant hand may be dropped for a 1st person object locus, while the dominant hand carries its movement from the top of the head, thus revealing this to be the underlying location.

²⁷ The orientation of the non-dominant hand does not change under alignment, since the handshape in the underlying form makes it difficult for the radio-ulnar part to twist comfortably.

(26) Table of NS signs which change orientation and hand order under alignment

Type 3
DAMASU 'deceive'
HAGEMASU 'encourage'
MAMORU 'protect'
TASUKERU 'help'

In DAMASU 'deceive', the dominant hand is upright and in the 'horn' handshape where the index and pinky fingers are extended while the thumb contacts the fingertips of the middle and ring fingers. The palm of the hand faces outward, and the dominant hand rotates behind the non-dominant hand in the vertical plane through a mixture of straight and sideways extension from the shoulder.²⁸ For alignment, one rotates the whole unit so that the non-dominant hand is closer to the object locus and the palm of the dominant hand is to the object locus, which can be achieved easily through a twist of the radio-ulnar part.

HAGEMASU 'encourage' and TASUKERU 'help' seem to be quite close in phonetic form, so I will treat them as a single sign here and use the gloss TASUKERU. The dominant hand is in the B handshape, with the palm facing up at a tilted angle and the fingertips pointing up. The palm side 'pats' the thumb side of the non-dominant hand through trilled extension from the elbow. The whole unit may also move away slight through extension from the shoulders. To align the sign, the non-dominant hand must be

²⁸ See footnote 13. NS DAMASU provides a nice, rare example of having movement in the vertical plane in the underlying form.

closer to the object locus, and the palm of the dominant hand must face the object locus, which is usually done through twisting the radio-ulnar part.²⁹ ASL HELP is different in that the palm of the dominant hand stays in contact with the ulnar side of the non-dominant hand the whole time, and there is no 'patting' movement (except in the nominal form) so that alignment is shown only through the direction of the path movement; thus ASL HELP belongs to category 2. While the DGS and AUSLAN signs differ from the NS sign even more than the ASL sign, they belong to the same category as the ASL sign, i.e. category 2.

The last sign is MAMORU 'protect', which has the dominant hand in the curved B handshape, palm facing the palm of the non-dominant hand, and the fingertips pointing out. The dominant hand makes a 'wrapping' gesture around the thumb side of the base hand through repeated twisting of the radio-ulnar part. Under alignment, the non-dominant hand is placed in such a way that it is closer to the object locus than the dominant hand, while the dominant hand's palm faces the object locus more or less.³⁰

²⁹ Two interesting notes which I will elaborate on in Chapter 3: (i) the reciprocal form for the R-L loci reveals clearly that the palm faces the object locus. It first pats the palm side of the non-dominant hand so that it faces the object locus on the left side; then it pats the back of the non-dominant hand so that it faces the object locus on the right. This last part requires raising the arm from the shoulder so that the dominant hand is turned upside-down. One could do it another way without turning it upside down, with the result that the fingertips of the dominant hand point towards the body. This option, however, would block the addressee's view of the non-dominant hand. This reciprocal form provides a nice way of fixing dominance, because the NS signers often switch dominance, and it is not always obvious whether the sign can align in absence of dominance-switching. (ii) For a first person object locus, the dominant hand pats the bottom rather than the back of the knuckles; this may be for the same reason, namely that the non-dominant hand remain visible to the addressee.

³⁰ Unlike in the other examples, the non-dominant hand has not been dropped for the 1st person object locus.

2.4 Interactions with other morphemes

Having presented primary data from ASL and cross-linguistic evidence from DGS, AUSLAN, and NS, I now turn to the third kind of argument in favor of alignment: interactions with other morphemes such as markers for number and aspect reveal that alignment is the right characterization of ‘agreement’ and that it is best treated as a phonological re-adjustment rule.

2.4.1 ‘Multiple’ morpheme

One marker for number is what has been called the ‘multiple’ morpheme (Klima and Bellugi 1979). This morpheme marks a plural object argument and adds an arc to the stem; the precise location of the arc depends on the loci whose associated referents are part of the object argument. As mentioned in the introduction, this ‘multiple’ morpheme can mark only object arguments, not subject arguments (Padden 1983, Supalla 1996). Why this is so, I leave for further investigation, but I suggest that it has to do with a general property in signed languages that movement is towards the object, and that when the movement is an arc, this means that the shape of the arc must be convex towards the object.

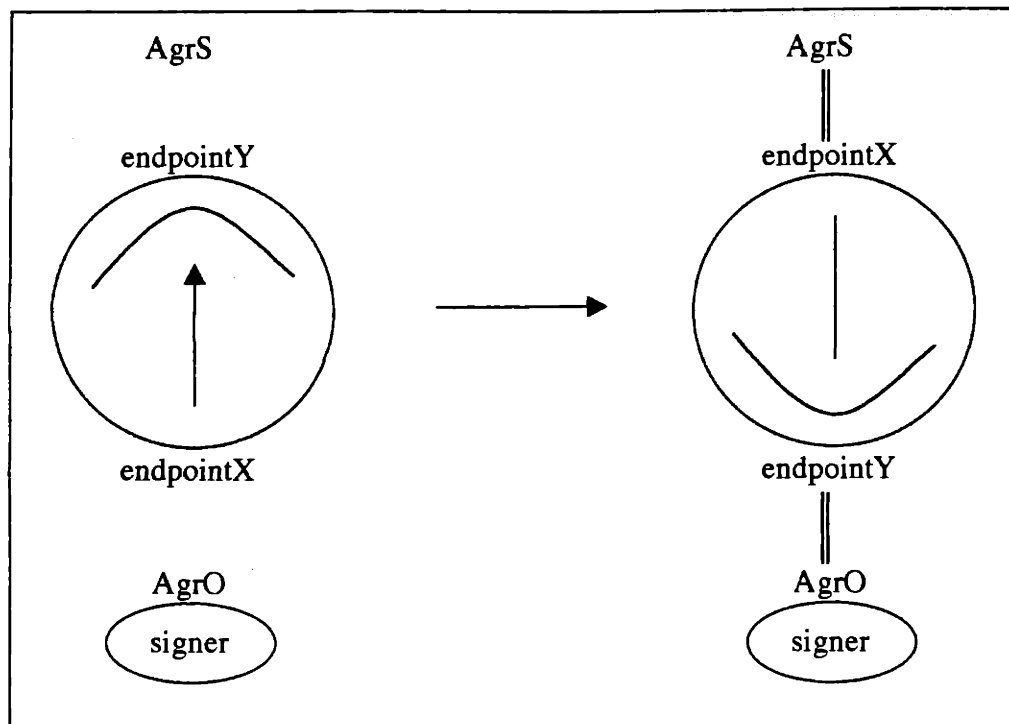
I propose to encode the object-oriented property of the ‘multiple’ morpheme by including the arc among the vocabulary items for AgrO, while leaving it out of the vocabulary items for AgrS. If the ‘multiple’ morpheme gets inserted at Vocabulary Insertion (VI), and if alignment takes place after Vocabulary Insertion, one comes to the conclusion that the insertion of the ‘multiple’ morpheme must precede alignment. I argue

that this is the correct result, for that is the only way to derive correctly the following forms, which I consider in turn:

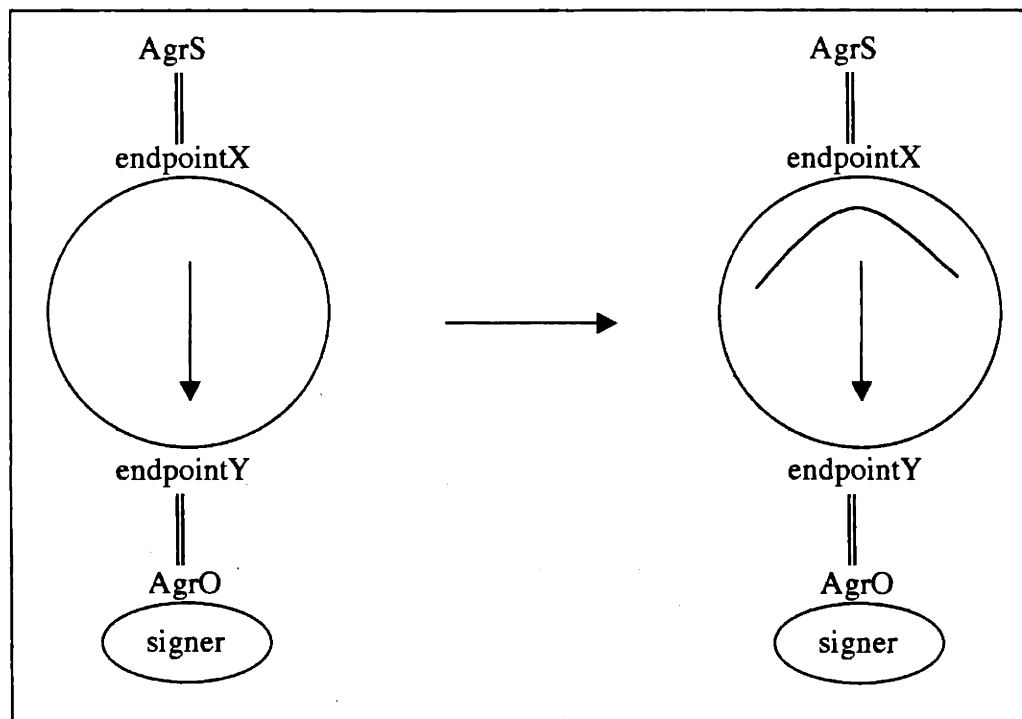
- (27) i. I-GIVE-YOU(multiple)
ii. YOU-GIVE-US(multiple)
iii. *I(multiple)-GIVE-YOU
iv. *YOU(multiple)-GIVE-US

To derive the first form (i), the underlying form of GIVE plus the multiple arc will have been placed inside the root/sphere at the time of VI. The AgrS and AgrO loci will be those associated with the signer and 'YOU-multiple' respectively, and since they already match the endpoints X and Y, the alignment will be vacuous. Since the alignment is vacuous, it makes no difference whether one inserts the 'multiple' morpheme or performs alignment first. It is the next form (ii) which distinguishes between the two ordering possibilities. If one adds the arc to the underlying form, which will be convex outward as in the first form, and then carries out alignment so that the AgrS and AgrO loci line up with the correct endpoints, the arc will be aligned in such a way that it is convex towards the 1st person object locus, which is the correct result. If one aligns the underlying form first and then adds the arc, the arc would be incorrectly convex outward since it will not have participated in the alignment. The following figures in (28) and (29) illustrate the two different ordering possibilities.

(28) 'Multiple' insertion followed by alignment



(29) * Alignment followed by 'multiple' insertion



The remaining two forms (iii) and (iv) will not occur, since there will be nothing in the vocabulary items for AgrS to indicate the insertion of an arc. While number will not be marked, the forms will still undergo alignment for person agreement, and this is the correct result. For example, the correct form for (iv) will be signed similarly to YOU(singular)-GIVE-US. The plural number of the subject will be clear from an overt pronoun, either in the same sentence or in the preceding discourse. (In other signed languages such as DGS and NS, the number may be marked through PAM-like elements.)

That 'multiple' insertion takes place before alignment is an interesting result because one could think that it would be the other way around. As we have seen, for a subject argument, number marking is dropped but person marking through alignment is still preserved. This could be accounted for by some universal hierarchy of features, e.g. that proposed by Noyer 1992, which ranks person features above number features, which are in turn ranked above gender features. One function of such a hierarchy is to decide which feature gets expressed in the event that two features cannot be expressed at the same time. According to that hierarchy, then, person features would 'win' out over number features when it comes to marking agreement features for a subject argument in signed languages. However, the hierarchy does not necessarily say anything about the order in which the markers for each of the features are inserted in case several can be inserted at the same time. Moreover, in the analysis presented here, number marking is not really dropped for subject arguments, as there is no impoverishment rule. The 'multiple' marking just does not get inserted in the first place for a subject argument, since it does not appear in the list of vocabulary items for AgrS. Also, alignment is not

necessarily equivalent to person agreement marking, for it is a phonological re-adjustment rule, which is dependent on the endpoints of the stem being aligned with loci that Agr heads are linked to. There is nothing in the vocabulary items for Agr to indicate an overt marker for person. I assume that a marker for a singular feature, whether 1st person or non-1st person, is a null morpheme.

Two more issues need to be discussed regarding the figure in (28) that reflects the correct ordering of 'multiple' insertion before alignment. First, one will notice that in the initial form and in the aligned form, I have not indicated in what direction the arc goes. I have done this on purpose, because the arc can actually go in either direction, depending on how one envisions the referents associated with the loci. For example, if there is a row of people in front of me who I am giving books to, I can either start at the extreme right locus and make an arc to the left, or vice versa, depending on who I give the book to first. However, if the starting point is not specific (either not known or not important), the default direction is to the right. This is not surprising, for there seems to be a general preference for lateral (or horizontal) movement to return the hand to its resting position. If the dominant hand is the right hand, for example, there is a preference for the horizontal movement to proceed from left to right. Thus, I leave the direction of the arc unspecified at Vocabulary Insertion, leaving it to be fixed by a combination of discourse and/or phonological factors.

By leaving open the direction of the 'multiple' arc, I also avoid one potential problem in correctly aligning the direction of the arc. Suppose that the vocabulary item for a 'multiple' AgrO specifies an arc that is convex outward and also specifies the direction of the arc, e.g., to the right. This would be consistent with the fact that the arc

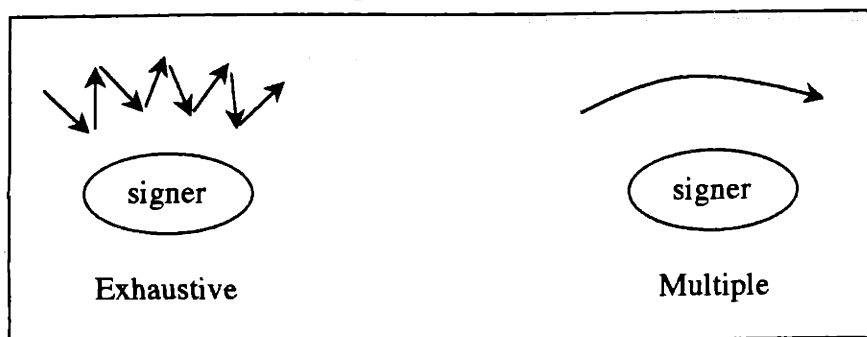
generally goes to the right for a non-1st person object, but not with the fact that it could also go in the opposite direction, but let's leave that aside for the moment and just suppose that the arc goes only to the right in the underlying form. Now suppose that AgrO is linked to a 1st person locus. The whole unit would align so that the arc goes through the 1st person locus and to the left. While this could be one way to sign the form, it does not allow another possible, if not more frequent, form which goes to the right. This becomes a non-issue if one does not specify the direction of the arc at insertion.

The second issue is how to combine the verb stem and the 'multiple' arc into a single entity. The combination can occur in one of four ways, depending on the underlying form of the verb. First, there are verbs like GIVE and HELP whose 'multiple' form consists only of an arc. There is no straight movement like that which is present for one-on-one forms prior to the arc (e.g. ME-to-Left or Left-to-Right). Second, there are verbs like ASK, BAWL-OUT, and INFLUENCE which involve a handshape change in the underlying form. This too is preserved in the 'multiple' form: the handshape change is spread over the arc. Like GIVE and HELP, there is no straight movement. Third, verbs like INFORM and VISIT involve initial contact with the face in the underlying form. This contact must be preserved in the 'multiple' form so that there is first a straight path movement away from contact with the face, followed by an arc. This differs from the previous signs, which do not involve straight movement in the 'multiple' form. This analysis receives further evidence from the fact that INFORM also involves a handshape change which does not start until the beginning of the arc. Thus, the straight movement is of the phonetic type, providing a smooth transition between the initial contact on the face and the arc. Another piece of evidence comes from the aligned form for YOU-INFORM-

US(multiple): the sign still starts with a straight movement away from the body, and then moves in an arc convex towards the body. The fact that the straight movement does not align suggests that it is not part of the root/sphere which participates in alignment, as noted earlier in the chapter.

