A Perfect End: A study of syllable codas in South African Sign Language

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Abstract

Coda constraints are common in spoken languages. German, for example, can only have voiceless obstruents in the coda position (Lombardi 1999). Most sign language research has been on other sign languages, most notably American Sign Language (ASL). This research serves to contribute to syllable theory and has a methodology that allows for cross-linguistic research, strengthening the understanding of sign languages in general, and enhancing the description of SASL in particular.

It is well known that syllables in spoken languages require a vowel nucleus to be well-formed. Sandler and Lillo-Martin (2006) provide evidence of sign languages requiring movement to be considered well-formed: even seemingly stationary signs such as WHO, which occurs at the chin, will have finger wiggling as some form of movement. It is thus natural to assume that movement is akin to vowels in syllable theory (Brentari 1998). Thus, locations are similar to consonants. However, the visual nature of sign allows for simultaneity – holds do not occur by themselves. Next to location, handshapes are phonetically complex features that may impact the constraints at coda position. To my knowledge, there is no formal research on the coda constraints of sign language syllables.

The data examined here comes from a video dictionary of approximately 175 words. From this dictionary, a database of coded locations and handshapes are recorded for both the onset and the coda. From this, a consonant inventory is made and patterns are identified. Each source of data is analysed individually based on Brentari's (1998) Prosodic Model. Patterns that are noticed are then looked at using Brentari's (1998) framework to account for what phonological rules are dictating constraints. However, as a hearing researcher cannot claim native knowledge of a sign language, the conclusions drawn from the data will be tested using native SASL signers for negative judgement.

The preliminary findings of the research suggest that there are constraints on the coda location and handshape of a sign and that this may be a result of the natural classes of handshape and location prohibiting certain onset-coda combinations. The onset and coda on monosyllabic signs mirror each other's location, while the handshape cannot change in repeated and many monosyllabic signs. These constraints provide more understanding into the rich phonological nature of sign languages.

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Phonological features used

Handshape

Primary features: Handshape

[A]	[I]	[R]
[B]	[J]	[S]
[C]	[K]	[T]
[D]	[L]	[U]
[E]	[M]	[V]
[F]	[N]	[W]
[G]	[O]	[X]
[H]	[P]	[Y]
[I]	[Q]	[Z]

Secondary features: Handshape

[curved]

[spread]

[curved], [spread]

[stacked]

Location

Regions and settings: Handshape

Head: [1] top of head

[2] forehead

[3] eye

[4] cheek/nose

[5] upper lip

[6] mouth

[7] chin

[8] under the chin

Arm: [1] upper arm

[2] elbow front

[3] elbow back

[4] forearm back

[5] forearm front

[6] forearm ulnar

[7] wrist back

[8] wrist front

Body: [1] neck

[2] shoulder

[3] clavicle

[4] torso-top

[5] torso-mid

[6] torso-bottom

[7] waist

[8] hips

H_2: [1] palm of hand

[2] finger fronts

[3] back of palm

[4] back of fingers

[5] radial side of selected fingers

[6] ulnar side of selected fingers

[7] tip of selected fingers/thumb

[8] heel of hand

Body Alignment: Location

[ipsi]

[contra]

Not specified

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1 Introduction

1.1. Introduction

There is a substantial amount of research on the phonological structure of sign languages, particularly in commonly known sign languages such as American Sign language (ASL), Isreali Sign Language (ISL) and British Sign Language (BSL) (Stokoe 1960, Sandler & Lillo-Martin 2006; Sandler 1993, 2011; Brentari 1996, 1998, 2007, 2010; Sutton-Spence & Woll 1999, Whitworth 2011, among others). However, there is little research on the phonological structure of South African Sign Language (hereby referred to as SASL). Of particular interest is the possibility of restrictions in SASL syllables. An understanding of phonological restrictions in SASL serves, not only to better the understanding of SASL as a language, but contributes to the current knowledge of sign language phonology. As the coda holds the most phonological restraints in spoken languages, it is possible that the same holds for SASL. This research aims to determine the existence of coda restrictions in SASL, and what they are.

This chapter serves to provide foundation to some of the theory that was fundamental in conducting the research, as well as explain the relevance of this research. To begin, I will briefly describe the theoretical and practical environment that affects this research, which will be discussed at length in the Theoretical Overview. Thereafter I will explain what the potential implications and applications the results of my research could have on Deaf Studies and the associated body of knowledge.

1.2. Sign Language Linguistics

Originally, sign languages were not seen as genuine language, but rather a sequence of gestures (Channon & van der Hulst 2011). Due to the signed modality's affinity for iconicity (which was at odds with the abstract relationship between spoken words and reality), it was treated as a deaf person's attempt at mimicking spoken language (Napoli & Sutton-Spence 2010). However, sign languages gained credibility as fully-fledged languages as a result of the phonological studies of Stokoe (1960) and his colleagues. According to their research, sign languages have articulatory features that create the signs, the change of which can result in a different sign (Stokoe 1960). Stokoe (1960) introduced three parameters of articulation: handshape, location and movement. His work inspired other sign language linguists, such as Battison (1978 [1973]), who not only added orientation as an articulatory feature, but provided insight into the constraints and conditions around two-handed signs. Liddell and Johnson (1989) further added to the body of knowledge by addressing the sequential nature in sign languages by introducing the Move-Hold Model. Since then, various models and notations have been formulated to explain sign languages, and research into the syntactic, morphological and sociolinguistic aspects of sign languages further legitimizes them as languages in their own right. Many of these studies draw on similarities between spoken and sign languages, opening the debate of whether there is one human language both modalities fall into (Sandler & Lillo-Martin 2006). Some theorists, still, argue against the use of comparison in sign language study. A brief discussion on this viewpoint can be found in 2.6.2.

However, as previously stated, most prominent work in sign language linguistics focuses on well-known and researched sign languages such as ASL and ISL. As such, research into lesser studied sign languages - such as SASL - can reveal much about sign language linguistics, and linguistics as a whole.

1.3. Scope of the research

Comprehensive research into sign languages is necessary in both practical and theoretical contexts. In this section I briefly explain the theory that is fundamental for my research, as well as explain the sociolinguistic background that affects my research.

1.3.1. South African Sign Language (SASL) in context

The sign language used by the Deaf community in South Africa is a product of the country's history. There had been no schools for the Deaf in South Africa until teachers, nuns and church members from abroad established them in various provinces (Storbeck 2010). It is through the establishment of those schools that the influence of BSL, ASL and Irish Sign language (ISL) (Ngwinika 2016, Storbeck 2010).

As provinces had schools run by different individuals, each province was influenced by different sign languages. During the 19th Century, Catholic nuns from the Irish Dominican Order opened the first school for the Deaf in the Western Cape. As a result, ISL had a heavy influence on signing in the Western Cape (Ngwinika 2016). BSL heavily influenced the signing in Gauteng province, due to the British teacher stationed at St. Vincent's School for the Deaf (Ngwinika 2016). The two-handed alphabet was brought in by German Dominican nuns, who also had a central focus on oralist methods (Ngwinika 2016).

Supported by Alexander Graham Bell, oralism was a practice that centred on generating integration into the hearing world by encouraging speech and lipreading (Watson 1998, Padd 2003). Using theories of evolutionary science and religion, oralism argued that deafness was a biological and/or spiritual defect that had to be prevented from spreading; while at the same time educating the deaf to use audio-verbal communication (Padd 2003). In other cases, it led to the belief that deaf individuals were somehow less human, as language was considered inherently human – naturally, overlooking the components of sign languages that made them languages of their own (Bauman 2004). This began to influence the manner in which Deaf students were educated in schools. Various oralist methods were used, depending on the school (Watson 1998). Members of the SASL community have recalled being forced to sit on their hands during class, to avoid communicating with them. Others recall being forced to sing or talk.

As detailed above, schools for the Deaf have been a large focus on the development of SASL. Schools were initially integrated, but began segregation before 1948, when the law separating students was passed. An exclusively black school of the Deaf was established in 1941, following the Dutch Reformed Church's exclusively coloured school of the Deaf in 1933 (Storbeck 2010). During that era, children in white schools were given a predominantly oral curriculum, as spoken languages carried more prestige (Ganiso & Kaschula 2013). Although the signs taught in schools did not match the signs naturally developed at home, children of colour used more manual methods in classrooms (Ganiso & Kaschula 2013). As a result, SASL used by black signers is considered more natural, with less hearing bias. This affects the kind of informants chosen by SASL researchers, as many researchers prefer to conduct research on the 'purest' SASL variation possible.

SASL is an under-studied language. In fact, to my knowledge, the research conducted for this dissertation would be one of the first studies done on the phonological structure of SASL. This is unfortunate, especially when one takes the language's richness and diversity into consideration. More formal research into SASL not only has the power to inform further developments on SASL education and legislation, but may also provide results worthy of cross-linguistic research.

1.3.2. Theoretical context

While the following theory will be discussed at length in the Theoretical Overview, it is worth mentioning some of the key concepts that inform this thesis, as well as establish the definitions I will be working with. The concepts that have the most significant effect on my work are the difference between phonetics and phonology, syllables, markedness and sonority.

1.3.2.1. Phonetic representation vs. phonetic representation

To avoid confusion, the difference between phonetic and phonological representations should be established first. While both are concerned with sound (or, in the case of sign languages, the movements and locations of articulators), there is a distinct difference between phonetics and phonology, and thus the way in which both are used in research.

Phonetics is the study of the physical features of articulation (Davenport & Hannahs 2013). In spoken languages, this is the tongue, teeth, lips and lungs that together create different vowels (e.g. the high front back [u]) and consonants (e.g. the voiceless bilabial plosive [p]). In sign languages, phonetics focuses on formation of active articulators (such as the face and hands) to construct meaning.

Phonology is the study of the patterns that dictate the arrangement of articulatory features. In spoken languages, these are the rules that determine which sounds are allowed at various parts of the word. Phonology is the study of the grammar behind articulation (Davenport & Hannahs 2013, among others). In sign languages, it is the grammar that dictates the patterns of the parameters in a sign. As determining the constraints on the coda of a syllable is an investigation into SASL's articulatory grammar, this study will be a phonological one.

1.3.2.2. Syllables in spoken languages

For an understanding of the syllable in sign languages, I will explain some basic theory of the syllable in spoken languages first. Syllables are a suprasegmental phenomenon that exists in spoken language phonology. Bigger than the phoneme and smaller than the phonological word (Selkirk 1996), syllables are important to phonological theory for a number of reasons. Firstly, it is at the syllable level that the phonological generalisations and constraints of a language are most likely to exist (Féry & Vijver 2003). Secondly, syllable structure is quickly internalised by children during the period of language acquisition (Spencer 1996). One such example is the Coda Condition (or CodaCon, used in Optimality Theory), which determines the inclusion of a coda in relation to the onset of the syllable following it (Itô & Mester 1994). Another example is the constraint in German that prohibits voiced obstruents in the coda position (Lombardi 1999, Lombardi 2004, Wetzels & Marcaró 2001: 208), as shown below:

ei[z]ig 'icy' → Ei[s] 'ice' → Ei[sb]är 'polar bear'

wei[s]er 'whiter' → Wei[s] 'white' → Wei[sb]ier 'wheat beer'

Numerous theorists (Carins & Feinsten 1982, McGregor 2009, Spencer 1996, Prince and Smolensky 2004, Carlisle 2001, Lombardi 2004) argue that, while each language has its own syllable structure rules, the universal core syllable is CV. That means that every language should possess some syllable structure. Since sign languages are natural languages, it is natural to assume that they might be subject to syllable structure and phonotactic constraints. In fact, Brentari (1998) states that sign languages would experience a greater amount of phonotactic constraints due to the richness of the modality. As discussed previously, articulatory features can occur simultaneously, as well as sequentially (Brentari 1998, Liddell & Johnson 1989). With numerous articulators performing at the same time, it is logical to assume that there are constraints for each individual articulator.

1.3.2.4. Syllables in sign languages

There has been strong evidence for the existence of syllables in sign languages: theorists such as Brentari (1998), Sandler & Lillo-Martin (2006), Sandler (2008), Corina & Sandler (1993) and Perlmutter (1992), among others, have used the sequential properties of sign languages to argue for an onset-nucleus-coda structure.

Movements are the most sonorous part of a sign – making them parallel to vowels in spoken languages – and it is here that the boundaries of a sign syllable can be defined. While most syllables in sign language are monosyllabic, movement assists in separating the syllables in polysyllabic signs (Wilbur 2011).

From the spoken language examples above, it is evident that a large number of syllable constraints occur at the coda. Hence, I investigate the constraints that exist at the coda position in SASL syllables.

1.3.2.5. Markedness

Markedness has several definitions that dictate a variety of differing theories. At its base definition, markedness exists as a result of featural asymmetries in a language's phonological structure (Rice 2007). According to Rice (2007), there are 3 diagnostics for determining phonological markedness, namely:

1. Neutralisation
2. Epenthesis
3. Asymmetries in assimilation

Firstly, we can look to the conditions that trigger the unmarked, such as neutralisation or epenthesis: conditions where the unmarked is suppressed, such as assimilation or in instances of deletion and coalescence - as with Modern Greek and their choice of vowel (Mackridge 1985).

For the purposes of this thesis, markedness is defined by the features defined as unmarked in sign linguistic theory (Brentari 1996, Sandler & Lillo-Martin 2006). Forms that are unmarked are the ones that occur more frequently, are geometrically distinct, are seen cross-linguistically and are the first acquired by children (van der Kooij 2002, Morgan & Mayberry 2012). Forms that do not fit these criteria are marked, or uncommon. As such, unmarked forms are preferred during changes.

Markedness has a place within syllable theory. Carins and Feinstein (1982) and Rice (2007) argue that the universal CV structure is an unmarked syllable, and that the inclusion of a coda in this structure is marked. This further places interest on the constraints that must then exist in the marked coda position.

If unmarked forms are preferred, it is possible that handshape changes that occur in syllable articulation will have a relationship with unmarked forms. In sign languages, handshapes are where unmarked forms are mentioned (Brentari 1998, Sandler & Lillo-Martin 2006, Morgan & Mayberry 2010). There are certain handshapes in sign language phonology that are considered less marked. These handshapes, namely [B], [A], [S], [C], [O], [1] and [5], are defined as unmarked handshapes. Additionally, they are the handshapes the non-dominant hand is restricted to in asymmetrical signs (Brentari 1998, Sandler & Lillo-Martin 2006, Morgan and Mayberry 2012, among others). This restriction further proves the existence of an unmarked form in sign languages, as well as preference for it. The relationship between markedness and handshape will be explored in both the Theoretical Overview and the Discussion chapters.

1.3.2.6. Sonority

Sonority is defined as the scale which organises the arrangement of sounds in the production of words (Zec 1995, Spencer 1996). Sonority constraints can be found on the prosodic level, where syllable is found (Zec 1995).

The manner in which sonority is arranged is dependent on the syllable. According to the Sonority Sequencing Generalisation (hereby known as the SSG), the most sonorous form of a syllable must be at the nucleus, and the onset and coda must be of lesser sonority (Zec 2007, Spencer 1996). For a sound to be sonorous, it must pass the sonority threshold of the language in question – in this way, certain consonants can be placed in the nucleus position (Zec 2007). Below, I provide the sonority hierarchy for most languages (Spencer 1996: 89). In spoken languages, the sonority of a sound is dependent on the amount of unobstructed airflow that sound has.

obstruents < sonorant consonants < vowels

Sonority in sign language phonology is deeply linked to the signed modality. Brentari (1998: 74) proposes "visual perceptual salience", where the sonority of a sign is attributed to the visibility of the movement. Therefore, the joints that define the different types of movement are given their own hierarchy, as shown below (Brentari 1998: 75). Signs that pivot around the shoulder generate greater – and more visible – movement and are thus more sonorous than non-base (finger) signs that are less visible from a greater distance.

shoulder > elbow > wrist > base joints > nonbase joints

The manner in which sonority is placed in sign language depends on the syllable to an extent. Movements that do not occur at the shoulder or elbow must happen at the nucleus of a syllable. In the case where the syllable only has a hand movement (i.e. the location does not change), the syllable can just be a location (Perlmutter 1992).

1.3.2.7. The Obligatory Contour Principle

ALthough not explicitly stated in the research, it is important to gain an understanding of the Obligatory Contour Principle (or OCP). Originally connected with tone in languages, the Obligatory Contour Principle states that similar or identical features cannot occur adjacent to each other (McCarthy 1986, Berkley 1994, Yip 2007 among others). OCP can also relate to features beyond tone - Berkley (1994: 67) provides rules for the suffix system in English. Walter (2007) presents OCP in relation to syllable boundaries.

(9) OCP(Place)-SUFFIX (OCP(Place)-Sfx) (Berkley 1994:67):
Identical consonants separated by a suffix boundary are prohibited.

According to Yip (2007), OCP can either block a language's rules, or trigger them. The ranking of OCP is based on Optimality Theory (Yip 2007, McCarthy 1986). If OCP ranks higher than a rule that allows similar consonants, that rule will be blocked to accommodate OCP (Yip 2007). Other times, a language's rule is generated to adhere to OCP. In syllable systems, a sonorous vowel is prioritized higher than the consonants and is oftentimes metathesized to separate similar consonants in a syllable (Berkley 1994). In sign language syllables, it is possible that movement is required for well-formedness to separate holds and adhere to OCP. This means that the surface representation of a movement might be triggered by OCP, thus proving that OCP is present in sign languages and providing an interesting perspective on constraints.

1.3.2.8. Centralisation

Another phenomenon that is important to the outcome of the research is the concept of centralisation. Originally, centralisation is the historical tendency signs have to move closer towards the centre to the signer's body over time (Fischer 2015). This means that signs that are articulated on the side of the signer will move to the centre of the signer, and signs that are articulated particularly high are relayed lower on the signer's body (Fischer 2015). This has been found in American Sign Language (ASL) (Fischer 2015) as well as British Sign Language (BSL) (Kyle & Woll 1988).

This research proposes an adaptation to centralisation, where the features of a sign are able to move towards the centre of the signer's body within in the syllable.

1.3.2.9. The Prosodic Model

The phonological framework used to conduct this research is the Prosodic Model (Brentari 1998). According to Brentari (1998), sign languages should be analysed in accordance with two types of features: Inherent Features (which are part of the underlying, unchanging nature of the sign such as the fingers selected or the start and end locations) and Prosodic Features (the dynamic aspects of a sign, such as movement). Within the IF and PF branches there are daughter nodes that are arranged hierarchically. The Prosodic Model uses the combination of handshape and location to create the orientation parameter. In other words, there is no branch directly pertaining to Orientation.

The Prosodic Model (Brentari 1998) combines the sequential emphasis of the Movement-Hold Model devised by Liddell and Johnson (1989) with the intricate detail to handshape found in the Hand Tier Model (Sandler 1986, 1987b, 1989), as well as drawing from spoken language theories such as Dependency Phonology, Enhancement Theory and Optimality Theory. While the Prosodic Model will be discussed in full in the Theoretical Overview in chapter 2, it is worth noting here.

The benefit of the Prosodic Model is that its initial intention was to provide a framework that could be used by researchers who were not fluent signers (Brentari 1998). Additionally, the differentiation of the features that undergo change and the features that remain the same are significantly beneficial to my research. As will be further discussed in my Methodology chapter, I looked at the features at the beginning at and the end of a sign syllable. By focussing on the features on the PF branch and comparing it to the IF branch, I was able to start formulating possible constraints from the patterns found in the PF branch. As a result, the Prosodic Model provided a clear and structured framework to conduct my research.

However, there are issues that the Prosodic Model presents in the analysis of SASL phonology. One such issue is the treatment of the Place of Articulation (or POA) in the framework. It was found in the data that the main region can change during the syllable's articulation. This observation came in conflict with the current model and a modification was made, which is thoroughly described in Chapter 2.

1.4. Research Questions

To guide the direction of my research, I have based my research on the following overarching questions:

Overarching question 1: Are there coda constraints in SASL?

Overarching question 2: If there are coda constraints in SASL, what are they?

I have constructed the following subordinate questions. By answering these questions, I am able to solve the overarching questions above.

Subordinate questions:

- what location features occur at syllable codas?
- what handshape features occur at syllable codas?
- are there limitations on what kind of onset-coda combinations can exist for handshape and location features?

Based off the above research questions and the research conducted in Chapter 2, I have formulated the following hypotheses:

- There are coda constraints on the coda in SASL. These constraints are limited to the handshape and location parameters.
- The handshape in the SASL syllable has a tendency to remain the same at both onset and coda positions. However, if there is a change between onset and coda, the handshapes selected at the coda will be unmarked.

- The body region selected will remain the same at both the onset and the coda ie. The location will change within a certain area.
- The coda can be omitted in the coda position.

1.5. Applications and implications of the data

From a theoretical standpoint, the syllable structure and constraints on SASL both confirm the preceding theory and propose changes to previous understanding about sign language universals. This is because the structure of location change in SASL syllables conflicts with the manner in which location is treated in the Prosodic Model. The structure of SASL also proposes a new type of syllable that differs from the agreed universal, which in turn generates more cross-linguistic research on SASL structures. Additionally, this research could be expanded to involve a comparative analysis against many other African sign languages, as there is a need for more research in the native languages of the African Deaf community.

From a practical perspective, this study could provide greater insight into how SASL syllables are constructed.

1.6. Thesis layout

This thesis is structured as follows. In Chapter 2, I review the spoken language theory that has influenced the theory on sign language syllables, sonority and syllable weight. In this chapter I also describe the various models used to describe sign language phonology, explain my preference for the Prosodic Model and describe the features characterised by this model. Additionally, I explain the syllable structure found in SASL and propose a modification to the Prosodic Model to accommodate SASL's phonology.

In Chapter 3, I thoroughly explain the data collection and analysis process I used, the informants that participated and the method of interviewing that I used. I also describe the manner in which I processed my data source and explain the issues that come with methodologies in sign language research.

In Chapter 4, I describe the observations and analysis of the processed data. This chapter is divided into handshape and location features, further dividing into the primary and secondary features that characterise each parameter. Here I propose the constraints that exist in SASL syllables through observation of what handshapes and locations are enacted at both onset and coda.

I conclude in Chapter 5 with a summary of the main points of the research. I also review my research questions and hypotheses and test them against the analysis. In closing, I describe the possible applications and implications my research may have and argue the need for further investigation.

2 Theoretical Overview

2.1 Introduction

Before any analysis into the syllable construction of SASL, it is necessary to explicitly state the framework to be used and the theory that guides the analysis discussed in Chapter 4. This chapter will begin with a brief introduction to the phonology of spoken syllables and how discoveries in spoken languages have influenced the way sign syllables are perceived. From there, I touch on the various models used to describe sign languages and why the Prosodic Model, developed by Brentari (1998), is the most suitable for my purposes. I end my exploration into sign literature by specifying the nature of the articulatory features as per the Prosodic Model.

2.2 Phonology of spoken syllables

Most work on syllables stems from spoken languages: As a result, research on spoken syllables generates questions that, when answered, enrich sign language theory and elicit research questions.

In the following subsection, I provide a most basic description of the phonology of spoken syllables necessary to the research. I begin by explaining the nature of prosody. Thereafter, I provide the reasons why syllables are fundamental to phonological theory. Following that, I describe the structure of the syllable, syllable weight and the relationship between moras and syllables. After exploring syllable structure, I am then able to list syllable constraints as displayed in numerous spoken languages. In closing, I propose certain questions about sign language inspired by the theory that will be answered in Chapter 4.

2.2.1. Prosody

A basic understanding of prosody is beneficial in understanding the foundation of syllable formation, as syllables are prosodic units. Simply put, prosodic phenomena are the features that spread over individual phonetic segments (McGregor 2009). In other words, prosody studies collective units of sound and the processes they enter into (Spencer 1996). Prosody is important to phonological theory as, on some occasions, prosody is what defines and distinguishes a word. According to Brentari (1998: 24), the prosodies that determine tone – "tonal prosodies" – in tonal languages exist in both surface and underlying tones. Brentari's properties of tonal prosodies will be described in the paragraphs below. Furthermore, prosody is a property that has an influence on both phonological and morphological theories (McCarthy & Prince 1986). Prosodic units additionally exist along the following hierarchy (Selkirk 1996: 191):

Utt	Utterance
IP	intonational phrase
PhP	phonological phrase
PWd	prosodic word
Ft	foot
σ	syllable

This hierarchy, as with any hierarchy, imposes constraints and principles for well-formedness. In particular, Selkirk (1996) presents the Strict Layer Hypothesis – each node can only dominate the node directly below it.

Brentari's definition of prosody is in line with the definitions provided by Firth (1957) and Selkirk (1978) above whereby prosody includes suprasegmental units such as the syllable. Numerous perspectives on prosody emerged from Firth (1957) and it is these multiple prosodies that Brentari acknowledges in her properties of prosodies as cited by Brentari (1998:24).

(11) Properties of prosodies, such as "tonal melodies"

a. Prosodies are timed with respect to units larger than the segment
b. Prosodies have a restricted set of abstract patterns
c. Prosodies have autosegmental status
d. Prosodies can carry lexical contrast

In tonal languages such as Venda, the wide range of tones that appear on the surface level are as a result of a limited set of underlying tones (Brentari 1998) and can carry lexical contrast as with languages like contemporary Korean (Silva 2006), Navajo (Young & Morgan 1992) and isiXhosa (Lanham 1958). Although it is not the focus of my research, the relationship between tonal languages and prosodies is important to note.

2.2.2. Syllables

According to Wilbur (2011), syllables are the smallest possible unit for a sign/word, rating the lowest on the Prosody Hierarchy. They exist between the word and the segment (Brentari 1998), operating on the post-lexical structure. That is, they deal with phenomena beyond the lexicon.

The general consensus is that the syllable is comprised of an onset, a nucleus and a coda, although certain languages may make amendments to it. The coda and nucleus are consonants, while the nucleus is comprised of a vowel, or a sound of a similar sonority (as shown in Figure 2.1). Together the peak and coda create the rhyme.

Furthermore, spoken languages allow for what is called an open syllable – a syllable with an empty coda node.

Syllables are important as it is at this level that phonological and phonotactic constraints are easily detectable. This is a result of the structure of the syllable being able to express generalisations in a clear way (Brentari 1998).

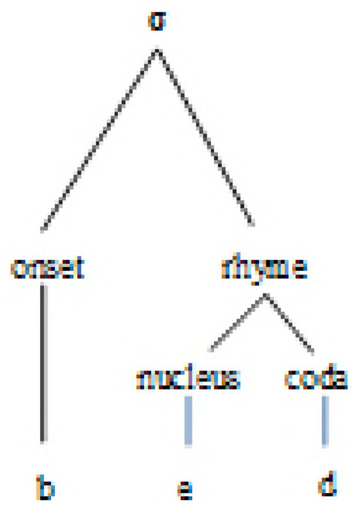

Figure 2.1 A representation of the monosyllabic word 'bed'.

Many phonotactic constraints occur at the syllabic level. For example, Koryak, a language spoken in the Eastern-most parts of Siberia, does not allow for the onset /tp/. However, there are words within the language that, on an underlying level, begin with such a consonant cluster. For the word to be well-formed, it must undergo epenthesis on the surface level (Spencer 1996: 73):

a. //t-pŋəlo-n//
b. //m-pŋəlo-n//

təpŋəlon	'I asked him'
məpŋəlon	'we asked him'

However, it is at the coda that most of the constraints on syllable structure exist. One such instance of coda constraints within syllables is German, where voiced obstruents cannot occur at the coda. This means that, if a word contains a voiced obstruent at an underlying level in the coda position, it undergoes what is known as final devoicing (Wetzels & Mascaró, 2001: 208):

(1) *ei[z]ig 'icy' → Ei[s] 'ice' → Ei[sb]är 'polar bear'*

(2) *wei[s]er 'whiter' → Wei[s] 'white' → Wei[sb]ier 'wheat beer'*

Another example is the phenomenon of debuccalization in syllable codas. Humbert (1995), in his study on Malay dialects, found that the dialects instated debuccalization. Debuccalization is a process whereby a word with /p, t, k/ or /s, f/ in the coda position are realised as [ʔ] and [h] respectively. In other words, codas that are stops will move to the stop [ʔ] and codas that are fricatives move to the fricative [h], as seen in (3) and (4):

(3) */ikat/ → [ikaʔ]* 'to die'

(4) */lipas/ → [lipah]*

Debuccalization is when the consonant in the coda position loses its original place of articulation and moves to the glottis. This is significant as it shows that certain sounds are restricted from the coda position and undergo some change at the surface level. This proves the point that constraints are clearly visible at the syllable level.

Other languages still prohibit codas from appearing at all. Hawaiian, for example, does not allow a consonant to occur at the coda position, as seen in (5) - (7) (Schütz 1995: 7-8):

(5) six → *ono*

(6) child → *kamali'i*

(7) night → *pō*

Syllable structure, as with other aspects of prosody, is a hierarchical structure (Spencer 1996). Below is the hierarchy of the syllable as dictated by sonority (Spencer 1996:89):

obstruents < sonorant consonants < vowels

Vowels are characterised by the lack of obstruction of air to and from the lungs (Spencer 1996). As such, they are the most sonorous and carry the most significance. It has been argued that the "V" in the general syllable structure is not restricted to a vowel, but represents sounds that have passed a particular language's sonority threshold (Zec 1995). For example, sonorant consonants in English can sometimes occupy the peak position, such as *stir* [str̩], *muddle* [mʌdl̩] and *chasm* [kæzm̩] (Selkirk 1999 [1982]: 336) This creates rules such as the Sonority Sequencing Generalisation (hereby referred to as SSG), where the peak is the only node allowed to contain the most sonorous segment. The coda and onset must have a lesser sonority.

There must be phonotactic rules governing the coda position in the spoken languages from which examples have been drawn in this section. If sign languages have a syllable structure similar to that of spoken language it is likely that there too are phonotactic rules governing the sign syllable.

2.3 Basic syllable structure in sign language

The syllable has been an area of great interest to many sign language phonologists. The concept of the sign syllable begins with Newkirk (1998 [1981]), Chincor (1978) and Liddell (1984b). The acknowledgement of the sequential aspects of sign separated movements holds – a concept that allows for extensive phonological analysis in terms of sequence and simultaneity. This starts with Stokoe (1960), who described signs as purely simultaneous, where all articulatory features occurred at the same time. Johnson and Liddell (1989 [1985]) developed on this, stating that sign languages possess both simultaneous and sequential components, where movements and holds are separate entities. Geraci (2009), Sandler and Lillo-Martin (2006) and Perlmutter (1992) provide many reasons that movements are the most sonorous part of a sign syllable, as well as being fundamental for well-formedness. Movements are then similar to sonorous peaks in spoken languages, which makes holds similar to consonants, forming the sign language syllable. A more detailed account on movement as understood in this research can be found in 2.7.3. Below is an example of how the general syllable tree for spoken languages can be modified to suit the sign syllable (Figure 2.2):

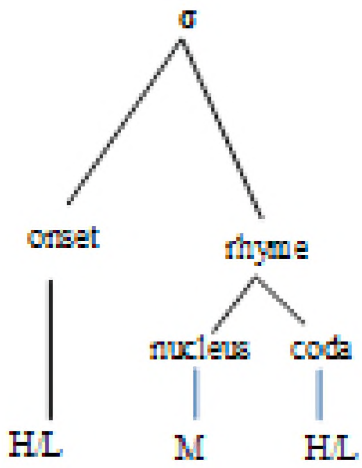

Figure 2.2 An interpretation of the syllable tree, modified to illustrate the general sign language syllable.

SASL syllables may be onset-less and coda-less, a topic that is discussed in the summary of SASL phonology in 2.8. According to Brentari (1998), signed syllables not only have constraints as spoken syllables do, but their modality means they are apt to carry more as seen in the section below. Some of these generalisations are universal to all sign languages, while some are unique just to SASL or ASL. For instance, SASL has a restricted set of handshape and movement specification in polysyllabic, monomorphemic signs. SASL also requires movement for well-formedness, conforming to what is known for sign languages as well as providing the basis for syllable analysis. This research operates on constraints c. and d. An account of sonority is provided in 2.5. Brentari (1998:74) proposes a set of constraints on the ASL syllable :

a. There are restrictions on the types of handshape and movement sequences that can occur in the disyllabic monomorphemic signs, as compared with a sequence of two signs of polymorphemic forms (Uyechi 1994: 104-106).

b. No monomorphemic sign is well formed unless it has a movement of some type.

c. The phonetic temporal coordination of the handshape changes with respect to movements occurs at the level of the syllable, not at the level of the lexical item or morpheme.

d. The notion of sonority, defined as “visual perceptual salience”, is relevant for syllable internal operations in sign language.

Compounds are polymorphemic forms, consisting of two stems joining together to create a new lexeme (McGregor 2009). In spoken languages, compounds are a form of derivation and can have an effect on the phonological structure of words, such as stress placement (Spencer 1996).

From the perspective of this study, compounds present an interesting and complex set of data. In ASL, compounds can only consist of two stems, as in (KNOW-NOTHING) (Brentari 1998: 108). While there has been debate on the syntactic categories of the stems involved, it is not the aim of this thesis to investigate this.

