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Syllable Contraction in Taiwan Sign Language

台灣手語音節連併

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Abstract

This thesis studies syllable contraction in Taiwan Sign Language (TSL) compounding. The first issue to discuss is whether syllable contraction in TSL follows the process of syllable contraction in spoken language. In this thesis, Hus's (2003) model used in Southern Min is followed. Southern Min is not related to TSL, but only because TSL represents a signed language, and Southern Min represents a spoken language. The second issue is to compare syllable contraction in Southern Min and in TSL. My findings are as follows.

First, data shows that different combinations of handshapes and orientations associated to the edges of the uncontracted compound result in different contracted outputs, and the place features and movements are also affected. In addition, after syllable contraction in TSL, movements in the more stressed syllable will be preserved and projected to the nucleus position, especially in the second component signs. The result is a grammatical syllable after compounding and contraction. Moreover, I propose that place features also have a sonority hierarchy, in which head and hand locations are more sonorous than locations on or in front of the body. Their sonority will also influence the four sign parameters and cause effects such as assimilation.

Second, there are many similarities of syllable contraction in Southern Min and in TSL, such as the process of syllable contraction in TSL is almost the same as which in Southern Min. The only difference is that movement Epenthesis is only applied in TSL syllable contraction.

Keywords: syllable contraction, prosody, movement, stress, compounding, Taiwan Sign Language, Southern Min

Notation Conventions

SIGN	Word in capital letters shows and English gloss representation for TSL signs.
^	Two roots are produced sequentially, i.e. sequential compound.
∪	Two roots are produced simultaneously, i.e. parallel compound.
→	Direction of the movement
	Close and open the fingers repeatedly.
	Move fingers sequentially as wiggling trilled movement.
	Make arc or circle movements.
	Turn the wrist repeatedly as trilled movement.
_A	Variations of the sign

Table of Contents

Chapter 1 Introduction 1
1.1 Introduction to Sign Language 1
1.2 Introduction to Taiwan Sign Language 2
1.3 The Goal and Issues of This Study 3
1.4 Data Collection 4
1.5 Outline of This Study 7
Chapter 2 Theoretical Background 9
2.1 Syllable Contraction in Southern Min 9
2.2 Sign Language Syllables – Hand Tier Model 12
2.3 Compounding in Sign Languages 17
2.4 Summary 23
Chapter 3 Analyzing Syllable Contraction in TSL Compounding 25
3.1 Prosody in TSL Compounding 25
3.1.1 Edge-in: Handshapes and Orientations 28
3.1.2 Nucleus Association: Movements 31
3.1.3 Movement Epenthesis 45
3.2 Place Features in TSL Compounding 57
3.2.1 Place Features in Serial Compounding 57
3.2.3 Syllable Contraction in Parallel Compounding 73
3.3 Summary 78
Chapter 4 Comparing Syllable Contraction in Southern Min and in TSL 80
4.1 What Causes Syllable Contraction in Southern Min and TSL? 80
4.2 Syllable Contraction in Southern Min and TSL Phonology 82
4.3 Summary 93
Chapter 5 Conclusions 95
5.1 Summary 95
5.2 Implications 97
References 98
Appendix A 102
Appendix B 116

List of Tables

3.1 TSL compound signs have the canonical LML templates.....33

3.2 TSL with Movement Epenthesis….....44

3.3 TSL with Movement Epenthesis in other cases……50

3.4 Facts for place features [trunk] in both component signs…….……69

3.5 Three parallel compound signs in TSL…….73

3.6 Facts for TSL compounding and syllable contraction…….....78

3.7 Combinations of place features…….....78

4.1 Possible combinations of the prosody in TSL compounding……87

4.2 Similarities between Southern Min and TSL syllable contraction……93

Chapter 1

Introduction

This chapter first introduces sign language followed by Taiwan Sign Language (TSL) to claim that sign languages are independent languages rather than gesture only. Then the methodology includes the materials and the processes of analysis will be introduced. The final part of this chapter points out the goal and what issues this thesis will discuss and the outline of this thesis.

1.1 Introduction to Sign Language

Many studies have shown that sign languages are not only gestural, but are natural languages. Sign languages use visual-manual modality while spoken languages use auditory-vocal modality. Studies also show that sign languages have many similarities with spoken languages. Sign languages have phonology and morphology. In sign language linguistics, Stokoe (1960) proposed three phonological features, hand configuration, location, and movement, which are combined simultaneously. These three features are the meaningless elements which are combined to form signs in sign languages. He showed that sign languages have minimal pairs that can be distinguished by features within one of these three parameters. Battison (1978) proposed the fourth parameter: orientation. Sandler (1987, 1989) argued that these categories consist of classes of features which are organized hierarchically. Liddell (1990) also discussed other phonological processes such as movement epenthesis, hold deletion, metathesis, germination, assimilation. in American Sign Language (ASL). Sign language not only has phonology, but also has its own morphology. For example, Klima and Bellugi (1979) claimed that compounding is one of the devices to expand the vocabulary in ASL, and demonstrated both morphological and

phonological processes where two words bound together as a unit, while phrases do not have these processes. These phonological and morphological evidences show that like spoken languages, sign languages are natural languages.