Last, there are verbs which involve specialized lexical movement, such as HIT2 (upward movement through supination of the upper arm), BEG (bending of the fingers at the K1 knuckles), CONTROL (alternating, trilled flexion of the arm from the elbow), CONVINC1 (supination of the radio-ulnar part), and FORGIVE (sideways movement of the arm from the elbow). All these signs preserve their lexical movement throughout the arc. That is, the movement is reduplicated throughout the arc. This is distinct from the 'exhaustive' form, which also involves reduplication of the movement and looks similar, but in the 'exhaustive' form, there is a clear phonetic movement present between each reduplicant, so that the hands seem to return to the body before going back to make the next reduplicant. These phonetic movements are not present in the 'multiple' form. This can be seen clearly with a two-handed, non-symmetric sign like FORGIVE, which involves rubbing the dominant fingertips against the upward palm of the non-dominant hand. In the 'exhaustive' form, the whole unit goes back and forth between the body and the outward space in forming each reduplicant. However, in the 'multiple' form, the whole unit stays on the arc and does not go back to the body until after the end; thus, the non-dominant hand makes a sweep through the arc while the dominant hand carries out its movement in concert with the non-dominant hand.

(30) 'Exhaustive' versus 'multiple'

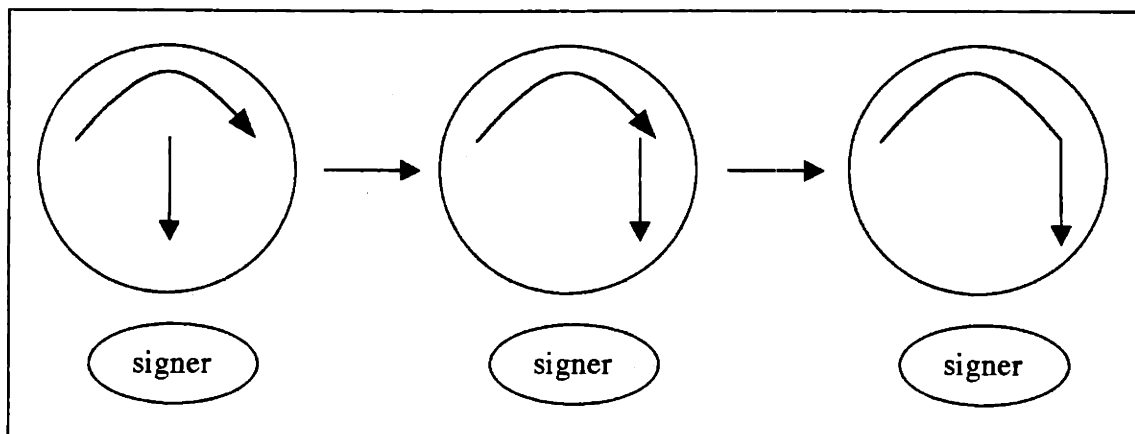


There are some signs like BEG which can either reduplicate its lexical movement throughout the arc like the above signs or which can carry out its lexical movement just once throughout the arc, like ASK, BAWL-OUT, and INFLUENCE. In fact, all those signs which involve a handshape change may reduplicate it throughout the arc as well, but the movement is reduced and finer in each reduplicant. More specifically, any lexical movement must be restricted to the joints within the hand, if it has not already been so in the underlying form. For instance, ASK in its underlying form already involves bending of the finger at the K1 knuckle, which is within the hand, so it is just a matter of bending the finger repeatedly throughout the arc. However, BAWL-OUT in its underlying form can involve extension of the arm from the elbow, in addition to the opening of the fingers from the K2 knuckles. In the reduplicated 'multiple' form, the extension from the elbow is dropped, and the opening of the fingers is distalized from the K2 to the K1 knuckles so that the opening movement is more reduced and finer.

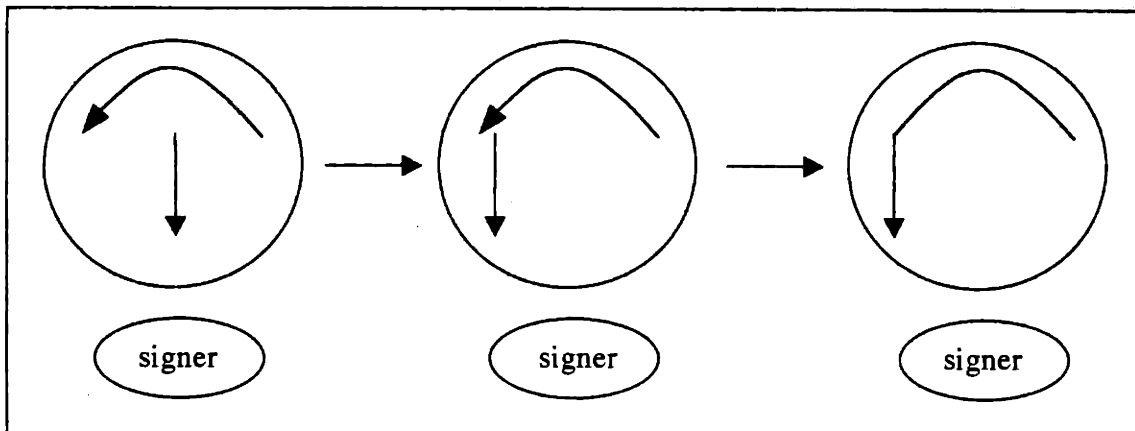
The set of 'backwards' verbs, in which the underlying movement is towards (rather than straight away from) the body, interacts with the 'multiple' arc in several interesting ways. First, there are several signs such as BORROW, INVITE, and PICK1, which involve straight movement towards the body in the underlying form. PICK1 in

addition involves a closing movement of the thumb and index fingers from the K2 joints. They are similar to INFORM and VISIT in that an arc is attached to the straight movement from the underlying movement, only that this straight movement occurs after the arc for the backwards verbs. This suggests that the direction of the arc, when it is assigned through discourse and/or phonological processes, is aligned with the direction of the stem in such a way that they form a continuous path. This makes the following predictions, which are consistent with the data seen so far:

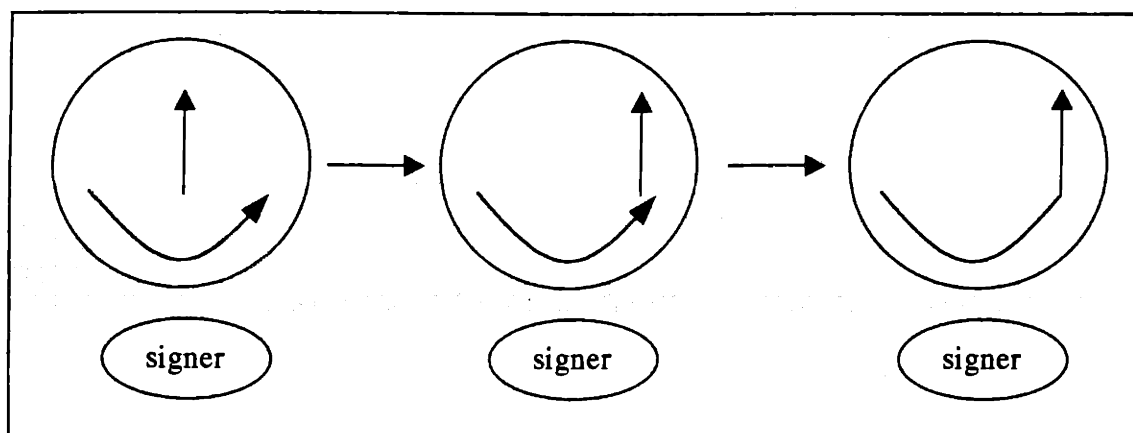
(31) Backwards verb, non-1st person multiple object (left to right)



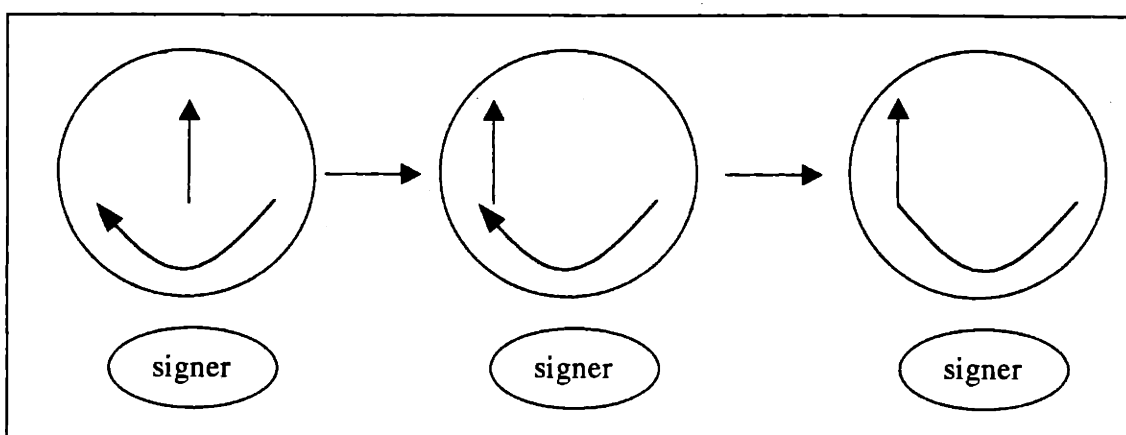
(32) Backwards verb, non-1st person multiple object (right to left)



(33) Backwards verb, 1st person multiple object (left to right)



(34) Backwards verb, 1st person multiple object (right to left)



I should note here that the aligned forms of these three verbs for 1st person multiple object do not occur as expected; instead, the arc is dropped (but the aligned form of the verb stem remains) and an overt pronoun is used to make visible the plural number of the object. That arc may be dropped if it makes the sign too complex, but it is only one of several options available to the signer in case a sign becomes too complex.

Another backwards verb, RECRUIT, shows a different way of combining the verb stem with the 'multiple' arc. The lexical movement towards the body is preserved

through the sweep when the form is for ME-to-YOU(multiple). In this form, the non-dominant hand moves steadily through the arc, while the dominant hand reduplicates its lexical movement on the non-dominant hand. This is similar to the case of FORGIVE, since the 'multiple' form can be clearly distinguished from the 'exhaustive' form by looking at the non-dominant hand which moves steadily through the arc in the 'multiple' form while it moves back and forth from the body in the 'exhaustive' form. For a aligned form like YOU-to-ME(multiple), the pattern is the same: the dominant hand carries out the reduplicated movement, this time away from the body, on the non-dominant hand, while the non-dominant hand moves in an arc convex to the 1st person object locus. Once again, the signer may choose to alter the form to make it easier to produce phonologically, such as aligning the orientation of the dominant hand only half-way or dropping the reduplication of lexical movement altogether and have the dominant hand make one sweep with the non-dominant hand.

In this respect, COPY is similar to RECRUIT. For the ME-to-YOU(multiple), the non-dominant hand moves in a sweep along the arc which is convex away from the body, while the dominant hand reduplicates its lexical movement from the non-dominant hand, namely, move away from the non-dominant hand while closing into a flat-O handshape. For the YOU-to-ME(multiple) form, one should also reduplicate the movement, which is now away from the body, as well the handshape change, while the non-dominant hand moves in an arc convex to the body. However, the signer chooses to reduce the complexity of this sign by dropping the reduplication of the movement and doing the handshape change only once throughout the arc.

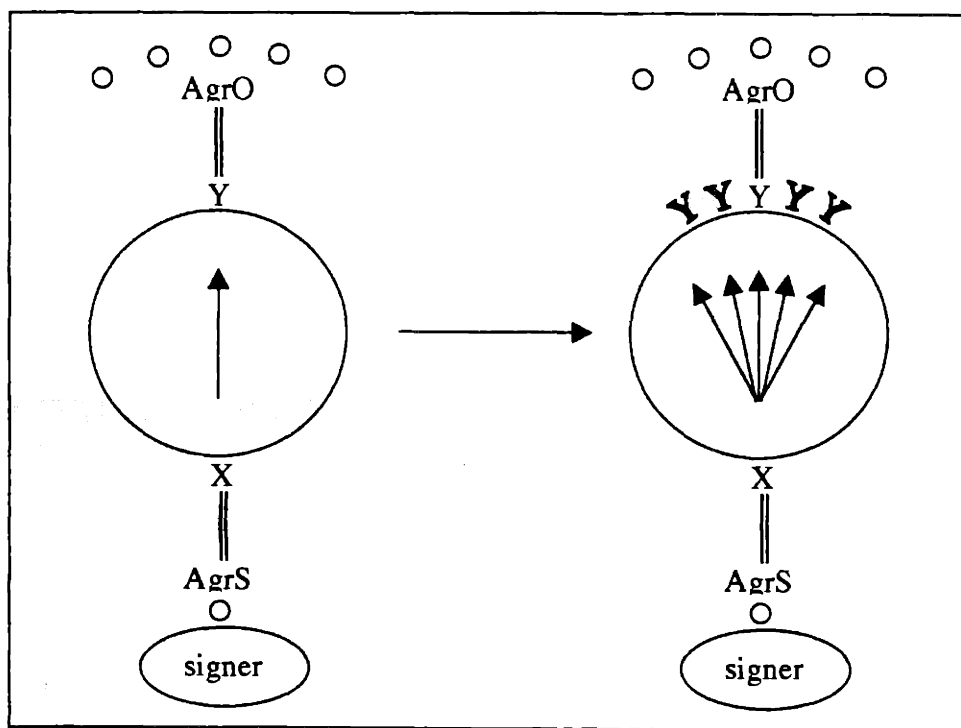
TAKE-ADVANTAGE is another backwards verb which is similar to BEG, ASK, BAWL-OUT, and INFLUENCE in that it can either reduplicate the handshape change throughout the 'multiple' arc or do it only once. This is a particularly interesting example, because there is a different mouth formation associated with each option. In the case where the handshape change is reduplicated throughout the arc, one must use the 'th' mouth formation, whereas in the case where the handshape change is done only once through the arc, one must use a 'bo' mouth movement. These mouth formations are often used as adverbials in other signs: 'th' carries a slightly negative connotation and when combined with some other signs, it adds the meaning that the action denoted by the sign was done carelessly or without concern. The 'bo' carries the connotation that the agent argument is thrilled, delighted at the prospect of the action happening. While these mouth formations contribute different shades of meaning to the sign, one should note that the 'bo' formation cannot be used when the handshape change is reduplicated (but the 'th' formation may be used if the handshape change occurs only once). This may have to do with a phonological requirement that there be coordination between the mouth movements and the hand movements, but I leave this aside for future research.

The preceding discussion of the backwards verbs shows that they still pattern like the regular verbs in that they conform to one of several ways, available to regular verbs, of combining the verb stem with the 'multiple' arc. Moreover, the interaction of the verb stem with the 'multiple' arc can reveal the underlying form of the verb stem. I would like to propose that for the underlying forms for verbs which involve a straight path away from the body, e.g. GIVE and HELP, the movement be left unspecified, which can be filled in by a redundancy rule later in the phonology component. However, all the other

verbs including those with specialized lexical movement and backwards verbs which involve straight movement towards the body, should have such movement specified in the underlying form, so that one is able to predict correctly the combination of the movement with the arc.