Phonologically, compounds provide more than a complexity. They provide evidence of underlying forms for handshape. Both Brentari (1998) and Geraci (2009) state that handshapes can exist in both surface and underlying form. This is particularly useful for distinguishing. This is an important distinction, as it is at the underlying form that the constraints pertinent to the study exist. In his study of epenthesis in Italian Sign Language (or LIS), Geraci (2009) found that signs lost movement when in a compound. This is because the importance of movement in sign articulation (2.3. and 2.7.3.) means that signs without underlying movement undergo epenthesis at the surface level. This is also found in Brentari (1998: 229), where the surface movement in the sign TIME is lost in the compound TIME-SAME (‘simultaneous’), proving that the movement in TIME is not underlying.

Additionally, the potential change compounding may have on syllable stems may affect the features specified at onset and coda positions. Additionally, syllables that show repeated movement tend to reduce to single syllable in compound form, proving that signs are monosyllabic as default (Brentari 2012, Geraci 2009). An example in LIS is HEAD/KNOW (Geraci 2009: 27). The sign is repeated in isolation (Figure 2.3), but the repeated movement is erased in any compound that uses the sign (Figure 2.4). This proves Geraci’s interpretation of repeated movements as monosyllabic, which is described in 2.4.

There are few compounds found in the data on SASL. However, the few that are present – GRANDMOTHER (Figure 3.5) and GRANDFATHER (Figure 2.10) respectively – exhibit movement in both stems. While these two examples alone cannot account for all compounds, they do prove that SASL has non-epenthetic compounds.

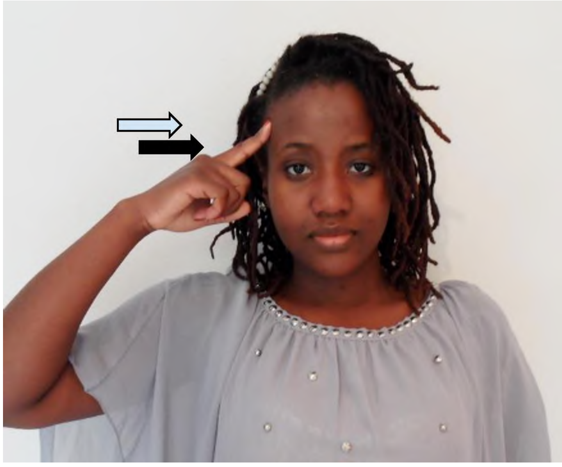

Figure 2.3 LIS: HEAD/KNOW (Geraci 2009).

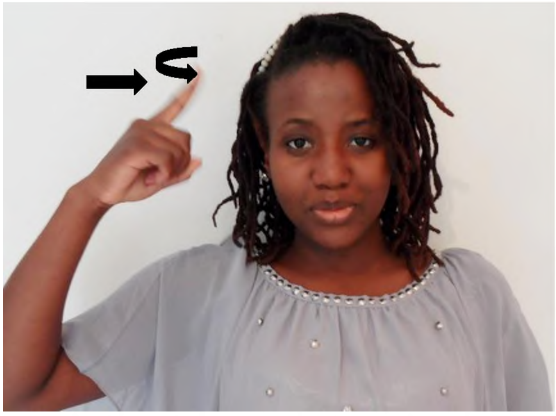

Figure 2.4 LIS: HEAD+TURN-AROUND 'dizziness' (Geraci 2009).

As will be mentioned in 2.7.1. and Chapter 4. the signs SON (Figure 2.23), DAUGHTER (Figure 2.24) and SICK (Figure 4.23) are interesting due to the change of body region. Looking at Geraci (2009), these signs could have possibly originated from compounds. However, this is likely to no longer be the case, as these signs are now lexicalised. An investigation into the origins of these signs would be a worthwhile study.

2.4 Repeated signs and polysyllabic forms

A phenomenon in all sign languages, but most particularly in SASL, is that of the repeated sign, or 2-movement sequences, as Brentari (1998) refers to them. A repeated sign is a sign that has two movements, where the second movement is a copy of the first (Geraci 2009). This repetition can happen in different angles, such as perpendicularly to the original angle, as in the LIS sign TABLE-DRESS () (Brentari 1998, Geraci 2009: 15).

In a repeated sign, the repetition is either a segment of the base or the whole base itself. The movement can be either path or local (Mak & Tang 2011). In the Prosodic Model, it is characterised by the feature [repeated]. That is, signs that must repeat their motion to be well-formed. In certain sign languages such as Italian Sign Language (LIS), repeated movement has lexical contrast, being all that determines the minimal pair PERIOD (Figure 2.6) and TO-CRITICIZE (Figure 2.7.).

SASL has numerous examples of repeated signs, such as Figure 2.7 below. In this sign, the hands initially move away from the signer in the neutral space. The hands then move back to the original starting location to repeat the movement again.

What may pose a problem for the research is how syllable boundaries are negotiated for such

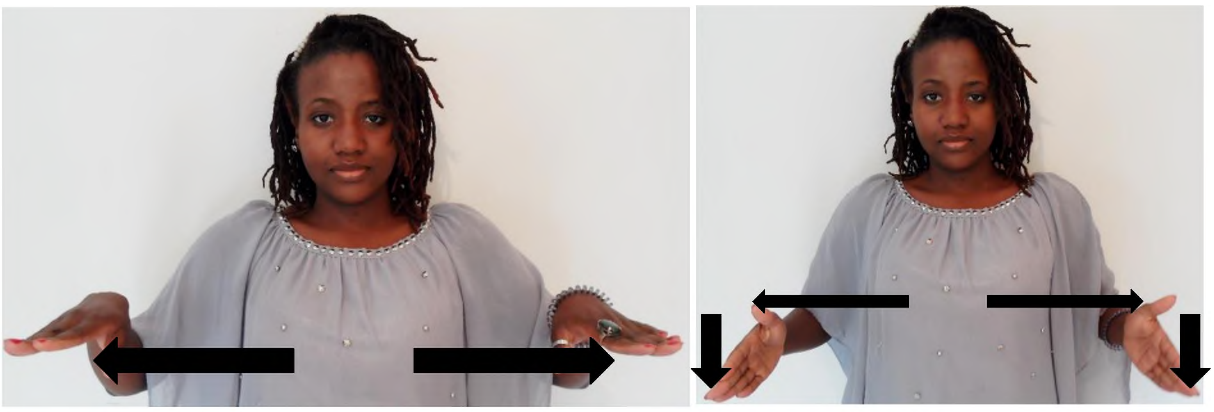

Figure 2.5 LIS :TABLE-DRESS (Geraci 2009).

signs. If we are to identify syllables by the presence of movement, then such signs as above should be constituted as multi-syllabic, as the movement can be repeated twice, or more. However, coding the signs as multi-syllabic determines the direction of the research. This is because the locations arguably become ambisyllabic – the coda of the one syllable becomes the onset of another (Fudge 1999), which makes the investigation on coda constraints all the more complicated. This happens if the movement back to the original starting position is considered a syllable.

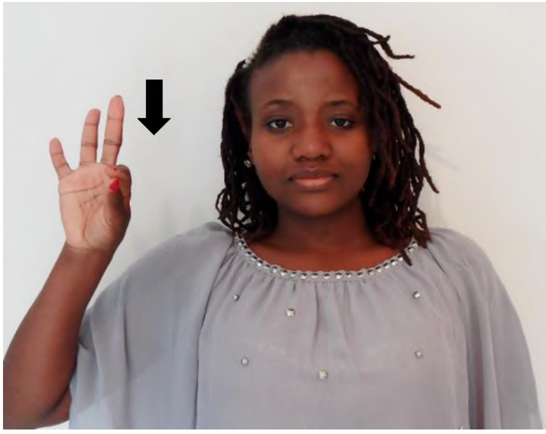

Figure 2.6 LIS: PERIOD (Geraci 2009:19).

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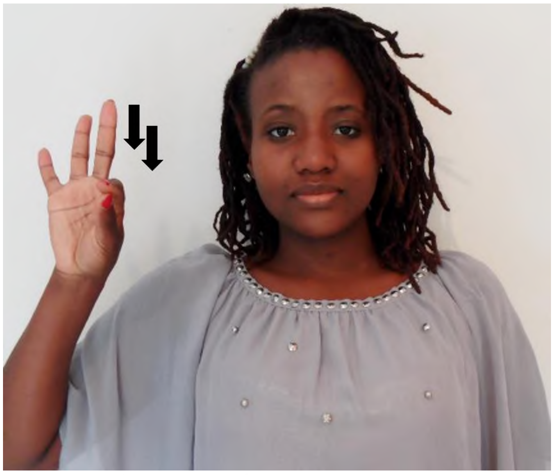

Figure 2.7 LIS: TO-CRITICIZE (Geraci 2009: 19).

Figure 2.8 illustrates the syllable boundaries of CART, considering the movement back to the starting position as a syllable. If the returning movement counts as a syllable, then the sign CART has three syllables in total. In this diagram, the features specified at the coda of the first syllable becomes the onset of the second syllable, and the features specified at the coda of the second syllable become the onset of the third. This ambisyllabicity creates complications, as the aim of this study is to determine what location and handshape features are specified at the coda. However, if the coda of one syllable is the onset of another, this might skew what is found in the data, as handshape and location features that may be coda-specific will be found at the onset of another syllable.

One could consider the double holds in ambisyllabic signs as geminates. In spoken syllables, a geminate occurs when the onset of one syllable spreads to the coda of the preceding syllable (Samek-Lodovici 1992). Geminates are oftentimes determined according to features such as OCP and other phonological boundaries - in these cases, only certain features are permitted to act as geminates (Hall 2007). Below is an example of reduplication by gemination in Ulithian, one of the official languages of Micronesia (de Lacy 2007: 15):

(7) A serialist approach to Ulithian reduplication

INPUT:	/ redþxasi/
(a) REDUPLICATION:	xas.xa.si
(b) GEMINATION:	xax.xa.si
(c) [XX] FORTITION:	*[xak.ka.si]

This mirrors the phenomenon found in sign languages. If we are to look at the examples above and assume that sign language syllables are ambisyllabic due to the effects of gemination, they do provide a solution to the concern of a coda and an onset having the same specified features, as it can be assumed that the coda node is underlyingly empty, and the only node to take into consideration is the onset of the following syllable. However, this is not feasible in accordance to SASL's Obligatory Coda Requirement discussed in 2.8., as well as in consideration of reduplicated timing segments and movement types, as will be discussed shortly.

Figure 2.8 CART (SLED 2006).

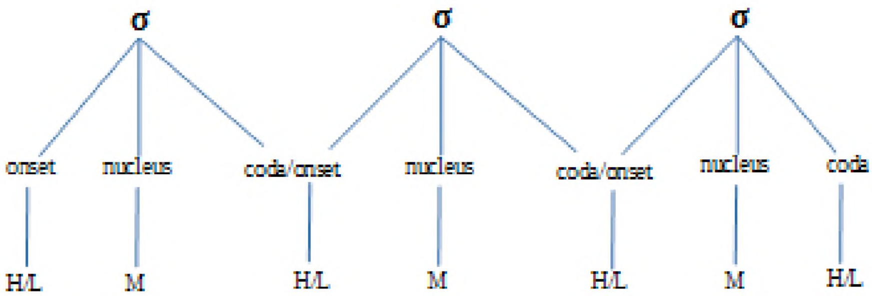

Figure 2.9 the multi-syllabic structure of the sign CART.

The manner of treatment and coding is dependent on two things: if the repetition happens on an underlying level and if the movement between the repeated signs is transitional (an account on the different kinds of movement is included in 2.7.3.). In his study on epenthesis in Italian Sign Language (or LIS), Geraci (2009) noted that, in signs that maintained no underlying movement, movement is given on the surface level, and that this movement is – more often than not – repeated. An interesting thing to note is that signs that are repeated in citation form may reduce to a single iteration when the sign is used as the first part of a compound (Geraci 2009). However, this does not seem to be the case in the compounds provided in SASL dictionary data (fig. 2.8.). In the figure below, the sign FATHER is repeated both in citation and in compound forms. If the first stem of a compound retains its repeated nature, the repetition then occurs underlyingly (Geraci 2009, Brentari 1998).

Figure 2.10 FATHER+OLD ('GRANDFATHER') (SLED 2006).

In FATHER (Figure 2.10), for example, the syllable is articulated – this has its own onset and coda. However, for the syllable to repeated, the hand must return to the syllable's original starting position. However, this makes the coda of the first syllable the onset of the second one. Geraci (2009) proposes a solution to this by stating that the return movement be considered a timing slot, but not a syllable in its own right as its function is mainly to return the hand to starting position. Using Geraci's (2009) classification of repeated signs, I will treat [return] movements as timing slots.

2.5 Sonority in sign language

As suggested in Section 2.2.2., spoken languages have levels of sonority that directly affect the syllable structure. For example, [open] sounds from the nasal or vocal tract carry a high sonority. In that same way, sign languages have their own levels of sonority. I reiterate one of Brentari's constraints on the ASL syllable, as introduced in 2.3..:

d. The notion of sonority, defined as “visual perceptual salience”, is relevant for syllable internal operations in sign. (Brentari 1998:74)

Sonority in spoken languages is based on the distance sound travels. Sonorous sounds can be heard further away than their less sonorous counterparts. As sign languages are corporal-visual, their sonority depends on visibility. As such, signs that are closer to the signer’s body ([proximal]) are more sonorous than signs further away from the body ([distal]) (Brentari 1998). This is because signs that end in locations further away from the body possess greater movements that are easier to be seen from further away, whereas signs that end with location closer to the body are hard to see unless they are up close (Sandler & Lillo-Martin 2006, Brentari 1998). When signs are articulated, they adhere to the following sonority hierarchy (Brentari 1998: 75):

shoulder > elbow > wrist > base joints > nonbase joints

In this scale, the shoulder joint is the most sonorous, as signs articulated from this point have the highest visibility. The visibility lessens as the joints move further from the signer’s body to the base joints (the joints where the hand and the finger meet) and the nonbase joints (the interphalangeal joints of the fingers and thumbs). The nonbase joints are further away from the main part of the signer, and any changes in these joints are less visually salient.

2.6 The Prosodic Model

As shown above, sign language phonology is a complex and intricate subject. Hence, there are various models and frameworks that seek to explain the phonological features of sign. Choosing a model suitable to research requires knowledge of the basics of available frameworks, each with varying opinions on how sign language processes should be represented and explained.

In the following section, I will describe some models that aim to explain the phonology of sign languages, briefly describing why each is not best suited to my study. Thereafter, I describe the characteristics of the Prosodic Model, and why it is best suited to my research.

2.6.1 The Dependency Model

A model that largely inspired the Prosodic Model (among others) is the Dependency Model. The Dependency Model is an asymmetrical, hierarchical structure where a daughter node/ set of daughter nodes are dominated by root node (Ewen 1995). In other words, the daughter node is dependent on the root node (Ewen 1995. McCarthy 1988).

The model also focuses on prioritizing - that is, some articulatory features (such as vowels and other sonorous phonemes) are prioritized as higher than others (such as consonants and other low sonority features), which affects their relationship with each other and their arrangement in a syllable (all parts of the syllable are dominated by a root node, but are treated and perceived differently based on their sonority) (Ewen 1995). Furthermore, theorists discuss the model's multiple tiers of hierarchy and dependency - that is, features can inherently or structurally dependent on other features, as well as dependency between class features (Ewen 1995, McCarthy 1988).

The Dependency Model not only provides the prioritization of and relationship between articulatory features, but it has provided the groundwork for numerous phonological models, one of which is the Prosodic Model.

2.6.2 Models of SL phonology

Some of the models of sign language phonology are the Move-Hold Model, the Hand Tier Model and the Prosodic Model. In this sub-section I evaluate the sustainability of these models to my research goals.

The Move-Hold Model, devised by Liddell & Johnson (Liddell 1984b, 1990b, Liddell and Johnson 1989 [1985]) brought primary focus on the sequential nature of signs, being the first model to recognise that movements were segments separate from holds (Brentari 2012). While there is particular emphasis on the sequentiality of signs, the Move-Hold Model does make allowances for simultaneity through adaptations of auto-segmental phonological theory (Sandler & Lillo-Martin 2006).

The Move-Hold Model has a plethora of features, including 150 handshapes and some 18 major places of articulation (Sandler & Lillo-Martin 2006). However, the model, in the words of Sandler and Lillo-Martin (2006: 130) "overgenerates" - that is, in its attempt to cover as many predictable features as possible, it not only recreates vast redundancies, but additionally fails to explain or provide possible causes for certain phonological processes (Sandler & Lillo-Martin 2006). For instance, there are a select few signs in SASL that make use of complete repetition (such as fig. 2.8. above). When the Move-Hold Model is used, the redundancy of features can potentially distract from phonological patterns of interest.

The Hand Tier Model (Sandler 1986, 1987, 1989) improves on the Move-Hold Model in that it allows for greater description – and thus analysis – of a sign's handshape. Furthermore, it proposes a set of phonological features that are similar to the later developed Prosodic Model (Brentari 1998). However, the Hand Tier Model falls short when considering dynamic changes to features that do not move, or are "static" (Brentari 1998: 87) e.g. the model accounts for palm orientation, but does not consider orientation change as a result of local movement. This is problematic for signs such as the SASL sign DEAD (Figure 2.11), where the main movement of the sign is the change of orientation in both the dominant and non-dominant hand.

Additionally, the Hand Tier Model treats all asymmetrical handshapes the same regardless of whether the handshapes are identical or not (Brentari 1998). Asymmetrical signs are two-handed signs where the non-dominant hand has a handshape that is different from its dominant counterpart.

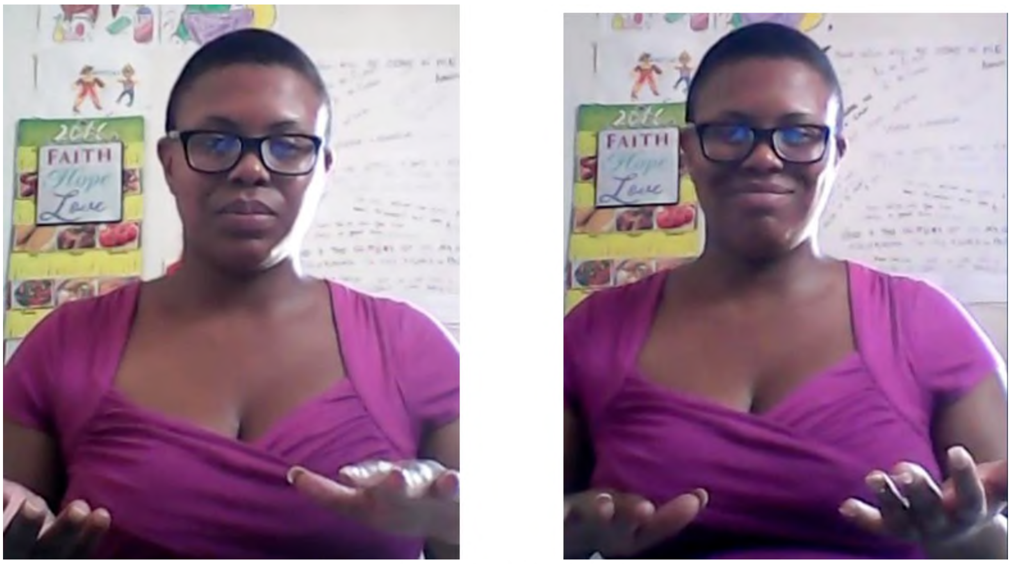

Figure 2.11 DEAD.

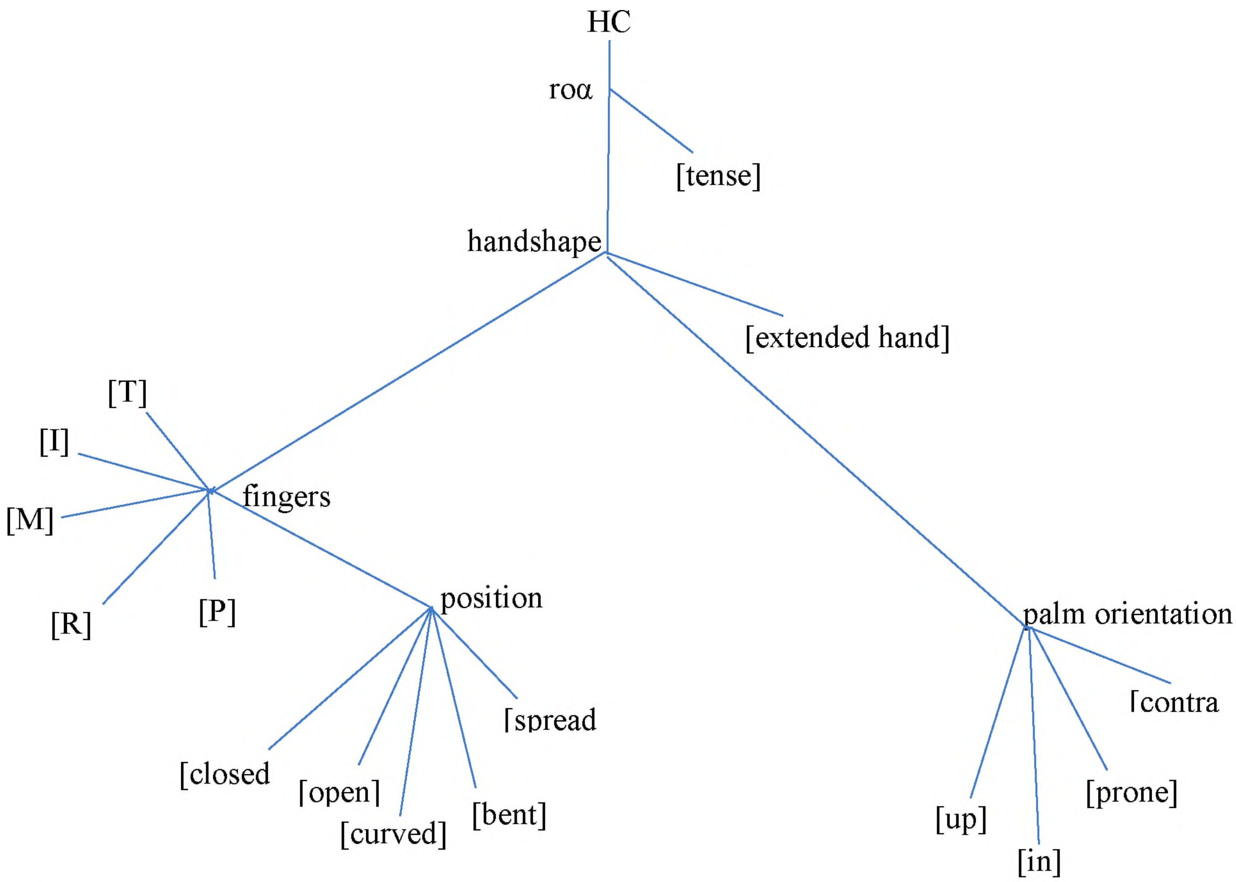

Figure 2.12 The Hand Configuration tree in the Hand Tier Model (Brentari 1998: 86).

As a complete understanding of static features requires an acknowledgement of their possibility for change during a lexeme's production, the Hand Tier Model cannot benefit the current research. Additionally, the Hand Tier Model has a separate feature tree to represent location. Movement shares the same feature tree as location, save for the arc. This is problematic as having the same feature tree does not address some of the features unique to movement, such as repeated signs, a phenomenon which is important in SASL (2.7.4).

Another model to consider is Uyechi's (1994) model of Visual Geometry. According to Uyechi (1994), a model on sign language phonology should not be based, but represent the complex visual nature of the modality. Using mathematics as seen in Figure 2.13 and Figure 2.14, Uyechi (1994) focuses on the spatial area within the signing space, with specific attention paid to the sign's handshape, location and orientation. Figure 2.13 presents a representation of the Visual Geometry framework, as well as detailing the manner in which features are arranged in the model.

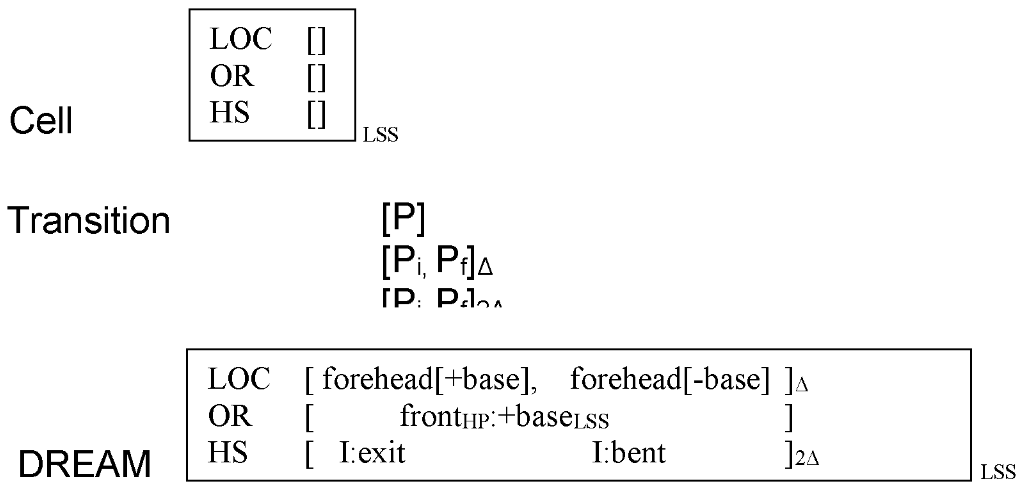

Figure 2.13 The representation of the ASL sign DREAM, as by the Visual Geometry Model (Uyechi 1994: 18).

(57) Canonical Sign Structure

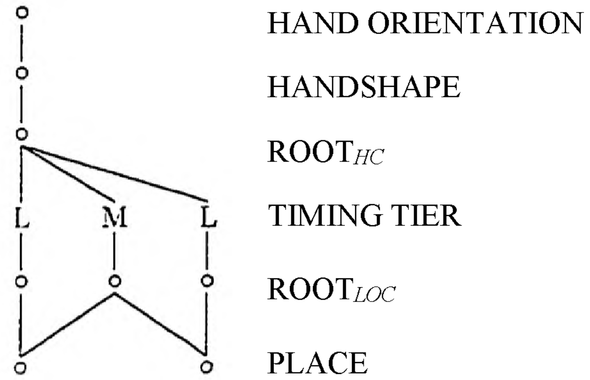

Figure 2.14 The framework for the model of visual geometry (Uyechi 1994: 214).

However, Uyechi's (1994) model considers all movement as purely transitional - movement is coded using the parameters of handshape, orientation and location, and not as a separate parameter in its own right. This is problematic, as the different types of movement carry meaning in SASL - when asked, my informants proved this by explaining that the movement in signs such as YEAR requires the circular movement to be well-formed. As previously stated, it is important for a model to adequately represent all aspects of a sign language, and therefore Uyechi's (1994) model of Visual Geometry is not a suitable option for this research.

The Prosodic Model is best suited to my research, as the relationship between dynamic features (the Prosodic Features that move) and the features that do not change during articulation (the Inherent Features that are underlying) is seen as less segmental. Brentari's (1998) model acknowledges the need for the features of the hand to be sufficiently represented, but the Prosodic Model's structure displays a stronger interdependency between movement and handshape, which is beneficial in observing the relationship of both handshape and location in syllable codas. As will be discussed below, handshape and location are specified as being inherent, underlying features in a sign, slightly and specifically altered by movement, which is a dynamic - or prosodic - unit (Brentari 1998). Although handshape and location is dominated by the Inherent Features branch, and movement by the Prosodic Features branch, the PF branch is dependent on the IF branch to provide an underlying form for dynamic processing, and the PF branch provides the movement necessary for well-formedness.

Additionally, the Prosodic Model was the framework that Geraci (2009) used in regards to repeated movement. The Prosodic Model also looks at timing slots which, as Geraci (2009) has proven, is important in the establishment of syllables.

2.6.3 Overview of the Prosodic Model

The Prosodic Model is a constraint-based framework, created by Brentari (1998), which started with the intention of explaining the prosodic systems that occur within sign languages. As such, the model is designed to discover the phonotactic and syntactic constraints on the paradigmatic, hierarchical and complex structure of sign languages. This overview draws largely on Brentari's (1998) description of the model.

The Prosodic Model draws on many phonological theories. From Dependency Phonology (Clark & Yallop 1995, Harris 2007), it developed binarity and the hierarchy of features. From Lexical Phonology (Goldsmith 1999, Spencer 1996), it suggests that, instead of having separate lexical and post-lexical components, that derivational rules feed phonological rules. This means that the creation of lexical items as a result of derivation can have an effect on phonological structure. From Optimality Theory (Féry & van de Vijver 2003, Prince & Smolensky 2004, McCarthy 2007), it bases the well-formedness of the sign on the relationship between the input and all output candidates. From Enhancement Theory, it utilises the concepts of primary and secondary features. Before introducing the framework, it is important to discuss the model's architecture as based on the theories that inspired it.

The representation of the model is realised through a feature tree, comprising first a class node which dominates a root node which dominates its daughter nodes which in turn dominate daughter nodes of their own. From this alone it is evident that there is a hierarchical structure within the model.

This allows for certain features to carry more daughter nodes and, with that, more complex structures that have additional constraints which may be pivotal in understanding the constraints on SASL syllables. This hierarchy is further realised by the existence of head-dependent asymmetry. This assumes that, if there are daughter branches, one of them will be specified as the head, which determines how that branch will be defined. The difference between a head and its dependent lies in its complexity; heads are more complex than their corresponding dependents. Brentari (1998) argues that the head-dependent relationship spreads to the greater nucleus-coda syllable structure.

The construct of heads and dependents is similar to the primary and secondary features found in Enhancement Theory. Primary features are the defining features of a branch and are thus the heads of that particular branch. Secondary features are dependent on the primary features; they enhance them. Brentari (1998) proposes that there will be primary and secondary features for every feature node in the Prosodic Model.

The rules of well-formedness are what govern the phonotactic constraints of the studied sign language. The rules of well-formedness according to the Prosodic Model can relate to the syllable. Below is a representation of the signed word as defined by Brentari's (1998: 26) framework:

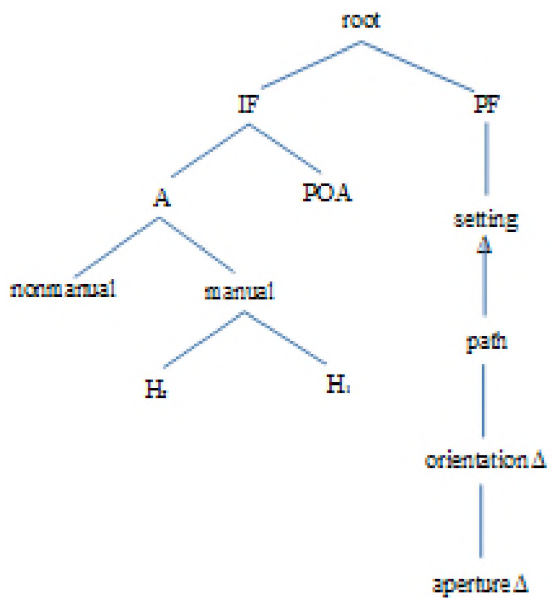

Figure 2.15 The Prosodic Model feature tree (Brentari 1998:26).

According to the tree diagram above, signs are structures that can be divided into two broad categories: Inherent Features (IF) and Prosodic Features (PF). Inherent Features are the properties in a sign that are static during a lexeme's production – that is, they are selected and do not change throughout the sign (Brentari 1998). Prosodic Features are the opposite – they are the dynamic properties in a sign that can change (Brentari 1998). Brentari (1998: 26) further displays where the four parameters of sign (handshape, place of articulation, movement and orientation) are found within the Prosodic Model's feature tree. The IF and the PF branch are interdependent, meaning that they work with each other to articulate a sign syllable. The inherent features provide the boundaries of a syllable i.e. its handshape and set locations, whilst the PF branch dictates the movement necessary to connect the handshapes and locations with each other.

Movement is the dynamic part of a sign, and is responsible for the dynamic changes in a syllable, and is thus placed in the PF branch. As handshape and location do not change without the aid of movement, they are inherent, and are dominated by the IF branch. The "A" in the feature tree is short for "Articulator", as the hands are important in sign language articulation as described in 2.7.2. POA stands for place of articulation, and is the location specified for the handshape. The location and handshape combined is the orientation of the hand, which is discussed in 2.7.5.

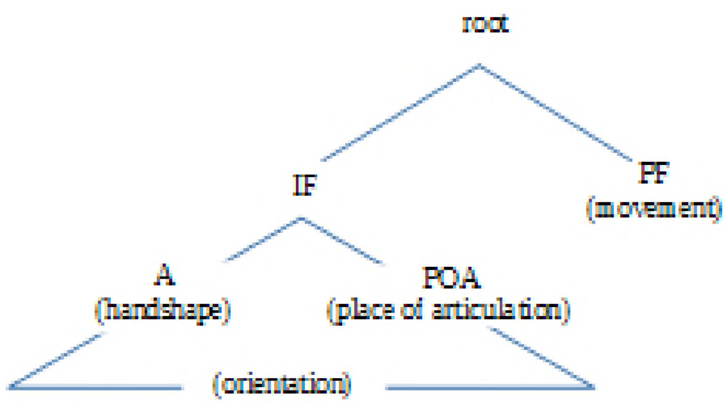

Figure 2.16 The placement of parameters in the Prosodic Model (Brentari 1998: 26).