In closing, I would like to note that 'multiple' is not the only number that is present in signed languages. For instance, there is 'exhaustive' which has been mentioned. I assume that there is a morpheme RED (short for 'reduce') which gets inserted at Vocabulary Insertion for an 'exhaustive' feature, whether in AgrS or in AgrO. I assume that since Agr will be attached to several (not one) loci, alignment will then apply in such a way that it will be repeated for each of the loci. This has the desired result of reduplicating the movement, which is the correct form of the 'exhaustive' morpheme.

(35) Insertion of 'exhaustive' morpheme



Padden (1983), among others, draws a semantic distinction between repeating the verb for each respective locus and the 'exhaustive' form, which is an abbreviated form of the repeated verb. This is where the morpheme RED comes into play. Later in the phonological component, RED will be interpreted as reducing the repetitions into a grammaticized form known as the 'exhaustive'.

There are other numbers such as 'dual' which I assume is reduplication of the verb stem for each of two loci. Padden (1983) mentions three different ways of showing the 'dual' form. First, one can reduplicate the verb stem for each of the two loci in the same manner described above for the 'exhaustive' morpheme. Second, if the verb is one-handed, one can use the dominant hand to align for the first object locus, and then use the non-dominant hand to align for the second object locus. One could do these in turn or at the same time, yielding the third way. I suggest that all of the three forms can be generated from the underlying form, with the option of using the non-dominant hand to align for the second locus being provided in the phonology component. Moreover, I suggest that whether to use the two hands one after another or at the same time is determined by discourse factors: if one wishes to stress the fact the two events conveyed by the 'dual' form of the verb occurred at the same time, one may use the two hands simultaneously. Otherwise, the default form seems to be using one hand after another, which is less marked phonologically than using two hands at the same time, and which does not specifically convey the order of the two events.

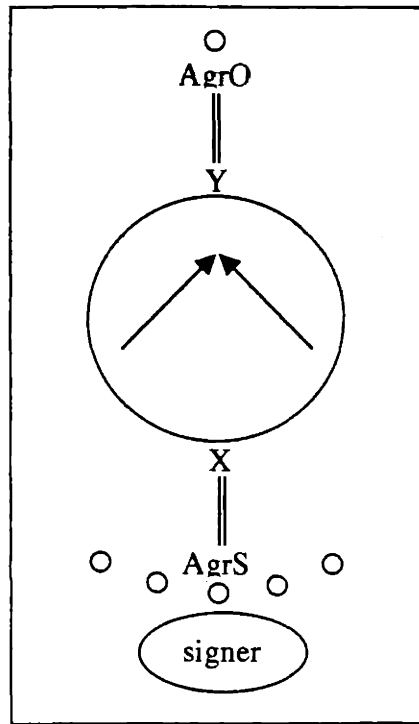
Finally, in the course of eliciting ASL data from one signer, two forms were discovered which can express a plural subject. I leave them for further investigation, and for now describe them briefly. Both look like the 'dual' form in that both hands are used,

but they are still distinct. One is what I will refer to the 'alternating two-handed' form. This is similar to what Klima and Bellugi (1979) describe as 'allocative indeterminate', but they show the inflection as applying to the object, whereas I show that this can apply to the subject as well. Imagine a series of loci aligned on an arc that is associated with the subject. From these loci, the hands alternate in moving towards a single, definite object locus. As one ASL signer notes, the singularity of the object is clear from eye gaze which is focused only on a single locus. This form can align for non-1st person and for 1st person subjects. While this form applies straightforwardly to one-handed signs, it can apply to signs with contact on the face (e.g. FEED, IGNORE, RESPECT, TELL) or to two-handed signs of type 3 (e.g. TAKE-ADVANTAGE, CALL-TTY, FALL-IN-LOVE), provided one starts with the full form first, after which one may drop contact with the face or with the non-dominant in reduplicating the verb stem. As a result, it seems to be productive, as it has been applied by one signer to over one third of the sample data.

The other form for marking a plural subject is less productive, applying only to 11 out of 150 verbs. Most of these 11 signs are one-handed and the rest two-handed symmetric. Again, imagine a series of loci arrayed along an arc that is associated with the subject. From each of two loci that are equidistant from the center of the arc, one hand moves directly towards the object locus. This is different from the dual form. For a dual form that includes the signer as one of the two subjects, one would use a loci associated with the signer and another apart from the signer, not two loci on either side of the signer. Moreover, another way to distinguish the dual form from this form is through eye gaze; in a dual form, one would gaze at the two subject loci if they are non-1st person, but in this form, one would gaze at a point between the two loci so that it is clear that one is

gazing at a group of people (cf. Bahan 1996). This form is alignable for 1st person and non-1st person forms, as shown below in the figure.

(36) Insertion of alternate 'multiple' form for a 1st person subject



The meaning is clearly that all the loci in between the two loci from which the hands move are included as part of the subject argument. This may be an alternative to the 'multiple' marking which is not available for subjects generally, since the meaning is quite close to that of the 'multiple' marking, i.e. that all the referents associated with the subject loci are equal participants in the action denoted by the verb. However, it is possible that the forms may interact with aspectual forms which may be compatible with a plural subject, so I will refrain from assuming that these are the true counterparts to the

'multiple' morpheme for the object and therefore will leave the vocabulary items for AgrS as they are.

2.4.2 *Continuous aspect*

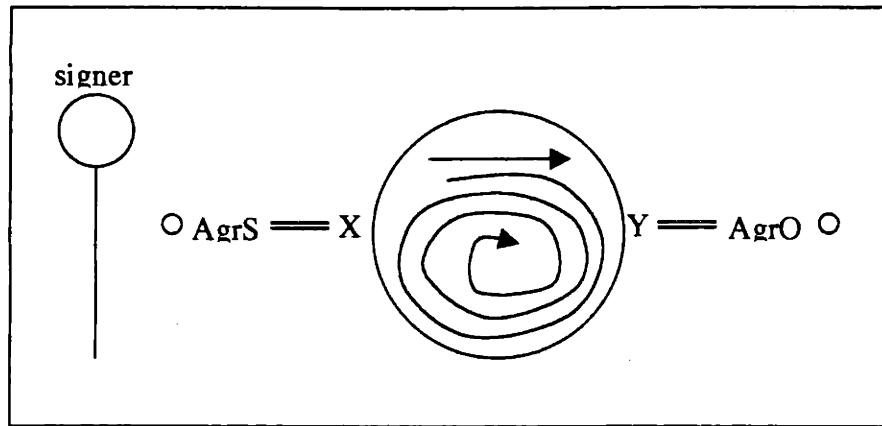
Now I turn to another kind of marker, that for aspect. Klima and Bellugi (1979) describe a multitude of aspectual modulations, but I will focus on just one for ease of exposition: the continuous aspect, which modulates the verb stem in such a way that the movement traverses several times in the same circle within the midsagittal plane and which adds the meaning that the action denoted by the verb is drawn out over a long time. I assume that there is a morpheme inserted for continuous aspect at Vocabulary Insertion which will generate the circular movement in the phonological component.³¹

It is possible to align a form that is modulated for continuous aspect. For example, ASL LOOK with continuous aspect is formed with a V handshape, palm down and fingers pointing outward, that moves continuously in a circle within the midsagittal plane. For an object locus associated with the addressee and a subject locus associated with the signer, the fingertips are oriented so that they face the object locus. The movement is carried out as usual in the circle. If the object locus is with the signer, however, the fingertips will face the signer and the direction of the circular movement will be towards the signer as well. The following figures demonstrate these two different scenarios, but

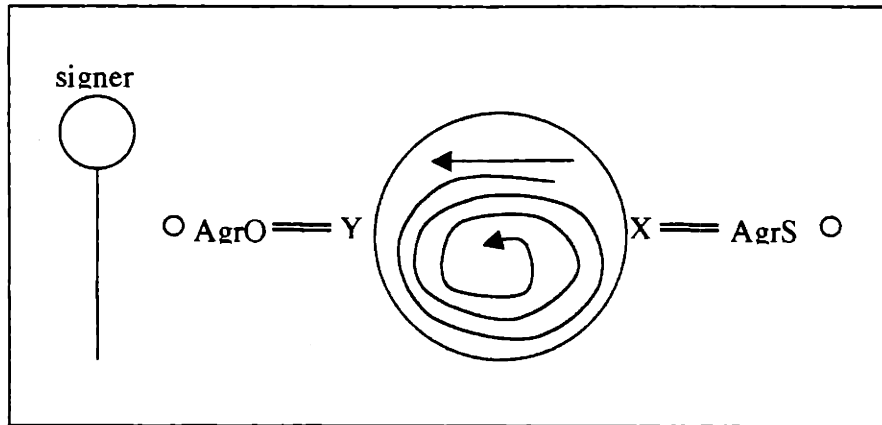
³¹ It remains to be seen how this aspect can be applied to backwards verbs or verbs that involve final contact with the non-dominant hand. There may also be semantic restrictions on the use of this aspect, i.e. it must be compatible with some semantic property of the verb. Finally, it is possible that this aspect may be inserted via a phonological re-adjustment rule rather than through vocabulary insertion. I leave all those issues for future research, but for now I will assume that the continuous aspect is inserted as a morpheme at Vocabulary Insertion.

the aspectually modulated verb can be aligned to face most other object loci as well to the extent that is permissible by phonetic constraints.

- (37) Continuous aspect with aligned form for 1st person subj. and non-1st person obj.



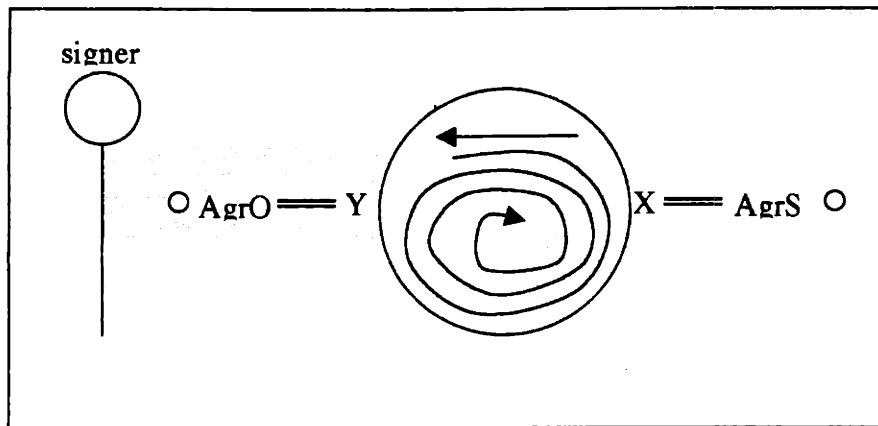
- (38) Continuous aspect with aligned form for 1st person obj. and non-1st person subj.



I assume that the insertion of aspect occurs before alignment, as with 'multiple' insertion, because if one aligns the sign first for a 1st person object locus so that the fingertips face the signer, and then add aspect, the direction of the circular movement will be away from

the signer, not towards the signer as it should, since it will not have participated in the alignment.

(39) * Alignment before insertion of 'continuous' aspect



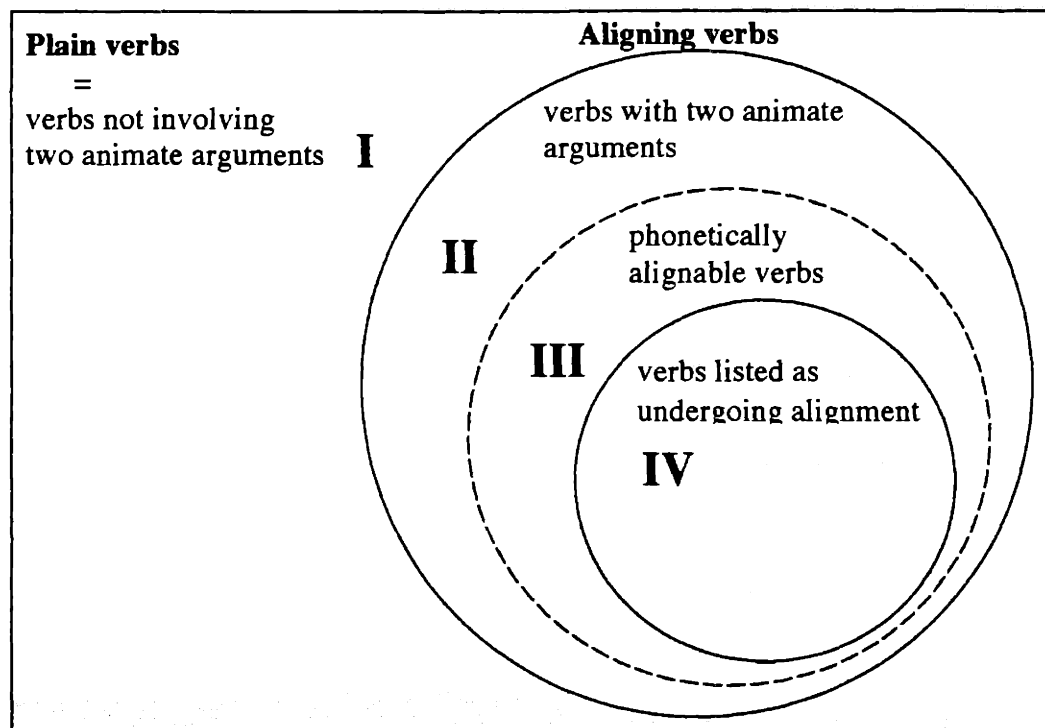
Finally, it is possible to combine the 'multiple' form, the 'continuous' aspect, and alignment into a single form, although this is quite marked due to its phonological and informational complexity. I assume that there is a process which will correctly combine the 'multiple' form and the 'continuous' aspect so that the plane of the circular movement matches the plane of the arc (horizontal). Then, the form will go in a circular movement within the horizontal plane, i.e. the arc becomes reduplicated. This is one clue suggesting that 'multiple' insertion occurs before 'continuous' aspect is inserted, and that 'continuous' aspect is indicated as some kind of reduplication in a circular path at Vocabulary Insertion, with the plane of the circular movement being decided later in the derivation, depending on the stem. In whatever way these two morphemes are combined, the result is alignable: for a set of object loci associated with the addressees, the fingertips will face the object loci, while the movement will go in a clockwise direction within the

horizontal plane, if one is looking at the plane from above.³² For a set of object loci that include the signer's, the fingertips will face the signer's locus, among other loci, and the movement will be in a counterclockwise direction.

2.5 Residue

In this section, I wish to discuss remaining signs that do not fall as neatly into one of the five categories that I have described for each signed language, i.e. what some may call 'plain'. So far, the following typology of verbs has emerged:

(40) Set of all verbs in a signed language



³² This assumes that the direction of the arc has been fixed as going from left to right. If it went in the other way, the movement would become counterclockwise.

Since I define alignment as applying only to (di)-transitive verbs with two animate arguments, those verbs which do not have two animate arguments (I) do not participate in alignment and may be properly considered as 'plain' verbs in the terminology of Padden (1983). I have already discussed verbs which are possible candidates for showing alignment phonetically (III), and the further subset (IV) which actually show alignment in a given signed language. While alignment should in principle apply to all verbs that have two animate arguments, phonetic constraints may prevent it from happening for some or all pairs of loci for some verbs. Thus, some verbs may look like as if they belong to the proper set of plain verbs which do not undergo alignment, but I argue that they are in fact aligning verbs but fail to show alignment for some pairs of loci due to phonetic constraints. In other words, these verbs would belong somewhere among categories II and III. Given that some verbs can align for some pairs of loci and not for others, the boundary between II and III is somewhat blurry, which I have indicated with dotted lines. Within this grey area are three subcategories which I discuss in turn: RESIST-type verbs, FORGIVE-type verbs, and SEE-type verbs.³³

2.5.1 *RESIST-type verbs*

There are several verbs such as ASL DEFEND, ENCOURAGE, FLIRT, KILL, PROTECT, and RESIST which at first glance seem not to be alignable. For example, RESIST uses the S handshape, palm down and ulnar side facing outward, which moves outward in a straight path from the elbow in the underlying form. It is not possible to align this sign for a 1st person object locus. One would have to twist the arm inward from

³³ The terms categorize verbs according to their phonetic shape, **not** according to their semantics, which is usually the case with similar terms in the spoken language literature.

the shoulder in order to keep the palm facing down and have the ulnar side face the body. Instead, one would have to use head tilt (Bahan 1996) and/or body shift to indicate the subject locus, and in fact this device is also frequently used in the same verbs for other pairs of loci such as L-to-R and R-to-L. However, if one does not use this device, it is still possible to align this sign for some pairs of loci. For instance, one can clearly distinguish the aligned forms for ME-to-R, L-to-R, ME-to-L, and R-to-L forms. For the ME-to-R form of RESIST, the arm is adjusted from the shoulder so that the ulnar side of the hand faces the locus at the R(ight) side. The movement is then carried out. This is different than the L-to-R form, in which the arm is tilted slightly so that the radial side of the hand partly faces the L locus, from which the movement is carried out. Another way to distinguish these two forms is by looking at the position of the elbow with respect to the body: in the ME-to-R form, the elbow is farther away from the body, while in the L-to-R form, the elbow is tucked in towards the body. The ME-to-L and R-to-L forms are the mirror image of the ME-to-R and L-to-R forms, i.e. in the ME-to-L form, the elbow is tucked in towards the body, but in the R-to-L form, the elbow is farther out. In both of these forms, the ulnar side of the hand faces the L(ef) locus. Since RESIST can align phonetically for these four pairs of loci and presumably more in between these pairs, and since it cannot align for a 1st person object locus only due to phonetic reasons, I argue that RESIST belongs properly to the set of aligning verbs.

There are many other verbs which pattern similarly as RESIST, i.e. they show alignment for the ME-to-R, L-to-R, ME-to-L, and R-to-L forms but not for the R-to-ME and L-to-ME forms. In all these cases, it was found that if one attempted to align the sign for R-to-ME and L-to-ME forms, some kind of phonetic constraint would be violated. As

another example, consider the sign ENCOURAGE: one could have the front of the sign (i.e. the fingertips) face the body by raising the arms from the shoulders and flexing the wrists sideways (inward). However, when one adds the lexical movement of rotating the arm from the shoulder and elbow, one seems to exceed the threshold of comfortable signing. I will elaborate on these constraints in the next chapter, but the point remains that it is only phonetic constraints which seem to block alignment for a 1st person object locus; otherwise there is no reason why RESIST and other similar verbs should not be categorized as aligning verbs.

These signs raise the point that in order for a child to determine whether a verb can be listed as an aligning verb, one need not look only at the 1st person object forms. It is sufficient to see the sign being aligned for R-to-L or L-to-R forms before listing it as an aligning verb in that language and to let the phonetic component handle those forms which are not possible for certain pairs of loci. Thus, having a distinct 1st person object form is not the only criterion for being listed as an aligning verb in a given signed language.

Before I turn to the next section, I would like to comment briefly on two verbs in this subcategory, DEFEND and PROTECT. By definition, aligning verbs are those which have two animate arguments. For most aligning verbs, these arguments usually take the AGENT and THEME roles. However, the argument structures for DEFEND and PROTECT are slightly different. While both involve AGENT thematic roles, the internal argument does not play exactly the same role as the THEME in other aligning verbs: in DEFEND, it is someone that one defends (oneself) **against**, while in PROTECT, it is someone that one protects **on one's behalf**, i.e. BENEFICIARY. While these argument

structures are not exactly identical to those of the usual aligning verbs, the point remains that they have two animate arguments which still qualify them as aligning verbs. We see that it does not matter what roles the animate arguments have, as long as they are present.³⁴

2.5.2 *FORGIVE-type verbs*

There are yet other signs such ASL BEG, CONVINC, FIRE, FORGIVE, HURT, REVENGE2, SPANK2, TAKE-OFF-NECK, TRUST and TURN-DOWN2 which may not be aligned even for R-to-L and L-to-R forms. One could argue that they are true plain verbs following Padden (1983), but according to my definition, they are still aligning verbs by virtue of their argument structure. Moreover, I show that it is phonetic constraints which block their alignment for R-to-L and L-to-R pairs of loci. In fact, they would be the best examples of category (II) in the above figure.

For instance, one may recall from an earlier description that FORGIVE involves rubbing the dominant fingertips against the upward palm of the non-dominant hand. In the underlying form, the fingertips of the non-dominant hand and the ulnar side of the dominant hand face outward. Thus, to align the sign, say, for an R-to-L form, one would have to twist both arms uncomfortably from both shoulders so that the non-dominant fingertips and the dominant ulnar side face the L object locus. The only pairs of loci for

³⁴ Further evidence could come from Rathmann (2000) who describes a set of non-verbal elements in DGS that can undergo alignment. PAM is one example which has already been mentioned, but Rathmann (2000) presents a couple of other examples such as FÜR and ÜBER which undergo alignment as well. FÜR aligns for a pair of loci that are associated with the AGENT and BENEFICIARY roles respectively. Thus, if a DGS sign that is equivalent in semantics to ASL PROTECT is not able to align due to some phonetic constraint, the prediction is that one would use FÜR rather than PAM to reflect not only the alignment but also the argument structure of the verb stem. What this example shows is that even a different argument structure which requires a different element than PAM still leads to the same phenomenon of alignment,

which the sign may align are those close to the ME-to-R form, but this itself is quite close to the underlying form and does not require more than a minimal adjustment of the arms.

However, there is another option available to these verbs which can mark the object locus, and that is by placing the whole unit at the object locus. That is, the non-dominant hand may be placed at the object locus, while the dominant hand carries out its movement on or towards the non-dominant hand. Thus, for an object locus at the R(ight) side, the non-dominant is placed there, while the dominant hand does its movement. For a 1st person object locus, the non-dominant hand is placed near the body, where the dominant hand carries out its movement. However, there is no way in the form itself to indicate who the subject is, which must be conveyed through other means (e.g. overt pronoun or PAM) earlier in the discourse. This option is not by all means mandatory, and in fact, right-handed signers do not consistently use this option for object loci that are on the right side, since that would require placing the non-dominant away from its side. Recall the general preference in signed languages for hands to return to their side as part of the movement; I propose as a corollary that given the choice of moving either hand away from its side, one prefers to do it with the dominant hand rather than with the non-dominant hand.³⁵

I argue that the option of placing the whole unit at the object locus is **not** the same thing as aligning a sign for a pair of loci, for two reasons: (i) the two operations require different kinds of input in order to run. Situating the sign at the object locus requires only one input, namely, the object locus, while alignment requires both the object and the subject loci as input. (ii) Second, situating the sign at the object locus is part of a broader

lending support to the claim that it is sufficient to have two animate arguments, regardless of their precise roles, for alignment.

phenomenon that is available generally in signed languages. One can situate at a particular location not only these signs but also many other types of signs: nouns, adjectives, intransitives, and even transitives with one animate argument (and one non-animate argument). I claim that FORGIVE-type verbs being placed at particular loci are part of the following paradigm:

- (41) a. *Nouns*
 SAW THREE ANIMAL aIX bIX cIX, **aDOG bTURTLE cDOG**
 ‘(I) saw three animals, a dog here, a turtle there, and a dog over there.’
- b. *Adjectives*
 PAINT THREE HOUSE aIX bIX cIX, **aYELLOW bGREEN cBLUE**
 ‘(We) painted three houses, one yellow, one green, and one blue.’
- c. *Intransitives*
 TODAY DO-DO? **aRUN bRUN cRUN**
 ‘Today what I did was run here, run there, and run over there.’
- d. *Transitives with one animate argument*
 THREE STUDENT aIX bIX cIX, JOB **aWANT bWANT cWANT**
 ‘There were these three students. This one wanted a job, that one wanted a job, and that one over there wanted a job.’
- e. *Transitives with two animate arguments*
 THREE THIEF aIX bIX cIX, **aFORGIVE bFORGIVE cFORGIVE**
 ‘There were these three thieves. I forgave this one, forgave that one, and forgave that one over there.’

These examples use either different signs at the different loci (e.g. YELLOW GREEN BLUE) or same signs (e.g. WANT WANT WANT). It does not matter, as long as some context has been previously set up for these loci (e.g. by assigning referents to the loci through a phrase like THREE STUDENT aIX bIX cIX), and situating new signs at these same loci relates to that context by distinguishing (or drawing similarities) between

³⁵ This could be subsumed under Battison’s (1978) Dominance Condition.

different referents.. That is, the situated signs must predicate something of a previously established referent; they cannot introduce a new referent into discourse as in:

- (42) a. * BUY aBLUE aCOMPUTER bYELLOW bCOMPUTER
 b. ok BUY BLUE COMPUTER YELLOW COMPUTER
 'I bought a blue computer and a yellow computer'

There is one general phonological requirement that a sign must satisfy before it can be situated at a particular locus: the sign must be free of contact with the face or the body, so that it can be manipulable and placed at any location in the space.³⁶ One will notice that in all the above examples, the signs are free of contact with the face or body. All the aligning verbs which undergo this operation also fulfill this requirement. Most of the signs are type 3, i.e. non-symmetric two-handed, and do not involve any contact with the face or body. What about the other aligning verbs such as GIVE, PITY, or BOTHER which can align phonetically? These verbs also satisfy the requirement that they are free of contact with the face/body. Can they also undergo this operation of being situated at a locus as opposed to being aligned for a pair of loci? While I do not have any strong arguments in favor of either answer, I would like to answer no, because the fact is that these verbs always undergo alignment and never end up being situated at a locus. To account for this fact, one could propose an Optimality-theoretic analysis ranking alignment above situating a sign at a locus. Alternatively, one could say that the FORGIVE-type signs do not have any identifiable endpoints (i.e. the underlying form does not have endpoints X and Y) so that alignment cannot apply to them, leaving them free for the other operation of being situated at a locus.

Another property of situating a sign somewhere within the space is that one need not restrict oneself to loci within the horizontal plane, as is usually the case with aligning verbs. That is, one can situate a sign not just within the horizontal plane but anywhere in the space, even in the vertical or the midsagittal plane.³⁷ Thus, one prediction is that one should be able to situate signs like FORGIVE anywhere in the space, not just in the horizontal plane. While this is hypothetically possible, it does not happen, because when the loci refer to animate arguments, they tend to be arrayed within the horizontal plane. Thus, situating FORGIVE is restricted to the horizontal plane not because FORGIVE stands out from other kinds of signs in some property but because the referent associated with the locus is animate. This would be true not just for FORGIVE but also for signs like FAST (adjectives), WANT (transitives with one animate argument) and DIE (unaccusative intransitives) which must be restricted to being situated within the horizontal plane if they apply to animate arguments. Thus, it is more accurate to say that one may situate a sign anywhere within the space as long as the referent of the locus is inanimate; otherwise, if it is animate, one is restricted to the horizontal plane.

One last thing deserves explanation. Padden (1990) has analyzed sentences like (41d) as involving pronominal cliticization, to be distinguished from true agreement. One test she provides to distinguish between the two is that pronominal cliticization is ambiguous between subject and object, whereas verb agreement is not: (I have adapted the relevant example from Padden 1990: 121 by moving the loci symbols to the end of the word, and by adding a parallel example for verb agreement.)

³⁶ In case the sign is not free of contact with the face/body, one may use the non-dominant index finger to point to the locus at the same time one articulates the sign with the dominant hand.

- (43) WOMAN WANT_a WANT_b WANT_c
 ok 'The women_{i,j,k} want (something)'
 ok 'The woman wants this_i, that_j, and that one_k, too'

- (44) WOMAN oGIVE_a oGIVE_b oGIVE_c
 * 'The women_{i,j,k} gave (something)'
 ok 'The woman gave (something) to him_i, her_j, and her_k, too'

If the same test is applied to FORGIVE-type verbs, one finds that they pattern like GIVE in that only the object reading is available.

- (45) WOMAN FORGIVE_a FORGIVE_b FORGIVE_c
 * 'The women_{i,j,k} forgave (someone)'
 ok 'The woman forgave him_i, her_j, and her_k, too'

Since I claim that FORGIVE-type signs pattern like WANT, it remains to be explained why they cannot allow a subject reading if they are situated at different loci. The fact that WANT and FORGIVE have slightly different argument structures does not provide the full story. WANT involves only one animate argument while FORGIVE involves two. Suppose we replace WANT with another sign that is a transitive with two animate arguments like FORGIVE but is body-anchored so that the non-dominant hand must be used to articulate the pronominal cliticization, e.g. LIKE. One finds that verbs like LIKE still pattern like WANT, i.e. both readings are available:

³⁷ As a digression: within the midsagittal plane, one may use higher loci to refer to hypothetical situations (Lillo-Martin, p.c.), and within the vertical plane, one may use a series of loci to refer to the internal components of a single entity (cf. Klima and Bellugi 1979:289 on 'apportionative internal').

- (46) R: WOMAN LIKE LIKE LIKE
 L: IXa IXb IXc
 ok 'The women_{i,j,k} like (something)'
 ok 'The woman likes this_i, that_j, and that one_k, too'

Actually, the two readings of (43) and (46) are signed differently with respect to eye gaze: if the cliticization is associated with the object, the eyes must gaze at the loci; if the cliticization is for the subject, one cannot gaze at the loci; instead, one must gaze at somewhere else, either higher in the plane or at the locus of the object, if it is available (Bahan 1996). However, the point remains that both possibilities are available for both WANT and LIKE, while they are not for GIVE and FORGIVE.

At this point, the only explanation I have to offer for the absence of the subject reading in FORGIVE-type signs is that this subject-object asymmetry is not unique to FORGIVE-type signs and is actually part of a broader phenomenon. The bias towards the object reading is present in many other parts of the agreement system as well: the optionality of subject agreement but obligatoriness of object agreement; the use of only object agreement in reflexive forms; the impoverishment rule that deletes a subject plural feature if an object plural feature is present; the multiple arc being available only for the object; and assimilation of the object pronoun, which will now be discussed in the next subsection.

2.5.3 *SEE-type verbs*

In the literature on signed languages, there is some discussion of verbs that agree only with the object and not with the subject, e.g. SEE and TELL in ASL. These signs have in common that they have initial contact with the face. (Other than FORGIVE-type

signs, I cannot think of examples not involving contact with face which show only object agreement.). Some researchers, e.g. Janis (1993), have suggested that this initial contact blocks subject agreement. Such an analysis assumes the traditional path-oriented model of verb agreement in which verbs are seen as moving from the subject locus to the object locus. That is, a verb is represented as having two slots, each of which becomes associated with a subject or object locus:

(43) VERB
 subj obj
 agr agr

(For backwards verbs, the order of the subject and object morphemes would be aligned.)