2.7 Features of signs and coda constraints

It has been previously stated that the Prosodic Model is constraint-based. A constraint-based model aims to provide the smallest amount of constraints to explain the phonology of a language in a way that is simple (Brentari 1998). A satisfactory description of the constraints of the spoken syllable can only be bettered from the use of articulatory features. The description and understanding of sign language syllables, too, can benefit greatly from the inclusion of features. Each model that endeavours to explain sign language phenomena has a different understanding of how to quantify and analyse the features and parameters of sign.

It is important at this point to establish the difference between features and parameters. The parameters of a sign are the main components needed to articulate a sign (Sandler & Lillo-Martin 2006). Features are the properties that characterise the parameters. Each parameter has a set of main (major class) and minor (secondary) features that define it (Brentari 1998).

Thus, it is necessary to describe how the Prosodic Model views the basic parameters and what features are put to each. This section will first elaborate on the two features of particular interest to the research – namely, location (2.7.1) and handshape (2.7.2.) – before describing movement (2.7.3.) and orientation (2.7.4.) respectively.

2.7.1 Location

If movement is the syllable peak, location is one of the features at its boundaries i.e. it is a feature found at the onset and coda. Location refers to where the hand is located at particular parts of articulation. The division of the signer's body is dependent on the viewpoint of the theorist in question.

As stated earlier in Section 2.2.2., spoken syllables can consist of solely a peak. And, likewise, locations can be the peak of a sign syllable if the movement present is secondary (Perlmutter 1992). Location is one of the four main parameters of sign articulation and is a fundamental part of syllable boundaries. Because of its importance in the sign syllable, location must be unpacked in terms of existing theory (Stokoe 1960, Sandler & Lillo-Martin 2006) and in terms of the Prosodic Model.

Stokoe (1960) proposed 10 distinct regions that are defined by the place the hand is found, including the area in front of the signer, known as the neutral space. Many of the theorists after Stokoe adapted the primary and secondary feature classification as found in the Dependency Model (Ewen 1996 [1995]). If body parts are to be considered primary features by this standard, then smaller, distinct places within that body region should count as secondary features. Liddell and Johnson (1989) expanded on locational features by adding nine sub-locations which would vary according to the body region. Uyechi (1992, 1995), on the other hand, criticises the construction of subsettings under the mathematical conclusion that 9 sub-locations would result in 81 more locations. These locations would also amount to numerous secondary features, further increasing the number of features particular to location. As previously discussed, a description of sign language phonology needs to be as concise as possible. An expansive set of sub-locations are not preferable.

In her work, Uyechi (1995) proposed that researchers should consider the 3-dimensional qualities of the space around the signer instead. Her hierarchy of signing space is detailed in Figure 2.17.

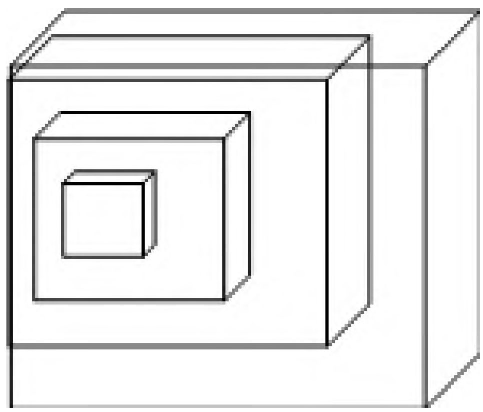

Figure 2.17 Uyechi's 3-dimensional hierarchy (Uyechi 1995: 57).

The Hand Prism is the 3-dimensional space where the features specified are handshape and orientation (Uyechi 1994). The LSS, or Local Signing Space, is the space where the features of the hand undergo articulation, such as the neutral space, the head and the torso (Uyechi 1994). The torso of the signer is notated in the Global Signing Space (GSS). When engaging in conversation, the signers and all points of view are in the Discourse Signing Space (DSS) (Uyechi 1994). Each signing space builds upon the next: the Hand Prism can be found within the LSS, and the LSS is found within the DSS. All levels of signing are dependent on the one before it.

Both Uyechi (1995) and Liddell & Johnson (1989 [1985]) described her features in their relationship to the centre. However, Uyechi uses the binary feature [±CENTER] as the only set of secondary features. When accompanied by the signing hierarchy in, the distance from the signer can be determined. However, the use of [CENTER] does not distinguish between the dominant or non-dominant side of the signer. The dominant side of a signer is dependent on the side their writing hand is.

As mentioned previously in 2.6.3., the Prosodic Model is divided into two interacting nodes – Inherent Features and Prosodic Features (Brentari 1998). As it does not change during the production of a lexeme, location is an Inherent Feature and would be realised in Figure 2.18.

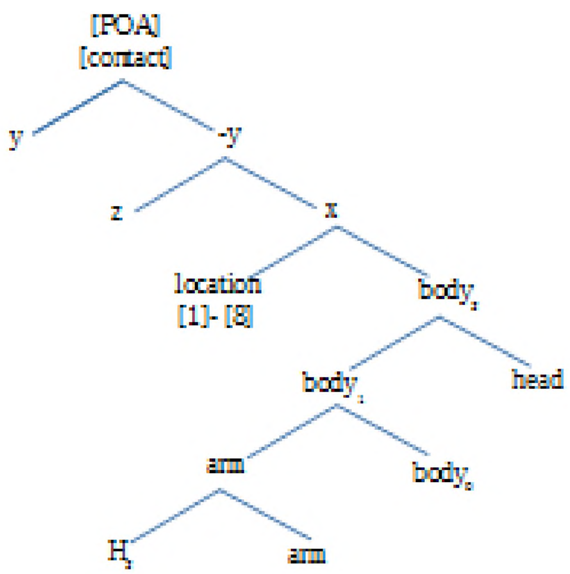

Figure 2.18 The POA branch in the Prosodic Model (Brentari 1998:119).

To be fully understood and utilised, the POA branch requires some explanation. *X*, *y* and *z* refer to 3-dimensional planes that run both perpendicularly and parallel to the body (Brentari 1998). This is particularly useful, as not all signs contain contact – some occur in the 'neutral space' in front of the signer's body (Sandler & Lillo-Martin 2006). The determination of the plane a sign occurs in is dependent on whether the sign is articulated on one of the planes, or perpendicular to it.

The x-plane is ventral (that is, it runs through the front and back of the signer), the y-plane is transverse (runs through the top and bottom of the signer) and the z-plane is midsagittal (runs through the left and right of the signer) (Brentari 1998). The planes are shown below in Figure 2.19.

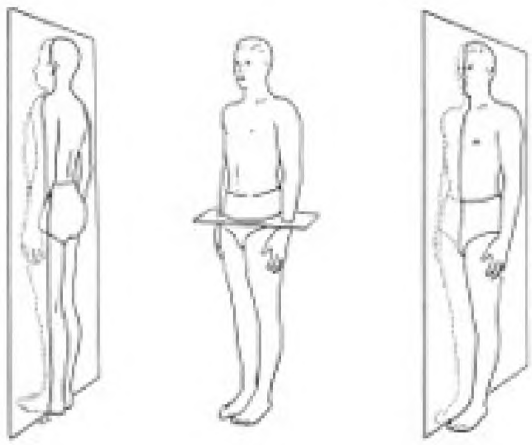

Figure 2.19 The x-plane (left), the y-plane (middle) and the z-plane (right) (Luttgens and Hamilton 1997: 38, cited in Brentari 1998: 121).

What is interesting is that, even within the neutral space, there are contrastive locations. For instance, American Sign Language (hereby referred to as ASL) has signs such as SIT and THROW, which must occur at different locations within the neutral space (Sandler & Lillo-Martin 2006). However, according to Ormel, Crasborn and van der Kooij (2013), distinction between areas in the neutral space is as strictly divided as in locations on the body. A distance that can be made, and has been, is in relation to how close the sign occurs to the signer's body (Brentari 1998). For that we have the secondary features [proximal] (closer to the signer's body) and [distal] (further away from the signer's body). There are also two sides of the body, and thus two sides to account for. This is dealt with by the secondary features [ipsi] and [contra]: [ipsi] being the side of the body of the dominant hand and [contra] being the opposite (Brentari 1998).

Below the *x*, - *y* and *z* nodes is a daughter node that is labelled 'location' – this is in regards to location in instances where the articulating hands make contact with parts of the body. As mentioned above, the contact areas of the body can be divided into regions and settings (Sandler & Lillo-Martin 2006). Body regions refer to larger sections of the body, such as the arm or torso (Brentari 1998). Settings refers to the smaller areas within those regions, such as the elbow or chest (Sandler & Lillo-Martin 2006). Each model of SASL phonology has its own inventory of features for the regions and settings of available contact. Brentari (1998: 121) states the following:

Principles governing the number of major body region distinctions
a. There are four major body regions
b. Each region has eight place distinctions

The four major types of body regions include the head, the arms, the body and the non-dominant hand, referred to as H2 (Brentari 1998). Below is a summary of the eight settings given to each region (Brentari 1998: 122-123):

Head: [1] top of head
[2] forehead
[3] eye
[4] cheek/nose
[5] upper lip
[6] mouth
[7] chin
[8] under the chin

Arm: [1] upper arm
[2] elbow front

[3] elbow back
[4] forearm back
[5] forearm front
[6] forearm ulnar
[7] wrist back
[8] wrist front

Body: [1] neck
[2] shoulder
[3] clavicle
[4] torso-top
[5] torso-mid
[6] torso-bottom
[7] waist
[8] hips

H2: [1] palm of hand
[2] finger fronts
[3] back of palm
[4] back of fingers
[5] radial side of selected fingers
[6] ulnar side of selected fingers
[7] tip of selected fingers/thumb
[8] heel of hand

However, this notational system is not without its limitations. I have found that SASL has settings within the region [head] that do not have areas represented in the Prosodic Model. These signs are shown in Figure 2.20 and Figure 2.21 below. In THIRSTY, the sign occurs in contact with and close to the signer's throat. In the SASL sign DEAF, the selected fingers make contact with the ear.

Figure 2.20 THIRSTY (SLED 2006).

Figure 2.21 DEAF (SLED 2006).

Reversible signs, or signs that undergo metathesis, are another aspect of consideration. In signs that are reversible, the beginning and end location are interchangeable, as in BABY (Figure 2.22) below, where the onset location can be either [ipsi] or [contra]:

Figure 2.22 BABY (SLED 2006).

If the onset and coda locations can be changed, this invariably affects the constraints that I find in my data. The nature of reversible signs is elaborated on in Section 2.7.3.

Location is not without constraints that exist in the literature. The most noticeable one is Sandler's (1989) Revised Place Constraint below:

> Revised Place Constraint
> There can be only one place of articulation per morpheme.

The Revised Place Constraint is a morphological matter – that is, it is concerned with the units of meaning, as opposed to the units of articulation (Sandler 1989). As this study is centred on the phonological patterning in SASL, morphology is not significant here. It is mentioned here as it shows a parallel to the phonological patterning that appeared during the analysis process in Chapter 5.

While this is the case, the structure of the Prosodic Model accommodates for this constraint by placing the POA node in the IF branch, where features do not change during the sign's articulation. In my research I have come across signs in SASL that are interesting. These signs are SON and DAUGHTER, seen in Figure 2.23. and Figure 2.24. In both signs, there is a move from the onset region [head] to the coda region [body]. These signs will be discussed at length in Chapter 4.

Figure 2.23 SON.

Figure 2.24 DAUGHTER.

The signs in fig. 2.20a. and fig. 2.20b. show a change in body region from [head] in the onset to [arm] in the coda. While it is common for the body region in a syllable to remain the same throughout the production of the syllable, signs such as SON and DAUGHTER illustrate that there are signs in SASL that have a change in body region. As an ideal model must account for all possible signs in the lexicon, this means that the structure of the Prosodic Model needs to modified to accommodate for this occurrence in SASL phonology. Considering that there can be more than one major body region in a syllable, I propose that the POA node, and all nodes it dominates, be moved to the PF branch, as in Figure 2.25.

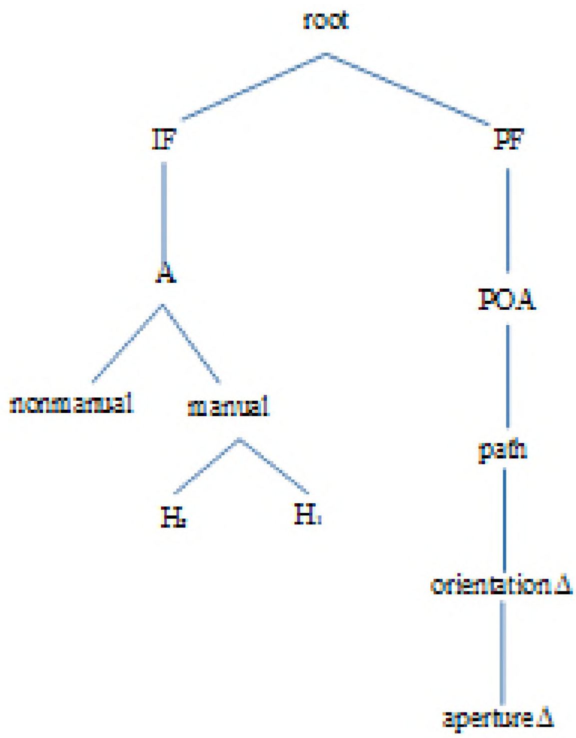

Figure 2.25 The proposed modification to Brentari's (1998) feature tree.

The reason POA replaces the setting Δ node of Brentari's (1998) feature tree is that the major body region dominates the settings that are found within it. Setting change is still in the POA branch, considering the hierarchical relationship between region and setting, where settings happen within body regions. Figure 2.26 is the sign SON, as it would be represented by the modified feature tree.

There is a possible argument against this modification to the existing model. One pertinent argument is that SON (Figure 2.23), DAUGHTER (Figure 2.24) and SICK (Figure 4.23) are the only signs included in the study that require the movement of the POA branch. However, thorough discussion with our sign informants revealed that there are additional signs that present a change of POA, such as MOUNTAIN (Figure 4.28) and BED-SHEET (Figure 4.27) While these instances are not frequent within the data, they are signs in the lexicon and exist in SASL. For a model to accurately represent a language, it should ideally be able to account for instance within that language. As such, the Prosodic Model should be able to represent all possible articulations in SASL to be an ideal model - this includes the aforementioned signs. This is especially important, as these signs have a major influence on the outcome of the research, as discussed in Chapter 4. Additionally, further research into SASL may provide more signs that require the modification.

There is concern surrounding the effect this change will have on the nature of orientation. As was shown in Figure 2.16, the orientation parameter is not explicitly represented, but is instead a combination of handshape and POA in the IF branch. With the movement of the POA node to the PF branch, this potentially changes the nature of the orientation parameter.

However, the modification to the feature tree does affect the way in which the Prosodic Model represented the four parameters. As shown in Figure 2.16, the orientation feature is represented as a combination of handshape and location. In the original model, both handshape and location were daughter nodes of the IF branch. However, as a result of the modification will affect the nature of the orientation feature. As orientation change is a daughter node of the PF branch, orientation is both a prosodic and an inherent feature. This means that orientation can still be comprised of POA and handshape, but it is no longer dominated by the POA branch. Should the orientation not change, it will not need to be represented in the feature tree.

It has been found that, in SASL, location features have more secondary features than handshape. This is interesting in that handshape, being the active articulator, is more complex than location (Sandler & Lillo-Martin 2006). Location tends to have more features associated with it than with handshape. As such, it is possible that there will be more constraints pertaining to location features, as these features will have constraints dictating when they can be specified.

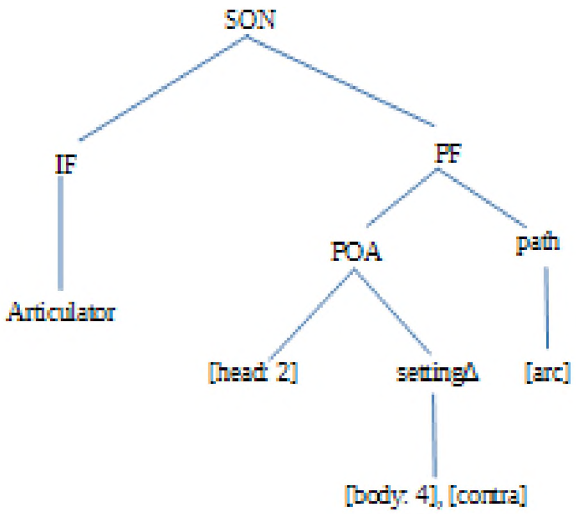

Figure 2.26 The PF branch for the sign SON.

2.7.2 Handshape

When the H1 – or dominant hand – is not in resting position as being either slightly spread and slightly curved, [open] or fully open, it is an active articulator.

In Stokoe's (1960) earlier description of sign parameters, handshape and orientation were not distinguished from each other. The results of this are explained below. However, handshape features required greater description, as later models – including the Prosodic Model – showed.

As can be seen above, orientation is acknowledged as a set of features that provide greater detail to handshape, but is dominated by the selected fingers and is part of what represents the hand's contour (Sandler & Lillo-Martin 2006). Together, handshape and orientation – and the features within these parameters – are what Sandler (Sandler & Lillo-Martin 2006: 150) terms hand configuration.

The hierarchical relationship between orientation and handshape has also been employed by the Prosodic Model (Brentari 1998), though to a different degree. Here, orientation is seen as the sum of the parameters' handshape and location.

According to Stokoe, Casterline and Cronenberg (1965), there are forty-five possible handshape specifications in ASL. In most recent work, this inventory has been developed and altered by several theorists (Uyechi 1994, Brentari 1998, Sandler & Lillo-Martin 2006, Brentari 2011).

The Prosodic Model (Brentari 1998) proposes an inventory of its own. This concise list specifies 26 handshapes, as based off the letters of the alphabet. However, the inventory provided by the model requires further modifications. The handshapes above, although fashioned from ASL, exist in SASL as well. In SASL several handshapes are differentiated by orientation, such G and Q and K and P. While orientation is a fundamental parameter in sign language phonology, the focus of this research is primarily on the handshape and location features specified at the coda position. I have therefore decided not to include orientation, as that adds to the handshape inventory I will use. The articulator branch in the Prosodic Model is shown in Figure 2.27.

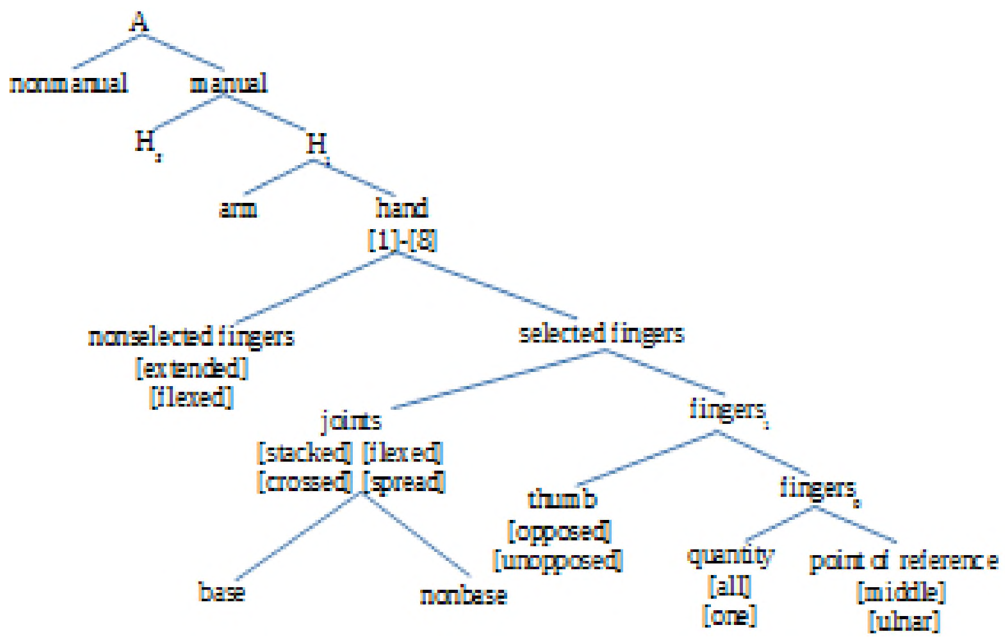

Figure 2.27 The Articulator branch (Brentari 1998: 100).

As the most complex articulator, handshape has constraints that determine the arrangement of its features. The one most pertinent to my research is the selected finger constraint (Mandel 1981). According to this constraint, the selected fingers do not change during a lexeme's production. In this context, selected fingers are the fingers that move during the duration of the sign (Brentari 1998). Sandler (1978) and Brentari (1998) have sought to accurately describe the complexities of the hand through the inclusion of joints in the feature tree. These joints vary from base (joints at the knuckles) to the nonbase (the joints used to bend the fingers). These joints are characterised by the secondary features [stacked], [flexed], [crossed] and [spread] that further describe contours for handshapes that do not conform to the alphabetical inventory. Below, I present the Articulator branch for the SASL sign AEROPLANE (Figure 2.28), which specifies the [Y] handshape through the selection of joints.

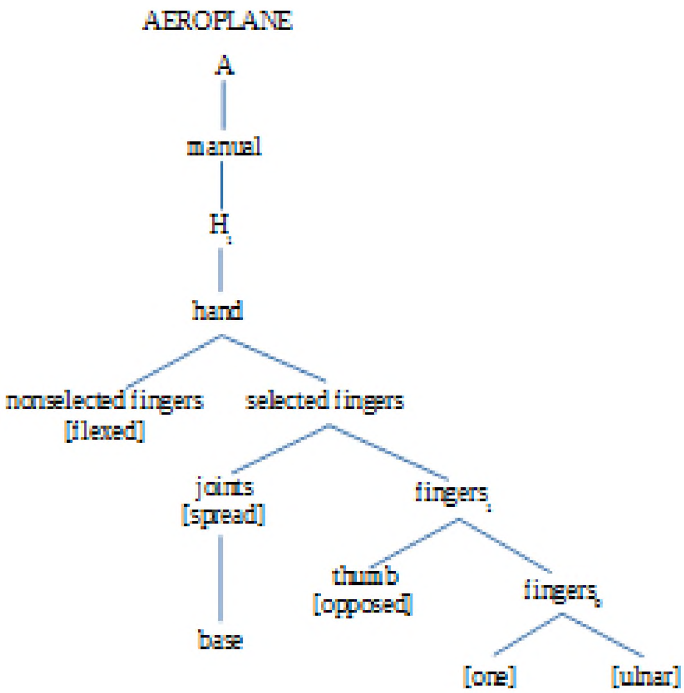

Figure 2.28 The articulator branch in the SASL sign AEROPLANE.

Another set of secondary features that define the aperture (a sign's handshape) in a sign are [open] and [closed]. [open] handshapes display the palm and [closed] handshapes conceal it. In signs where the hand moves from [open] to [closed], the handshape might be changed as a result, such as in PLEASE:

PLEASE: [B] [open] → [Å] [closed]

It should be noted that the Articulator node dominates the non-dominant hand, or the H2. The notation of the H2 is particularly interesting, given the roles the H2 has in sign articulation. The role of the H2 in the Prosodic Model is to be discussed in length in Section 2.7.4.

2.7.3 Movement

Movement, although currently not a main point of focus, is an important parameter that has direct influence on the research. For, as stated in Section 2, movement is the feature that defines – not only the well-formedness of a sign, but the boundaries between syllables (Knapp & Cheek 2009). Because movement is an important parameter – but one on which I do not focus in this research – this review of movement is a brief one. Movement is part of the PF branch (Figure 2.29).

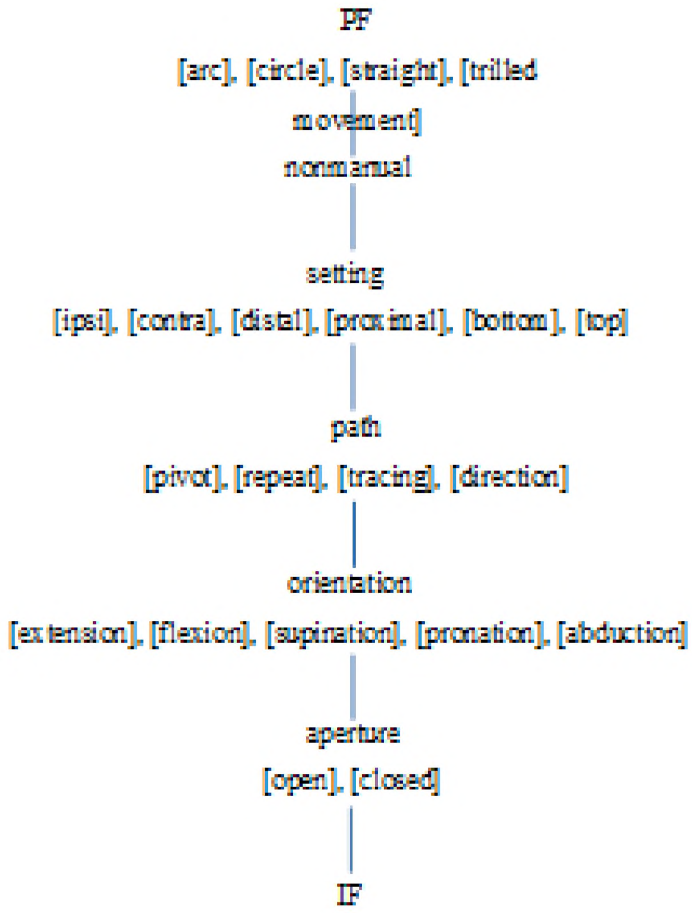

Figure 2.29 The Prosodic Feature branch (Brentari 1998: 130).

Movement can be sub-divided into greater (path) movements, or movements restricted to the hand (local and secondary movements) (Sandler 2011, Brentari 1998, Sandler & Lillo-Martin 2006). As explained in Section 4, sonority is dependent on movement type. Each node dominated by the PF branch presents this hierarchy and each node is characterised by secondary features.

Perhaps most interesting is the manner in which the Prosodic Model (Brentari 1998) treats movement. In her Hand Tier Model, Sandler (2011) argues for internal movement to be dominated by hand configuration. In the Prosodic Model, Brentari (1998) acknowledges that aperture change is reliant on the fingers selected. However, she holds that aperture change is still a dynamic phenomenon and should be dominated by the Prosodic Features branch. By this account, all kinds of movement or change features are daughters of the PF branch.

For the sake of this research, I will not be considering signs that have certain movement features. As movement is considered a syllable peak, signs with internal movements are considered to have syllables. The nature of this type of syllable is explained in an earlier section on sign syllables.

These include syllables that have the [circling] features. In Figure 2.30 below, the movement of the sign is circular. This means that the onset and coda locations are the same. Signs such as these cannot show any distinct patterns that pertain to my research.

Figure 2.30 BROWN (SLED 2006).

Syllables that comprise of [trilled] movement (or [TM], as termed in the Prosodic Model) alone are also excluded from the study. Figure 2.31 below exhibits a sign that has [trilled] movement alone. As discussed earlier, such syllables have the location in the peak position, where movement is specified, but is not a separate timing unit (see Brentari 1998 for a more detailed discussion on [TM]).

Figure 2.31 WHEN (SLED 2006).

Another factor to consider is metathesis. As defined in Section 2.7.1., movement can be alternated in reversible signs. An optional process, metathesis is where the onset location is interchangeable with the coda (Brentari 1998). Examples of this are monosyllabic signs WOMAN (Figure 2.32) and AUNT (Figure 4.2), where the organisation of onset and coda location can be either/or.

Figure 2.32 WOMAN (SLED 2006).

WOMAN: [body: 4], [contra] → [body: 4], [ipsi]

OR

[body: 4], [ipsi] → [body: 4], [contra]

AUNT: [head: 7], [ipsi] → [head: 7], [contra]

OR

[head: 7], [contra] → [head: 7], [ipsi]

In syllables that display metathesis, the choice of onset and coda location can be defined by the preceding sign in natural speech (Liddell & Johnson 1989 [1985]). When signing in conversation, the location specified at the onset of syllable with metathesis will be the location that is closest to the location of the preceding syllable's coda. For example, a signer will start the syllable for AUNT at [head: 7], [ipsi] if the coda of the syllable before that happened on the ipsilateral side of the signing space. However, the question then arises as to how to treat such signs in citation form. For this, Brentari (1998: 153) proposes the following:

Ordering of settings in the default case

When no setting order is indicated in the input, the following default settings are used: [contra] will occur before [ipsi], and [top] before [bottom].

Perhaps the greatest challenge of all is determining which movements are lexical (i.e. carry phonological meaning) and which signs movements are transitional (i.e. solely take the handshape from one location to another). Theorists such as Uyechi (1996) have questioned whether movement existed underlyingly or if all movement was transitional. According to Uyechi (1995), movement is not phonological in nature – they exist as a result of changes in the hand and location. However, there is evidence in sign languages that movements carry phonological meaning, as the movement that is specified can differentiate between signs that are identical save for one parameter – also known as minimal pairs. For example, the SASL signs TOILET and KNIFE have the same handshape and the dominant hand in both interacts with the H2. However, the dominant hand in TOILET moves perpendicularly to come into contact with the H2, where KNIFE is a forward and backwards movement. It is because of movement that these two signs are differentiated. In British Sign Language (or BSL), the signs ARRIVE and JAM share the same handshape, location and orientation, and are separated only by movement (Sutton-Spence & Woll 1998: 156). Additionally, Perlmutter (1992: 414 – 415) presents evidence that secondary movements (such as finger wiggles) can only occur on the nucleus of a syllable (co-occurring with a path movement) in ASL, as there are no lexemes that have secondary movements occurring at the coda. This proves that there are phonological rules that are attributed to movement, countering Uyechi's (1995) assertion that movement does not carry phonological meaning.

However, the question then arises as to which movements to consider. Sometimes both transitional and phonological movements can occur in the same sign, such as the multisyllabic compound GRANDFATHER (Figure 2.10). In the figure above, the signer articulates FATHER before the sign OLD. There is a transitional movement to allow the coda of FATHER to join with the onset of OLD, which has been confirmed by my informants. If lexical movements are to be considered and transitional movements are to be discounted, this presents a challenge in signs like OWL (Figure 2.40). Signs that may be presented as onsetless could be argued not to be such, and that the sign only consists of the coda handshape and location.

However, it is worth reiterating that movement is imperative to a well-formed sign. In particular compounds, movement exists in both signs already. The transitional movement from one sign to the next is not included for well-formedness, but rather ease of articulation. In the case of signs such as OWL (Figure 2.40), the movement to the coda location carries meaning, as it is the only movement that exists in the sign.

While the movement parameter may not be the main focus of the research, it is fundamental in determining the syllable boundaries necessary to determine what features occur at the onset and coda, as well as how to treat signs with multiple movement types. Another aspect of movement that is not the main aspect, but is worth considering, is syllable weight.

2.7.3.1 Syllable weight

In Section 2.2.2., it was established that the presence of a consonant/consonant cluster at the coda position was what differentiated light and heavy syllables. In sign languages, it is movement that makes this distinction. While movement is a feature to be discussed in a later section, its connection to syllable weight will be briefly elaborated on here.

Movements can be either simple or complex. Simple movements consist of only one movement, either path or local (explained in Section 2.7.3.). In complex movements, numerous prosodic features are specified simultaneously. The SASL sign SPIDER (Figure 2.33) below shows complex movement: a path feature is articulated at the same time as internal movement. In the following sign, the fingers are specified for secondary movement (i.e. a wriggle) while the hand is simultaneously specified for path movement.

Figure 2.33 SPIDER (SLED 2006).

2.7.4 Non-dominant hand

As mentioned earlier, the non-dominant hand, or the H2, has a dual role in Sign Language Phonology as both articulator and place of articulation. In certain signs, it acts as a passive articulator that is acted upon by the dominant hand. In other signs, it is an active articulator, performing the same duty as the dominant hand. The presence of H2 can be the distinguishing feature in a minimal pair, such as HUMAN-BEING and BEHAVIOUR in Sign Language of the Netherlands (Crasborn 2011: 224).

Despite the added complexity that comes with having two main articulators, there is a phonological system within which the non-dominant hand finds a place. The non-dominant hand must depend on the dominant hand in all situations – it is not independent (Crasborn 2011, Sandler & Lillo-Martin 2006).

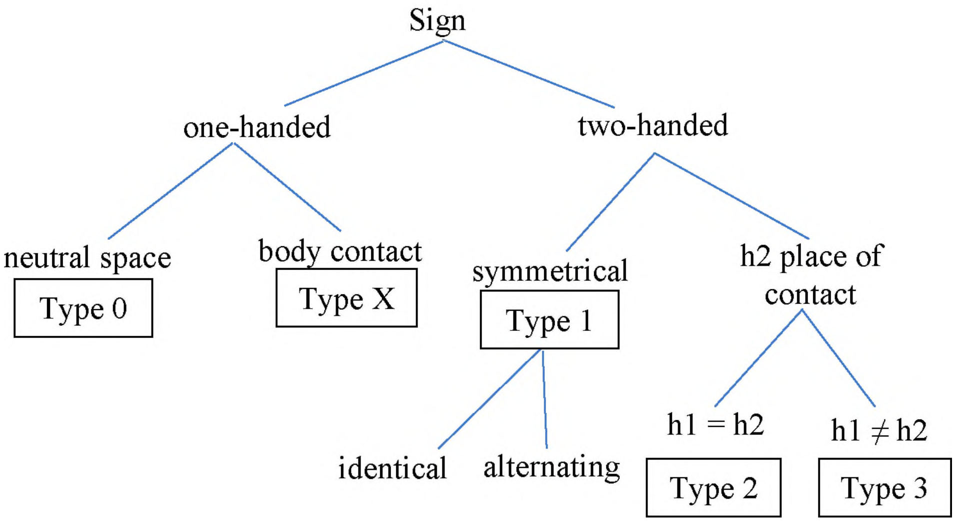

Figure 2.34 Battison's sign typology (Morgan & Mayberry 2012: 150).

Type 0 signs are one-handed signs that exist in the space around the signer, such as YELLOW in Figure 2.35. These signs do not come into contact with the body. Type X signs are one-handed signs that come into contact with the body at some point in the sign's articulation, such as HEARING (Figure 2.36).

Two-handed signs are further categorised into symmetrical and asymmetrical signs. These can be characterised by Battison's (1978 [1973]: 34-35) Symmetry and Dominance Conditions. These conditions dictate the permissible features that can exist in two-handed signs. Type 1 signs conform to the Symmetry Condition. Here, the non-dominant hand is only allowed to move if it adopts the same handshape and direction of movement of the dominant hand.

Figure 2.35 YELLOW (SLED 2006)

Figure 2.36 HEARING (SLED 2006).

Type 2 and 3 signs, on the other hand, conform to what is known as the Dominance Condition. In this situation, the non-dominant hand becomes a base location that the dominant hand interacts with – in other words, it (the H2) cannot move. The handshapes in Type 2 signs are identical, but the H2 remains static. In Type 3 signs have two different handshape features at each hand. Furthermore, Type 3 signs have restrictions on the types of handshape features that can exist on the H2.

The handshapes of the H2 in Type 3 are specified as unmarked for a variety of reasons. Firstly, they are listed as the first handshapes acquired by children in ASL (Morgan & Mayberry 2012); secondly, they are argued to be handshapes of the most geometrically distinct of the ASL handshape inventory (Morgan & Mayberry 2012). Thirdly, errors in substitution production tend to be related to these particular handshapes (Morgan & Mayberry 2012). Another interesting suggestion is that the handshape features specified for the H2 in Type 3 signs (Figure 2.34) are universal across most sign languages, as these are common in ASL contexts (Morgan & Mayberry 2012). The possibility of unmarked handshapes being universal is true to an extent. Evidence from numerous sign languages suggests that unmarked handshapes are a standard in Type 3 signs (Morgan & Mayberry 2012, Crasborn 2011, Brentari & Crossley 2002 & van der Kooij 2002). In cases where H2 is a location, Brentari (1998) proposes a phonological rule: the dominant hand must either come into contact with the H2 or be close to it at some point of the lexeme's production.

Markedness is worth a brief mention here, for it has a direct relationship with the non-dominant hand. The constraints on the dominant hand are asymmetrical (or "unbalanced", as termed by van der Hulst (1993, 1996), cited by Crasborn 2011). The constricted inventory of handshapes is listed as B, A, S, C, O, 1 and 5. (Morgan & Mayberry 2012, Brentari 1996, Benner 2012, Sutton-Spence & Woll 1999, among others). This is shown in the Revised Dominance Condition (Sandler & Lillo-Martin 2006: 184):

> Revised Dominance Condition
> In signs in which h2 is passive (i.e., does not move), h2 must either be unspecified underlyingly, or it must be characterized by an unmarked handshape.

There has been debate over how to treat the non-dominant hand in the conceptualisation of the sign language syllable. Brentari (1990a) and Brentari & Goldsmith (1993), for instance, have proposed regarding the restrictions on the H2 as akin to the coda constraints on spoken syllables. This is a beneficial viewpoint, as it not only presupposes the existence of a coda in sign languages, but also presupposes that there are restrictions on it. This stems from the conceptualisation that the H2 can be considered a morpheme in all asymmetrical signs (Brentari 1998). While this argument can be solidified by the existence of classifiers, I argue that it cannot be seen as such. As a result of asymmetry, the H2 becomes a place of articulation and, as such, a passive articulator. There are signs where the H2 as a location is a morpheme, but there are signs where it does not seem to be, such as the SASL sign FAMILY (Figure 2.37).

Additionally, the consideration of a passive feature as a coda might then bring to question as to whether the other passive articulators (locations on the body) are not considered codas.

Figure 2.37 FAMILY (SLED 2006).

2.7.5 Orientation

Orientation is the last of the initial parameters of sign languages. It determines the direction the palm is facing, be it H1 or H2 (Sandler & Lillo-Martin 2006). Interestingly, Crasborn (2012) takes note of orientation in terms of more than just the signer's hand. For example, orientation can relate to parts of the body such as the arm. However, the orientation of the arm could possibly be as a result of the orientation of the hand. Along with movement, orientation is not an immediate focus for this study. However, it is worth noting the unique structure the Prosodic Model (Brentari 1998) gives to the orientation parameter, as has been earlier referred to.

The description of orientation is treated differently according to the perspective of the theorist defining it. While orientation is not included in Stokoe's parameters (1960, Battison (1978) defines orientation as an independent parameter. In the Prosodic Model (Brentari 1998), orientation does not dominate a branch of its own. Rather, orientation is produced as a result of the relationship between the articulator and POA nodes. This perspective has been supported by theorists such as Sandler & Lillo-Martin (2006).

The orientation of a hand can also be used to make meaning in classifier constructions. The orientation of handling and body classifiers determines the direction of an action being done (Brentari 2007). While this is not pertinent to the current research, it does provide further evidence of the importance of orientation feature.

The eight settings of articulation stated for the H2 in Section 2.7.1. are obviously also found in the H1. These eight settings become orientation features when they describe the direction of movement in the H1. An example is the SASL sign RUDE (Figure 2.37) Here, the regional setting [H2: 5] (see the list of settings in Section 2.7.1) moves in a radial motion. Because of the treatment of orientation in the Prosodic Model (Brentari 1998), there is no orientation branch in the Prosodic Model's feature tree.

Figure 2.38 RUDE (SLED 2006).

The four features above are fundamental for the articulation of well-formed signs. In the next section, I describe how these features relate to the phonology of SASL, as found through my research.

In my creation of feature tables (which is discussed in 3.5.), I discovered that location features had more secondary features than handshape. This is interesting in that handshape, being the active articulator, is more complex than location (Sandler & Lillo-Martin 2006). From my discovery, however, there are more features defining location. While this does not discount the fact that the active articulator will always be more complex, it does perhaps indicate that there is a deeper complexity (which assumes more constraints) to location. Moreover, this proves that location cannot, by itself, be considered as sonorous as movement, as there are too many features defining location for it to be considered sonorous.

2.7.6 Non-manual features

While not the focus of this research, non-manual features (or NMFs) are an important parameter in sign language phonology. NMFs, as the name suggests, are features of articulation that are not the hands, such as body leans and facial expressions (Sandler & Lillo-Martin 2006). In SASL, as the dictionary data and my informants have confirmed, a WH-question is not well-formed without a body lean and slight frown. NMFs have been noted to carry intonation in sign languages, such as Israeli Sign Language (or ISL) (Sandler & Lillo-Martin 2006). NMFs can also carry syntactic and morphological meaning (Sandler & Lillo-Martin 2006). Additionally, NMFs can occur over a whole sentence, or at a particular sign to add syntactic, morphological or lexical meaning (Brentari 1998, Sutton-Spence & Woll 1999, Emmorey 2002, Sandler & Lillo-Martin 2006 among others).

Some NMFs – such as mouthing – are influenced by the spoken language that is in contact with a sign language (Emmorey 2002). According to Emmorey (2002), signers would mouth parts of English words whilst signing said words. However, NMFs such as mouthing are fundamental to the articulation of certain signs, such as the adverbials 'carelessly' in ASL or 'for a long time" in ISL (Sandler & Lillo-Martin 2006: 62), which demonstrates that NMFs such as mouthing do not depend on spoken languages.

In the Prosodic Model, non-manual features are present in both the IF and PF branches. NMFs that are dominated by the PF branch include signs where the non-manual feature has a movement similar to the hands, as in ASL's VANISH (Brentari 1998: 173). This is represented in the Prosodic Model as the assimilation of the non-manual branch to the manual branch (Brentari 1998).

2.8 The SASL Syllable

Both the handshape and location node must be empty at the less sonorous parts of the syllable to say that an onset or coda of a particular sign does not exist. In the data, it emerges that there are, indeed, a fair number of signs in SASL that appear to have an empty articulator node at the onset position.

[N/A] → [3] such as SOUR
[N/A] → [C] such as in OWL

In the signs discussed above (depicted in Figure 2.39. and Figure 2.40), the hand does not seem to have any defined handshape before gradually moving into the coda handshape. This is an occurrence that can be supported by native signers. My informants confirmed this finding, showing preference for handshapes defined as being 'at rest' (Brentari 1998), and thus unspecified.

Figure 2.39 SOUR (SLED 2006).

Figure 2.40 OWL (SLED 2006).

A feature tree for SOUR, based on this observation, may be structured the following way (Figure 2.39). Given the substantial data, it is safe to assume that SASL does not require a handshape specification at the onset position of a syllable. This is possibly due to the increased visibility of a feature at the end of a syllable. Alternatively, I suggest a constraint that governs this phenomenon in accordance to SASL's phonological grammar:

(1) Obligatory Handshape Coda Principle

There must always be a handshape specified at the coda position in a syllable.

This constraint affects the grammar of SASL on a larger scale. Recalling what has been written about the simultaneity of features (2.2.2.), sign languages can only allow for a coda if all the features that would normally occur at the coda position are unspecified.

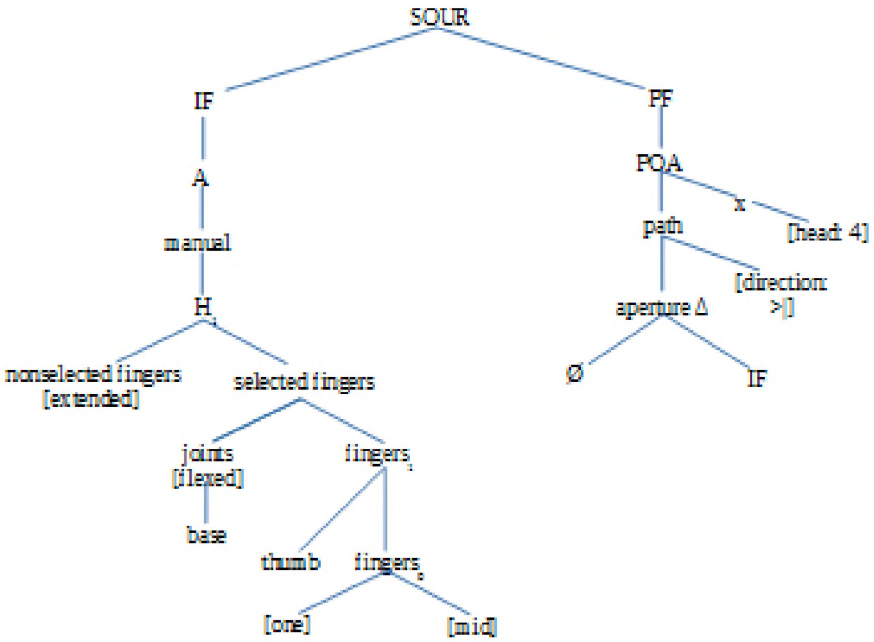

Figure 2.41 The feature tree for SOUR.

Although I have yet to discuss the patterns on location, it can be assumed that the lack of an unspecified handshape at the coda position implies a mandatory handshape. As such, I propose the follow constraint, based on the Obligatory Coda Requirement:

(2) Obligatory Coda Requirement

If a syllable contains path movement, it cannot be codaless.

If signs have not path movement, but instead secondary movement via handshape or orientation change, there are no specified onset and coda boundaries, such as in WHEN (Figure 2.31) (Perlmutter 1992). What is additionally interesting in that SASL deviates from what is known in spoken phonology as the core syllable (Spencer 1996). Theorists of spoken phonology, such as Mester (1994) and Spencer (1996) called the CV core of a spoken language a light syllable. As a result, the CV core became the light syllable (2.2.2.). This proves that, while the core syllable is claimed to apply to all spoken languages, SASL – and perhaps all sign languages – prefers a VC syllable core.

2.9 Research Questions

Although I have mentioned in section 1.1. of chapter 1, I elaborate on why I have structured my research questions in a particular way, and why certain aspects of the SASL syllable are chosen over others. It is important to study the coda of a syllable, for it is where the bulk of phonotactic constraints are (2.2.2.). Coda constraints have been extensively studied in spoken languages, but there is less research in the coda constraints of sign languages like SASL.

To guide my research, I have used what is known on syllables in spoken languages (2.2.2.), syllables in sign languages (2.3.) and SASL syllables (2.8.) to guide the direction of research. The aims of my research can be answered through the following two overarching questions.

Overarching question 1: Are there coda constraints in SASL?
Overarching question 2: If there are coda constraints in SASL, what are they?

However, my research is one of the first on the topic. As such, it would be more efficient to formulate subordinate questions that will aid in answering my overarching ones. As mentioned in (2.3.), the onsets and codas in sign language syllables are locations features, where handshape features are simultaneously specified. While movement and orientation are important features, location and handshape features are the ones to be found at the syllable boundaries. I have chosen to include onset features, as there may be features specified at the onset that are not found in the coda, leading to possible constraints. I further discuss my research questions in Chapter 3.

Subordinate questions:

What location features occur at syllable codas?
What handshape features occur at syllable codas?
Are there limitations on what kind of onset-coda combinations can exist for handshape and location features?

Upon reviewing the literature, I formulated hypotheses about the results of my research:

I supposed that there would be constraints on the syllable coda in SASL, and that these would largely conform to the phonological constraints on sign language syllables that already exist in the literature (2.3.).
Where handshape change occurs during the course of a syllable, the coda handshape would be limited to one of the unmarked handshapes (2.7.4.).

2.10 Conclusion

Although this work is one of the first studies of its kind in SASL, there is a substantial amount of literature and phonological theory that support its significance and provide foundations from which to build my argument. In this chapter, I have explored this theory and explained how it pertains to my needs as a researcher.

I first provided a brief explanation of prosody and syllables in spoken languages, I then used that theory and the theories of many sign linguists to confirm the existence of a syllable in sign language. From there, I explained the SASL phonology that I deduced from my data. After this I explained processes, such as compounding and repetition, that would have an effect on how syllable boundaries are defined. I then established that I would use the Prosodic Model framework and explained how location, handshape, movement, orientation and the non-dominant hand are described by the Prosodic Model. In closing, I presented my research questions and their hypotheses.

The execution of my research, of course, depends on the manner in which I collect, process and analyse my data. In the following chapter I explain the challenges and requirements of sign language data collecting, and the process by which I derived constraints and generalisations from my data.

3 Methodology

3.1. Introduction

The following chapter discusses the methodology undertaken to collect and analyse this data. Firstly, I discuss the challenges that arise with sign language research and how previous researchers have overcome these challenges. Secondly, I describe how the information on the phonetic shape of SASL was collected, using signs from a video dictionary and from informants. Finally, I expand on the layout of my data collection and structure.

The following chapter is divided into sections on data collection and data analysis. Before I can explain the manner in which I formulated constraints, I must first detail the nature of my data. Section 3.2. covers the main sources of data I used in my study, namely the SLED (2006) SASL dictionary and native signer interviews, discussing the benefits and drawback of each. After that, I explain how I analyse my data, first by collecting and coding the dictionary data. First, I describe how I interviewed my informants to confirm analytical categories. I then discuss the process that I used to propose constraints from the patterns I noticed and the tables I drew. To ensure that my constraints were true of SASL, and not a result of a gap in the data, I conducted a second round of interviews with my informants. After testing my constraints with my informants, I then reviewed the analysis and restructured my constraints. I then contacted Informant A via a Skype interview to determine the scope and inclusion of my constraints.

The collection of data is especially challenging when investigating sign languages. Sign languages employ a different modality to spoken languages and are the languages of an oppressed minority (Ganiso & Kaschula 2013). As a minority, signers are more likely to accommodate to the majority language. This means that, when acting as an informant for hearing researchers, native signers are more likely to sign in a manual code of a spoken language, or a more gestural sign system to accommodate to the hearing modality. However, it should be noted that manually-coded forms of spoken languages mostly affect research in the syntactic and morphological structure of sign languages (Supalla & McKee 2009). However, it is possible that informants might use more iconic signs that are not normally used in natural signing when interacting with hearing researchers. Additionally, as Supalla and McKee (2009) found, manually coded signs use less of the signing space than natural signing in ASL, and that might be the case in all sign languages. This means that the manner in which data is collected and processed must be altered to better suit the complexities of sign languages. For the purposes of this research, I have used two sources for data collection and analysis: a video dictionary and SASL informants.

Many sign language linguists have successfully created methodologies suitable for sign language research and, in the majority of these cases, data has derived from numerous sources, such as the use of an interlocutor – more specifically, a Deaf interlocutor – instead of making use of hearing researchers to interview informants (Vermeerbergen, van Herreweghe, Akach and Matabane 2007). Multiple sources create a more credible analysis, as a larger, more varied amount of data can more accurately describe the nuances of a language in general. Below, I review the advantages and disadvantages of various data collection methods,

Brentari & Crossley (2002) used an hour of naturalistic video evidence in their research concerning the prosodic cues in ASL. In their research, a Deaf signer was recorded giving a lecture to Deaf people and hearing ASL students (Brentari & Crossley 2002). The benefit of naturalistic data is that the signing is spontaneous and is less influenced by the researcher and any possible hearing bias. However, naturalistic data runs the risk of being too much, meaning that that the researcher has the time-consuming task of searching through the data for what is needed for the research, with the possibility that the aspects of sign the researcher is looking for is not present.

Elicited data, while running the risk of influencing the way a signer articulates, is a better form of isolating aspects of research for study, as the researcher is able to control the stimulus the signer reacts to. In his study on epenthesis in Italian Sign Language (otherwise known as LIS), Geraci (2009) makes note that the majority of his data comes from elicitation using stimuli. For stimuli, informants were asked to sign the LIS equivalent of written Italian words. The use of stimuli is useful as it allows the researcher to directly focus on areas of interest. The use of elicited signing is effective when confirming results derived from additional sources. In a study performed by Vermeerbergen *et. al.* (2007), data was elicited from native signers using video cameras and numerous stimuli consisting of pictures. where the participants were asked to sign what was happening in each picture. The benefit of the data collection method used by Vermeerbergen *et al.* (2007) is that it shows that data collection via elicitation need not have a negative effect on the way participants sign. In my study, I have chosen to use a video dictionary that was recorded in a controlled environment, as I am more likely to isolate the handshape and location features at the coda position through a controlled environment.

The use of dictionary inventories has been beneficial to numerous previous studies. Geraci (2009) built a collection of signed videos – also known as an inventory – derived from online and printed dictionaries, previous research and the use of native signer knowledge through Deaf informants. Brentari and Eccarius (2010) employed a similar methodology in their research on the contrastive nature of handshape features. To determine the differences in three-finger signs, Brentari and Eccarius (2010) used evidence provided by a sign language dictionary. While a dictionary cannot account for all words in a language, or how connected signing affects the phonological structure of the syllable, a dictionary is a preferable starting point in understanding the syllable in isolation.

In addition to using a dictionary, I chose to use informants from the SASL Deaf community to provide counter-examples to the constraints derived from patterns found in the dictionary. In the Brentari and Crossley (2002) research mentioned earlier, patterns were analysed from the data, before reaffirming their analysis with another native signer from a different region. The benefit of this method is that it acknowledges that sign languages exist on a continuum with levels of deafness and dialectal differences, and that an analysis of this continuum can more accurately claim to represent a sign language. Additionally, the re-evaluation of the analysis with a native signer further confirms what the researchers have discovered, while also involving members of the Deaf community in studies on their language. This is important socio-politically, as work towards empowering and creating awareness of a minority language cannot accurately empower that language without involving the people who use that language. This is especially true of sign languages, as it is a fundamental part of Deaf culture (Ganiso & Kaschula 2013). To further test the data provided by the dictionary in their study, Brentari and Eccarius (2010) employed the help of informants in what are known as "test interviews" (Brentari & Eccarius 2010: 290). This method is the most effective for my research, as informants have inherent knowledge of what is phonologically possible in their sign language. In this way, I am able to see what constraints relate to all syllables of SASL, and which ones. In addition, the informants have knowledge of dialects that the dictionary does not. As such, this is the particular method I have adapted for my purposes.

It is from these data collection techniques that I have adapted my data collection and analysis processes.

3.2. Data collection

There were two sources of data used in this study: the primary data, which came from a video-recorded dictionary, and native signer intuitions which were used to test the conclusions reached on the basis of this data. It was important to have varying sources of data as not only is this one of the first studies of its kind, but I am not a native signer and am thus at risk of incorrectly analysing aspects of SASL phonology. While the sources are separate, the process of analysis calls for patterns I have found from the dictionary, and this, together with information from my informants helps me to determine the constraints found in SASL. This is because the preliminary dataset provided by the dictionary is relatively small, but native signer intuition can compensate for that, as they can provide counter-examples to generalisations that are not in the dictionary, as well as provide negative evidence of feature combinations that do not exist in SASL phonology.

The following section aims to describe the nature of the data sources that were used for collection, as well as stating the benefits of each. However, no data is without its flaws, and I will fully explore the limitations of each source choice.

3.2.1. The SLED (2006) dictionary

The primary source of data is a dictionary titled "A South African Sign Language Dictionary for Families with Young Deaf Children", created by Sign Language Education & Development (SLED). SLED is a non-governmental organisation, dedicated to the improvement of SASL education. Their dictionary is a compilation of 175 everyday words, designed with the purpose of equipping parents of Deaf children with a basic vocabulary, so as to communicate with their children in their own language. The dictionary provides an accurate but limited set of signs that represent the phonological structure of SASL. The signs that are chosen for the dictionary are iconic to aid parents in learning SASL (SLED 2006), which poses a challenge as the iconic signs might negatively impact my results. This is because iconic signs create a direct link to the thing in the world they represent, which does not easily fit into the phonological rules of the language. Despite this, iconic signs still conform to phonological rules of the language. The iconic signs in the dictionary will still display patterns from which constraints can be formulated and these constraints can still be applied to abstract signs. In addition, the dictionary includes different dialect signs.

Considering the corporal-visual nature of sign languages, the dictionary is a booklet with an accompanying DVD, which shows how to accurately articulate the signs. In the DVD, there is a clip where the sign entry is described in writing and pictures (as drawn by a member of SLED) before the video articulation. The signer used in the DVD dictionary is a native SASL signer. Each sign's entry on the DVD comprises of the headword, signed in citation form, and an example sentence where it is signed in context. The word is then signed in citation form again. An example is the SASL sign HELLO (Figure 3.1 and Figure 3.2 respectively). In Figure 3.1, the picture on the left illustrates the handshape and movement required for the citation sign. The illustrations on the right depict the example sentence. Figure 3.2 depicts the signing of the word HELLO in citation form.

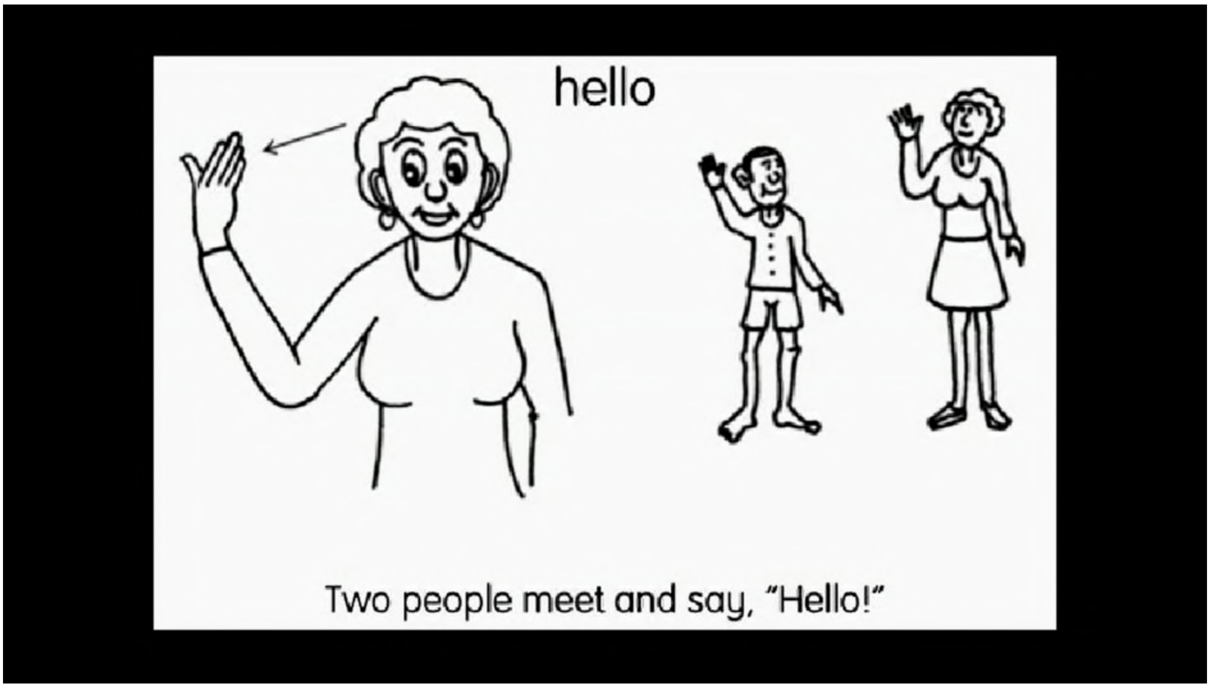

Figure 3.1 A screenshot of the page for the sign HELLO (SLED 2006).

This research is not the first of its kind to use a video dictionary. As mentioned in 3.2.1., numerous studies on sign language have used dictionaries as both primary and confirming evidence (Morgan & Mayberry 2012, Geraci 2009, among others). The use of a dictionary is beneficial, particularly to researchers not fluent in the language under investigation, as it provides the researcher with visual examples of how signs are articulated. Furthermore, recorded signs allow the researcher to pause and replay the recording where s/he sees fit for better observation of phonological features such as handshape and location. As it is important to see the beginning and end of syllables, a video dictionary is best-suited to my research.

I used the citation form, as the syllable boundaries are more visible and there is less influence of connected speech. The use of citation words is a potential problem for the fact that, as in spoken language, signs do not naturally occur in citation form. This is because signs undergo further phonological processes in connected signing. However, a dictionary is ideal for the purposes of this study for two reasons. Firstly, there is a scarcity of research into SASL phonology and, as such, the use of a dictionary is a preferred starting block – one which researchers in the future may use to expand upon the body of knowledge. Secondly, the research places its focus on the phonological structure of SASL, and does not consider the phonological processes associated with connected signing that would necessitate a more natural corpus.

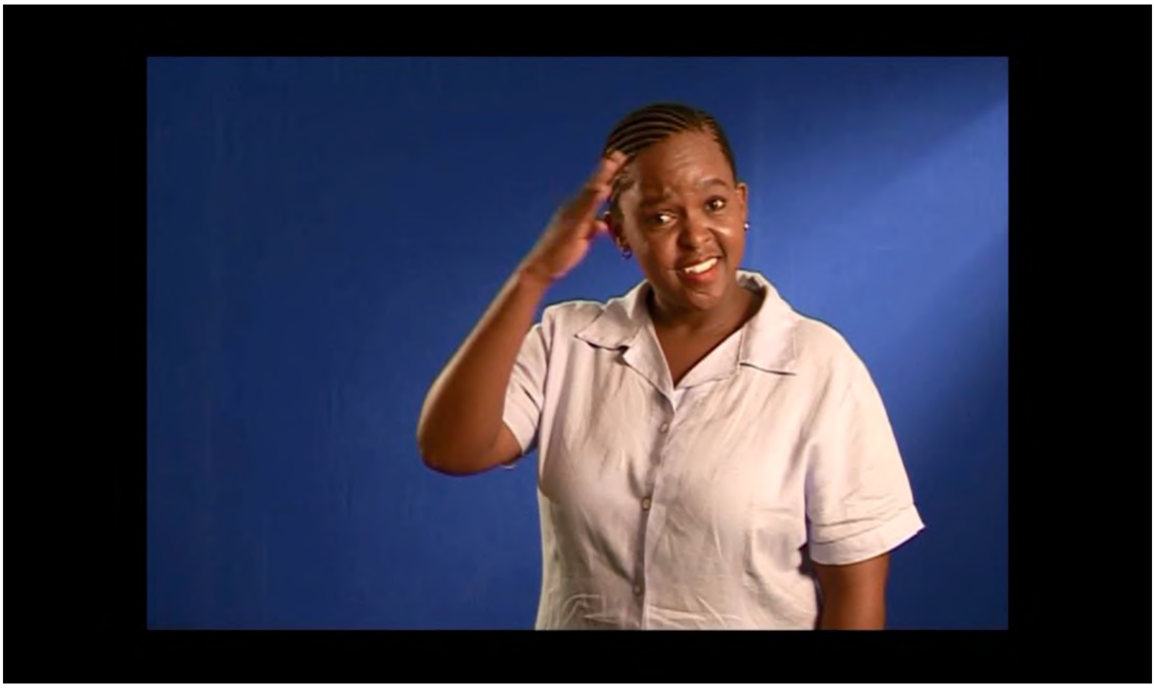

Figure 3.2 A screenshot of the sign HELLO (SLED 2006).

It could also be argued that the 175 citation words in the dictionary are too small to accurately account for the constraints throughout SASL. While the number of the words in the dictionary is small, it suits the study of a previously unexplored area of SASL linguistics. Moreover, the dictionary was created with the intention of educating parents of Deaf children with a basic vocabulary. If the words represented in the dictionary are basic, it is likely that these signs will depict the most common handshape and location combinations in SASL.

There were other data sources available for the study's analysis. One such alternative was the *Dictionary of Southern African signs for communicating with the deaf* (Penn 1992 – 1994). The dictionary is a multi-volumed set of books that provide visual diagrams of the signs used in SASL.

It should be noted, however, that while these dictionaries have a larger corpus for analysis, they are made up of pictures alone. Static images may not always clearly illustrate the movement created at a syllable peak that may have implication on the coda in a sign. Moreover, pictures are more open to interpretation, whereas a video dictionary, signed by a native SASL signer, provides a clearer understanding to a non-signing researcher such as myself.

In addition to the dictionary, I have employed the assistance of SASL informants, who have helped me determine the validity of the generalizations made on the basis of the dictionary data. The way I have used these informants is described in the following section.

3.2.2. Sign informants

Native signers are instrumental in the research of sign languages, as they possess intuitive knowledge that can help researchers confirm or revise their claims (de Quadros 1999, cited by Kimmelman 2011). In this vein, I have employed the help of two members of the South African Deaf community as informants. Although the history of the Deaf in South Africa is mentioned in 1.3.1., it is important to reiterate how the history of SASL affects the informants chosen. As a result of Apartheid, schools for the Deaf were divided up according to race (Ganiso & Kaschula 2013). Due to the lack of emphasis on oralism in Deaf schools for black students, SASL from black members of the Deaf community is considered to have less spoken influence on it. As such, the preferred informants for SASL study are black. As both informants come from the Eastern Cape, they are considered to have less spoken language influence on their signing. However, it should be noted that both informants have travelled around South Africa and are familiar with the different dialects of SASL.

Informant A is a black woman, who was born in East London, in the Eastern Cape, but has lived in three different provinces throughout her life. Although she is hearing, she is born from Deaf parents and has SASL as her first and native language. She obtained both a university diploma and a BA Hons from the University of the Witwatersrand, specialising in sign language interpretation and translation. She is an active member within the Deaf community and works with Deaf individuals as an interpreter and a teacher to SASL interpreters. As a result of her work as a sign language interpreter, she has worked in Sweden, Spain, Swaziland, Nigeria, Mauritius and Botswana.

Informant B is a black man, who was born in the Eastern Cape. He was born fully Deaf and attended a school for the Deaf in King William's Town, in the Eastern Cape. He is an active member of the Deaf community. Additionally, he worked as a sign language teacher and a representative of the Deaf Federation of South Africa (DeafSA). As part of his work, he has travelled extensively throughout South Africa and is familiar with the different dialects of SASL.

Ideally, informants should be born Deaf to Deaf parents (Nespor & Sandler 1999, Brentari, Coppola, Jung & Goldin-Meadow 2013, among others). This is to ensure that the influence of any spoken languages is as small as possible, and that the informant has as pure a version of SASL as possible. If a Deaf individual is born to Deaf parents, s/he is immediately exposed to sign language, acquiring it in its purest form. As shown above, only one of my informants conform to that ideal. However, they are suitable for my purposes in numerous ways.