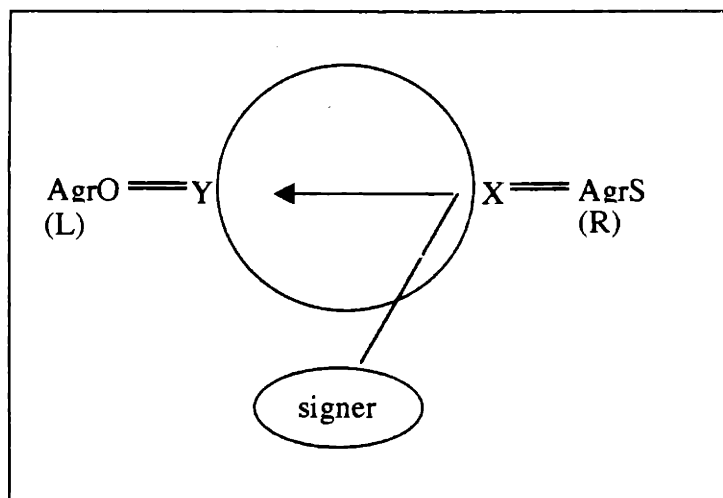
The initial contact with the face in signs like DISAGREE, INFORM, KISS-FIST, PHONE, RESPECT, SEE, TELL, and THANK block the first slot, so that only the second slot is available, which must be linked to object agreement, not to subject agreement. This is yet another example of the bias for object agreement discussed in the previous subsection.

Given that alignment is an operation which requires two loci for input, how does one fit such verbs under the model of alignment? I show that these verbs are still potential candidates for aligning phonetically. There is another option which may be available to these verbs (and other verbs in general), whether they are listed as aligning stems in a particular language. I argue that this second option is best treated as pronoun assimilation and is distinct from alignment.

To understand the difference between the two options, consider the ASL sign INFORM. Both hands start in the flat-O handshape and open into a lax 5 handshape (with

the K1 joint) as they move away (with the use of the elbow) from the forehead. The palm orientation is angled between towards the face and towards up. To align the sign for a R-to-L form, one moves the hands from the forehead towards the R locus while keeping the hands closed. Then the hands align through twisting of the radio-ulnar part so that the fingertips face the L locus; at the same time, the hands move towards the L locus while opening into the lax 5 handshape. This is exactly the same process that has been described for a set of AUSLAN verbs towards the end of subsection 2.3.2. The path of the hands for a R-to-L form will thus look something like the following figure:

(48) Aligned form for INFORM

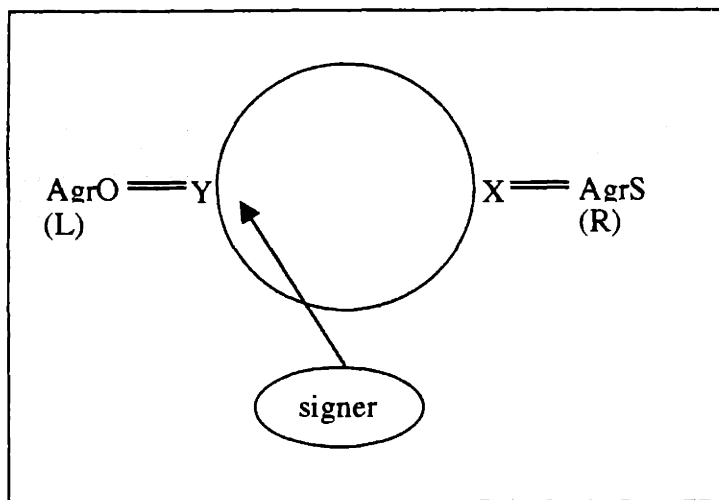


One piece of evidence for subsuming this process under alignment is that the handshape change in ASL INFORM does not begin until the R locus. One may add a 'segment' before the alignment in order to preserve the initial contact and then carry out the underlying movement, e.g. the handshape change, in the next segment which will come from alignment. A second piece of evidence comes from another variant of INFORM, in

which this segment may be dropped, i.e. one may drop the initial contact and start directly from the subject locus. If one can indeed relate the two variants by the deletion of this contact-preserving segment, one sees that alignment is central to both variants.

The other option with which one can mark subject and object arguments is through pronoun assimilation. Under this option, for a R-to-L form, one would have to point to the R locus with a overt pronoun at some point in the discourse, and then execute the sign in such a way that it moves from contact with the face directly towards the L locus.

(49) Alternative way to align INFORM



Let us use the same example, INFORM, to see the difference between the two options.

Under the option of pronoun assimilation, the hands move away from the forehead towards the L locus while opening into the lax 5 handshape at the same time. This is different from the other option of alignment, under which the handshape change does not start until the hands reach the subject locus. Another way to see the difference between

the two options is by looking at the 1st person object forms of signs like PHONE. Under the option of alignment, there is one variant of PHONE which may drop contact with the face (near the ear) so that the hand moves directly from the subject locus to the area near the signer's ear. Similarly, for an R-to-L aligned form, the hand moves directly from the subject locus to the object locus. Under the option of pronoun assimilation, however, the sign PHONE starts with contact near the ear and then moves downward to contact with the chest for a 1st person object form.

Within this category of signs, verbs vary as to whether they allow one or both options for the 1st person and non-1st person object forms.

(50) Possible forms for SEE-type verbs

	alignment		pronoun assimilation	
	1st person obj	3rd person obj	1st person obj	3rdperson obj
INFORM	1,2	1,2	*	✓
KISS-FIST	*	*	*	✓
PHONE	1	1,2	✓	✓
RESPECT	1,2	1,2	*	✓
TELL	*	2	✓	✓
THANK	*	2	✓	✓
VISIT	1	1,2	✓	✓

Key: 1 = alignment, without contact, possible; 2 = alignment, with contact, possible; ✓ = possible; * = not possible; 3rd person = non-1st person

The first thing one notices is that all verbs can readily do assimilation of a non-1st person object pronoun, since this involves straightforward movement from the face to the object locus. Assimilation of a 1st person pronoun, however, seems to be more restricted. The signs which can do this (PHONE, TELL, THANK, and VISIT) do not seem to involve

any underlying movement, so that it is also a simple matter of moving the hand from the face directly to the chest. The other signs which cannot assimilate the 1st person pronoun (INFORM, KISS-FIST, and RESPECT) all seem to involve some special underlying movement: INFORM involves a handshape change, while KISS-FIST requires a downward twist (flexion) of the wrist and RESPECT moves in a slight downward arc. Combining these special underlying movements with assimilation of the 1st person pronoun may lead to phonologically ill-formed signs, that other options are preferred instead.

As for alignment, there is variation as well. Verbs can show alignment for objects of both persons, e.g. INFORM, PHONE, VISIT and possibly RESPECT. In aligned form, INFORM can either drop the contact with the face or keep it. RESPECT can pattern like INFORM in this respect. PHONE and VISIT can do it either way like INFORM and RESPECT for a non-1st person object, but for the 1st person object form, one must drop the contact with the face and move directly from the subject locus to the face. This may have to do with the fact that, as suggested above, PHONE and VISIT not seem to have an underlying movement. In the absence of any special lexical movement, there seems to be a preference for a single segment consisting of a straight movement towards the face, rather than two, one starting with contact on the face followed by another moving back to the face. TELL and THANK seem to require preservation of contact with the chin. This is compatible with a aligned form for R-to-L or L-to-R; the form would consist of two segments, starting with contact followed by movement from the subject locus to object locus. However, this option does not seem to be available for a 1st person object for the same reason that PHONE must drop contact for a 1st person object form. However, since

TELL and THANK do not have the option of dropping contact, there is no other form available to mark the object except through pronoun assimilation. Finally, KISS-FIST does not seem to allow alignment for either object person. This may be due to the obligatory contact with the face (like TELL and THANK) and also due to its special lexical movement of a sharp twist from the wrist.

One last source of variation comes from the use of role shift to mark non-1st person subjects when using pronoun assimilation. Thus, for an R-to-L form, INFORM illustrates all the four different possible ways: (i) a aligned form without contact moving directly from R to L, (ii) a aligned form starting with contact on the face and then moving from R to L, (iii) pronoun assimilation without body shift, in which the hands move directly from the face to the L locus, (in which case, the subject must be licensed in some other way), and finally (iv) pronoun assimilation with body shift, in which the body shifts towards the R locus and the hands move directly from the face to the L locus.

By sorting out the variations across the different signs, I hope to have shown that it is possible to distinguish clearly between alignment and pronoun assimilation, and that they are not to be confused for one same process, even though both devices may serve the same function of licensing an argument.

2.5.4 *Wrap-up*

In summary, I discuss three types of signs which at first glance do not seem to fit under the model of alignment but I demonstrate that the model of alignment can still accomodate these signs. First, I show that RESIST-type verbs still align for many pairs of loci and that their inability to align for 1st person object forms can be explained by low-

level phonetic constraints. Similarly, I show that FORGIVE-type signs' inability to align for many pairs of loci can be traced to the same sort of phonetic constraints that block 1st person aligned forms for RESIST-type signs. I describe another process that FORGIVE-type signs may undergo to mark an object locus, that of being situated at a particular locus, but I argue that this process is distinct from alignment and is not restricted to FORGIVE-type signs but available generally in a signed language. Finally, I show that while some SEE-type verbs may still be able to undergo alignment, some can also assimilate an object pronoun, which I argue to be distinct from alignment.

One may collapse the alternative processes described for FORGIVE-type and SEE-type signs, i.e. being situated at a locus and assimilating an object pronoun, by proposing that they are just different manifestations of incorporating the pronoun associated with the object locus. It is desirable to maintain this proposal in the end for three reasons. First, it reduces the number of alternative processes for marking an object locus, which then may be manifested in different ways at the phonetic level depending on the underlying form of the verb. Second, by emphasizing that it is the pronoun, not the locus, which gets incorporated, the proposal is still consistent with the model in which the use of space is separated out from the grammar. Just as Agr heads may be linked with loci via indices inherited from a noun phrase, so pronouns may be linked with loci through their own indices. Then, incorporating the pronoun will have the automatic consequence of linking the verb to the locus as well.

Finally, the next reason may be the most powerful argument for the proposal: explaining the subject-object asymmetry. Recall that when FORGIVE-type signs are situated at a locus, it must be associated with an object argument. Also, when a SEE-type

sign is articulated towards a locus, it must be associated with an object argument. There is independent evidence (e.g. Baker 1988) that incorporation is restricted to internal arguments. This can explain why only object pronouns but not subject pronouns may be incorporated into FORGIVE-type and SEE-type signs. It also explains why pronouns may be associated with either the subject or the object for LIKE-type signs, since they are not incorporated into the verb but only cliticized via the non-dominant hand. WANT-type signs, which involve one animate argument and(/or) one inanimate argument, may incorporate pronouns associated with either type of argument. I refrain from saying that the animate argument is necessarily the subject, because it would become problematic if WANT can incorporate a subject pronoun. Rather, I leave it an open issue whether WANT may be best analyzed as an intransitive in cases where the argument is animate and 'subject'-like, e.g. as an adjectival predicate.³⁸

While I discuss three types of signs, I do not mean to imply that the three categories are mutually exclusive. There are some signs which may transcend one or more categories. For example, while I show that FORGIVE can align mostly for R object locus forms, some signers may choose to stretch the phonetic constraints and align it for an L object locus form, so that FORGIVE behaves more like RESIST-type signs, thus confirming its status as a aligning verb. There are signs like EVALUATE, PAY-ATTENTION, and OBSERVE which vary across signers in their ability to align for a 1st person object form. If they can, EVALUATE and OBSERVE would fall under category 1 while PAY-ATTENTION would fall under category 2. Otherwise, they would belong to the set of RESIST-type signs. One last example of a sign with variants is APPROVE. If

³⁸ There is a possibly parallel phenomenon in Japanese, in which the Japanese word for 'want' takes on adjectival markers to express tense rather than the usual tense markers, thus suggesting that 'want' may

the non-dominant hand's orientation is mid (so that the fingertips point to the right for a right-handed signer, and the palm faces the body), the sign can align like category 4 signs, e.g. MEET. But if the non-dominant hand is supine (facing up), it behaves more like FORGIVE, which has exactly the same form of the non-dominant hand. These variations once again underscore the fluidity of the categories within aligning verbs, but otherwise they all remain aligning verbs in some way or another.

There are some verbs which are truly unalignable for all pairs of loci: ACCEPT, PUNISH, and SPANK. (LIKE seems to be yet another 'fence-sitter' which can behave either like the ACCEPT-type signs or like SEE-type signs.³⁹) It is obvious that their phonetic forms bar alignment for any pair of loci. For example, these signs all involve medial or final contact with the body which must be preserved. It is these same properties which even bar one from using alternative processes available to FORGIVE-type and SEE-type signs. In spite of being able to show alignment at the phonetic level or even being able to mark the object locus in some other way, I still propose to group them with the aligning verbs for their argument structure. One prediction of this proposal is that they will project similar (tree) structures at the level of syntax as other aligning signs, which I leave for future investigation.

In closing, I offer one final piece of evidence for placing all these category II signs (from the figure in (40)) within the category of aligning verbs: the use of PAM in

behave morphologically more like an adjective. I thank David Pesetsky for bringing this to my attention.

³⁹ LIKE is the only verb that I can think of that has two animate arguments, that involves initial contact with the chest and that moves in a straight path away from the body, accompanied by handshape closing. I cannot think of signs (with two animate arguments) that involve contact with the chest but no handshape change as the hand moves away from the body. This may be a gap that deserves explanation elsewhere. Like ACCEPT-type signs, LIKE does not seem to be able to align for any pair of loci, due to its initial contact with the chest which must be preserved (unlike INFORM or PHONE) and due to its closing movement in the hand. Like SEE-type signs, it may undergo pronoun assimilation but only for a non-1st

DGS and similar elements in NS. As Rathmann (2000) shows, PAM can be used only with a verb that has two animate arguments, which according to definition is a aligning verb. PAM cannot be used with non-aligning verbs, i.e. all the plain verbs in my categorization in figure (40), which do not have two animate arguments, such as BUY or WANT. Thus, PAM provides an independent diagnostic, apart from the argument structure, for the aligning status of a verb. Based on discussion by Fischer 1996 of similar elements in NS, I assume that the same thing is involved in NS as well.

person object, because the initial contact with the chest and the closing movement in the hand seem to block assimilation of a 1st person object pronoun.

Chapter Three

Interactions between ALIGN-Sphere and Phonetic constraints

In Chapter 2, we have seen how alignment has been justified as one way to view agreement in signed languages. At the same time, we have seen how the joint movements required to execute the R-to-ME form, for example, are often different than the joint movements required for the 'citation form' ME-to-R. This suggests that alignment as a representation of such forms is best understood as a 'target' which can be executed differently depending on the phonological possibilities of the apparatus. It is these phonological possibilities that I wish to explore in this chapter.

I will start in section 3.1 with several examples of phonetic constraints. The next section will then defend their linguistic status, even if the constraints look like they emerge from constraints imposed by the articulatory system. The following section (3.3) discusses several options that signed languages provide in case one or more of these phonetic constraints are violated. Section 3.4 will finally consider these constraints in light of other work that has been done on spoken languages.

3.1 A catalog of various phonetic constraints in signed languages

Here, I present several examples of phonetic constraints that bar various aligned forms. To formalize the constraints, I draw on terminology that describes the different joints of the arm and their actions. One is referred to the diagram in (12) in the introductory chapter for a glossary of these terms.

The first example comes from Mathur and Rathmann (2000). This constraint bars a configuration in which the palm is facing up and the fingertips traverse an arc against the chest.

- | | | | |
|-----|------------------------------------|--------------------|-----------------------------|
| (1) | * [shoulder]
inward
rotation | [elbow]
flexion | [radio-ulnar]
supination |
|-----|------------------------------------|--------------------|-----------------------------|

This phonetic constraint serves to rule out forms like ASL GIVE, OFFER, INVITE, and FEED which align for a 1st person multiple object. These verbs have in common that the palm faces up (i.e. the radio-ulnar part is supine). Aligning for a 1st person multiple object requires moving the hand in an arc, which requires both flexion of the arm from the elbow and inward rotation from the shoulder. This movement combined with the joint specifications for the above verbs proves to be fatal and is not allowed. As will be shown in the next section, this constraint applies not just to these particular alignments but also to the lexicon, a fact which suggests that this is a phonetic constraint, not a morphological one.