Both informants spent time growing up in the Eastern Cape, where SASL is known to be at its purest. Additionally, as both are teachers of SASL, they are less likely to allow spoken languages to influence their signing. Informant A is a hearing woman and her hearing might disqualify her as an informant in the eyes of some. Firstly, as she is not audiologically deaf, there is the argument that she will not have as much of a grasp of SASL than if she were. Another argument is that her hearing might influence her signing. However, her participation in the Deaf community and her acquisition of SASL from her parents qualifies her as a native signer, as well as the fact that she identifies as culturally Deaf and she places SASL in high prestige, meaning she is less likely to let spoken languages influence her signing. Additionally, as she is hearing I am able to discuss features of handshape and location with her in spoken English.

Informant B was born Deaf to hearing parents and has been educated at a Deaf school, which poses the problem of hearing influence, as he did not acquire SASL from home, but in another environment. As a member of DeafSA, he is very highly involved in the Deaf community and holds SASL in high prestige, meaning that it is more likely that he will avoid signing in a way that is influenced by spoken languages. Additionally, having two informants allow for varied views on my discoveries, as well as allowing them to discuss features among themselves. This method also encourages the informants to use the most natural varieties of SASL possible.

For my first meeting with my informants, I had compiled a few questions concerning complications I had come across in the initial coding of my data, which is discussed in 3.3.2. The aim of the interview was to elicit signs so as to determine syllable boundaries and handshape and location changes. I arranged the layout of the room of my first interview with them by adapting the arrangement of informants and cameras used in Vermeerbergen et al's (2007) study, as shown in Figure 3.3 below. The structure below is useful in a number of ways.

The chairs of both informants are angled so that they are able to face each other as well as be visible to the camera. Camera A is positioned to record Informant A, and Camera B is positioned to record Informant B. This way, I was able to record both informants at the same time.

Because the informants live some distance away from where this research was conducted, I was not able to arrange other face-to-face interviews with my informants. However, I was able to continue my contact with them via social media and Skype video calls. After my preliminary analysis, I contacted Informant A via Skype to test my constraint, by formulating counter-examples, which is found in Appendix 1. Unfortunately, Informant B was unavailable for the interview.

The informants proved invaluable confirmation for the constraints I found, adapted and made. The first thing I consulted my informants for was the phonotactic rules of syllable boundaries. During my face-to-face interview, I initially signed the words COW, ORANGE and YEAR from various starting positions and asked the informants to offer judgements on the well-formedness of each sign. These signs were chosen as I was unsure of syllable boundaries in them. Speaking English to Informant A, I asked them to sign COW, ORANGE and YEAR from places that felt the most natural. She relayed this information to Informant B and they discussed among themselves. According to my informants, it was most natural to begin producing these signs from the lap with hands at rest. Additionally, they did not consider that the signs have any starting handshape or location. This demonstrated that both handshape and location features need not be specified in the onset position. I then asked about features at the coda position. I signed the second syllable of the sign HOT, ending the sign in various locations above and below my ear in the neutral space, asking them if the signs were well-formed. According to the informants, the ending location of a sign such as HOT would only specify a meaningful location as a result of assimilation in connected speech. This means that, when signed in a normal conversation, the coda location of the second syllable of hot would be as close to the onset location of the next sign. To test this point, I asked them to sign the sign HOT in various sentences that used various locations.

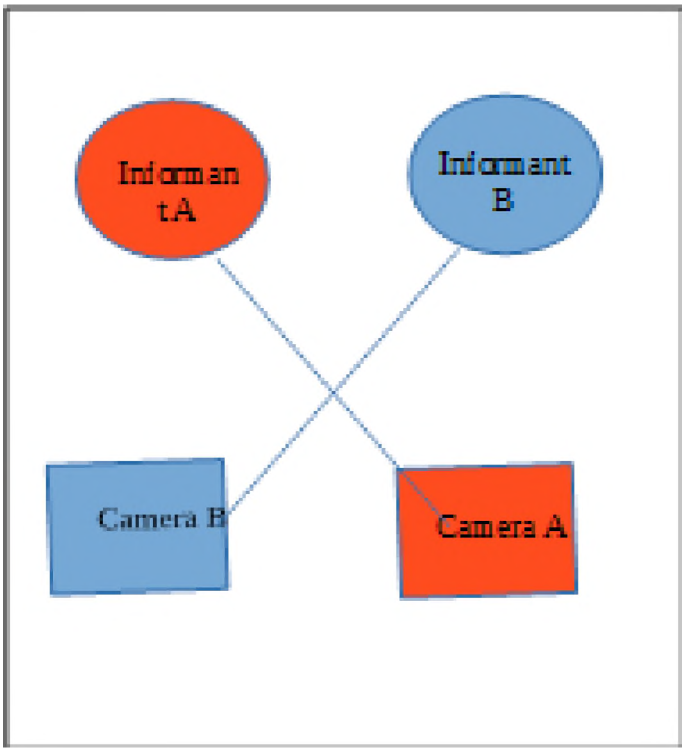

Figure 3.3 A diagram representation of the interview layout, as adapted from Vermeerbergen et al. (2007).

I was aware that certain signs were reversible (2.7.1.), and so, during my analysis on body alignment (which is later discussed in 4.3.2.5.), I used the known reversible signs BABY, WOMAN and DEAD, using the same process as in the previous task. I changed the start and end locations of each sign, asking if the sign was well-formed. I signed AUNT, UNCLE and PLAY as they are signed in the SLED (2006) dictionary. I then produced the three signs with onset and coda locations reversed, asking if this was well-formed. My informants confirmed that this was so.

After discovering SICK (Figure 4.23) – a sign where the body region specified at the onset is different to the body region specified at the coda – I asked my informants if there were other signs that showed the same pattern where two different major parts of the body were being specified in one syllable. The signs SON and DAUGHTER were mentioned, proving that this phenomenon occurs more than once and is worth analysis.

Naturally, I encountered challenges in my dealings with my informants. Firstly, I am not fluent in SASL and, as such, relied heavily on Informant A to relay information to Informant B, which forced her to perform the role of an interpreter. Because of her dual-role in my research, there is a possibility that Informant A might have skewed Informant B's results through how she interpreted my questions or during the times they discussed the well-formedness of a sign. This potential skewing might mean that Informant B may not be giving his true opinion. However, this is not a large problem for the research, as I have enough knowledge of SASL to take notice of instances where Informant B vehemently disagreed with Informant A. As it stands, this did not occur. Also, it is possible that they could both sign in the Eastern Cape dialect, and that would be similar.

Additionally, I had to be sure to ask questions that did not use linguistic terminology that the informants would not understand. Another obstacle was dialectal differences. The variant of the sign PLAY used in the SLED dictionary was interpreted by Informant A to be AUSTRALIA in all the dialects she was familiar with. While the accounts of both sources are counted as valid, this does not largely affect the research and I decided to code PLAY as seen in the dictionary. My motivation was that the sign PLAY as used in the dictionary is a variant that exists in the language.

To summarise, my data collection process comprised two sources, namely the SLED (2006) dictionary and SASL informants. In my first stage of data collection, I coded my dictionary and performed a preliminary analysis. Afterwards, I elicited opinions from my SASL informants which helped me to either confirm or revise my analysis.

The following section describes the process by which I analysed my data, formulated constraints and confirmed or revised them. In 3.3., I discuss the manner in which I defined the syllable boundaries of the signs in the SLED (2006) dictionary. In 3.4., I explain how I coded and analysed the dictionary. In 3.5., I explain the way I organised the handshape and location features in tables in order to see patterns better, and in 3.6., I explain how I formulated my constraints.

3.3. Establishment of syllable boundaries

The most challenging aspect of processing the dictionary data was determining the difference between the end of a syllable and the beginning of a new one. As discussed extensively in 2.2.2. a syllable can consist of an onset, nucleus and coda, a nucleus and a coda, or just a nucleus (which is a location with a trill movement) (Perlmutter 1992). Fortunately, the literature on sign language states that the movement is the nucleus, as mentioned in 2.3. As such, I determined that the holds that occurred between each movement were justified as syllable boundaries. From there, I made note of the handshapes and locations that were present at each syllable boundary. However, this classification of syllable boundaries is not without its own complications.

The first obstacle was what to do with signs that did not seem to have distinct starting or ending locations and handshapes. The definition of distinct handshape and location features depends heavily on the literature surrounding handshape and locations. Upon close inspection, it was found that the handshape at syllable boundaries where there is either no distinct onset or coda likens to what Brentari (1998: 104) terms as handshapes at 'rest'. Locations that did not seem to be specified at either onset or coda seemed to come from the signer's lap – a place that is also considered 'at rest'. This was confirmed with the help of Informants A and B. Their role in determining syllable boundaries is elaborated on in 3.3.

Throughout the dictionary, there were instances where the only movement documented was either a trill or a local movement, as in Figure 3.4. In Figure 3.4, the sign MESSY consists of a trill movement towards and away from above the signer's chest. In these situations, the location remained constant through the duration of the syllable. The question then arose surrounding the way such signs should be coded. In 2.7.3. I addressed the problem of signs that had no path movement, considering them, instead, as consisting of only a P – or place – with handshape change constituting the movement (Perlmutter 1992). In this instance, there is only a nucleus and, as such, the sign cannot be considered in this study, as there is no coda. Therefore, this study limits the signs analysed to signs containing path movement, as in 2.7.3.

Figure 3.4 MESSY (SLED 2006).

Multisyllabic signs present what is known as ambisyllabicity – a phenomenon as stated in 2.4. of the Theoretical Overview, where the coda of one syllable becomes the onset of another. Noting the ambisyllabicity in signs has a significant effect on the results of my study, as possible constraints may be affected by it. However, there are not many multisyllabic signs in the SLED (2006) dictionary.

There are two types of multisyllabic signs where there is a transitional movement between syllables: compounds and repeated signs. The onsets and codas on either side of this transitional movement are therefore not ambisyllabic. Additionally, some multisyllabic signs are compounds. Compounds are a type of multisyllabic sign where two signs with different meanings are combined to create a new word (Spencer 1996). Examples include GRANDMOTHER, which is formed from the signs MOTHER + OLD (Figure 3.5). However, Sandler and Lillo-Martin (2006), among others, have stated that certain movements in a compound contain meaning and others are purely transitional, and thus non-syllabic. While it is true that path movements justify syllables, I propose that only path movements that are meaningful can justify as syllable nuclei. My informants have corroborated this, agreeing that the movement from one part of a compound to another does not carry meaning, and thus is transitional and non-syllabic.

Figure 3.5 The syllables in GRANDMOTHER: MOTHER and OLD (SLED 2006).

Repeated signs presented another coding challenge. The question arose as to how many syllables each sign has. In the case of a sign such as GIRL (Figure 3.6), there are three path movements: the movement from the top of the chest to mid-chest, the movement back to the initial starting position, and the movement from chest top to mid-chest again. If I am to apply my usual syllable boundaries to repeated signs, a sign such as GIRL creates three syllables. The question then arises as to whether the movement back to the initial starting position constitutes as a syllable, once again raising the issue of ambisyllabicity. However, according to Geraci (2009), repeated signs consist of four timing units, but two syllables, such as in GIRL. This is a fact confirmed by my informants, as they stated that they consider the movement from the final location of MOTHER to the starting location in OLD as transitional. However, although there are two syllables in repeated signs, the coding of these signs are exactly the same, and so I have entered the sign as one coding movement.

3.4. Sign database

After determining the syllable boundaries, the next step was to code the data from the SLED (2006) dictionary. As stated previously, I used Brentari's (1998) feature theory to create a sign database of the dictionary items. The database is included in the appendices on the CD-ROM accompanying this thesis.

The database is arranged to group onset and coda features together for easy observation. As such, it is divided into the following columns: Lexical Item, Onset Handshape, Onset Location, Coda Handshape and Coda Location. The inventory is also colour-coded. The colours are used to indicate special features about specific signs. Green indicates compound signs, brown indicates repeated signs, grey represents monosyllabic signs, blue represents unspecified features and pink represents signs that contain trilled or local movements. In this way, if there are patterns that occur more frequently in certain sign types, it is easier to see them.

Figure 3.6 GIRL (SLED 2006).

As a complete set, it becomes difficult to see the distinct patterns that occur in the inventory. To aid the identification of patterns, the document the inventory is written in contains many spreadsheets which will be found in the CD-ROM appendices: the main dictionary, dominant handshape and location features and non-dominant handshape and location features. Each spreadsheet contains the columns and colour codes as listed above. Using these spreadsheets, I performed a more thorough analysis on individual sections of interest.

However, I did not depend on my database alone. Whenever I found a pattern of interest, I made sure to replay the relevant words from the dictionary to ensure that my coding was correct. From there, I referred to the previous literature on sign language phonology to determine whether there was a theoretical reason for the pattern. Once I had found sufficient examples for constraints and phenomena, I made screenshots of the signs involved. Taking screenshots allowed me to provide examples of the constraints I found, and these screenshots are found in Chapter 4. Considering that the focus of this study is based on syllable boundaries, in most cases there are two screenshots: one depicting the onset location and handshape, and one depicting the coda location and handshape.

3.5. Creating feature tables

While I have created an extensive database, the data does require additional analysis in order to establish what constraints on codas may be revealed. To perform such, I created tables to show which features co-occurred with which, allowing me to observe patterns in the data. The tables that were used in the thesis were based on the major and secondary class features of handshape and location, as prescribed in the literature. For handshapes, I created tables of the major handshape features and secondary features (such as [curved] or [spread]). For location, I investigated the major body regions, the settings for each body region (each region justifying its own table) and body alignment. An example table is included in Table 3.1. A complete set of the tables will be included in the printed appendix at the end of the thesis.

			C	**O**	**D**	**A**				
		1	2	3	4	5	6	7	8	groin
	1									
O	2									
N	3							1		
S	4				1	2				
E	5					1				
T	6						2			
	7									
	8									
	groin								1	

Table 3.1 An example table of the settings within the body region in the SLED (2006) dictionary data.

The table shows features of the onset in rows, and features of the coda in columns. In Table 3.1., the numbers in the row and column headings refer to different settings within the body as a Place of Articulation. The inclusion of the onset is also to determine what onset-coda combinations of features are permissible in SASL. The numbers listed within the table represent the number of lexical items that carry that distinct feature in the dictionary data, even though I have treated repeated signs as one syllable. If certain featural combinations occur more than once, this may provide additional support for a particular tendency or constraint. The database serves a purpose here as well – when patterns of interest were discovered, I used the database to determine which words specified for those patterns. From there, I used the dictionary for visual examples.

3.6. Formulation of constraints

In the previous subsection, I drew attention to how the constructed tables could be used to look for patterns in feature specifications. To determine which constraints dominate in the coda in SASL, I used the SLED (2006) dictionary, SASL informants and the literature available on sign language phonology.

Once I had noticed patterns in the dictionary and table, I used the literature to note which of these constraints have already been established through research on other sign languages. Considering that this research is on the phonological nature of SASL, all constraints that did not directly relate to sign phonology were excluded, such as the Revised Place Constraint (Battison 1978 [1973]), which is a constraint based on the morphology of signs and is discussed further in 4.3.1. Constraints that were relevant to my study were constraints related to change in handshape and location between onset and coda.

There were some phonological constraints mentioned in the literature that I found did not apply to SASL. These will be discussed in Chapter 4. In cases where SASL provided counter-examples to constraints found in research on other sign languages, I surveyed the theory of both spoken and signed languages to try to account for why the constraint was flouted. I was then able to identify the similarities SASL shared with other sign languages, and the similarities between sign languages and spoken languages, as well as the differences between them all. After all this, I revised the constraints I found in the literature to explain my SASL data and formulated new constraints for patterns unique to SASL.

It should be noted here that the current study focuses on constraints on features of the dominant hand in codas. While two-handed signs are included in SASL and in the SLED (2006) dictionary, the features of the non-dominant hand as an active articulator are not considered here. The non-dominant hand functions either as a passive articulator that interacts with the dominant hand, or it is an active articulator that adopts the same handshapes, movements and locations of the dominant hand, as mentioned in Battison's (1978 [1973]: 34-35) Dominance and Symmetry Conditions, mentioned in 2.7.4. Thus it can be assumed that the non-dominant hand will be subjected to the same phonological constraints as its dominant counterpart.

It is in my analysis that my modification of the Prosodic Model's (Brentari 1998) feature tree (see 2.7.1.) is best employed. In Chapter 4, I drew feature trees for patterns of SASL that appeared unique. It was through feature trees that certain patterns, as the change of body region between onset and coda in 4.3.1., were noticed. There are instances where certain intricacies within patterns were noted through the construction of these feature trees, such as noticing the syllables in SON and DAUGHTER not only had a change of body region, but moved from head to body. After talking to Informant A, I made the appropriate amendments to my constraints.

3.7. Conclusion

The methodology used in this study is an adaptation of methodologies used in various types of research on sign languages. Both sources of data – the SLED (2006) dictionary and Deaf informants – were not without problems, but each proved to be important to the analysis of SASL codas. The following paragraphs briefly list the advantages of both data sources and my methodology in general.

I started my research by using the SLED (2006) SASL dictionary. As a recorded dictionary, it allowed me to observe the signs to form patterns. The use of a native SASL signer was also beneficial, as she signed what she knew to be the correct articulation. The signs were produced in citation form, which is beneficial for use in establishing the basic constraints operative in SASL's syllable codas, as the results found here can lead to further research on codas in connected speech. From the material in the dictionary, I was able to code an inventory and feature tables, in addition to taking numerous screenshots. These screenshots were beneficial in providing examples to the patterns I noted and the constraints I formulated. The patterns that I noted in the feature tables were compared and contrasted with the existing constraints formulated by researchers of the phonology of other sign languages. When I came across patterns of interest, I compared them with the literature to see if there was an existing explanation for the phenomenon. If there was no existing explanation, I read the literature on both spoken and sign languages to explain what may be the cause of the constraints. The repeated use of the literature is beneficial, as this allows me to see what patterns in SASL are similar to other sign and spoken languages, and what is unique to SASL and why.

I also confirmed signs of interest that could exemplify patterns and, in the case of body region change, my informants were able to provide me with examples that were not found in the dictionary. It is also important for researchers to work with native speakers of their languages of research, and my informants were an important source of SASL knowledge. Where constraints were formulated, they were test-proven with my informants through personal interviews and Skype interviews.

I describe the results of my data collection, processing and analysis in Chapter 4, and explore their potential implications for sign language phonology in Chapter 5.

4 Discussion

4.1. Introduction

In the Theoretical Overview, I reviewed the theory supporting constraints in the SASL syllable. In the Methodology, I explained how I derived the existence of these constraints. In the following section, I report on my analysis on the information I have collected and processed for patterns in onset and coda formatting. From these patterns, I derive constraints, generalisations and the phonological grammar of SASL.

This analysis compares handshape and location features at the onset with handshape and location features at the coda (3.6.) This is due to the fact that a fair amount of sign language constraints are concerned with changes in articulation (Sandler 1989 & Mandel 1981). It must be here, then, that rules exist concerning the changes in onset and coda that are permitted. Therefore, it is necessary to first observe instances in the data where the coda is different from the onset. Thus, the sections in the following chapter make note of the patterns found at both the onset and the coda position, and account for the constraints. The tables that are referred to in this chapter are found in the printed appendices at the end of the thesis.

In section 4.2, I observe the handshape patterns found in SASL syllables, covering what is seen in signs that have no change between onset and coda, as well as accounting for the instances where change does occur. This includes both primary features and secondary features.

Location patterns, in section 4.3, are investigated in terms of the relationship between major body regions, within settings and between alignments. This highlights the complexities of the location feature, which is evidence for the argument in 2.7.1. of the Theoretical Overview that location cannot be seen as more sonorous as movement.

However, for an analysis of the codas in SASL to be accurate, it is necessary to investigate the handshape and location features that occur in repeated signs. Lastly, in 4.6. I include a summary of the constraints, generalisations and principles found.

4.2. Handshape Patterns

In this section, I observe both the major handshapes (section 4.2.1.) and the secondary features that characterise them (section 4.2.2.). In section 4.2.1.1., I mention the tendency of the major handshape to remain the same at both the onset and coda positions. However, there are syllables where major handshape change occurs, and I provide explanations and constraints in section 4.2.2.

4.2.1. Major class features

In Appendix 1, I present the major class features at onset and coda, and list the amount of times a certain onset-coda combination is found in the data.

4.2.1.1. Handshapes with no change

According to Appendix 1, the identical handshape specification at onset and coda is the most common pattern, such as in the signs WANT and AUNT.

Figure 4.1 WANT (SLED 2006).

It is evident that there is a preference for signs to have the same handshape in onset and coda. It is possible that this is the default of the SASL syllable. For a syllable to be considered to have handshape change, the major class feature at the onset must be different from the major class feature at the coda.

Figure 4.2 AUNT (SLED 2006).

Where there is a slight change in handshape, there is a preference for major class features to remain the same, while the secondary features undergo change. This is seen in signs such as NAME (Figure 4.3):

Figure 4.3 NAME (SLED 2006).

Therefore, it can be assumed that the default state of onset and coda is that the handshape does not change, which supports previous theories in a number of ways. Firstly, it supports the view that selected fingers do not change during the production of a sign (Mandel 1981). Secondly, it further proves the hierarchy between primary and secondary features.

However, there are syllables where the handshape at the coda is different from the onset. I describe the patterns behind these changes in the following sub-section.

4.2.1.2 Handshapes with change

While not an overly frequent trend across the data, the results in Table 1 show that 23% of the citation signs show handshape change. The instances of handshape change are pertinent as there is a higher likelihood of constraints that dictate what environments allow for such a rare change.

Handshape change is a phenomenon that not only exists but is necessary to the lexicon of SASL and other sign languages. Consider Figure 4.4:

Figure 4.4 PLEASE (SLED 2006).

The sign PLEASE changes from [5], [thumb], [opposed] to [Å]. It is important to note that the handshape change is mandatory for the sign's existence, as it is the coda specification that separates the minimal pairs PLEASE (Figure 4.4) and THANK-YOU (Figure 4.5). Where PLEASE has a change from onset to coda, THANK-YOU maintains its original handshape specification throughout the production of the sign. This proves that handshape change is phonemically contrastive and deserves consideration.

Figure 4.5 THANK-YOU (SLED 2006).

This distinction is even more apparent when we use the notation system of the Prosodic Model. Due to its handshape change, the feature tree of PLEASE (Figure 4.6) has an extra daughter node in the PF branch.

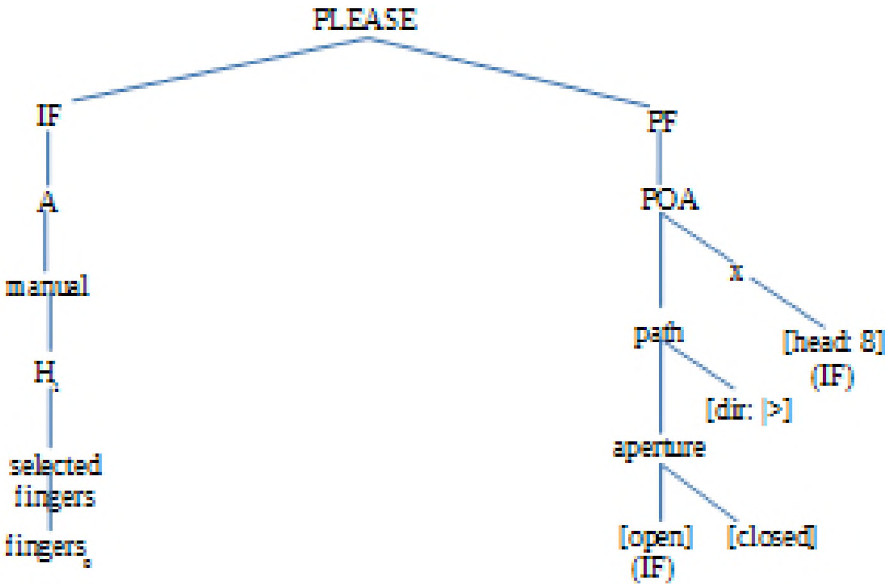

Figure 4.6 The feature tree of PLEASE.

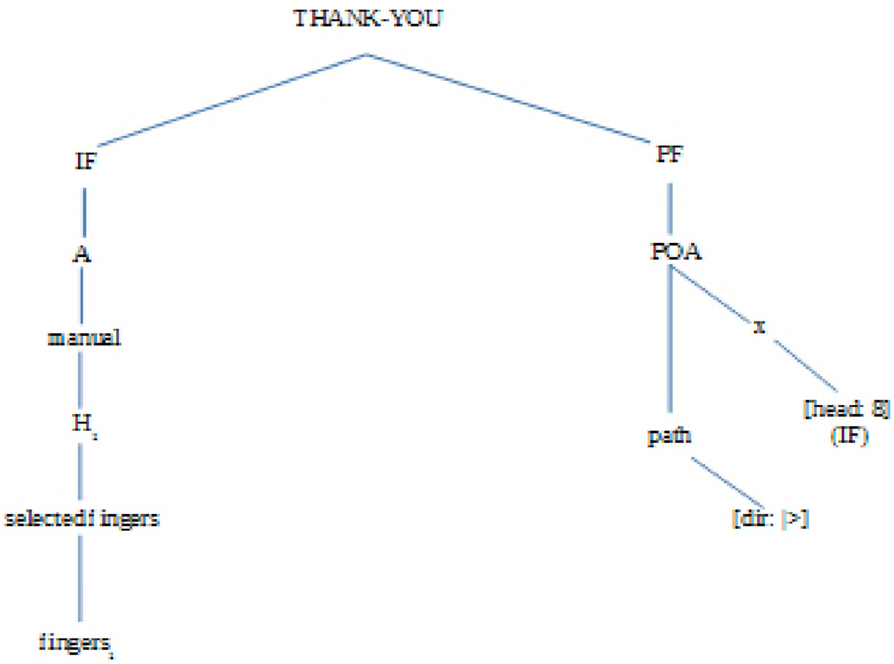

Figure 4.7 The feature tree of THANK-YOU.

Figure 4.8 DR Y: [5], [thumb], [stacked] → [Å] (SLED 2006).

Figure 4.9 WET: [5], [curved] → [Å] (SLED 2006).

The most common handshapes found cross-linguistically are what are known as the unmarked handshapes. These handshape classes are found in H2 in Type 3 signs (Morgan & Mayberry 2012). The dictionary data showed that this was the case: the handshapes that were significantly frequent choices for change between onset and coda were from the major classes of [A], [S], [B] – handshapes that are part of the unmarked handshape inventory. Example signs are provided below in PAP (Figure 4.11), SATURDAY (Figure 4.12) and SORE (Figure 4.13.).

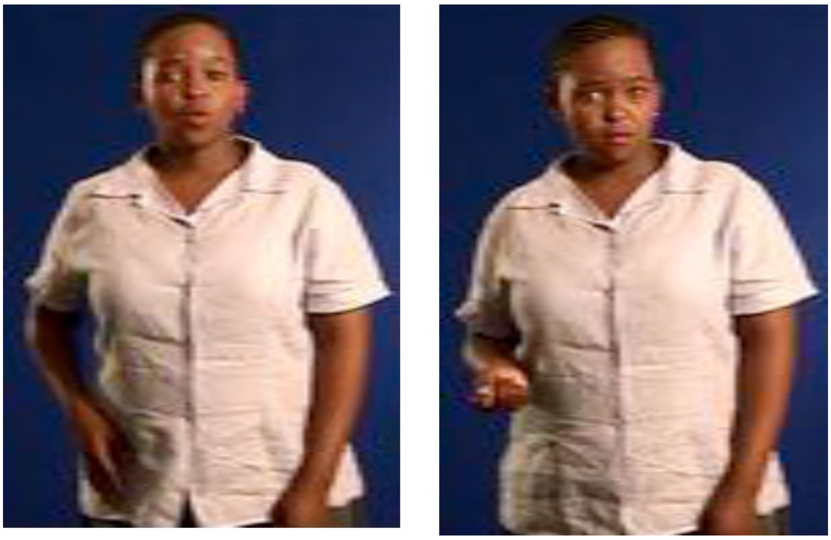

Figure 4.10 DOG 2: [3], [thumb], [stacked] → [A] (SLED 2006).

Figure 4.11 PAP (maize porridge): [5], [spread] → [S] (SLED 2006).

Figure 4.12 SATURDAY: [thumb], [2], [stacked] → [5], [spread] (SLED 2006).

Figure 4.13 SORE: [S] → [5], [spread] (SLED 2006).

From this observation, I propose the following constraint regarding handshape change:

(3) Revised Handshape Change Constraint

If there is an instance of handshape change during a syllable's production, the coda will have [A], [S] or [B] as its major feature.

However, there are exceptions to this constraint. There are syllables where the handshape changes to [T] and a variety of other handshapes (such as [F]) in the coda position. The specification of [T] in the coda position as found in MAN (Figure 4.14) could be a result of an [A] handshape that only looks like [T] as a result of the selected fingers coming together and not completing the move to [A] due to ease of articulation.

Signing the days of the week presents another challenge. In MONDAY (Figure 4.15) below, the handshape [F] is at the coda position. The days of the week are interesting, as they seem to be more of a list, with each finger representing a day of the week. I propose that, in this manner, the days of the week are closer to classifier constructions, which are outside the scope of this research.

Figure 4.14 MAN (SLED 2006).

Figure 4.15 MONDAY (SLED 2006).

While the coda can be any variation of the [A] class and [S] has no other variations, the data shows that – of the [B][1] handshapes – [5], [spread] is the only variation found in the coda after handshape change. This could be for a number of reasons. [5] is perhaps the most unmarked of handshapes in the phonological inventory. This is because all of the fingers are selected, which results in all joints undergoing the same processes. This means that the handshape is less complex than other recorded handshapes. According to Sandler & Lillo-Martin (2006), an open hand – with fingers evenly spaced – is one of the resting states in the hand, as found in 2.7.2.

It may also have to do with the nature of the handshape in the onset position. In SATURDAY (Figure 4.12), the fingers [thumb] and [3] move to [5], [spread] in a flicking motion. The unselected fingers are complying with the rule stated by Sandler & Lillo-Martin (2006), which states that the selected fingers do not change during a sign's articulation.

As shown in the Figure 4.16, the selected fingers started [flexed]. To comply with the rule stated by Sandler & Lillo-Martin (2006), the unselected fingers must be specified for contrasting joints. As they are unselected and thus do not move, the fingers remain the same while the selected fingers undergo a change via a flicking movement, which results in flexed joints, hence the [5], [spread] specification. It should be noted that all variants of [5] belong to the [B] major handshape class.

In SORE (Figure 4.13), all fingers are selected as all fingers undergo change from onset to coda. Again, as with SATURDAY (Figure 4.12 and Figure 4.16), the movement is a flick as the handshape changes. Here, it is possible that the choice of [5], [spread] as coda features is as a result of anatomical ease, but it could also be due to the joint changes.

As a result, the analysis above leads me to propose the following constraint:

(4) [5], [spread] Constraint

If the major class feature changes to [B] in the coda position, the secondary feature [spread] will be specified, resulting in [5], [spread].

The [5], [spread] Constraint introduces another concept for consideration. We must question the extent to which a handshape change can be constituted as such. As established in 2.6.2., the handshape features are hierarchically grouped into major/natural classes, and there are secondary features unique to the classes. Signs such as BLACK (Figure 4.17) present the less complex nature of the relationship between an overarching natural class and a secondary feature that modifies it. At the onset, the handshape is specified as [V]. At the coda, it is specified as [V], [curved].

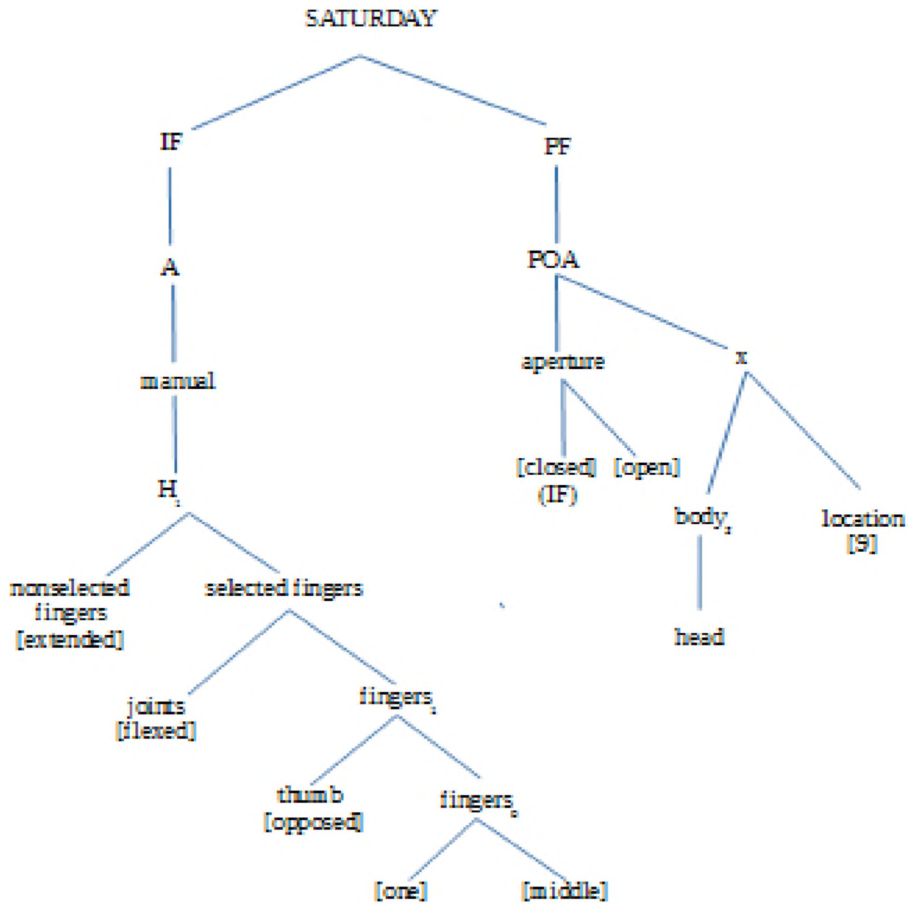

Figure 4.16 The feature tree organisation for the sign SATURDAY.

Figure 4.17 BLACK (SLED 2006).

In Figure 4.17 [curved] is the secondary feature that modifies [V] in the coda. In signs such as this, the secondary feature does not change the major class feature of the handshape – it is still clearly [V]. Another example of this is [1] changing into [X], seen in the signs CRY (Figure 4.18) and RED (Figure 4.19). As discussed in 3.4., handshapes were coded using Brentari's (1998) handshape features. Thus, [X] is nothing more than [1], [curved]. In this case, syllables such as that in Figure 4.17 should be considered as examples of secondary feature change rather than handshape change. This is aperture change, as the movement from [1] to [1], [curved] is a change of the secondary features of the selected fingers in the hand, and conforms to the claim made by Mandel (1981) that states that the fingers selected for a handshape must remain the same throughout the duration of the sign. It is evident that the handshape changes in the data conform to this rule. Additionally, this was confirmed by Informant A during the constraint screening process.

As seen in Figure 4.18. and Figure 4.19, the selected finger is modified by a secondary feature – even in two-handed signs – and is coded as a different handshape.

This aperture change occurs in signs that change from one handshape class to another. For example, in the signs that change from [S] → [5], all fingers are selected and undergo aperture change. In syllables that change to [Å] in the coda position, such as PLEASE (Figure 4.4), or DRY (Figure 4.8), the same situation occurs: all fingers and thumb are selected. While the fingers move, the thumb does not. This conforms to the possible actions of the thumb in signs (as the thumb is governed differently from the other fingers), as stated in Brentari (1998). However, [thumb] is a complex articulator that operates slightly differently from the other fingers, and a detailed description of how the thumb is treated in the Prosodic Model can be found in Brentari (1998).

Figure 4.18 CRY (SLED 2006).

Figure 4.19 RED (SLED 2006).

Thus, when the selected fingers undergo aperture change and the coda becomes [Å], the selected fingers are still obeying Mandel's rule, which states that the fingers selected for articulation may not change during the sign's production. There are other signs where two fingers are selected, but the handshape at the coda appears to have all fingers selected (however, only two fingers are selected, as those are the fingers that are allowed to move), as in the case of PLAY (Figure 4.20). In Figure 4.20, [3] and [thumb] are the selected fingers, yet the handshape realised at the coda is [5], [spread].

Figure 4.20 PLAY: [thumb], [2], [stacked] → [5], [spread] (SLED 2006).

Regardless of what the coda handshape is, SASL conforms to the Selected Finger Constraint stated in the literature. The Revised Handshape Change Constraint illustrates the importance of secondary features on the coda in a sign syllable. The change of selected secondary features is what causes handshape changes, which is why secondary features are important. If secondary features have such an effect, then there must be rules governing the secondary features allowed at the coda position.

4.2.2. Secondary features

The secondary features may be dominated by the major class node, but their impact on major class nodes suggests that there are phonological rules that dictate the combination of secondary feature at onset and coda. A suitable starting point is observing the finger arrangements of [curved]; [curved], [spread]; [spread] and [stacked].

Appendix 2 provides interesting insights into what onset-coda combinations are permissible for the SASL syllable. 80% of the secondary features specified at the coda are identical to the features specified at the onset, much like with major class features. However, much like with major class features, there are instances where the onset and the coda are not identical.

As seen in Appendix 2, [curved] and [spread] are not compatible in an onset-coda combination. That is, a handshape with the [curved] specification at the onset cannot specify [spread] at the coda position, and vice versa. While uncomfortable, the movement from [curved] to [spread] is anatomically possible, meaning all fingers – including the thumb – are selected. This means that there must be a phonological reason that blocks the combination.

Interestingly, [curved] and [spread] can co-occur in one timing unit as [curved], [spread]. It is likely that the feature specification [curved], [spread] follows the general rule that prefers features to remain identical throughout the syllable. The combination [curved], [spread] is seldom specified and only occurs in syllables that may be influenced by the iconic nature of the signs involved, such as MONKEY (Figure 4.21) and CAT (Figure 4.22):

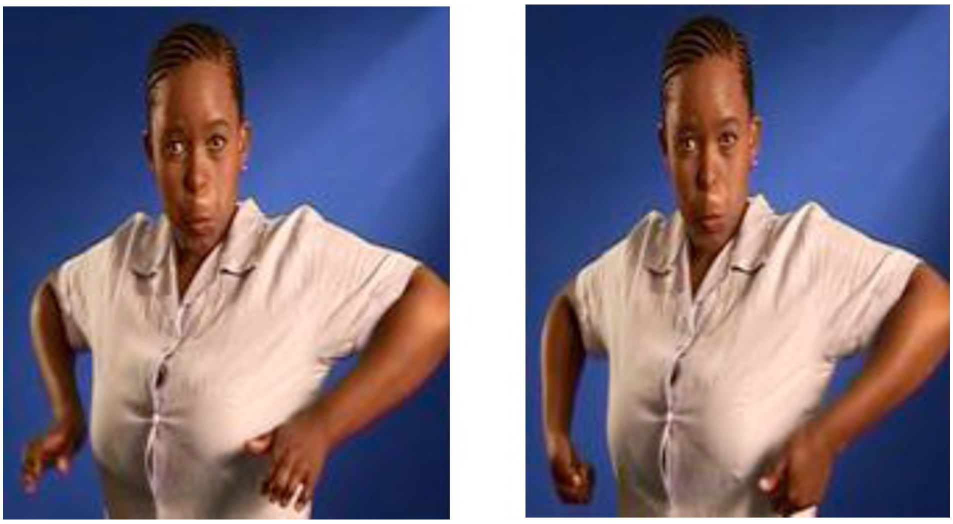

Figure 4.21 MONKEY: [curved], [spread] → [curved] (SLED2006).

Another relationship of interest is [curved] and [stacked]. As shown in Table 4.2, [stacked] and [spread] can be specified interchangeably in onset and coda positions, but [curved] cannot be specified at either the onset or the coda if the selected fingers possess the [stacked] feature. It has become increasingly obvious that there are restrictions around the secondary feature [curved]. I propose the following constraint:

(5) [curved] Agreement Constraint

If the onset has the feature [curved], this feature must also appear in the coda.

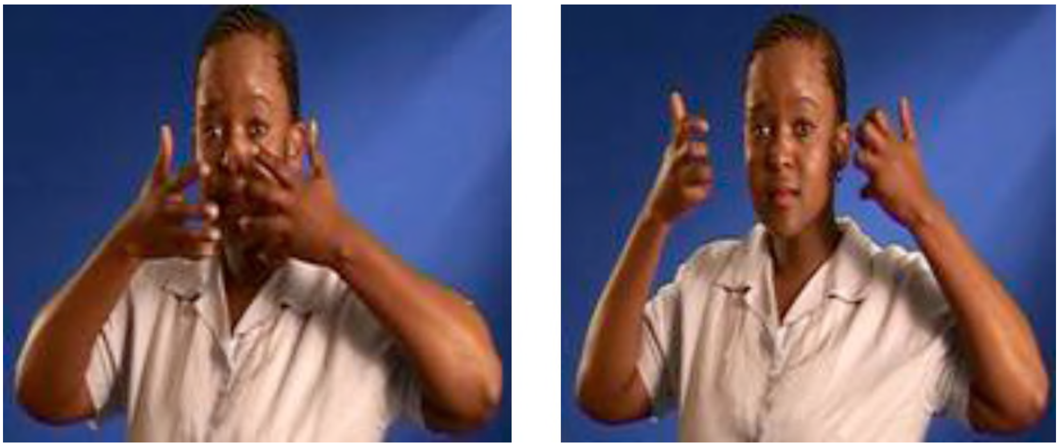

Figure 4.22 CAT: [spread] → [curved], [spread] (SLED 2006).

This pattern has also been confirmed by Informant A to be true to all sign syllables to her knowledge, as she could not identify any syllables in SASL where [curved] was specified at the onset, but not at the coda.

This is a phenomenon not unusual in spoken languages. According to Bennett (2015: 179), the language Obolo creates the same constraints on the feature [+nasal]: a syllable is prohibited from specifying a [-nasal] feature if the onset of a syllable has specified [+nasal].

The relationship between [curved] and [spread] has been discussed, but the data shows that [curved] cannot co-occur with [stacked] at either onset or coda. It is highly likely that this is a result of anatomy. Because [curved] cannot co-occur with [stacked] at the onset, [curved] will not appear at the coda, conforming to the [curved] Agreement Constraint listed in (5).

The SLED (2006) dictionary shows that there are constraints on main handshape class features, as well as the secondary features that modify. While handshapes have a high tendency to remain identical at both onset and coda positions that occur in the coda position, as a result handshape changes are [A], [S] and [B] classes. This conforms to the Selected Finger Constraint (Mandel 1981).

Of particular interest is the secondary feature [curved], which must be at the coda if it is specified at the onset. However, the anatomy of the hand prohibits certain co-occurrences between secondary features, such as [stacked] and [spread].

4.3. Location Patterns

This section discusses the location patterns found at the onset and coda. As with 4.2., the layout of this section is arranged in terms of major class features (4.3.1.) and secondary class features (4.3.2.). In 4.3.1., I discuss the patterns found in the major body regions [head], [body], [arm] and [H2]. In 4.3.2., I discuss the patterns of the 8 settings found in each of the major body regions, as well as the patterns of alignment (i.e. non/dominant side of the signer).

4.3.1. Inter-regional patterns

Out of 175 signs in the SLED (2006) SASL dictionary, about 34% of signs have contact with the body specified at both the onset and the coda. While locations chosen can be in the neutral space, the neutral space is an area that follows a different structure to that of body contact, and is thus out of the scope of the research. According to Sandler (1989), and Battison (1978 [1973]) there are limitations attached to the onset-coda combinations of a location, found in ASL:

(7) Revised Place Constraint

There can be only one place of articulation per morpheme.

However, this constraint is morphologically based, meaning that the POA is not permitted to change during the articulation of a single unit of meaning. Compounds – where two measures of meaning are combined to create a new lexeme – then, may have two POAs; one for each morpheme. However, this constraint cannot be applied to syllables, as compounds can be monosyllabic. Monosyllabic compounds are a result of one stem lacking an underlying movement. Since movement is important to the well-formedness of a sign, the sign undergoes epenthesis on the surface level. When put in a compound, this stem loses its epenthetic movement, as the second stem will have underlying movement to make the sign well-formed (Brentari 1998, Geraci 2009). However, as Geraci (2009: 27) has shown in his work on Italian Sign Language (or LIS), this monosyllabic compound may have two POAs during articulation.

Appendix 3 represents the onset-coda combinations between the body regions, found in the dictionary data. The syllables that were considered for this table were ones that had contact with the signer's body at both onset and coda. Out of 175 signs, 79 signs had body contact at both onset and coda.

It should be noted that there are situations where the place of articulation can change from onset to coda. An example is the sign SICK (Figure 4.23), in which [head] is the place of articulation in the onset, and [body] in the coda. This is a possible variant of SICK used in the dictionary data.

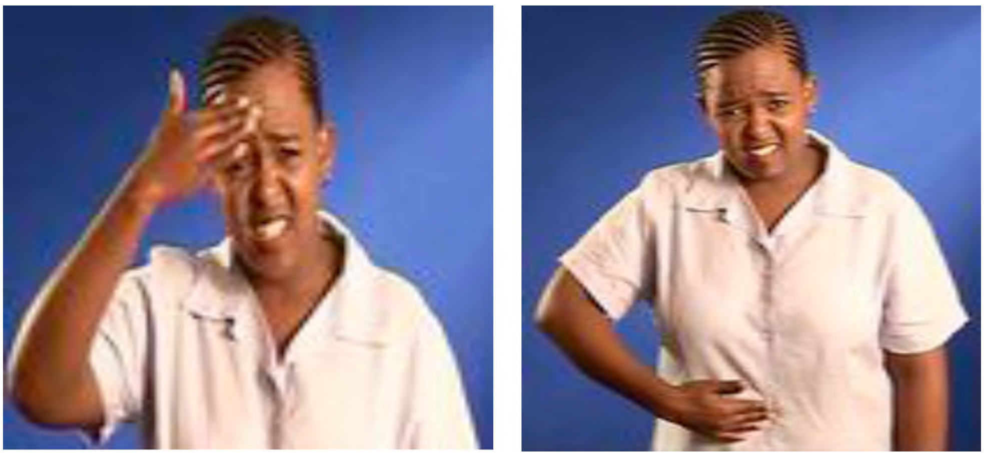

Figure 4.23 The sign SICK (SLED 2006). The onset location occurs at the [head] and the coda location occurs on the [body].

It is worth noting that, despite the statistics on Table 3, this is not an isolated phenomenon. While not found in the dictionary corpus, there are other signs that share the same region change from [head], such as SON and DAUGHTER (Figure 2.23 and Figure 2.24, found in Chapter 2). According to dialect, SON and DAUGHTER can have either [arm] or [body] in the coda.

It could be argued that each of these signs originated as compounds, as with Geraci's (2009) LIS compounds. According to this argument, SICK (Figure 4.23) represents the areas where someone is likely to fall ill, such as HEAD + STOMACH. SON could be analysed as the compound BOY-MINE, with progressive assimilation of handshape to [T] in the coda. DAUGHTER uses the handshape [D] in the same onset position as SON, also ending with the location of MINE on the body, in one variant. However, even with that in consideration, this does not change my analysis for two reasons:

a. Firstly, we cannot definitively claim to know the origins of the signs in question, as there has been no research into the etymology of SASL signs as far as I am aware. While an interesting and worthwhile subject matter, it is unfortunately out of the scope of this thesis.

b. Secondly, even if the signs involved are compounds, this does not change the fact that on a phonological level, place of articulation change between onset and coda is possible in SASL.

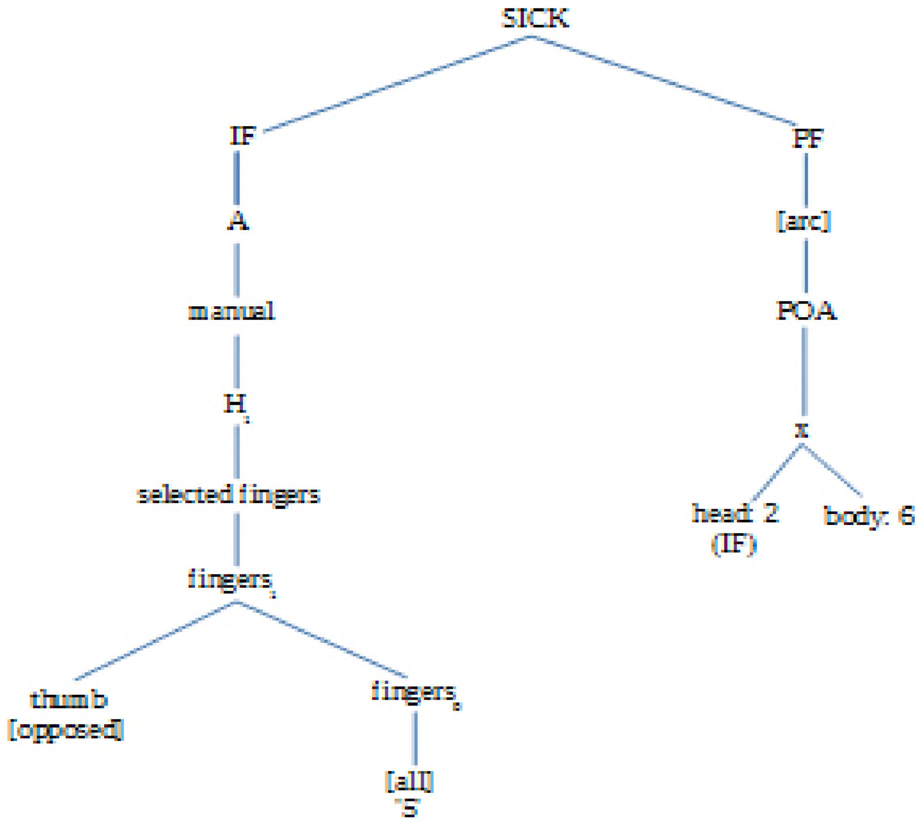

Figure 4.24 A feature tree representation of the sign SICK, depicting the POA change.

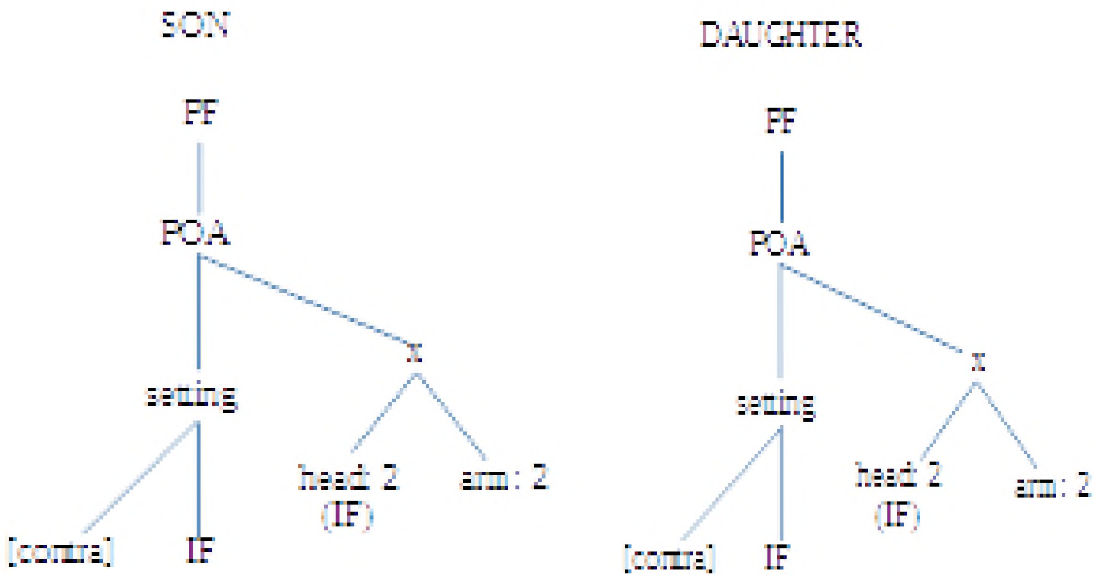

Figure 4.25 The PF branches of SON and DAUGHTER.

The change of major body region is also confirmed by Informant A, who uses the sign SICK as found in the SLED (2006) dictionary.

There seems to be a pattern in region change, where [head] changes to another region. What is of particular interest to the research is that [head: 2] – the forehead – is the onset location that triggers the change in body region. Additionally, when asked if the SON, DAUGHTER and SICK were reversible, Informant A confirmed that this was not possible, in addition to stating that the region change moved away from the [head], not towards it.

(6) Onset Location Constraint

The place of articulation may change during the production of a syllable, provided that the onset is [head: 2].

This is similar to Humbert's (1995) case of debuccalisation in spoken languages, seen in Chapter 1. In SASL, [head: 2] is the only feature that allows for region change – it is a trigger for region change to other, larger regions. There are two possible reasons for this phenomenon. The first is that [body] – much like the [B], [A] and [S] – may be an unmarked feature, which leads to the conclusion that the coda will specify an unmarked major class feature in instances of major class feature change. [arm] may be less marked than [head], allowing for the change. Markedness in sign languages is generally held only to relate to handshape. Revisiting Sandler and Lillo-Martin (2006)'s formulation: unmarked forms appear cross-linguistically, are simple to articulate, are the first features a child acquires, are more prone to assimilation, are more common (Rice 2007) and – according to Jakobson (1968) – are unaffected by the onset of aphasia.

While there has not been research into aphasia and SASL to my knowledge, place of articulation can be measured against the other defining properties of unmarked features – the most important of these being acquisition. Unmarked handshapes, as previously discussed (2.7.4.), are the first handshapes acquired by deaf children (Morgan and Mayberry 2012). As a passive articulator, POA features cannot be acquired. Rather, they are already there to be articulated upon. However, if we consider the possibility of this region change as debuccalisation, markedness is a credible explanation, as the places of articulation in Humbert's (1995) analysis were less marked than the original starting features.

According to Major & Faundree (1996), an unmarked coda in most languages is a devoiced one – a quality that is found in German (Wetzels & Mascaró, 2001) and English.

While all these examples are various unmarked forms from a variety of differing languages, they all define traits of markedness based on manner of articulation. Even in the case of Cairns, the markedness of the lip location lies in the manner of articulation required to pronounce the vowels – an action which is based from an active articulator (the tongue).

The second possibility to explain the change in body region – linked to the first – is to assume that the POA change to [arm] and [body] is the result of an adaptation to sonority. Sign language sonority, in a traditional sense, is directly proportional to the visibility of the sign (Brentari 1998). While linked to joints of articulation, sonority is dependent on the nucleus of a syllable – that is, the movement (Sandler & Lillo-Martin 2006). However, there are theorists who have disputed this view of sonority, such as Sandler (1993d), who proposes a (partial) sonority hierarchy that expands beyond articulatory joints, including locations in planes and contact:

path movement > internal movement > locations > contacting locations

In addition, Corina (1996) suggests that sonority occurs in terms of feature change:

Movement sequence > full handshape change or orientation change > location change (i.e. path movement) > partial handshape change

While both alternatives offer a promising perspective on sonority, neither of them are sufficient to provide explanation to [body] or [arm] existing on a sonority scale.

However, the head is more sonorous than the arm, as it (the arm) is a more marked and less visibly distinct area. This is satisfactory in explaining why the [head] feature specifies [body] in POA change – movement can only move to more sonorous features. However, it has been noted by several theorists (Brentari 1998, Sandler & Lillo-Martin 2006, among others) that the head is the most sonorous region of a signer's body. This is for three reasons: non-manual features are necessary for appropriate sign language articulation (Sandler & Lillo-Martin 2006, Brentari & Crossley 2002, Brentari 1998, among others). For instance, the non-manual feature is mandatory for appropriate articulation in questions (Sandler & Lillo-Martin 2006, among others). Secondly, the face is the location seen as the area with the most distinct settings. A final argument for head being the most sonorous location is that eye contact, in sign language, indicates that one is listening. As such, the head is the first and most commonly noticed area.

Figure 4.26 The sign WHY (SLED 2006).

With evidence such as this, it is clear that trying to explain the POA change in syllables using the current understanding of sonority is flawed. Another aspect to consider could be to consider sonority as centralisation in passive articulators. Centralisation is the tendency of features to move closer to the centre of the body over time. In terms of sign languages, centralisation pulls the sign towards the centre-most part of the signing space. Adapting this phenomenon to the sign syllable, we can determine sonority as the movement towards the centre-most part of a sign. While the [head] region is more sonorous than the [body] region, the [body] region is more centralised as the elbow must bend to contact it. This is a more accurate account, as it explains the change in location towards the [body] and arm from the more sonorous [head] region. It could also be argued that the number of SLED (2006) dictionary signs that occur at the [body] region prove its central nature, as seen in Appendix 4.

Although the data only shows movement from [head] → [body], Informant A presented a monosyllabic sign that showed region change between two other regions. In the sign BED-SHEET (Figure 4.27), the region specified is [body] (as shoulder is one of the region's settings) at the onset, but the region [H2] is specified at the coda. While this confirms the validity of region change between onset and coda, it brings into question whether the Coda Location Constraint should be modified to include all region changes, and also brings the idea of centralisation into question. However, the nature of the [body] and [H2] in Figure 4.27. seems to represent the bed that is covered with the sheet. While it could be considered a classifier construction, it is possible that this sign reveals a gap in the data, as does MOUNTAIN (Figure 4.28).

Figure 4.27 BED-SHEET.

Figure 4.28 MOUNTAIN.

4.3.2. Intra-regional patterns

As signs require movements in order to be well-formed (Geraci 2009, Sandler and Lillo-Martin 2006, Wilbur 2011), many of these movements will occur between the settings of a major body region. Thus, there is an interest in what happens within regions i.e. the relationship between settings within the greater body region. Although the eight settings for each individual region was previously stated in 2.7.1., I include the settings to each region as they are discussed and possible centre-most setting. These features are also included at the beginning of the thesis. As such, this subsection will investigate the possibility of constraints and generalisations within each body region. Due to the small size of the database, the numbers in the data tables in the appendix are small. However, the generalisations made in this section have been confirmed by Informant A to be true to her knowledge of various dialects of SASL.

4.3.2.1. [head]

The eight settings within the [head] region are as follows (Brentari 1998: 122-123):

Head: [1] top of head
[2] forehead

[3] eye

[4] cheek/nose

[5] upper lip

[6] mouth

[7] chin

[8] under the chin

Although it is not placed in the centre, a large degree of syllables specify the chin setting in the coda position.

It would appear, on close observation of Appendix 5, that settings in the [head] region follow the same generalised rules as all other major features in the sign syllable. That is, settings seem to show a tendency to remain identical at both onset and coda positions Therefore, a sign that has an onset at [6] – the mouth – will specify [6] as the coda, be it through internal movement (DUCK in Figure 4.29), or through path movement (UNCLE in Figure 4.30).

Figure 4.29 DUCK (SLED 2006). As the movement comes from aperture change, the hand remains on [7] for the sign's production.

Figure 4.30 UNCLE (SLED 2006). The setting [7] remains the same through the movement from [ipsi] to [contra].

In the data, the setting [3] is specified at the onset, but not at the coda position. This is seen in signs such as CRY and BLACK (Figure 4.31). In CRY, [3] moves to [4] and in BLACK, [3] moves to [8].

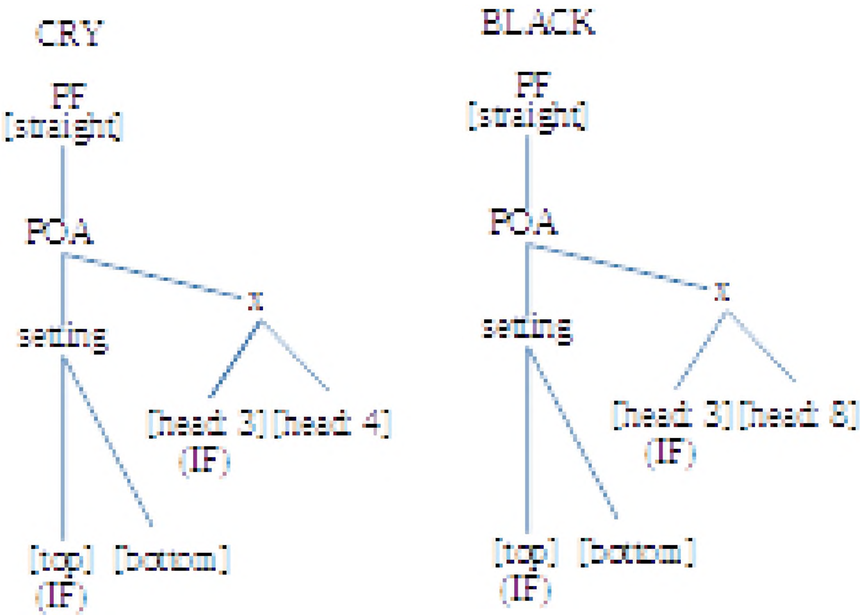

Figure 4.31 The PF branch for CRY and BLACK.

As [3] is found at the onset, but not at the coda, this forces onsets specified at [3] to undergo setting change. This means that there is possibly something in the grammar of the language that prohibits the selection of [3] at the coda. Henceforth, I propose the following constraint:

(7) [head] Setting Constraint
The eye cannot be specified at the coda location.

A possible explanation for the blocking of the eye in the coda position is the result of visual sonority. As stated previously, movement is the most sonorous part of a syllable – but the onset and coda carry sonority as well.

From an articulatory standpoint, if the eye were specified at the coda of a syllable, a signer could possibly injure her/himself during connected speech, in addition to obstructing eye contact between signers. Discussion with our informants reveal that the constraint in (6) is a pattern seen outside the scope of the data.

4.3.2.2. [body]

The eight settings within the [body] region are as follows (Brentari 1998: 122-123):

Body: [1] neck
[2] shoulder
[3] clavicle
[4] torso-top
[5] torso-mid
[6] torso-bottom
[7] waist
[8] hips

In Appendix 6, I have added an additional setting named [groin], which is not included in Brentari's (1998) inventory. This is due to the fact that the SASL sign UNDERPANTS (Figure 4.32), which is found in the data, specifies [groin] in the onset position. Interestingly, the groin is an area that is lower than the universal signing space, giving it the same qualities as a setting with a small surface area. It is possible that other sign languages do not have signs that occur at the [groin].

The body region also shows the pattern of agreement between onset and coda, but to a lesser degree as a result of numerous setting combinations that are not attested. Settings that are specified at the onset, but not at the coda, are [3] – the clavicle – and the groin. The possible reasons for the gaps are, again, a result of visual sonority. The clavicle is a small area for signs to be articulated on.

In the instance of [groin], an unusual setting, the same constraint applies, despite the appearances of the table. As [groin] is not within the universal signing space, it is not empirically sonorous, nor is it close to the centre-most part of the signer's body, if we are to consider sonority as influenced by centralisation. As such, it must change to a setting that occurs within the signing space which, by definition, is more sonorous than [groin].

Figure 4.32 UNDERPANTS (SLED 2006).

The opposite can be said for the waist location ([7]) and the hips ([8]). Neither occur as an onset, but instead as a coda. In the case of [8], it may be because the sign is on the peripherals of the signing space. Signs like SUNDAY (Figure 4.33) move from [3] to [7] and in those situations, [7] is the product of the fulfilment of the constraint. As previously established, [3] is a less sonorous setting.

This contributes to the general tendency that codas tend to be closer to the centre of the signer than onsets, if the centre is defined as the signer's torso. Therefore, signs that change settings in the [head] region will be expected to undergo a downwards movement to move closer to the centre of the signer. In the case of UNDERWEAR (Figure 4.32), the setting change is an upward movement to move closer to the centre of the signer. Hence, I propose the following constraint:

(8) Setting Centralisation Constraint

If there is setting change between onset and coda locations, the setting specified at the coda will be closer to the centre of the signer.

Figure 4.33 SUNDAY (SLED 2006).

During the constraint screening process, Informant A made reference to a sign that violates this constraint. In the monosyllabic word FACEBOOK PROFILE (Figure 4.34), the onset location is [7] (i.e. the chin), but instead of complying to the constraint in (5), the sign moves to [2] (i.e. the forehead).

However, as this is the only sign of this nature that Informant A can think of, it is possible that this is an exception to the rule. That said, Figure 4.34 is proof that a greater scope of data is needed to make definite claims of all instances of the language. In general, the patterns of the data and confirmation of Informant A have shown that there is a high tendency of the settings within a region to move towards the centre-most part of the signer's body.

Figure 4.34 FACEBOOK PROFILE.

4.3.3.3. [arm]

The eight settings within the [arm] region are as follows (Brentari 1998: 122-123).

Arm: [1] upper arm
[2] elbow front
[3] elbow back
[4] forearm back
[5] forearm front
[6] forearm ulnar
[7] wrist back
[8] wrist front

In the cases that settings are specified, the Setting Centralisation Constraint is adhered to, meaning that signs with differing onsets and codas show a tendency to move toward the centre of the signer's body in the coda position. What is particularly interesting, is that the majority of the signs that occur at the [arm] region – such as MOUSE (Figure 4.35) and SHEEP (Figure 4.36) – have a local movement occurring within a path movement.

Even with signs that possess complex movement, the sign syllable still conforms to the Setting Centralisation Constraint. It is possible that the centralisation can explain for location change in both regions and settings.

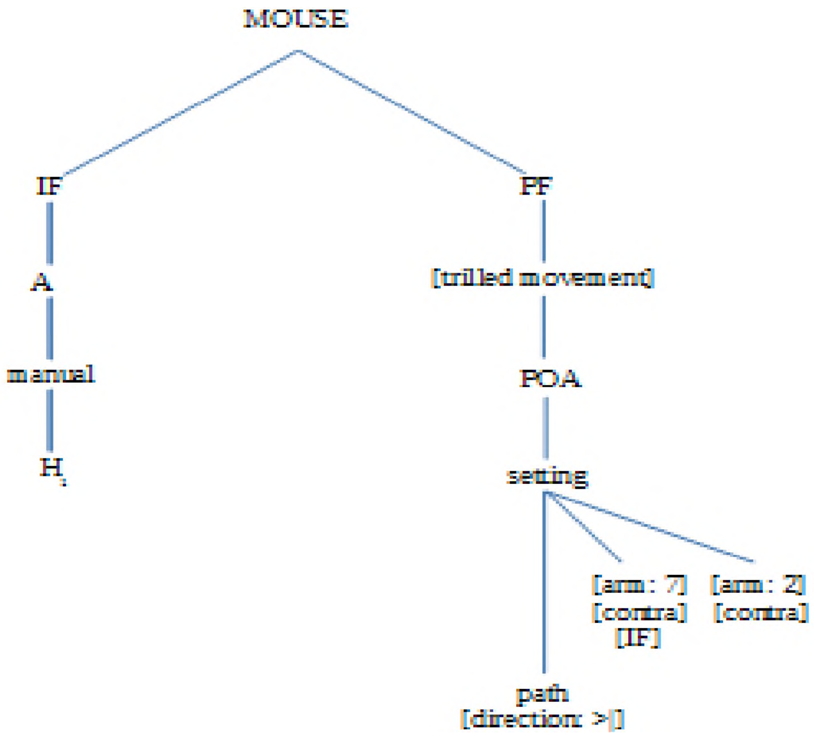

Figure 4.35 The feature tree of the sign MOUSE.