The next example also comes from Mathur and Rathmann (2000). This constraint rules out configurations in which the elbow is pointed towards the stomach (the perceptual equivalent of diagonal shoulder abduction), while keeping the arm upright and twisted away from the body.

- | | | |
|-----|--------------------------------------|--------------------------------|
| (2) | *[shoulder]
abduction
diagonal | [elbow]
outward
rotation |
|-----|--------------------------------------|--------------------------------|

This constraint serves to rule out the configuration of the non-dominant in two-handed signs like ANALYZE and BAWL-OUT when they align for a 1st person multiple object. It also serves to rule out 1st person singular object forms of RESIST-type signs aligned for a 1st person singular object. In such cases, one would have to twist the arm inward from the shoulder in order to keep the palm facing down and have the ulnar side face the body, which is not possible as indicated by the above constraint. Again, one sees that this constraint is phonetic, not morphological, since it applies alike to some verbs that are aligned either for a 1st person singular or a 1st person multiple object.

The third example applies mainly to two-handed verbs in which the non-dominant is stationary, i.e. it applies to signs of type 3 under Battison's (1978) typology. Many signs involve the non-dominant hand with the palm facing down and the ulnar side facing away from the body. However, it is not possible to twist the non-dominant hand so that the palm remains facing down (radio-ulnar pronation) but the ulnar side now faces the body (sideways extension of the wrist):

- | | | |
|-----|------------------------------|----------------------------------|
| (3) | * [radio-ulnar]
pronation | [wrist]
sideways
extension |
|-----|------------------------------|----------------------------------|

This constraint explains why it is only the dominant hand that gets visibly aligned when both hands should align as part of the stem/sphere. Examples from ASL include ADVISE, BLAME, and CALL. These examples all involve the same handshape lax A for the non-dominant hand. When one aligns these verbs for a 1st person singular object, it is difficult to twist the non-dominant hand so that its ulnar side faces the body. Instead, the

non-dominant hand remains as it is in the underlying form, and only the dominant hand gets aligned.

The last example filters out configurations in which the dominant hand faces down palm-wise (radio-ulnar pronation) and twists sideways from the body (wrist abduction) while the arm is extended towards the opposite side but away from the body (upper arm pronation).

(4)	* [upper arm]	[radio-ulnar]	[wrist]
	pronation	pronation	abduction

This constraint serves to rule out some verb forms which are aligned for a L-to-R pair of loci (if the signer is left-handed, the same will be true for a R-to-L pair). Such verbs include the following ASL signs: GET-HOLD-OF, CAUGHT, and APPLY/FILE. These signs require some part of dominant hand's surface (e.g. the webbing between the fingers) to make contact with non-dominant hand. This in turn requires the dominant hand to face palm-down. If the non-dominant hand is at the R locus, and the dominant hand starts from the L locus, one must extend the arm so that the dominant hand is at the L locus. Moreover, the dominant hand must also twist sideways so that it faces the non-dominant hand in the right direction for final contact. It is this configuration which violates the above constraint and which is therefore not possible. In such cases, one may replace the subject locus with a default one closer to the body. Contrast these cases with the ASL sign EXPOSE, which may align for the L-to-R pair of loci without any problem. In this sign, the dominant hand in the underlying form does not have to face palm-down; thus pronating the upper arm and twisting the radio-ulnar part part so that the palm faces

the non-dominant hand is sufficient and does not violate the constraint. The constraint is again phonetic in nature, not morphological, since there is otherwise no principled reason for a gap in the L-to-R forms but none in the R-to-L forms.

These constraints deserve further study since there are many more that are not listed here, and some of the constraints seem to overlap. For example, constraints in (1) and (2) seem to be the mirror images of each other and could be collapsed into a single constraint. It is also possible to decompose the constraints into descriptions of each joint and define a threshold so that if one adds so many of these descriptions, the threshold is exceeded. This proves to be a promising line of research into the phonetics of signed languages that is best reserved for another study.

3.2 The linguistic status of phonetic constraints in signed languages

In a cross-linguistic study of ASL, DGS, AUSLAN, and Russian Sign Language (RSL), Mathur and Rathmann (2000) have found that the constraints in (1) and (2) appear in all these signed languages. Thus the constraints are not specific to ASL. Given that these joint-based constraints seem to hold across several signed languages, one may wonder if they are not merely physiological constraints imposed by the articulatory system and therefore hold for everybody regardless of the language they use. The other possibility is that they belong to grammar and that they hold only for those people who have internalized that grammar. In that case, the constraints have to do with language and not with the articulatory system.

The latter possibility predicts that native Deaf signers who have grown up using signed language as a native language will have internalized the joint-based constraints as

part of their grammar, whereas those people who have not will not 'know' the constraints and will therefore commit errors violating these constraints. In contrast, the other possibility would not predict the above scenario. If the joint-based constraints were simply physiological in nature, one would expect that the non-native hearing signers would perform equally as well as native Deaf signers and would not make mistakes with respect to these constraints.

Rathmann and Mathur (1999) have developed a test to distinguish between the two possibilities. As mentioned earlier, not all verbs in ASL align for a 1st person multiple object due to the constraints (1) and (2). Thus, deaf native signers will align a verb for a 1st person multiple object insofar as the constraints are not violated. If hearing non-native signers added the morphology in those cases where deaf native signers would not add them, it would show they do not know the joint-based constraints that would otherwise prevent them from aligning the verb. On the other hand, if the hearing subjects aligned the verbs only in those situations where the deaf subjects align them, it would suggest that they know the joint-based constraints and that the constraints may therefore be physiological in nature.

Rathmann and Mathur (1999) have run this experiment of second language acquisition, which will now be described briefly. For the experimental group, 10 hearing subjects were enlisted who have been learning ASL for two or three years. For the control group, 5 deaf subjects were enlisted, all of whom are native ASL signers who have deaf parents and who have been exposed to ASL from birth. We chose hearing people who have been learning ASL for two or three years through university courses and are more or less comfortable with communicating with Deaf people. We chose those hearing signers

rather than hearing people who do not know sign, so that we could obtain more robust results. If we found that hearing signers familiar with sign language still make mistakes by violating these constraints, this would be a stronger result. It would show that even though they may have acquired some parts of the grammar of ASL as a second language, they still have not internalized all the rules, including the joint-based constraints. This in turn would suggest that these constraints are part of the knowledge that a native signer must have in order to use the signed language fluently. Another reason we chose to test hearing signers was that if we test non-signers and discovered that they made mistakes, we would not be sure whether their mistakes are due to their lack of knowledge of the joint constraints, or whether their mistakes are due to a simple awkwardness with using a new modality in general that is often seen in first-time signers.

All subjects were asked to align each of the 30 verbs shown on videotape for four pairs of loci: ME-to-YOU, YOU-to-ME, ME-to-YOU(multiple), and YOU-to-US(multiple). The analysis focused on verbs that can align for a 1st person multiple object (Class V) versus verbs that could not align for the same but could still align for a non-1st person multiple object (Class IV).¹ These alignments as signed by a ASL model were compared with those produced by hearing and deaf subjects. A 2x2 ANOVA was carried out on verbs aligned for 1st-person multiple objects, the two factors being deaf/hearing status and whether alignment was done or not.

It was found that with respect to the non-1st-person multiple object, both hearing and Deaf signers correctly did the alignment, both for Class IV and Class V verbs. In contrast, with respect to the first-person multiple object, for Class IV verbs, hearing

¹ The terms Class IV and Class V come from Mathur and Rathmann (2000) where we discuss other classes which do not concern us here.

signers incorrectly aligned the verb, while the deaf signers did not. For Class V verbs, both hearing and Deaf signers otherwise correctly aligned the verb. After running 2x2 ANOVAs on these data sets, the results were found to be statistically significant.

The results have shown that hearing non-native signers usually align a verb in cases where deaf native signers would not, thus suggesting that the deaf subjects 'know' the exceptions due to joint-based constraints, whereas the hearing subjects do not. That in turn suggests that the constraints have linguistic status.

Having established the linguistic status of these constraints, one is left with the logical possibility that these seem to be 'universal' constraints in the phonology component. This may not be such an unusual result, given that the joint-based constraints seem to have their analogue in spoken languages as well. For instance, in spoken languages, there seems to be a 'universal' constraint against a simultaneous stop at both the lips and the velum, barring rare exceptions.

To show that these constraints, being phonetic, apply not just to aligned forms but also to any other sign, Mathur and Rathmann (2000) checked whether there were any signs in the lexicon that violated either of the constraints. The British Sign Language (BSL) dictionary (Brien 1992) was chosen, because it, unlike many other signed language dictionaries, has clear photographs of each entry, enabling quick inspection of the signs. As mentioned earlier, the dictionary was also organized according to the formational properties of the sign, rather than according to the glosses in the corresponding spoken language, thus expediting the analysis. It was found that there were indeed no signs with combination of *[+supine radio-ulnar], [+shoulder rotated inward], [+elbow flexed], i.e. there were no signs violating constraint (1). On the other hand, out

of about 1800 signs in the BSL dictionary, a total of 21 nouns and adjectives were found with a combination of other joint features, specifically [+prone radio-ulnar], [+shoulder rotated outward], [+elbow extended], suggesting some combinations of joint specifications are not allowable while others are. Thus constraints against possible combinations like the one in (1) apply not only to alignment but also apply to nouns and adjectives, suggesting that these constraints are phonetic in nature.

Moreover, the fact that constraints on joint specifications are linguistic (as opposed to physiological) is consistent with the fact that information about the joints plays a role in the grammar in other domains. For instance, information about joints play a role at the phonetic level with respect to register variation (Brentari 1999, Mauk 1999), first language acquisition (Meier et al. 1998), and second language acquisition (Mirus et al. 1999). Finally, information about joints can also appear at the phonological level. For instance, a sonority hierarchy can be stated in terms of joints (see Mathur and Rathmann 2000, Brentari 1999).

3.3 A catalog of options for aligned forms violating phonetic constraints

In circumstances where alignment is blocked for some pair of loci, the language must have some mechanism for encoding the same information. In the course of fieldwork, several mechanisms have been noted that resolve the blocking of alignment by joint conflicts. Since this thesis focuses more on alignment and whether it can be carried out rather than on what resolutions a signer uses in the event of a blocked alignment, I leave these resolutions for further analysis, which promise to reveal more about the phonetic structure of the sign. For now, I only list some of the resolutions here and

provide a brief description of each. The following resolutions are given with the assumption that the dominant hand is the right hand. If the dominant hand is the left hand, assume that what is true for R-to-L forms is true for L-to-R forms. I group the resolutions by the contexts they usually appear in. For example, if a verb cannot align for a specific pair of loci, I describe the resolutions under that context.

3.3.1 Resolutions for any blocked alignment

There are three resolutions that are generally available for any alignment that is blocked for phonetic reasons. They are the use of an overt pronoun, the use of PAM for those sign languages that have it as described by Rathmann 2000 for DGS and Fischer 1996 for NS, and the use of non-manuals such as eye gaze and head tilt as described by Bahan 1996. When one uses one of these resolutions, the signer has the option of aligning the verb, if phonetically possible, for a default locus near the body instead of the specific locus. Otherwise, the verb may not show any alignment (i.e. it may look like a plain verb). Rathmann (2000) notes that the use of PAM is not necessarily restricted to contexts when a verb cannot align for phonetic reasons. A signer may “withhold” the alignment and use PAM instead for discourse reasons². He notes that the same option is available with an overt pronoun in ASL.

These resolutions represent a syntactic alternative to the one in which there is no alignment of the verb and no overt argument(s). I assume these two alternatives constitute separate derivations. The derivation with no alignment and no overt argument will crash,

² Rathmann (2000) list two possible discourse reasons: (i) emphasis, and (ii) focus on the specific spatio-temporal event.

while those derivations with some overt argument, PAM, and/or alignment on the verb will converge.

3.3.2 Resolutions for blocked R-to-ME and L-to-ME forms

Sometimes when a verb aligns for a 1st person singular object, full alignment is not possible. In such cases, one resolution is to do the alignment halfway. As long as the alignment remains partially visible, this is sufficient. Recall from chapter 1 that alignment does not use space continuously. Thus it is not important that alignment follow literally the input pair of loci. Rather, the input pair of loci establish a target which alignment may achieve to the extent that it remains visible and to the extent that it is allowable by phonetic constraints. Since partial alignment is still visible, alignment may occur fully or partially.

Some examples from ASL include BLAME, FIRE, and OPPRESS. In the underlying form of the sign BLAME, it is the back of the fingers between K1 and K2 joints which face outward. If this verb were to align for a 1st person singular object, one would have to flex the wrist inwards past the threshold of phonetic well-formedness so that the back of the fingers face the 1st person locus. Instead, it is sufficient just to flex the wrist halfway.

Another kind of resolution may occur in signs that involve the two hands in a fixed relationship with respect to each other. For example, the ASL sign TEACH has the two hands shaking outward from the body in the underlying form. The radial sides of the two hands must face each other all the time, since it is a lexical property. To align for a 1st person singular object, one would have to twist the arms past the point of well-

formedness in order for the fingertips to face the signer while keeping the radial sides next to each other. In this case, one resolution permits breaking the fixed relation between the two hands so that it is the ulnar sides which face each other when the fingertips face the signer. However, this resolution seems to be restricted to signs in which there is no meaningful contact between the two hands. ASL FLIRT requires contact between the two thumbs thus disallowing the split between the two hands for alignment purposes. In such cases, one uses a more general resolution, like the use of an overt pronoun.

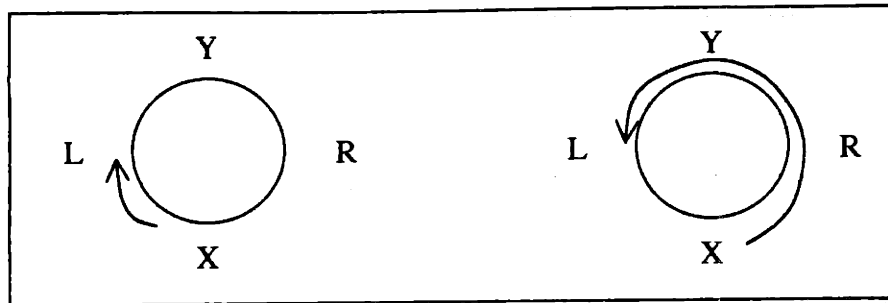
3.3.3 *Resolutions for R-to-L and L-to-R forms*

In the preceding section, partial alignment was described as one possible resolution in case phonetic constraints do not permit a full alignment. This resolution is also used when verbs align for a pair of loci on the right and left sides. For example, when the ASL sign FEED aligns for a R-to-L pair of loci, the constraint in (2) prevents the non-dominant arm from twisting inwards too much so that the fingertips face the L focus. In that case, partial alignment is sufficient. The fingertips do not have to face the left locus literally, but the change in the orientation of the non-dominant should still be visible enough. Other ASL signs such as CONTROL, TEACH, GIFT, HATE2, and GIVE-HARD-TIME behave similarly.

Another resolution concerns specifically the L-to-R forms. Recall from the definition of ALIGN-Sphere that the stem should be rotated in such a way that endpoint X should line up with the subject locus while endpoint Y matches up with the object locus. There are two ways one can do this for a L-to-R form, but the following can be

generalized for any pair of loci. One, one could rotate the sphere clockwise (from the top, bird's eye view). The other way is to rotate the sphere counterclockwise.

(5) Clockwise alignment versus counterclockwise alignment



For the sake of simplicity, the direction in which one may rotate the sphere should be free insofar as it does not violate phonetic constraints. Since rotating the stem counterclockwise for a L-to-R form will invariably violate some phonetic constraint(s), the alignment will generally proceed clockwise. One need not say anything about this in the grammar; it is sufficient to let the phonetic constraints pick the optimal direction.