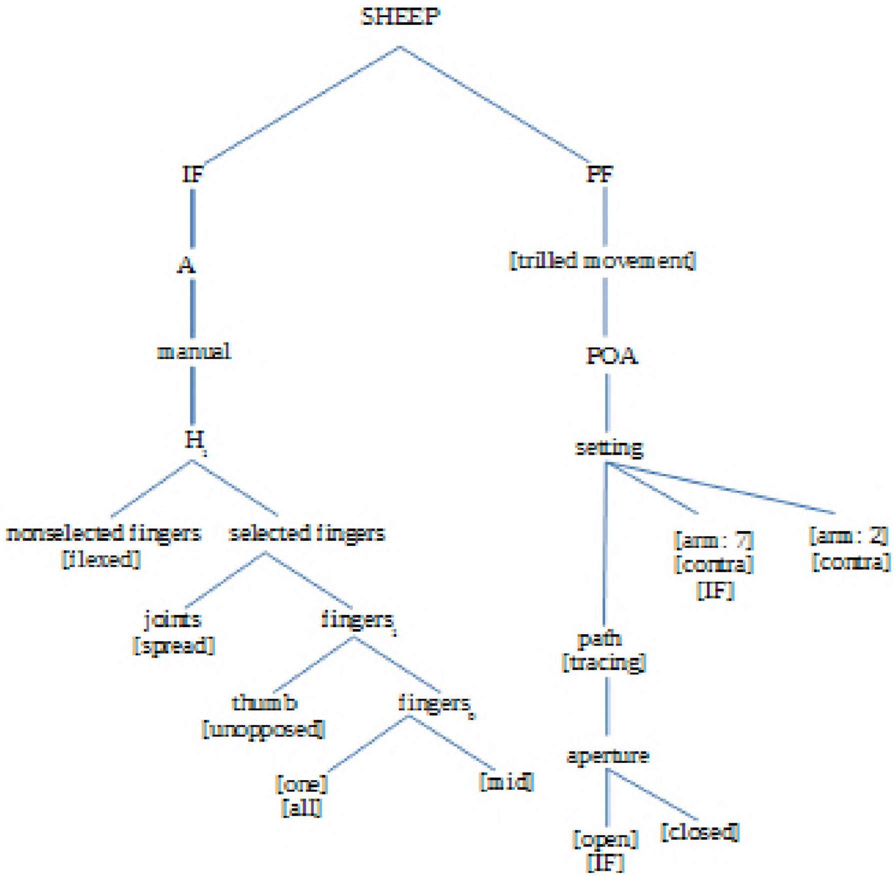

Figure 4.36 The feature tree of the sign SHEEP.

4.3.2.4. [H2]

Although it has been previously mentioned in 3.3.4., the [H2] referred to here is the static non-dominant hand found in Type 3 signs. It is not a common location in the dictionary corpus. The eight settings within the [H2] region are as follows (Brentari 1998: 122-123).

H_2: [1] palm of hand
[2] finger fronts
[3] back of palm
[4] back of fingers
[5] radial side of selected fingers
[6] ulnar side of selected fingers
[7] tip of selected fingers/thumb

[8] heel of hand

The table in Appendix 8 provides evidence of the validity of the Setting Centralisation Constraint: here, settings show a preference for remaining the same in onset and coda positions or, in the case of the sign SOCKS (Figure 4.37), move closer to the centre of the signer's body. As with the change of regions and the change of [head], [arm] and [body] settings, the pattern seen in Table 4.8. shows a pattern of features changing towards the torso – the centre – of the signer.

In SOCKS (Figure 4.37), the setting [2] (finger fronts) is specified at the onset. The coda fulfils the Setting Centralisation Constraint by specifying [3] (back of palm), which is a move towards the centre of the signer's body.

Figure 4.37 SOCKS (SLED 2006).

4.3.2.5. [ipsi] and [contra]

The secondary features [ipsi] and [contra] specify which side the signer is articulating on during the production of a sign – in other words, body alignment. Features can be articulated on either the side of the dominant hand ([ipsi]), the side of the non-dominant hand ([contra]), or in middle space in between (which, for the sake of this thesis, has been labelled 'not specified' as in Table 4.9.) (Brentari 1998, Sandler & Lillo-Martin 2006). Another feature that has been included in Table 4.9. is the column N/A, which represents signs that have no alignment at the coda as a result of an absence of a specified location.

As [ipsi] and [contra] are secondary features like body settings, it is beneficial to analyse potential patterns for constraints. This is because body alignment can change during the production of a syllable. If there is a change, then there is a possibility that there is phonological explanation as to why certain alignment combinations are not permitted, as is seen by the empty cells in Appendix 9.

In Appendix 9, there is a preference for syllable to specify either [ipsi], or what we can assume to be the centre ([not specified]) at the onset location. On closer inspection, it can be determined that [ipsi] is the preferred specification, with greater instances of the feature being specified at both onset and coda locations. An interesting factor to notice is how the centre interacts with [ipsi] and [contra].

Signs cannot move from the centre at the onset to [contra] at the coda, suggesting that there may be some constraint prohibiting the combination from happening. This is possibly due to the fact that, according to Brentari (1998), [contra] is the default positioning of a sign and will thus come before [ipsi] if [ipsi] is not specified at the onset – although Appendix 9 has more syllable onsets that specify [ipsi] than [coda]. If that is the case, then, it can be assumed that the feature [contra] is less sonorous than [ipsi]. As the eight distinct settings can occur on both sides of the signer, sonority depends on dominance – the dominant hand, and all parts concerned with the dominant hand, are more sonorous. Therefore, I construct the following hierarchy for body alignment:

(11) *Sonority hierarchy for alignment*

[N/A] < [contra] < [centre] < [ipsi]

The question of sonority in [ipsi] and [contra] varies slightly from the visual sonority of the higher ranking features.

However, if a sonority hierarchy is to be applied, there are some signs that move from [ipsi] to [contra] that challenge this assumption. The majority of these signs, such as PLAY (Figure 4.20) and SPIDER (Figure 2.33), occur within the neutral space. It is possible that syllable locations completely articulated in the neutral space are governed by a different phonological standard. For example: in SPIDER, the movement of the hand is possibly dependent on context – where the spider is moving – which gives the sign qualities of a classifier construction, making it unsuitable for this research. However, the scope of this thesis is primarily on contact locations at either the onset or the coda. The sign FRIDAY (Figure 4.38) starts at [ipsi] and moves to [contra], meaning that [ipsi] can move to [contra], even when not in the neutral space, as FRIDAY occurs at the chin.

Figure 4.38 FRIDAY (SLED 2006).

In signs that do not occur in the neutral space, [ipsi] changes to [contra] in the coda position if the major body region and setting match and, with the exception of WOMAN (fig. 2.33.), and FRIDAY (fig. 4.29.) occur at [head: 7] – the chin – as seen in WHITE (fig. 4.30.). In WHITE, the features specified are [head: 7], [ipsi] → [head: 7], [contra].

Now I discuss the relationship between [centre] and [ipsi]. While changes from the centre to [contra] are not attested in the data, there are instances where the centre in the onset occurs with [ipsi] in the coda. On observation of the signs that show this phenomenon, it is evident that they occur in the neutral space contacting the non-dominant hand.

Figure 4.39 WHITE (SLED 2006).

In the signs BOOK and DIFFERENT (Figure 4.40), the onset specifies both hands in centre of the neutral space. We can assume that, in hands where H1 is in contact in H2, the default positioning of both hands is the centre, unless otherwise stated. In both cases, this is a result of the H1 and H2 coming into contact with each other from either sides of the signer's body. Hence, it can be assumed that the centre here is not specified – rather, it is the default. This is based on Brentari's (1998) account of body alignment.

Figure 4.40 BOOK and DIFFERENT (SLED 2006).

The sign SAME, although articulated in the opposite direction from DIFFERENT, makes contact with the H2 in the coda position in the default aligning. As BOOK and DIFFERENT begin with contact with the H2, the alignment at the onset should be unspecified rather than [ipsi] or [coda].

If centre only co-occurs in the same syllable as [ipsi] in cases where H1 contacts H2 in the coda, and centre blocks certain matches with [contra], it can be proposed that there is a constraint governing alignment:

(9) Body Alignment Constraint

(a) [ipsi] in the onset can co-occur with the [contra] in the coda and vice versa

(b) centre cannot be specified with either unless it is the location at which H1 contacts with H2 in a two-handed sign.

From working with my informants, I found that there are two dialectal ways to articulate the monosyllabic signs SON and DAUGHTER. The first way to articulate SON and DAUGHTER is provided in Figure 4.41, where the onset is [ipsi] and moves to [contra].

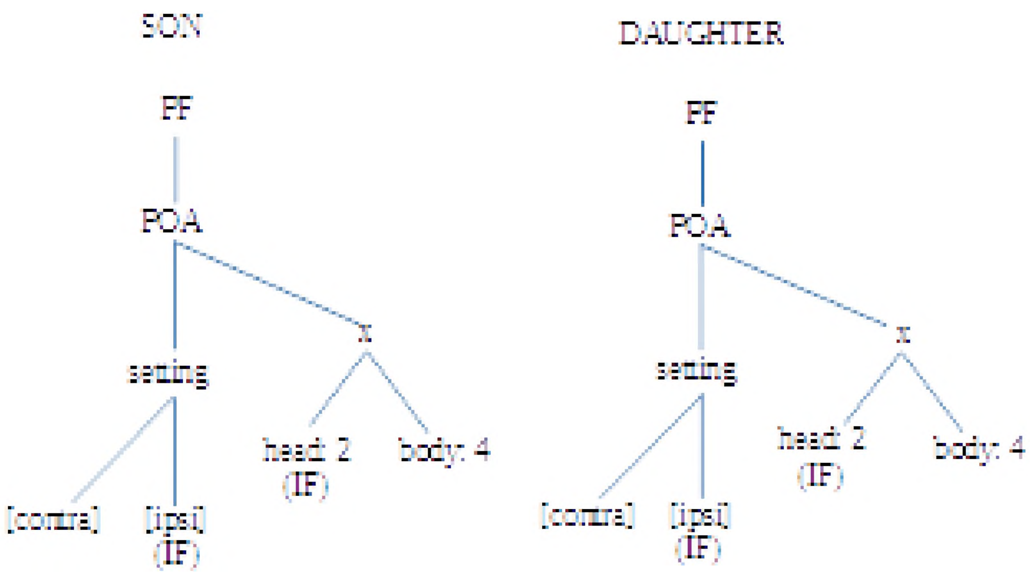

Figure 4.41 The PF branches of SON and DAUGHTER.

The second method – as seen in Figure 4.42 – is when the onset alignment is in the centre and the coda alignment is [contra]. This dialectal variety violates the Body Alignment Constraint in (9). However, discussion with Informant A revealed that this constraint is not true for all dialects of SASL. In her signing of SON (Figure 2.23) and DAUGHTER (Figure 2.24), Informant A signs the onset of both in the centre, specifying [contra] at the coda. This proves that there is a gap in the data that requires further study to determine the scope of this constraint.

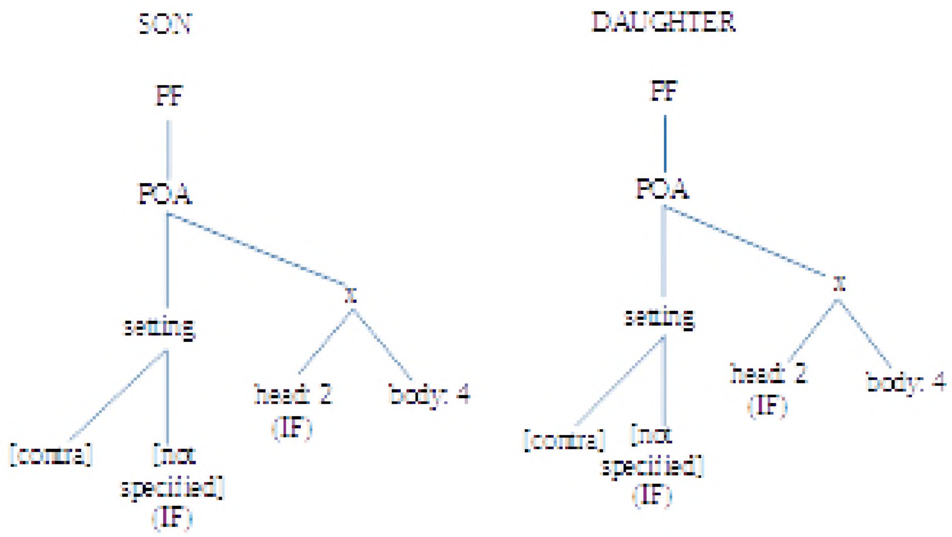

Figure 4.42 The PF branches of the alternative articulation of SON and DAUGHTER.

Initially, BOY is specified for centre alignment (it should be noted that the signer in Figure 4.43 is over-emphasising the sign BOY, thus making it appear as if the sign is [ipsi]). The sign MINE (fig. 4.34.) is specified for [contra]. Because the former sign is specified for centre and the latter is specified for [contra], the alignment of one of the signs must change to suit the Body Alignment Constraint.

When both signs come together, the Body Alignment Constraint prohibits the alignment match of centre and [contra]. Therefore, one of the alignments must change. When phonological processes require spoken syllables to change, it is usually the coda that undergoes modification (Spencer 1996). As discussed in the Theoretical Overview, syllables in SASL must have a coda, while onsets are optional. Therefore, onsets in SASL could be considered weaker than the coda. This suggests that, should modifications be required for phonological processes, the onset would undergo changes. This means that the alignment [centre] must move to satisfy the constraint and, as [ipsi] is the more sonorous choice, it is [ipsi] that is selected. DAUGHTER shows a relation SON and the sign would thus undergo the same processes for the same reason.

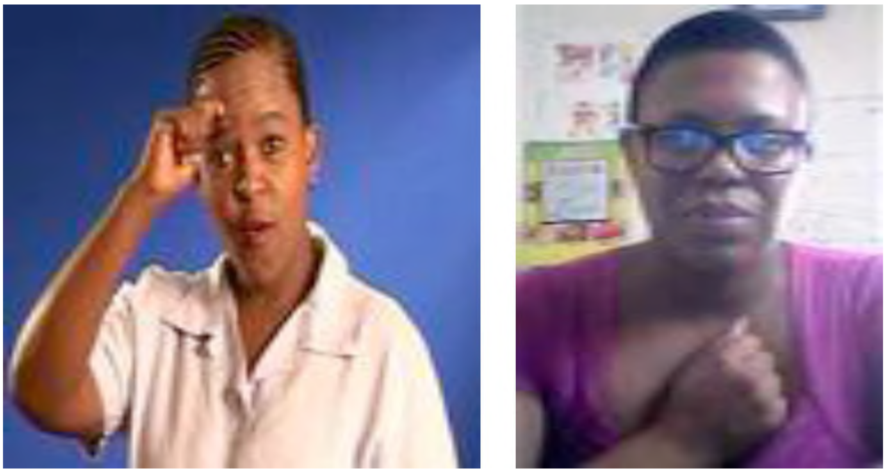

Figure 4.43 BOY (SLED 2006) and MINE.

This section demonstrates that the alignment at the onset and coda of a syllable follow patterns that are of interest to SASL phonology. However, the Body Alignment Constraint does not appear to apply for all varieties of SASL, as Informant A's versions of SON and DAUGHTER provide counter-examples to the constraint. Further research is needed to determine the scope of the constraint.

4.5. Repeated signs and cross-categorical constraints

As stated in 2.4., repeated signs are polysyllabic signs where the first syllable is repeated to create a complete sign. Repeated signs exist in SASL. Roughly 34% of signs found in the SLED (2006) involve some form of repetition. This section investigates the patterns seen in repeated signs and provides an account for them. Here, I show that repeated signs provide evidence that there is a cross-categorical constraint on handshape and location change.

In the repeated sign BUTTER (Figure 4.44), there is a change of setting within the non-dominant hand region. In MOTHER (Figure 4.45), the location at the onset is in the neutral space just above the coda location. Thus there can be location change between onset and coda in repeated signs, provided that they comply with the constraints listed earlier.

Figure 4.44 The sign BUTTER (SLED 2006). The location here undergoes the change

Figure 4.45 The sign MOTHER (SLED 2006). The location moves from the neutral space to contact with the non-dominant hand.

This change is not limited to coda location; handshape is capable of change too. However, as we can see in the first syllable of BIRD and the sign TAXI (Figure 4.46), the selected fingers comply with the Selected Finger Constraint – the selected fingers are the same. This is further proof supporting movement as the most sonorous feature in the sign syllable.

Figure 4.46 The first syllable for BIRD and TAXI (MINIBUS) (SLED 2006).

However, the question remains as to whether change in both handshape and location can occur between onset and coda in a repeated sign.

It can be initially thought that change in both handshape and location cannot happen, as the complexities of changes in both features would be too confusing in terms of articulation and perception. However, with the exception of some, the majority of repeated signs show change in both handshape and location between onset and coda. One such sign that shows this is MAN (Figure 4.47).

This is also seen in two-handed signs with repeated properties, such as PLAY (Figure 4.20) or MILK (Figure 4.48). Both location and handshape features exhibit changes between onset and coda, regardless of the type of path movement (as path movement is what this research focuses on). These changes, as with the individual changes, conform to the above-mentioned constraints, which means that coda constraints exist at more than the surface level.

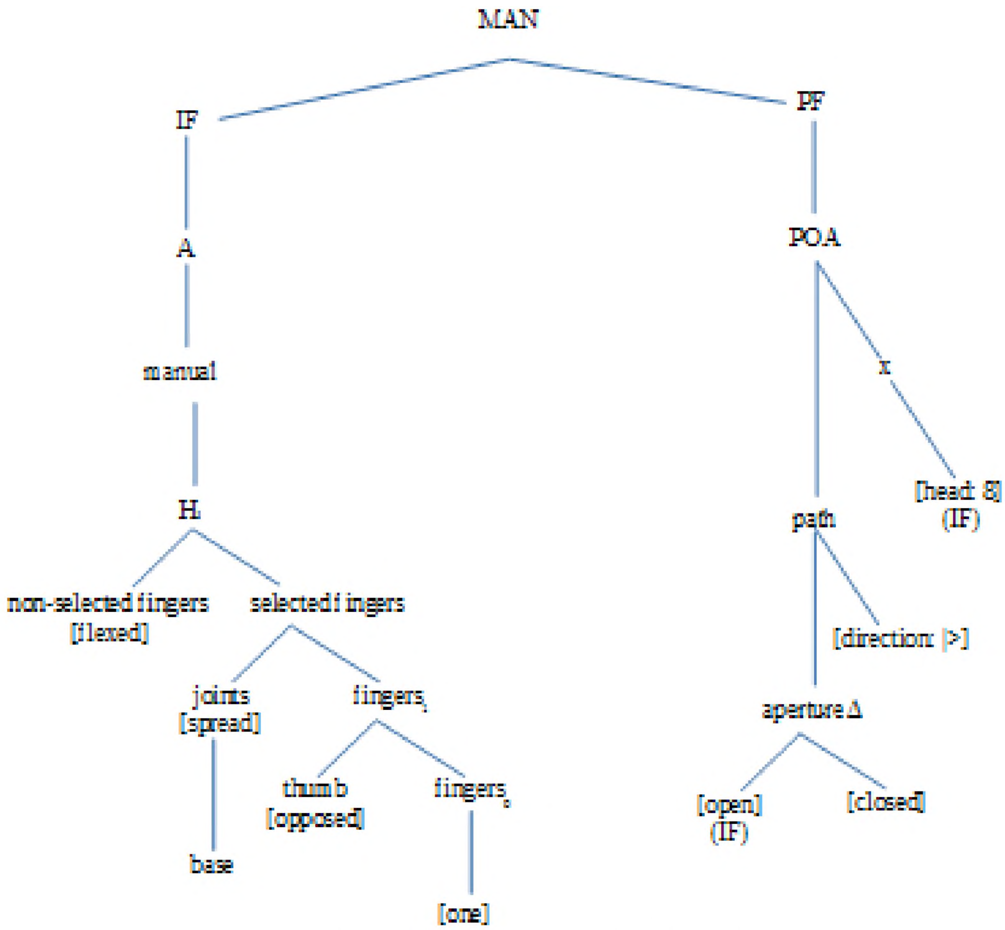

Figure 4.47 A feature tree for the sign MAN.

When considering handshapes, it is noticeable that, in repeated signs, all the handshapes that undergo changes involve change in secondary features. With the sign MAN in Figure 4.14 and Figure 4.47, the movement from [X], [thumb], [opposed] → [T] is a matter of whether the [X] is stacked on [thumb]. The selected fingers – [1] and [thumb] – do not change between onset and coda, nor do the secondary features. The position of the selected fingers do. In the sign MILK (Figure 4.48), the movement from [X], [thumb], [opposed] → [A] can be characterised by the modifications of [opposed]. In essence, the major class feature stays the same in both onset and coda of these signs.

Figure 4.48 MILK (SLED 2006).

Repeated signs that have location change also exhibit this preference for a change in secondary features. The sign MILK (Figure 4.48) has an alternating movement, remaining in the neutral space, moving between [top] and [bottom]. The sign PLAY, shown in Figure 4.20, moves between [contra] and [ipsi]. Thus, I propose the following constraint:

(10) Feature Change Constraint

A syllable can change both handshape and location features, provided that the changes specified are restricted to secondary features.

This constraint is not restricted to repeated signs. The sign NAME (Figure 4.49) – a monosyllabic word – contains changes in secondary features. Indeed, even PLEASE (Figure 4.6) as detailed earlier in the chapter, contains secondary feature changes (as the secondary feature [distal] does not occur in the neutral space). Additionally, the Feature Change Constraint (10) is a cross-categorical sign that applies to both handshape and location features.

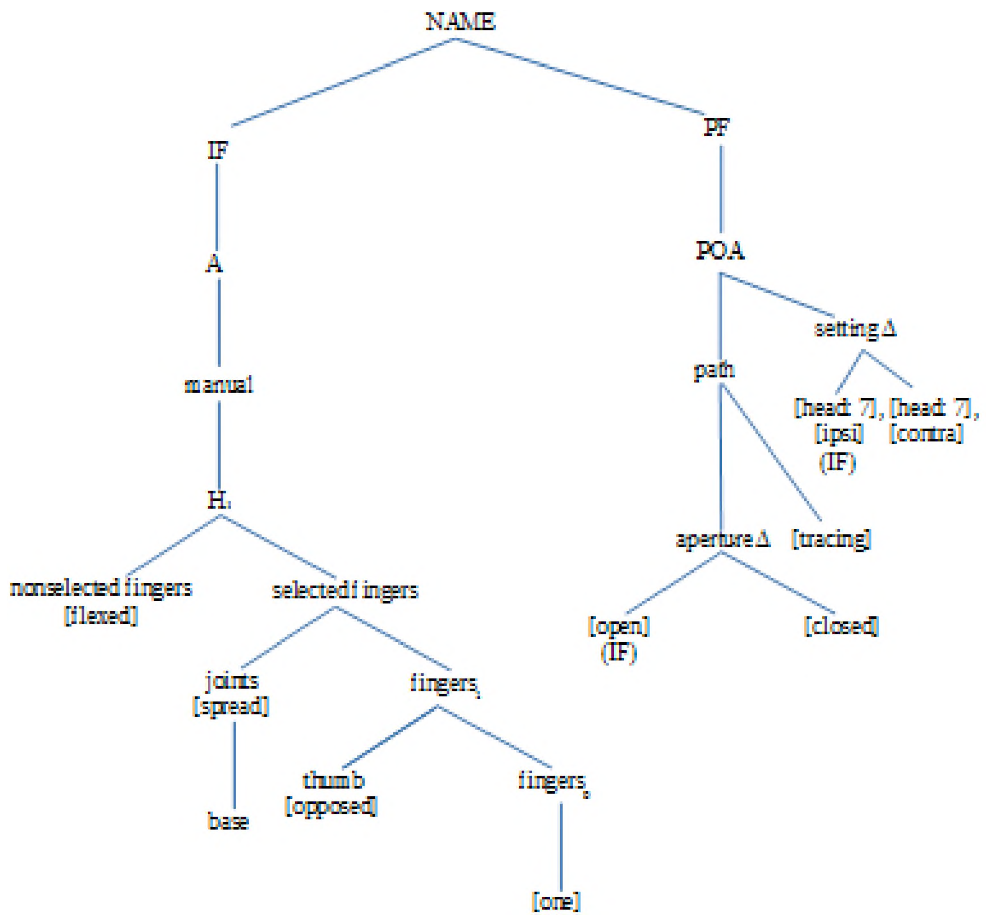

Figure 4.49 A feature tree for the sign NAME.

4.6. Conclusion and summary of constraints

Now that I've provided constraints to explain the patterns seen in the SLED (2006) SASL dictionary data, I summarise them below:

(1) Obligatory Handshape Coda Principle

There must always be a handshape specified at the coda position in a syllable.

(2) Obligatory Coda Requirement

If a syllable contains path movement, it cannot be codaless..

(3) Revised Handshape Change Constraint

If there is an instance of handshape during a syllable's articulation, the coda will have [A], [S] or [B] as its major feature change.

(4) [5], [spread] Agreement Constraint

If the major class feature changes to [B] in the coda position, the secondary feature [spread] will be specified, resulting in [5], [spread].

(5) [curved] Agreement Constraint

If the onset has the feature [curved], this feature must also appear in the coda.

(6) Coda Location Constraint

The place of articulation may change during the production of a syllable, provided that the onset is [head: 2].

(7) [head] Setting Constraint

The eye cannot be specified at the coda location.

(8) Setting Centralisation Constraint

If there is setting change between onset and coda locations, the setting specified at the coda will be closer to the centre of the signer.

(9) Body Alignment Constraint

(a) [ipsi] in the onset can co-occur with the [contra] in the coda and vice versa

(b) centre cannot be specified with either unless it is the location at which H1 contacts with H2 in a two-handed sign.

(10) Feature Change Constraint

A syllable can change both handshape and location features, provided that the changes specified are restricted to secondary features.

As shown above, there are indeed constraints on sign language codas, some of which are exceptionless. The results above both support and challenge rules set out by previous theorists of other sign languages. For instance, we've identified that handshapes of the dominant hand can change in sign languages, provided that the change conforms to both the Dominance Condition (Sandler & Lillo-Martin 2006: 184, as mentioned in 276.4) and the Selected Finger Constraint.

Secondly, SASL challenges the widely-accepted region constraint: major body region can change within a syllable. While the reason behind this occurrence has not been completely determined, it is possible that this is an effect of the wide surface area of the body. A more likely explanation for this direction of POA is the tendency of the location to move closer to the centre of the signer's body.

It has also been discovered that secondary features have constraints of their own. The handshape secondary feature [curved] in the onset blocks all other features that do not include [curved] in the coda. Within body regions, onset and coda will either remain at the same setting, or the coda's setting will be closer to the centre of the signer's body than that of the onset. Additionally, there are constraints on the body alignment combination at onset and coda positions. These prohibit [ipsi] or [contra] from combining with what is assumed to be central alignment, unless it is the locus of contact between hands in a two-handed sign.

The current chapter proves the existence of constraints on syllable codas in SASL. In fact, many of the coda restrictions here mirror instances of neutralisation attested in spoken language – such as debuccalisation.

What is left to consider, then, is the implications of this study and the potential it has to add to the body of knowledge about sign language phonology. This will be discussed in the following chapter of the thesis.

5 Conclusion

5.1. Introduction

This chapter provides a summary of the constraints and generalisations found in both SASL syllable codas and SASL phonology as a whole, as found in the data. In addition, this chapter discusses the implications and applications of this research. Here, I discuss the theoretical implications and practical applications that this thesis may have.

5.2. Review of the research

In this section, I use what has been found in the previous chapter to answer the research questions that guided this study. Previously listed in 2.8., I review my research questions and hypotheses here:

Overarching question 1: Are there coda constraints in SASL?
Overarching question 2: If there are coda constraints in SASL, what are they?
Subordinate questions:

1. What location features occur at syllable codas?
2. What handshape features occur at syllable codas?
3. Are there limitations on what kind of onset-coda combinations can exist for handshape and location features?

My hypotheses, derived from the research questions, were the following:

- I hypothesised that there would be constraints on the syllable coda in SASL. These constraints would largely conform to the phonological constraints on sign language syllables that already exist in the literature (2.3.).

- Where handshape change occurs during the course of a syllable, the coda handshape would be limited to one of the unmarked handshapes (2.6.4.). This was proven to be true through observation and analysis of handshape change between onset and coda.

Before describing the constraints found in SASL and their influence on SASL phonology, I restate the generalisations found overall in SASL phonology:

(1) Obligatory Handshape Coda Principle
There must always be a handshape specified at the coda position in a syllable.

As a result of constraint (1), we derive constraint (2):

(2) Obligatory Coda Requirement
If a syllable contains path movement, it cannot be codaless.

In 2.4., I discuss the problem of ambisyllabicity in terms of defining distinct syllable boundaries. I emphasise that, in the case of syllables, movement must carry phonological meaning for it to be considered the peak of a syllable. According to Geraci (2009), the transitional movement from the end of a syllable to the beginning of its repeat does not count as a timing unit. As a result, ambisyllabicity has no effect on (2). Because sign languages can carry more simultaneous features than spoken languages, there are multiple features found at the onset and coda of a sign syllable, namely the location and handshape features. For a syllable to be onsetless or codaless, the handshape and location features must not be specified. While this is possible for the onset of a SASL syllable, a handshape feature must always be specified at the coda position. This is mirrored in (2) – a syllable in SASL must have a coda and, as a result, must have a feature specified at the coda.

Another discovery found from the data is the pattern of simultaneous feature change in signs. Location and handshape features can change at the same time, but this simultaneous change can only happen in secondary features, leading to the following constraint and confirmation of the simultaneous nature of sign languages:

(10) Feature Change Constraint

A syllable can change both handshape and location features, provided the changes specified are restricted to secondary features.

The following sections repeat the constraints in Chapter 4.

5.2.1. Handshape patterns

The following section reviews the patterns found in the primary and secondary handshape features, summarising the constraints attributed to these patterns.

5.2.1.1. Primary features – handshape

The handshape specified at the coda shows a strong tendency to be the same as the handshape specified at the onset. There are signs, however, where the onset handshape differs from the coda handshape.

Handshape change from onset to coda follows a distinct pattern in the data. In syllables that display handshape change, the handshapes allowed at the coda were the natural classes [A], [S] and [B] – a subset of the handshapes that the H2 is restricted to by the Dominance Condition (Battison 1978 [1973]). Whether the [A], [S] or [B] classes are chosen is dependent on the selected fingers and their secondary features. This is because of Mandel's (1981) constraint on selected fingers remaining the same throughout the articulation of the sign, leading to the constraint listed in (3). This constraint was found to be exception-less through consultation with my informants:

(3) Revised Handshape Change Constraint

If there is an instance of handshape during a syllable's articulation, the coda will have [A], [S] or [B] as its major feature change.

5.2.1.2. Secondary features – handshape

There were also constraints that determined the change of secondary handshape features between onset and coda. The secondary features within handshapes followed the same tendency to be the same at both onset and coda. There is a constraint that prohibits the onset-coda combination of certain secondary features and this has been proven to be true from both the dictionary and the signs

(5) [curved] Agreement Constraint

If the onset has the feature [curved], this feature must also appear in the coda.

.

The secondary feature [curved] has strict prohibitions in the SASL syllable. That is, if there is any variation of [curved] at the onset, a variation of [curved] must be at the coda. This implies that there is a constraint prohibiting the secondary feature [curved] from being in the same syllable with anything other than [curved] or [curved], [spread]. On a broader scale, this entails that not all secondary features can necessarily change.

5.2.2. Location patterns

The following section reviews the patterns found in the primary and secondary handshape features, summarising the constraints attributed to these patterns.

5.2.2.1. Primary features – location

As with handshape, region features show a tendency to remain the same between onset and coda. SASL has shown that the region of articulation can change within a syllable. However, the data indicates that the region change is permitted if [head: 2] is specified at the onset. When this happens, the coda specified is either [body] or [arm].

(6) Coda Location Constraint

The place of articulation may change during the production of a syllable, provided that the onset is [head: 2].

There are two possible reasons for this. The first relates to markedness: as with Humbert's (1995) research on debuccalisation, it is possible that [head: 2] triggers movement to a less marked region, making [body] and [arm] the unmarked regions. This may also be an adaptation to centralisation, as the head is not the most central part of the body. This introduces another way of considering sonority in passive articulators.

5.2.2.2. Secondary features – location

There are a number of constraints that govern the secondary location features, as this is where the majority of feature change occurs. The first of these is the constraint listed in (7). The most likely cause of this constraint is articulatory – when signed in connected speech, specifying the eye as the coda could result in the signer hurting themselves.

(7) [head] Setting Constraint

If a sign occurs at the [head], the eye cannot be specified at the coda location.

A constraint that governs the majority of setting change in all regions is the Setting Sonority Constraint, listed in (7):

(8) Setting Centralisation Constraint

If there is a setting change between onset and coda locations, the setting specified at the coda will be closer to the centre of the signer.

Setting change within regions also displays a tendency for centralisation, as settings that are further away from the centre of a region at the onset of a syllable specify a setting closer to the centre. This is the same as with region change. However, Informant A gave the counter-example FACEBOOK-PROFILE (Figure 4.34) that confirms that this constraint is not absolute, but covers a significant amount of SASL syllables.

In terms of alignment, it was found that [contra] and [ipsi] can co-occur at both the onset and the coda. Additionally, if the middle of the signer is a feature of the onset, it is a feature of the coda as well, much like [curved]. The only instance where [ipsi] would be in the coda position of such a syllable is if the syllable occurs in neutral space, leading to the constraint in (8).

(9) Body Alignment Constraint

- (a) [ipsi] in the onset can co-occur with the [contra] in the coda and vice versa
- (b) centre cannot be specified with either unless it is the location at which H1 contacts with H2 in a two-handed sign.

However, Informant A provided counter-examples with SON and DAUGHTER, showing that this constraint is not an absolute, but still governs a significant part of the lexicon.

As the focus of this thesis was on phonological analysis there is no direct practical impact this thesis may have. However, formal descriptive work on sign languages can have a variety of practical benefits, as I explain below.

As stated in the Introduction (1.2.2.), SASL is an under-represented language. Not only is it not one of the official South African languages, but there is not enough research conducted on SASL, nor do the Deaf have as wide access to information as do the hearing community. Theoretical works such as those from Stokoe (1960), Battison (1978) and Brentari (1990) have legitimised sign languages as natural languages in their own right. This understanding started when Stokoe (1960) conducted research that proves that sign languages have phonological structures that are linguistically organised like spoken languages. It is from Stokoe (1960) that other sign language phonologists have been proving the legitimacy of sign language phonology. Therefore, there is a possibility that this research could be used in further legitimising the importance of SASL, providing additional support for SASL becoming one of South Africa's official languages. This is important considering the minority status of the SASL Deaf community in terms of empowerment and exposure.

Another possible outcome of this research is added understanding of the SASL syllable, which can greatly benefit the way SASL is taught and learned by the Deaf, as the majority of teachers of the Deaf are hearing. This is important in that learning syllabification can aid in fluency as well as provide teachers with a new way to approach signing fluency in their students.

Additionally, this research stands to encourage cross-linguistic research in other African sign languages. This is important as this gives lesser known sign languages further legitimacy and more exposure. This interest in sign language requires working with the Deaf community – an act which promotes Deaf pride and validates sign languages with both researchers and those who use them. Through cross-linguistic research, researchers of African sign languages are able to build linguistic communities and strengthen the presence of African sign languages both theoretically and socially.

Though theoretical in nature, this research also has the potential to lead to better understanding of SASL and many other African sign languages. Through this exposure, the manner in which SASL is seen and treated could possibly improve. Nevertheless, this research will have theoretical implications on how the sign language syllable is considered.

5.3. Theoretical implications

This research can add some interesting insights to our understanding of SASL phonology as well as phonological theory in general. Firstly, the phonology of SASL has not yet been well-researched and it is research such as this that promotes more research into SASL phonology, creating more knowledge in sign language linguistics as a whole.

This research also has led to proposed modifications to the Prosodic Model. In this model, Brentari (1998) distinguishes between Prosodic and Inherent Features based on their ability to change during articulation. Originally, region – or place of articulation (POA) – was considered an inherent feature while settings were prosodic features. However, this classification of features needed to be modified to accommodate SASL. The examples of region change not only generate constraint (5), but they also challenge what is assumed to be dynamic and what is assumed to be inherent. This thesis presents a challenge to the role of setting and region within the sign syllable. Once again, this provides possibility for cross-linguistic research to determine whether this modification to Brentari's (1998) feature tree can be applied to other sign language syllables, or if it is unique to SASL.

In the original Prosodic Model (Brentari 1998), the POA branch is dominated by the IF branch, as previous research showed that only settings change within the syllable. However, as shown in SASL, [head: 2] triggers change to another place of articulation, to either the torso or the arm and moving closer to the centre of the signer. This means that body region in SASL is not an inherent and unchanging feature, but is instead a prosodic, dynamic feature within the syllable. It is then important to move POA to the PF branch.

For instance, the syllable structure in SASL challenges the concept of CV as being the core syllable for all languages (Spencer 1996, Mester 1994). SASL prefers a VC syllable structure, which means that the concept of a core syllable requires revisiting and more research, especially in sign languages.

This research presents the opportunity for cross-linguistic research between well-researched sign languages (such as ASL or NGT) and lesser-researched sign languages in terms of core syllable structure, as well as the constraints on these syllables. Such research has the potential to establish what phonological properties exist across the world's sign languages, and what ones distinguish one sign language for another. It also has the potential to identify linguistic universals that exist across the signed and spoken modalities, such as debuccalisation and onset-coda agreement.

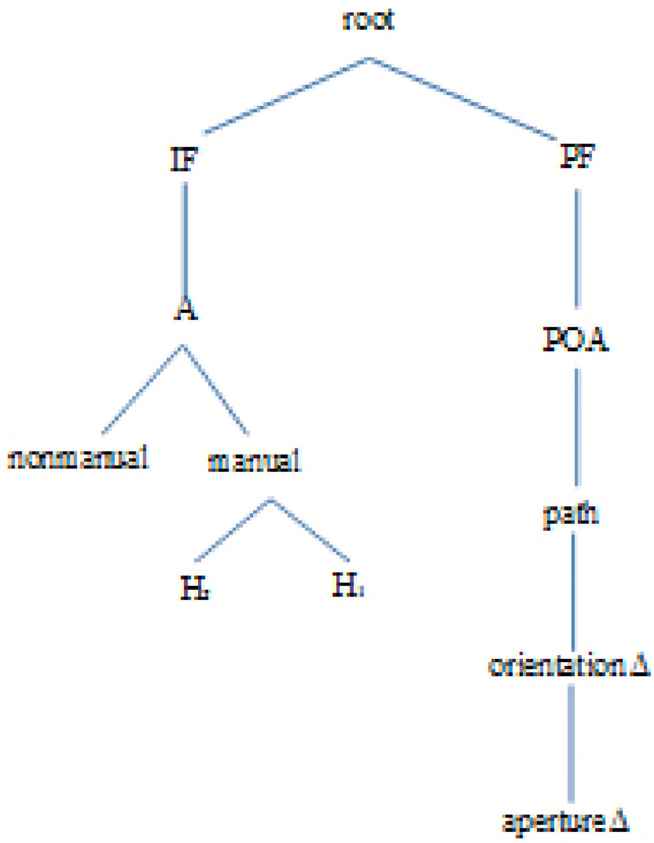

Figure 5.1 The proposed modification to Brentari's (1998) feature tree.

5.4. Conclusion

Using data collection and analysis methods from previous studies on sign languages, as well as the help of informants from the SASL Deaf community, I have discovered a set of constraints that dictate under what circumstances the features specified at a syllable coda can vary from those at the onset. This methodology made use of visual mediums – a dictionary and informants – to determine patterns in a language with a visual modality. Another advantage to this methodology is that I used the dictionary to formulate constraints, but had the help of informants who provided counter-examples that did not exist in the dictionary, allowing me to determine which constraints were generalised across SASL, which ones pertained to specific circumstances and which constraints possessed exceptions.

The structure of the SASL syllable opens research into assumptions on the concepts that were considered universal and unchanging in the literature, such as an unchanging region, markedness in handshape and location change and the notion of sonority. The possibility for additional research is made all the better by the existence of this research, as this provides a starting point for investigating the SASL syllable.

Reference List

Battison, R. 1978. *Lexical borrowing in American sign language.* Maryland: Linstok Press.

Bauman, H-D. L. 2004. "Audism: Exploring the Metaphysics of Oppression". *Journal of Deaf Studies and Deaf Education, 9*(2).

Benner, U. E. 2012. *Phonological Processing of German Sign Language.* Stuttgart: Institut für Maschinelle Sprachverarbeitung der Universität Stuttgart. PhD thesis.

Berkley, D. M. 1994. "The OCP and Gradient Data". *Studies in the Linguistic Sciences, 24*(1-2), 59-72.

Brentari, D. 1990. Licensing in ASL handshape change. *Sign language research: Theoretical issues*, 57-68.

Brentari, D. 1996. "Sign Language Phonology: ASL". In J. A. Goldsmith, ed. *The Handbook of Phonological Theory*. Massachusetts: Blackwell Publishing.

Brentari, D. 1998. *A Prosodic Model of Sign Language Phonology*. Massachusetts: MIT Press.

Brentari, D. 2007. Sign language phonology: "Issues of iconicity and universality". In E. Pizzuto, P. Pietrandrea & R. Simone, eds. *Verbal and Sign Languages, Comparing Structures, Constructs and Methodologies*, 59-80. Berlin: De Gruyter Mouton.

Brentari, D. 2011. "Handshape in Sign Language Phonology." In M. van Oostendorp, C. J. Ewen, E. Hume and K. Rice, *The Blackwell Companion to Phonology.* New Jersey: Blackwell Publishing.

Brentari, D. 2012. "Phonology." In R. Pfau, M. Steinbach & B. Woll, eds. *Sign Language: An International Handbook,* 21-54. Berlin: De Gruyter Mouton.

Brentari, D. & Goldsmith, J. 1993. Secondary licensing and the nondominant hand in ASL phonology. *Coulter (1993)*, *19*(41).

Brentari, D. & Crossley, L. 2002. "Prosody on the hands and face: Evidence from American Sign Language". *Sign Language & Linguistics, 5*(2), 105-130.

Brentari, D. & Eccarius, P. 2010. "Handshape contrasts in sign language phonology". In D. Brentari, ed. *Sign Languages*, 284-311. Cambridge: Cambridge University Press.

Brentari, D., Coppola, M., Jung, A. & Goldin-Meadow, S. 2013. "Acquiring word class distinctions in American Sign Language: Evidence from handshape". *Language Learning and Development, 9*(2), 130-150.

Broselow, E., Chen, S., & Wang, C. 1998. "The emergence of the unmarked in second language phonology". *Studies in Second Language Acquisition, 20*(2), 261-280.

Cairns, C. E. 1986. "Word Structure, Markedness, and Applied Linguistics". In F. R. Eckman, E. A. Moravcsik, & J. R. Wirth, eds. *Markedness,*13-38. New York: Plenum Press.

Cairns, C. E. & Feinstein, M. H. 1982. "Markedness and the Theory of Syllable Structure". *Linguistic Inquiry, 13*(2), 193.225.

Carlisle, R. S. 2001. "Syllable Structure Universals and Second Language Acquisition". *International Journal of English Studies, 1*(1), 1- 19.

Channon, R. & van der Hulst, H. 2011. "Introduction". In R. Channon and H. van der Hulst (eds), *Formational Units in Sign Language,* 1-18. Berlin: De Gruyter Mouton.

Clark, J. E. & Yallop, J. F. 1995. *An Introduction to Phonetics and Phonology*. http://tocs.ulb.tu-darmstadt.de/178080047.pdf. 3 March 2016.

Corina, D. P. (1996). ASL syllables and prosodic constraints. *Lingua*, *98*(1), 73-102.

Corina, D. & Sandler, W. 1993. “On the Nature of Phonological Structure in Sign Language”. *Phonology*, *10*(2), 165-207.

Crasborn, O. 2011. “The Other Hand in Sign Language Phonology”. In M. van Oostendorp, C.J. Ewen, E. Hume & Rice, K., eds. *The Blackwell Companion to Phonology*, 223-240. New Jersey: Blackwell Publishing.

Crasborn, O. 2012. “Phonology”. In R. Pfau, M. Steinbach & B. Woll, eds. *Sign Language: An International Handbook.* Berlin: De Gruyer Mouton.

Davenport, M. & Hannahs, S. J. 2013. *Introducing Phonetics and Phonology*. New York: Routledge.

de Lacy, P. 2007. "Themes in Phonology". In P. de Lacy, ed. *The Cambridge Handbook of Phonology*, 5-30.

Emmorey, K. 2002. *Language, Cognition and the Brain: Insights from Sign Language Research.* New Jersey: Lawrence Erlbaum Associates, Publishers.

Ewen, C. J. [1995] 1996. “Dependency Relations in Phonology”. In J. A. Goldsmith, ed. *The Handbook of Phonological Theory*. Massachusetts: Blackwell Publishing.

Féry, C. & van de Vijver, R. 2003. “Overview”. In C. Féry & R. van de Vijver, eds. *The Syllable in Optimality Theory,* 3-22. Cambridge: Cambridge University Press.

Firth, J. R. 1957. Applications of general linguistics. *Transactions of the Philological Society*, *56*(1), 1-14.

Fischer, S. 2015. "Sign languages in their historical context". In C. Bowern & B. Evans, eds. *Routledge handbook of historical linguistics,* 442-465. Oxford: Routledge.

Friedman, L. 1976. *Phonology of a Soundless Language: Phonological Structure of the American Sign Language*. PhD dissertation. University of Columbia Berkeley.

Fudge, E.C. 1999 [1969]. "Syllables". In J. A. Goldsmith, ed. *Phonological Theory: The Essential Readings,* 370-391. Massachusetts: Blackwell Publishing.

Ganiso, M. & Kaschula, R. 2013. *Sign Language: A South African Perspective.* Germany: Lambert Academic Publishing.

Geraci, C. 2009. "Epenthesis in Italian Sign Language". *Sign Language and Linguistics, 12* (1), 3-51.

Goldsmith, A. 1999. "Introduction". In J. A. Goldsmith, ed. *Phonological Theory: The Essential Readings (1999)*, 1-16. Massachusetts: Blackwell Publishing.

Gordon, M. 2004. "Syllable weight". In B. Hayes, R. Kirchner, & D. Steriade, eds. *Phonetically Based Phonology.* Cambridge: Cambridge University Press.

Goswami U. & Sterne, A. 2000. "Phonological Awareness of Syllables, Rhymes and Phonemes in Deaf Children". *The Journal of Child Psychology and Psychiatry and Allied Disciplines, 41*(5), 609-625.

Hall, T. A. 2007. "Segmental features". In P. de Lacy, ed. *The Cambridge Handbook of Phonology,* 311-334.

Harris, J. 2007. "Representation". In P. de Lacy, ed. *The Cambridge Handbook of Phonology*, 119-138. Cambridge: Cambridge University Press.

Hayes, B. & Steriade, D. 2004. “Introduction: the phonetic bases of phonological markedness”. In B. Hayes, R. Kirchner, & D. Steriade, eds. *Phonetically Based Phonology.* Cambridge: Cambridge University Press.

Humbert, H. 1995. *Phonological Segments: Their Structure and Behaviour.* PhD. Thesis. University of Amsterdam.

Itô, J. & Mester, A. 1994. “Reflections on CodaCond and Alignment”. *Phonology at Santa Cruz, 3*, 27-46.

Jakobson, R. 1968. *Child language, aphasia and phonological universals*. The Hague: Mouton Publishers.

Johnson, R. E. & Liddell, S. K. 2010. “Toward a Phonetic Representation of Signs: Sequentiality and Contrast”. *Sign Language Studies, 11*(2), 241-274.

Kimmelman, V. 2011. “Word order in Russian Sign Language: An extended report”. *Linguistics in Amsterdam,* 1-56.

Knapp, H. & Cheek, A. 2009. “Phonological structure in signed language”. In R. P. Meier, K. Cormier, D. Quinto-Pozos, eds. *Modality and Structure in Signed and Spoken Languages,* 27-35. Cambridge: Cambridge University Press.

Kyle, J. G., & Woll, B. 1988. *Sign language: The study of deaf people and their language*. Cambridge: Cambridge University Press.

Lanham, L. W. 1958. The tonemes of Xhosa. *African Studies*, *17*(2), 65-81.

Liddell, S. K. & Johnson, R. E. 1989. “American Sign Language: The Phonological Base.” *Sign Language Studies, 64*, 195-277.

Lombardi, L. 1999. “Positional faithfulness and voicing assimilation in Optimality Theory”. *Natural Language and Linguistic Theory, 17*, 267-302.

Luttgens, K., & Hamilton, N. 1997. “Kinesiology”. *Scientific basis of human motion. Brown & Benchmark, USA*.

Mackridge, P. 1985. *The Modern Greek language: A descriptive analysis of standard Modern Greek*. Oxford: Oxford University Press.

Major, R. C. & Faudree, M. C. 1996. Markedness universals and the acquisition of voicing contrasts by Korean speakers of English. *Studies in Second Language Acquisition*, *18*(01), 69-90.

Mak, J. & Tang, G. 2011. “Movement types, Repetition and Feature Organization in Hong Kong Sign Language”. In R. Channon & H. van der Hulst., eds. *Formational Units in Sign Languages*, 315-338. De Gruyer Mouton.

Mandel, M. 1981. *Phonotactics and Morphophonology in American Sign Language*. PhD Dissertation. Berkeley: University of California.

McCarthy, J. J. 1986. “OCP Effects: Gemination and Antigemination”. *Linguistic Inquiry, 17*(2), 207-263.

McCarthy, J.J. & Prince A. S. 1999 [1986]. “Prosodic Morphology”. In J. A. Goldsmith, ed. *Phonological Theory: The Essential Readings*, 238-288. Massachusetts: Blackwell Publishing.

McGregor, W. B. 2009. *Linguistics: An Introduction.* London: Continuum International Publishing Group.

Meir, I. 2012. “Word classes and word formation”. In R. Pfau, M. Steinback, M. & B. Woll, eds. *Sign Language: An International Handbook*, 77-111. Berlin: De Gruyter Mouton.

Mester, R. A. 1994. "The quantitative trochee in Latin", *NLLT, 12*, 1-61.

Morgan, H. E. & Mayberry, R. I. 2012. "Complexity in two-handed signs in Kenyan Sign Language". *Sign Language & Linguistics, 15* (1), 147-174.

Napoli, D. J. & Sutton-Spence, R. 2010. "Limitations on Simultaneity in Sign Language". *Language, 86*(3), 647-662.

Nespor, M. & Sandler, W. 1999. "Prosody in Israeli Sign Language". *Language and Speech, 42* (2-3), 143-176.

Ormel, E., Crasborn, O. & van der Kooij (2013). "Coarticulation of hand height in Sign Language of the Netherlands is affected by contact type". *Journal of Phonetics, 41*, 156-171.

Pater, J. & Werle, A. 2003. "Direction of assimilation in child consonant harmony". *The Canadian Journal of Linguistics, 48* (3-4), 385-408.

Penn, Claire ed. 1992-1994. *Dictionary of Southern African Signs for Communicating with the Deaf. 1-5.* Pretoria, South Africa: Human Sciences Research Council.

Perlmutter, D. M. 1992. "Sonority and syllable structure in American Sign Language". *Linguistic Inquiry, 23* (3), 407-442.

Pike, K. L. & Pike, E. V. 1999 [1947]. "Immediate constituents of Mazateco syllables". In J. A. Goldsmith, ed. *Phonological Theory: The Essential Readings*, 238-288. Massachusetts: Blackwell Publishing.

Prince, A. & Smolensky, P. 2004. *Optimality Theory: Constraint Interaction in Generative Grammar*. Massachusetts: Wiley-Blackwell Publishing.

Randolph, M. A. 1990. “Syllable-based Constraints on Properties of English Sounds”. *RLE Technical Report no. 555*, Massachusetts Institute of Technology.

Rice, K. 2007. “Markedness in phonology”. In P. de Lacy, ed, *The Cambridge Handbook of Phonology,* 79-98. Cambridge: Cambridge University Press.

Samek-Lodovici, V. 1992. "A unified analysis of crosslinguistic morphological gemination". *Proceedings of CONSOLE-1 Utrecht.*

Sandler, W. 1986. The spreading hand autosegment of American Sign Language. *Sign Language Studies, 50*, 1-28

Sandler, W. 1987. Assimilation and feature hierarchy in American Sign Language. *Papers from the Chicago Linguistics Society; Parasession on Autosegmental Phonology, 23*(2), 266-278.

Sandler, W. 1989. *Phonological Representation of the Sign: Linearity and Nonlinearity in American Sign Language*. Dordrecht: Foris.

Sandler, W. 1993. “A sonority cycle in American Sign Language”. *Phonology, 10*, 243-279.

Sandler, W. 2008. “The syllable in sign language: considering the other natural language modality”. *The Syllable in Speech Production. New York: Lawrence Erlbaum Associates,* 379-408.

Sandler, W. 2011. “The Phonology of Movement in Sign Language”. In M. van Oostendorp, C. J. Ewen, E. Hume and K. Rice, eds), *The Blackwell Companion to Phonology.* New Jersey: Blackwell Publishing.

Sandler, W. & Lillo-Martin, D. 2006. *Sign Language and Linguistic Universals*. Cambridge: Cambridge University Press.

Schütz, A. J. 1995. *All About Hawaiian*. Honolulu: University of Hawai’i Press.

Selkirk, E. O. 1996. "The prosodic structure of function words". In J. L. Morgan & K. Demuth, eds. *Signal to Syntax: Bootstrapping From Speech To Grammar in Early Acquisition*, 187-214. New Jersey: Lawrence Erlbaum Associates.

Selkirk, E. O. 1999 [1982]. "The Syllable". In J. A. Goldsmith, ed. *Phonological Theory: The Essential Readings (1999)*, 238-288. Massachusetts: Blackwell Publishing.

Silva, D. J. 2006. "Acoustic evidence for the emergence of tonal contrast in contemporary Korean". *Phonology, 23* (2), 287-308.

Spencer, A. 1996. *Phonology: Theory and Description*. Cambridge: Blackwell Publishing.

Sommerstein, A. H. 1974/1999. "On phonotactically motivated rules", in J. A. Goldsmith, ed. *Phonological Theory: The Essential Readings*. 84-90. Massachusetts: Blackwell Publishing.

Stokoe, W. C. 1960. "Sign Language structure: An outline of the visual communication systems of the American Deaf". *Studies in Linguistics: Occasional Papers*. Buffalo: University of Buffalo Press.

Stokoe, W. C., Casterline, D. & Croneberg, C. 1965. *A dictionary of American Sign Language on linguistic principles*.

Supalla, T. 1986. "The classifier system in American Sign Language". In C. G. Craig, ed. *Noun Classes and Categorization*. Amsterdam: John Benjamins, 181-214.

Supalla, S. J. & McKee, C. 2009. "The role of Manually Coded English in language development of deaf children", in R. P. Meier, K. Cormier & D. Quinto-Pozos, eds. *Modality and Structure in Signed and Spoken Languages*, 143-166. Cambridge: Cambridge University Press.

Sutton-Spence, R. & Woll, B. 1999. *The Linguistics of British Sign Language: An Introduction.* Cambridge: Cambridge University Press.

Tumtavitikul, A., Niwatapant, C. & Dill, P. 2009. "Classifiers in Thai Sign Language". *SKASE Journal of Theoretical Linguistics,* 6(1), 27-44.

Uyechi, L. 1992. "Secondary signing location in American Sign Language". *Proceedings of the Eighteenth Annual Meeting of the Berkeley Linguistics Society: General Session and Parasession on The Place of Morphology in a Grammar*, 249-259.

Uyechi, L. N. 1994. *The Geometry of Visual Phonology.* California: Stanford University. PhD dissertation.

Van der Hulst, H. 1996. "On the other hand". *Lingua, 98*, 121-143.

Van der Hulst, H. & Mills, A. 1996. "Issues in sign linguistics: Phonetics, phonology and morpho-syntax". *Lingua, 98*, 3-17.

Van der Kooij, E. 2002. *Phonological Categories in Sign Language of the Netherlands: The Role of Phonetic Implementation and Iconicity.* Utrecht: LOT.

Vermeerbergen, M., van Herreweghe, M., Akach, P. & Matabane, E. 2007. "Constituent order in Flemish Sign Language (VGT) and South African Sign Language (SASL)". *Sign Language & Linguistics, 10*(1), 22-54.

Walter, Mary. A. 2007. *Repetition avoidance in human language*. Ph.D. dissertation, Department of Linguistics, Massachusetts Institute of Technology.

Watson, L. 1998. "Oralism – current policy and practice". In S. Gregory, P. Knight, W. McCracken, S. Powers, L. Watson, eds, *Issues in Deaf Education,* 69-76. New York: David Fulton Publishers.

Wetzels, W. L. & Mascaró, J. 2001. "The typology of voicing and devoicing". *Language, 77*(2), 207-244.

Whitworth, C. 2011. "Features and natural classes in ASL handshapes". *Sign Language Studies, 12* (1), 46-71.

Wilbur, R. 2011. "Sign syllables." In M. van Oostendorp, C. J. Ewen, E. Hume and K. Rice, eds. *The Blackwell Companion to Phonology,* 1399-1344. New Jersey: Blackwell Publishing.

Yip, M. 2007. "Tone". In P. de Lacy, ed. *The Cambridge Handbook of Phonology,* 161-194. Cambridge: Cambridge University Press.

Young, R. W. Morgan, W. & Midgette, S. (1992) *Analytical lexicon of Navajo*. New Mexico: University of New Mexico Press.

Zec, D. 1995. "Sonority constraints on syllable structure". *Phonology, 12*, 85-129.

Zec, D. 2007. "The syllable". In P. de Lacy, ed. *The Cambridge Handbook of Phonology,* 161-194. Cambridge: Cambridge University Press.

Zwitserlood, I. 2012. "Classifiers". In R. Pfau, M. Steinback, M. & B. Woll, eds. *Sign Language: An International Handbook,* 158/185. Berlin: De Gruyter Mouton.

Appendix 1: The handshape classes found at both syllable onsets and codas in the dominant hand

		CODA																				
		[1]	[1], [4]	[1], [thumb], [stacked]	[2]	[2], [thumb], [stacked]	[2], [3], [thumb]	[3], [thumb]	[3], [thumb], [stacked]	[4], [thumb], [stacked]	[B]	[A]	[C]	[F]	[K]	[L]	[S]	[T]	[U]	[thumb], [1], [stacked]	[W]	[Y]
O	[1]	18																1				
N	[1], [4]		1																			
S	[2]				1																	
E	[2], [3], [thumb]						1															
T	[3], [thumb], [stacked]											1										
	[A]											15										
	[B]	1				1			1	1	64	2		1			1					
	[C]												1									
	[F]													5								
	[G]			1																		
	[K]														1							
	[L]			1												3						
	[S]										1						10					
	[T]																	4				
	[thumb], [1]																			1		
	[thumb], [2], [stacked]										2											
	[U]																		12			
	[W]																				3	
	[Y]																					5
	[N/A]							1					1	1			1					

Appendix 2: The frequency of secondary features governing handshapes in the dictionary data

	C	O	D	A	
O		[curved]	[curved], [spread]	[spread]	[stacked]
N	[curved]	11	1		
S	[curved], [spread]	1	7		
E	[spread]		1	12	3
T	[stacked]			2	2

Appendix 3: The onset-coda relationship between major body regions in the dictionary data

		C	O	D	A	
		[arm]	[body]	[H2]	[head]	N/A
O	[arm]	4				
N	[body]		13			
S	[H2]			16		
E	[head]		1		23	1
T	[N/A]	3	4	6	8	

Appendix 4: The number of dictionary sign that occur in relation to the four body regions

[head]	[arm]	[body]	[H2]
46	5	56	37

Appendix 5: The onset-coda relationship between settings in the major region [head] in the dictionary data

		CODA								
		1	2	3	4	5	6	7	8	9
	1	1								
O	2		2							
N	3				1				1	
S	4				4					
E	5									
T	6						1			
	7							5		
	8								4	1
	9							1		1

Appendix 6: The onset-coda relationship between settings in [body] in the dictionary data

					C O D A					
		1	2	3	4	5	6	7	8	groin
	1									
O	2									
N	3							1		
S	4				1	2				
E	5					1				
T	6						2			
	7									
	8									
	groin								1	

Appendix 7: The onset-coda relationship between settings in [arm] in the dictionary data

		C	O	D	A				
		1	2	3	4	5	6	7	8
	1								
O	2								
N	3								
S	4								
E	5								
T	6								
	7		2					1	
	8								1

Appendix 8: The onset-coda relationship between settings in [H2] in the dictionary data

		CODA							
		1	2	3	4	5	6	7	8
	1	2							
O	2		1	2					
N	3			1					
S	4				2				
E	5					2	2		
T	6								
	7								
	8		1						

Appendix 9: The onset-coda relationship between [ipsi], [contra], what we assume to be the centre and unspecified locations in the dictionary data

O		C	O	D	A
N		[ipsi]	[contra]	Not specified	N/A
S	[ipsi]	60	8	1	1
E	[contra]	5	4	3	
T	Not specified	3		62	

Appendix 10: Initial interview plan

1. **Judgement questions**

- Show a picture of a cat. Ask them both to sign it. Ask why it needs to be repeated. Sign CAT without the repetition and ask them if it is ungrammatical.
    a) Ask the same of the sign BOY
    b) Ask the same of the sign GIRL
    c) Ask the same of the sign TOILET
- Please sign sentences that both begin and end in the words above.
- Try metathesise the sign BOY. Ask if it is possible to sign it in this way. Ask why they feel that that is the case, yet signs like BABY and DEAF can be reversed.
- Please sign SOUR. I get the feeling that the sign does not have to be in a set location with a set handshape until the end of the sign. Does the beginning handshape and location matter? Could you try sign it from different starting locations and starting handshapes to see if this is possible.

2. **The big question**

- Ask them to sign TABLE. Ask if the end location is important and why/why not. When does the sign technically finish?
    a) Is the same true for a sign such as HOT?
    b) Is this the same for FORK?
- Where is the desired onset location for the sign DANGEROUS?
- Please sign PEANUT BUTTER.
- Ask them to sign YEAR. Where is the hand before movement? Does it matter where the hand location is before you move it? Ask the informants to try signing it from different locations
    a) Is this the same as HOME?

- Ask them to sign AUSTRALIA and the PLAY. Ask them where the difference lies.
- With the sign for HOME, does it matter what the handshape is at the beginning of the syllable?
- Transitionalism: the sign for TROUSERS – what is the meaning of the sign from one leg to another? Does that carry meaning in articulation?

3. Normal elicitation questions

- Out of interest, possibly ask them where [body: 4], [body: 5], [body: 6], [body: 7] and [body: 8] are.
- Are there any signs that don't have a handshape at the end? Would it be possible to sign one?
- Is there any sign that
  a) begins in [1] and ends in [5]
  b) begins in [1] and ends in [B]
  c) begins in [1] and ends in [1]
  d) begins in [B] and ends in [1]
  e) begins in [1] and ends in [X]
  f) begins in [1] and ends in [U]
  g) begins in [1] and ends in [O]
  h) begins in [O] and ends in [1]
  i) begins in [K] and ends in another handshape
  j) begins in [5] and ends in [O]
  k) begins in [W] and ends in any other handshape
  l) what kind of signs begin with the handshape [5]?
  m) what kinds of signs end with the handshape [5]?
  n) what kind kinds of signs begin with [x]
  o) what kind of signs end in [X]?
  p) what handshapes feel unnatural to end with?

Appendix 11: Constraint confirmation interview

1. Ask if she knows any signs that start with the [B] or [5], and end with [5], [spread] (sign this).
2. Make a sign in neutral space that begins with [5] and goes to [S], such as the ISL sign TAKE (I think that's what it is). Ask: "Can you think of a sign that does this?" "Would it be possible for a natural SASL sign to do this?
3. Create a sign that starts at the shoulder and moves to the wrist. Ask her if this is possible.
4. Create a sign that starts at the waist and moves to the chest. Ask if there is such a sign. N/A unnatural
5. Create a sign that starts at the forehead and ends at the chin. Ask her if this is possible. Reverse the sign and ask again
6. **S**ign UNCLE. Ask her if it is correct as a sign. Now sign it starting at the middle of
7. Sign SCHOOL. Ask her if it is correct. Repeat the sign, but move from [centre] outwards. Ask if this would make sense.
8. Create a sign that starts [centre] then moves to [ipsi] in the neutral space. Ask if it is correct. Then sign again going using the torso. Ask if it is correct.
9. Sign SICK. Then reverse the onset and coda locations. Ask if this is possible.
10. Create a sign that starts at the forehead and moves to the arm. Ask her if this is possible.
11. Create a sign that starts at the shoulder and moves to the H2. Ask her if there is such a sign, or it is possible.
12. Explain the fact that there seems to always be a handshape at the end of a syllable. Compare the sign YEAR, where there isn't a set handshape at the beginning of the syllable.
13. Sign HOT. Ask about the coda in the second syllable. Ask if the handshape there is specific.
14. Ask her if she can think of any signs that do not have a handshape at the end.