A third resolution involves switching dominance to the other hand when it becomes phonetically awkward to do the alignment with the dominant hand. This option was prominent among the NS signers, although it is not necessarily characteristic of NS, for I have double-checked some forms with several other NS signers, some of whom reject that option. Moreover, this option is present not only in some NS signers but also in some ASL, AUSLAN, and DGS signers. What this tells us is that this option is not language-specific but rather is available generally. This is also true for all the other resolutions, but the dominance-switching presents the clearest example. What this tells us is that each signer varies to the degree that one uses the different options for alignment.

One may substitute some other device (e.g. a pronoun) for alignment or may make alignment visible to the extent allowable by phonetic constraints, which may involve using one of the resolutions described here.

3.3.4 Resolutions for blocked 'multiple' forms

The following resolutions have been noted by Mathur and Rathmann (2000) who focus specifically on the alignment possibilities for a 1st person multiple object. We have already seen the first kind of resolution which is to use other means to identify the argument as a 1st person multiple object, such as an overt pronoun, PAM, eye gaze or discourse context. Under this resolution, one essentially drops the 'multiple' morpheme in case the alignment is too phonetically complex and one may replace the multiple locus with a default, singular one for articulating the verb.

Sometimes, if it is not possible to align a verb for a multiple object for phonetic reasons, one will use another resolution also already described above: partial alignment. For example, the ASL sign GIVE-HARD-TIME involves the two hands in the flat-O handshape, palm up and fingertips pointing out in the underlying form. The lexical movement consists of rubbing the fingers against the thumb. The dominant hand may be placed near the nose, while the non-dominant hand shadows the dominant hand. To align for a 1st person multiple object, one must twist the wrists so that the fingertips face the signer. Moreover, while rubbing the fingers against the thumbs, one must also move the hands in an arc along the signer's chest. For some signers, the whole articulation may exceed the preferred threshold of well-formedness. One way to reduce the ill-formedness of this sign is to twist the wrists so that the fingertips face each other, not the signer's

body. This partial alignment is visible enough to identify the argument as 1st person. When this is combined with the 'multiple' arc, the whole articulation will remain within the threshold of well-formedness. This partial alignment in the 'multiple' form has also been noted for the ASL signs HATE1, PICK-ON, PITY2, and RECRUIT.

Yet another resolution which applies only to several two-handed symmetrical signs (such as ASL OFFER, AUSLAN PAY) is what has been referred to in Padden and Perlmutter (1987) as 'Weak Hand Drop.' The ASL sign OFFER involves two supine arms/hands, both in the B-shape, being raised upwards. When one adds an arc and aligns this sign to show first person multiple object 'agreement', the non-dominant hand is placed in an awkward configuration. To resolve this joint conflict, several signers have dropped the non-dominant hand entirely. The dominant hand may also be placed in an awkward configuration, in which case another resolution will be used. The 'Weak Hand Drop' will work as a resolution insofar as the meaning of the verb remains clear after dropping the non-dominant or 'weak' hand.

Another way to reduce the awkwardness of alignment for a first multiple object object is by removing the flexion from the elbow, thus removing the arc part of the 'multiple' morpheme. One possible replacement is a contraction of two verb forms that have different trajectories, one arc-like form that marks a non-first person multiple object and one straight-path form that marks a first person singular object. If one contracts those two verb forms, one is able to express the equivalent meaning of first person multiple object morphology (i.e., US = THEM+ME). This contraction has also been noted for the YOU-to-US(exhaustive) form. If alignment proceeds from left to right from the signer's

perspective, the hands will noticeably change orientation on the right side so as to avoid violating a constraint like that in (2).

A fifth resolution involves removing shoulder rotation. If one attempts to align ASL GIVE for a first person multiple object, the radio-ulnar part will have to be supine while rotating the shoulder inwards, making for an awkward articulation. One way to reduce this awkwardness is to remove the inward rotation from the shoulder and transfer it to the wrist. The result looks like a twisting of the wrist, similar but not identical to the form of GIVE aligned for a first person singular object. The process of transferring the movement from the shoulder to a joint lower in the arm, the wrist, is referred to as 'distalization' by Mirus, Rathmann, and Meier (2000) and Brentari (1999).

Another example of removing the shoulder rotation occurs for the ASL sign ANALYZE. Note that ANALYZE is a symmetrical two-handed sign. For the non-dominant hand, the 'multiple' arc would require outward rotation from the shoulder, combined with an extension of the elbow and a supination of the radio-ulnar part. This makes for an awkward situation. If one simply removes the shoulder rotation, the result is an extension of the elbow combined with radio-ulnar supination, i.e. a straight line across the face. This is exactly how one signer has shown the first person multiple object morphology for ANALYZE. The signer preserves the alignment for a first person object, yet flattens the arc into a straight line across the face to express the 'multiple' morpheme.

3.3.5 *Resolutions for the weak hand*

Since alignment applies to the whole sign as a unit, the non-dominant hand should participate in alignment like the dominant hand. However, there are cases where the non-

dominant hand cannot align due to phonetic reasons. Here are two resolutions for such cases.

One resolution is to drop the alignment part for the non-dominant hand. This has been noted with ASL signs PAY2, OVERCOME2, and CALL-TTY. Let us see what this looks like for CALL-TTY, whose underlying form involves the dominant hand in the X handshape and palm facing to the left side and the non-dominant hand in the index handshape with fingertip pointing away from the body. The hook formed by the bent index finger of the dominant hand then sweeps over non-dominant finger. When this sign is aligned for a 1st person singular object, one could twist the non-dominant wrist so that the fingertip points at the signer. Alternatively, if this exceeds the preferred threshold of well-formedness, one may leave the non-dominant as it is in the underlying form and just reverse the direction of the movement of the dominant hand.

Finally, there are many ASL signs that, when they align for a 1st person singular object, have the non-dominant hand raised rather than point directly at the signer's chest: APPROVE, DISCRIMINATE, CRITICIZE, SLIDE-OFF, FLICK, TAKE-ADVANTAGE, BACK-STAB, STARE-AT, FLIP, and PAY2. As an example, consider DISCRIMINATE, whose underlying form involves the non-dominant in the B handshape, with palm facing the body and fingertips pointing to the right. The dominant hand is in the D handshape and, with the tips of the flexed fingers, makes a crossing movement against the palm of the non-dominant hand. To align for a 1st person singular object, the non-dominant arm would have to be twisted inwards so that the palm faces the subject locus. To resolve this awkward configuration, some signers raise the non-

dominant hand so that the fingertips point up rather than to the left. Otherwise, the dominant hand undergoes alignment and proceeds with its movement as usual.

3.4 Further remarks on phonetic constraints in signed languages

One has seen that if an aligned sign violates at least one of the phonetic constraints, there are not just one but several options available to resolve the violation of the constraint. While the different options may be interchangeable within the same context, they vary in the complexity of production, which can be measured in the number of joints used and in the number of degrees that the joints are moved (cf. Ann 1996 for the complexity of handshapes). These options are available insofar as they do not lead to a result in which the joints are placed in an awkward configuration. For future research, these options could be used to motivate a model of 'gradience' for the phonetics of signed languages. In this model, the different forms are aligned on a gradient from least complex to most complex according to the above metric. Then one could identify a threshold on the gradient that well-formed options cannot exceed. This threshold may vary from one signed language to another, if not from one signer to another and even from one discourse situation to another.

Alternatively, one could sketch a model of the different options within the Optimality Theory (OT) framework (Prince and Smolenky 1993) in a fashion similar to that of Bresnan (1999), who seeks to explain morphological blocking and dialectal variants of English by using the OT framework. Within this framework Bresnan (1999) uses two types of violable constraints:

- (6) Faithfulness constraint (FAITH):
FAITH(P&N): preserve input person and number in the output
- (7) Structural markedness (or well-formedness) constraints
(a) *PL, *SG
(b) *2, *1, *3

(Bresnan 1999: 17)

The faithfulness constraint favors “featurally more complex forms and hence more informative forms” whereas markedness constraints “work to erode these contrasts by simplifying expressions” (Bresnan 1999:17). Through a particular ranking of the constraints shown in the following tableau, Bresnan (1999) seeks to derive the correct forms for each set of features. Her example (26) is repeated below as (8), which yields the correct form for the 2nd person singular present form of the English verb *be*.

- (8) input: [BE PRES 2 SG]

	*PL, *2	FAITH(P&N)	*SG, *1, *3
'am': [BE PRES 1 SG]		*	*!*
'is': [BE PRES 3 SG]		*	*!*
'are': [BE PRES]		*	
'art': [BE PRES 2 SG]	*!		*

The archaic form *art* violates the first set of constraints because it specifically marks 2nd person. Thus it is eliminated from the set of candidates early on. The first two candidates violate FAITH because they do not contain 2nd person in their set of features. The third candidate violates FAITH because its set of features is missing the features 2nd person singular. Since those three candidates are equal with respect to FAITH, the next set of constraints will have to distinguish among them. Indeed, the first two candidates are ruled out because they contain the features singular and either 1st person or 3rd person. On the

other hand, the third candidate does not mark any of these features and emerges as the winner. Furthermore, one could re-arrange the ranking of the constraints to account for the use of *art* in an older dialect of English. Specifically, if the constraint *2 is ranked below FAITH, the form *art* will win:

(9) input: [BE PRES 2 SG] for older dialect of English

	FAITH(P&N)	*PL, *2	*SG, *1, *3
'am': [BE PRES 1 SG]	*		*!*
'is': [BE PRES 3 SG]	*		*!*
'are': [BE PRES]	*		
☞ 'art': [BE PRES 2 SG]		*	*

Initially, the FAITH constraint may be ranked first as in (9). Over time, markedness constraints may become ranked higher than FAITH, as in (8), in order to simplify expressions but at the cost of reducing contrasts. Note that the candidate labeled *are* is underspecified for person and number features. The assumption that some candidates may be underspecified for features is crucial, since the underspecified sets of features interact with the constraints to yield the correct forms of the language. Within the Distributed Morphology framework, the vocabulary entries (e.g. the candidates) are ranked according to the number of specific features they mark. Bresnan's (1999) analysis is another way to implement the ranking, this time within the OT framework.

Bresnan's (1999) OT analysis provides a powerful tool for explaining the forms that arise from a tension between faithfulness and markedness constraints. This tool could be adapted to account for the different options that sign language use for alignment, ranging from full alignment to alignment in some modified form (i.e. one of the resolutions) to no alignment. In the following adaption of Bresnan's (1999) analysis, the

candidates are phonetic in nature and do not contain morphosyntactic features unlike those in Bresnan's (1999) analysis. This is because I assume that 'agreement' in signed languages is a phonological (re-adjustment) rule. While some re-adjustment rules may make reference to morphosyntactic features, this alignment rule does not directly refer to any morphosyntactic features and is phonological in nature. Even so, Bresnan's (1999) analysis remains a useful tool for deriving morphological options from a tension between faithfulness and markedness constraints whose ranking may vary from one sign language dialect to another, if not from one signer to another and even from one discourse situation to another, as mentioned earlier.

Suppose that there are at least two constraints roughly along the lines of the following:³

- (10) Faithfulness constraint (FAITH):
preserve input (=full aligned form) in the output
- (11) Markedness constraint (MARKED):
*[shoulder, inward rotation], [elbow, flexion], [supination]

The faithfulness constraint preserves the full alignment for a certain pair of loci, while the markedness constraints are the very phonetic constraints that have been previously listed. If we rank the Markedness constraint above the Faithfulness constraint, we are able to explain why an ASL verb like LOOK-AT may be able to align fully for a 1st person multiple object whereas another ASL verb like GIVE may not. Consider the following tableaux for LOOK-AT and GIVE.

(12) input: [[LOOK-AT + 'multiple' arc] full alignment]

	MARKED	FAITH
☞ a. LOOK-AT + arc + alignment		
b. LOOK-AT + arc + alignment + distalization		*!
c. LOOK-AT + alignment		*!

(13) input: [[GIVE + 'multiple' arc] full alignment]

	MARKED	FAITH
a. GIVE + arc + alignment	*!	
☞ b. GIVE + arc + alignment + distalization		*
☞ c. GIVE + alignment		*

In each tableau, there are three candidates listed. There are many more (in fact, infinitely many more according to the OT framework), but they will not be listed here for the sake of simplicity. The first candidate represents the full aligned form which matches the input in every way. Thus it does not violate FAITH. The second candidate represents a resolution in which distalization is used to transfer the movement from the shoulder to the wrist, as described earlier in the chapter. The third candidate omits the 'multiple' morpheme so that there is no arc present in the form.

Now consider the tableau for LOOK-AT in (12). All candidates do not violate the markedness constraint. It is FAITH which rules out the last two candidates, since they differ from the input in some way. The second candidate involves distalization, while the third one is missing an arc. As a result, the full aligned form for LOOK-AT emerges as the winner. Next consider the tableau for GIVE in (13). When the verb aligns fully for a 1st person multiple object, it violates the phonetic constraint and thus the first candidate incurs a violation under MARKED. However, distalizing the arc movement or removing

³ The following analysis was first presented in Mathur and Rathmann (2000) but with fewer refinements.

it altogether help to avoid a violation of the constraint, and thus the last two candidates pass MARKED. FAITH does not distinguish among the two, since both differ from the input and incur a single violation each. However, it does not matter, since they do not violate the first constraint which is more highly ranked and which the first candidate does violate. Thus we have two winners in the case of GIVE, which are on par with one another and which may be freely chosen by the signer.

To distinguish between the two, we could add two more constraints ranked below the first MARKED constraint. For example, one could be a markedness constraint against the 'multiple' arc and the other a faithfulness constraint in favor of some resemblance between the input and the output that could still be achieved through distalization.⁴ The ranking of these two constraints may depend on the particular discourse register. In a formal setting, it is preferred to see the full form as much as possible, so the faithfulness constraint would be ranked above the *multiple constraint. On the other hand, in an informal setting where one may not need to sign the form as fully, the *multiple constraint may be ranked above the faithfulness constraint.

The above analysis is just a sketch as it is beyond the scope of the thesis, but the analysis has much potential for being developed into a full-scale theory that can explain why some verbs can align fully whereas others do not. The analysis is also particularly suited to accounting for the resolutions that have arisen in signed languages. First, the discourse-oriented nature of signed languages leads to a multitude of resolutions that are dependent on the particular discourse situation (register). Second, signed language is in a constant flux of creolization (Newport and Supalla 2000). Unlike spoken language

⁴ Alternatively, one may loosen the original FAITH constraint so that it allows distalization.

communities, the sign language community consists mostly of non-native signers (around 90%), since most Deaf signers are born to hearing parents and do not learn sign language until later in life. Thus sign language is not passed on as a first language to every generation, as is the case with a spoken language, but undergoes creolization in each cycle. One consequence is that the particular forms used by the signing community are also in flux; thus the use of particular resolutions may vary greatly from one signer to another. Finally, the three-dimensionality of sign language offers a wider space in which to make contrasts. Witness the paucity of true homonyms in signed languages. I can think of only two pairs for ASL: BUT/DIFFERENT and LETTUCE/GARBAGE.⁵ The wider space of contrasts makes possible even a wider multitude of possible resolutions. Bresnan's (1999) analysis, in adapted form, can encapsulate all those resolutions and through different rankings for each particular discourse situation, it can explain why one resolution is chosen over the others in a particular situation. By the same virtue of rearranging the rankings, it can also explain why some signers may choose some forms more often than others and why a signed language (dialect) prefers to use one form more often than another.

In a final note, one may wonder why I have used the term 'phonetic' rather than 'phonological' in describing the joint-based constraints. Even for spoken languages, there is much debate in the literature about the division between phonology and phonetics. The UCLA school of phonetics, e.g. Steriade (1997) and Flemming (2000), provide one promising view that may be well adapted for sign language. For example, Fleming (2000:3) argues that

⁵ I thank Diane Lillo-Martin for the second example.

these parallels [between phonology and phonetics] are best accounted for by analyzing both 'phonetic' and 'phonological' phenomena within a unified framework so the similar properties of the two can be derived from the same constraints. Unifying phonetics and phonology does not imply a denial of the distinction between scalar and categorical phenomena. Rather, the proposal is to derive phonological categories using scalar phonetic representations (cf. Lindblom 1986). This allows categorical and scalar phenomena (e.g. neutralizing assimilation and coarticulation) to be derived within a single component, so the same constraints can apply to both, giving rise to the observed parallels between the two.

There has yet to be a lot of quantitative research that clearly establishes what the phonetic categories are in signed languages. For instance, does the wider space of contrasts in sign language allow for finer-grained phonetic categories than those in spoken language?

While it has been shown that the joint-based constraints have linguistic status as opposed to physiological status, I refrain from calling them phonological and go with the null hypothesis that they are phonetic since there is apparently a tight relationship between phonetics and phonology in language, which needs to be better understood in signed languages as well.

Chapter Four

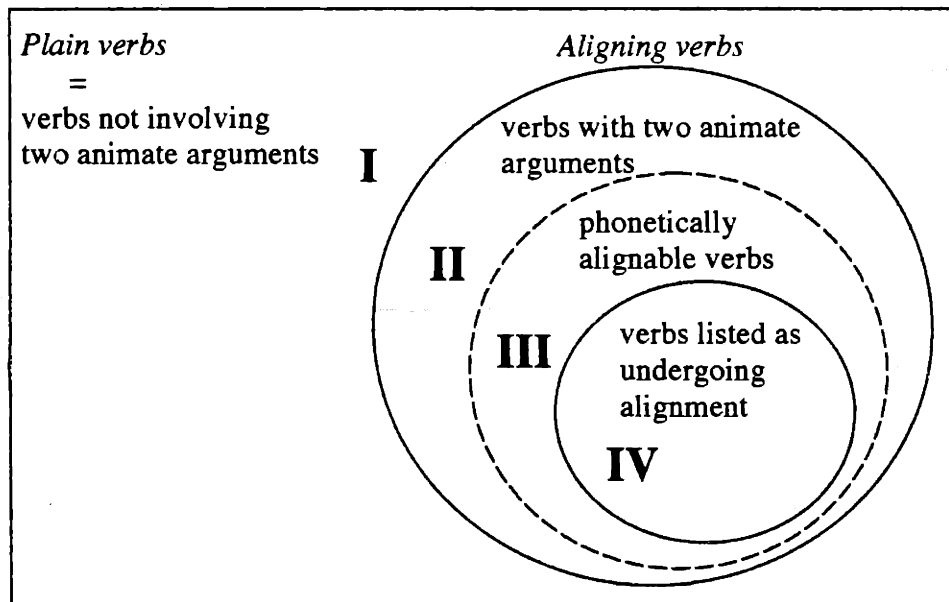
Some Consequences of ALIGN-Sphere

This chapter considers some consequences of the phonological re-adjustment rule proposed in Chapter 2, ALIGN-Sphere. Section 4.1 will consider the syntactic consequences of the new typology as a result of the ALIGN-Sphere rule. Specifically, it will consider what effects the typology has on the licensing of null arguments and will discuss heavily the analysis of Lillo-Martin (1991) which is dependent on Padden's (1983) typology of verbs. Section 4.2 closes the chapter with several more consequences of ALIGN-Sphere that should be investigated more in the future.

4.1 Licensing null arguments

The analysis in the thesis leads to the following typology of verbs in sign language.

(1) Typology of non-spatial verbs in sign language



Note this typology applies only to non-spatial verbs. I side with Padden (1983) and Janis (1992), among others, that there is a fundamental distinction between spatial and non-spatial verbs. Henceforth we will not be concerned with spatial verbs. Otherwise, the typology differs from Padden's (1983) typology which divides non-spatial verbs into plain verbs and inflecting verbs. While the two typologies categorize verbs at the lexical level, they are based on different kinds of criteria. Padden's typology is based on morphological criteria, by which a verb is inflecting if it can show morphological inflection. This would fit into category III (including IV) in the above typology. The typology in (1) is, on the other hand, based on semantic criteria: an aligning verb is any verb that takes two animate arguments. It does not matter whether it is not able to show alignment for phonetic reasons. In spite of the differences between the two typologies, they do not lead to different predictions about Lillo-Martin's (1991) mechanism for the licensing of null arguments. Rather, the distinction that is relevant for licensing of null arguments is between locus-showing verbs and non-locus showing verbs, not between plain and agreeing verbs nor between plain and aligning verbs.

Lillo-Martin 1991 provides a two-way licensing mechanism for null arguments in ASL. If a null argument occurs with an agreeing verb, it is a small *pro* licensed by the rich agreement on the verb. If the null argument occurs with a plain verb, it is a variable bound by a possibly empty topic.

To establish that the 'agreement' on agreeing verbs is inflection, i.e. true agreement, and not cliticization, Lillo-Martin (1991) uses Zwicky and Pullum (1983)'s four criteria. Under the ALIGN-sphere model, 'agreement' is not an inflection but a

phonological re-adjustment rule. How would this fare against Lillo-Martin's (1991) application of Zwicky and Pullum (1983)'s criteria? Let's discuss each criterion in turn.

The first criterion for an inflectional affix is that affixes exhibit a high degree of selection with respect to their stems. Lillo-Martin (1991:34) notes in regard to this criterion that "ASL agreement is notoriously selective." Only inflecting verbs can exhibit agreement morphology, and while there is a phonological tendency for inflecting verbs not to be body-anchored, there seems to be no way to predict whether a verb can take inflection or not. I claim that this can in fact be predictable: any verb with two animate arguments is a candidate for alignment. If one examines the list of inflecting verbs in Padden's (1983) list, one will see that they involve two animate arguments. Moreover, one will also see that any plain verb from Padden's (1983) list that involves two animate arguments will not be able to show 'agreement' due to phonetic reasons. These would fit in with category II in the above typology.

The second criterion from Zwicky and Pullum (1983) is that arbitrary gaps in the set of combinations are more characteristic of affixed words than of clitic groups. Lillo-Martin (1991: 34) observes that "even within the class of ASL verbs which take agreement, some verbs take both subject and direct object agreement (KICK), while others take subject and indirect object agreement (GIVE) and still others take direct (SEE) or indirect object agreement (TELL) only." Here, I claim the gaps are not arbitrary. First, it does not matter whether the object is indirect or direct, as long as it is an animate argument. To be fair, Lillo-Martin (1991) mentions in a footnote that the gaps are predictable. For example, if there is an indirect object, the verb will agree with that. However, the generalization remains that all those verbs involve 'agreement' with two

animate arguments, and verbs like SEE and TELL have been shown in section 2.5 not to 'agree' with the subject for phonological reasons.

A third criterion is that morphophonological idiosyncrasies are more characteristic of affixed words than of clitic groups. Lillo-Martin (1991) cites first person agreement forms which may or may not require final contact with the signer's body. For example, GIVE and TELL have optional final contact whereas SEND and FEED never do. One can still predict the 'idiosyncrasy' of SEND and FEED not to have final contact with a 1st person object if one considers the fact that these verbs have special lexical movement whereas GIVE and TELL do not. For example, SEND involves a handshape opening (in contrast to ASK and CATCH, which involve a handshape closing and may have final contact with the chest) and FEED has repeated movement as part of the underlying form. These lexical movements would bar final contact with the chest.

For the last criterion that semantic idiosyncrasies are more characteristic of affixed words than of clitic groups, Lillo-Martin (1991) cites backwards verbs. However, Meir (1998) has shown that the semantic properties of backwards verbs are not idiosyncratic. The difference between backwards and regular verbs lies in the mapping between semantic relations on the spatial tier (SOURCE, GOAL) and on the action tier (AGENT, PATIENT).

Even if the above criteria do not help establish 'agreement' as inflection, i.e. as true agreement, it is still possible for 'agreement' to license null arguments albeit not as true agreement. This is the position I wish to pursue. In particular, it is through making the loci visible that an 'agreeing' verb may license a null argument. I will come back to this point in the following discussion.

Lillo-Martin's (1991: 52) main argument for the status of the null argument of an agreeing verb as small *pro* is that "when agreement is present in ASL the effect is in several ways the same as if an overt pronoun were present, in that structures which otherwise would need an overt pronoun are grammatical even with null arguments. Note that I am referring specifically to those verb tokens which are marked for agreement, not to verbs in general from the class which may take agreement." Thus the prediction is that if agreeing verbs do not show overt agreement, they cannot license null arguments. This is one clue that it is the locus-showing property of the verb that licenses the null argument, not agreement per se. Recall that alignment is a phonological process which is optional, and it is not equivalent to agreement, so it cannot be directly responsible for licensing null arguments. I will now consider each form of the main argument in turn.

One part of the main argument is that *pro* can assign a referent to a locus, just as an overt pronoun can. The model here separates agreement, locus assignment, and alignment. Locus assignment is a discourse process which may link to the grammar just before alignment takes place, as discussed in Chapter 1. Thus, it looks like *pro*, the overt pronoun, or the alignment is doing the locus assignment when in fact it is a separate process.

Lillo-Martin (1991) provides examples in which the locus is assigned to an object noun phrase. Consider other examples in which a locus is assigned to the subject noun phrase as in (2).

(2) YESTERDAY aPITYc cFATHER. aPRONOUN/Mary aKISS1.

(3) YESTERDAY (a)pro aPITYc cFATHER. cPRONOUN cKISS1.

(where locus *a* is set up earlier in the discourse to equal Mary, but *c* has not been set up until the verb)

If sentence (2) were signed at the beginning of discourse, the use of aPRONOUN in the second sentence would be odd at best. In such cases, one would prefer to align the verb for a default point near the body rather than use a specific subject locus. On the other hand, the use of cPRONOUN sentence (3) is more felicitous because the noun phrase FATHER precedes cPRONOUN, not because of the 'agreement' on the verb PITY. That is, it is FATHER which serves to bind cPRONOUN, not the locus assigned by the 'agreement' on the verb. This explains why (2) is odd: there is nothing in the previous discourse to bind (a)PRONOUN/MARY; even the subject 'agreement' on the verb PITY is not enough. This provides the relevant evidence for locus-assignment being an operation independent of 'agreement'.

Another part of the argument is that *pro* behaves like a resumptive pronoun. Lillo-Martin (1991:55) provides her example (12), repeated below as (4).

- (4) $\overset{t}{\text{aTHAT aBOOK, bSTEVE aREAD ____}}^1$
'That book_i, Steve read (-it_i).

READ is not considered to be an aligning verb, since it does not have two animate arguments. In other examples, Lillo-Martin (1991) uses verbs like TAKE-UP and LOOK-OVER which are also not aligning verbs. They would be best analyzed as verbs with optional locus cliticization. However, it is clear that something is licensing the null

¹ The *t* symbol stands for the topicalization marker, which consists of raising the eye brows. The underlining indicates the extent of this non-manual signal. *br* in the next example is another symbol standing for brow raise, which serves a similar function.

argument in (4), and I suggest that it is the locus made visible by the sign READ, not verb agreement per se.

What happens when one replaces the verbs in these examples with aligning verbs, as in Lillo-Martin's (1991:56) example (17), repeated below as (5)?

- (5) $\frac{\quad}{a} \frac{\quad}{t} \frac{\quad}{b} \frac{\quad}{r}$
aTHAT aMAN, bSTEVE SAY cJULIE FINISH cGIVEa (aPRONOUN) BOOK
'That man_i, Steve said Julie already gave a book to (-him_i).'

The alignment on the verb GIVE still requires the loci to be first associated with the referents of the noun phrases THAT MAN and JULIE. It is the use of the loci themselves which are responsible for licensing the null arguments, not alignment/'agreement'. This explains how the set of possible null arguments licensed by the presence of loci is not limited to animate arguments, but includes inanimate arguments, which are in most of the extraction examples that Lillo-Martin (1991:56) uses. Furthermore, if the presence of a locus can license a null argument, one prediction is that it should also be able to license the arguments of a spatial verb, which seem to be the case. (Cf. Quadros (1999) who also adopts a broad definition of what can license a null argument and calls it 'agreement'.)

Another prediction is that if an aligning verb is not able to show full alignment due to phonetic reasons, null arguments should still be possible as long as some part of the alignment is visible, because it indicates where the loci are. In the circumstances where one 'withholds' the alignment for discourse reasons, null arguments should still be possible for the reason that the presence of loci have already been established earlier in the discourse.

Otherwise, null arguments are predicted not to be possible with non-aligning verbs that do not show a locus, consistent with Lillo-Martin's (1991) analysis. As long as the locus is visible in some way and the assignment between the referent of a noun phrase and the locus is made through an independent process in the minds of the signer and the listener, not through alignment which just makes use of the locus, the locus may license the null argument.

The distinction between between two some classes of verbs with respect to null arguments is real and is best described as locus-showing versus non-locus-showing verbs. Consider the following table, which illustrates the differences among the terminology.

(6) Distinctions among non-aligning, non-locus-showing, and plain verbs

		Agreeing (Padden)	Plain (Padden)
Aligning	locus-showing	GIVE	THANK
	non-locus-showing		ACCEPT, ENCOURAGE, LIKE, LOVE, SERVE, SUPERVISE
Non-aligning	locus-showing		MEMORIZE, READ, SET-UP
	non-locus-showing		ASHAMED, BUILD, DOUBT, SIGN, SING, STOP, THINK, VOTE, WONDER

According to this table, all agreeing verbs by Padden's (1983) definition are both aligning verbs and locus-showing. However, there are also plain verbs under Padden's (1983) terminology which may show loci and which therefore may license a null argument.

These verbs can either be aligning (have two animate arguments) like THANK or they may not, like MEMORIZE, READ, and SET-UP. It is the presence of a locus, then, that

determines whether a null argument is possible, not whether a verb is showing agreement or alignment.

4.2 Directions for future investigation

One question about ALIGN-Sphere is how a child will acquire it. The rule requires using space discretely rather than continuously (as in the use of classifiers). If the child knows the rule, will she also know the difference between the two uses of space? One way to test whether a child knows the rule is by using a preferential eye experiment to determine whether the child can distinguish between an R-to-L form and an R-to-ME form.

As mentioned in the previous chapter, more work should be done on the nature of the phonetic constraints. In addition to investigating the resolutions further, one should also examine more closely the interaction between a stem and other morphology such as aspect and classifier morphemes, as has been done for 'agreement' here. These studies should aim to address the following issues: (i) what do the phonological alternations under other morphology reveal about the phonology of signed languages; and (ii) to what extent do the tension between the demands placed by the perceptual systems and the demands placed by the articulatory systems play a role in the derivation of a sign?

Aspect and classifier morphemes were mentioned as two possible domains that could shed more light on the interface between morphology and phonology. One should also consider how they are formed within the morphology component. Are they formed through a re-adjustment rule as Glück and Pfau (1999) have proposed, or are they better understood as vocabulary items? If it turns out these morphemes are expressed through

re-adjustment rules like 'agreement', for example, it will be an interesting result that says something about modality and the DM framework.

Finally, another area of research that should also be explored is how ALIGN-Sphere interacts with non-manual signals such as eye gaze and head tilt, as described by Bahan (1996). One question is whether they may fall under the stem-sphere that undergoes alignment, since the eye gaze and head tilt shift depending on only one particular locus, not two as is the case with an aligning verb.

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