1.2 Introduction to Taiwan Sign Language

Taiwan Sign Language (TSL) originated from Japan. According to Smith (1989), during the Japanese occupation of Taiwan, a deaf school was established by Japanese in Tainan in 1915. Later, in 1917, another deaf school was established in Taipei. Dialect differences exist between the southern and northern Taiwan sign languages. TSL has historical related with Japanese Sign Language, and is different from the spoken language used in Taiwan.

TSL, also called as ‘ziranshouyu’ (natural sign language), is used as the daily language by deaf people and hearing-impaired people who live in Taiwan. However, few teachers in deaf schools really use ‘TSL’, but instead use the signed form of Mandarin. This signed system is called ‘wenfashouyu’ (grammatical sign language) which is signed character by character and adopts the word order of Mandarin. This so-called grammatical sign language is used in order to improve deaf students’ Chinese ability. It adds many signs that do not exist in TSL, and lacks many important linguistic properties of TSL like phonological rhythm, morphological compounding, and so on (Lee 2003). In this thesis, TSL, ‘ziranshouyu’ (natural sign language), is used for the reason that it not only is used by deaf in their daily life, but also has phonology and morphology as in spoken language.

1.3 The Goal and Issues of This Study

The goal of this thesis is to study whether TSL compounding has syllable contraction, and find out whether the process of syllable contraction in sign languages is the same as which in spoken languages.

Syllable contraction is a common phenomenon in spoken languages which contracts two syllables into one. According to Chung (1996), in Southern Min, syllable contraction occurs in two types. The first type contracts the first two syllables of a trisyllabic adjective reduplication. The other type contracts two successive syllables into one. There are two environments for two successive syllables contracted into one. The first one is obligatory in plural forms. For example, *li 53* 'you' + *n* 'the plural suffix' → *lin 53* 'you, plural,' the suffix *–n* is a bound morpheme which should be bounded with root. The other one is optional such as *ka 33(31)* 'let' + *laŋ 13* 'people' → *kaŋ 33*. Syllables would not be contracted that *ka 33(31) laŋ 13* may be used in a deliberate speech while syllables would be contracted into one that *kaŋ 33* may be used in ordinary occasions.

As to TSL, most syllable contraction can be found in compound signs which are combined by two independent roots. Because movements (M) are more sonorous than location (L), movements are analogous to vowels while locations are analogous to consonants in spoken languages (Sandler 1993). Some researchers use the term hold (H) (Liddell and Johnson, 1986) or the term position (P) (Perlmutter 1992) to represent that signs do not have movements. Like a CVC sequence in spoken language, a syllable should be combined by at least a nucleus which is the most sonorous peak. There is a rise-fall sonority sequence within syllables, going from the less sonorous L to the most sonorous M, and then goes to the less sonorous L (Sandler 1993). Some phonologists have claimed that the canonical phonological compounding process would be: MH + MH = HMH (Liddell & Johnson, 1986); or LML + LML =

LML (Sandler 1993) which is followed in this paper because Sandler's model (1986, 1987, 1989) is adopted. Furthermore, Klima and Bellugi (1979) have claimed that movements are deleted or weakened in lexicalized compounds. The mean duration of the compound sign was not significantly different from each of its component signs as free words. So, I propose that sign languages have syllable contraction in compound signs. This study will discuss whether syllable contraction in TSL is affected by sonority or not. If the contraction is affected by sonority, will the nucleus in the less sonorous syllable be dropped? In addition, this thesis will point out what environments cause syllable contraction in TSL compounding. That is, will the four parameters of handshape, location, movement, and orientation have influences on syllable contraction in TSL compounding? Finally, this study will compare the syllable contraction in TSL and Southern Min.

1.4 Data Collection

The data was collected from (1) the third edition of the Taiwan Sign Language online dictionary established by the Institute of Linguistics of National Chung Cheng University (Tsay, et al. 2015), and (2) the Taiwan Sign Language Database for Place Names (Chang 2011). Of the 1180 compound words collected for this study, 275 compounds come from Tsay et al. (2015), in which there are 36 compounds with syllable contraction. The other 905 compounds come from Chang (2011), in which there are 21 compounds with syllable contraction. That is, there are a total of 57 compounds with syllable contraction in TSL (see Appendix A). The sample is not comprehensive in that some cases are collected from the ordinary dictionary while some cases are collected from the Database for Place Names. The rate of syllable contraction in the Taiwan Sign Language dictionary is higher than the rate of the Database for Place Names.

After collecting all the compounds from the two databases, I divided them into two groups. One is compounds with syllable contraction, and the other is compounds without syllable contraction. For example in TSL, MINXIONG (PLACE NAME) is a compound sign with syllable contraction. MINXIONG (PLACE NAME) is combined by the sign MEN (CHINESE SUFFIX FOR PLURALITY) and the sign BRAVE, Figure1.1. As shown in Figure 1.2, MINXIONG (PLACE NAME) deletes two syllables 'MEN (LML)^BRAVE (LML)' into one syllable. Hence, this is an example of syllable contraction. ("^" indicates that the two roots are produced sequentially, i.e. this is a sequential compound.)

a. MEN (CHINESE SUFFIX FOR PLURALITY)

b. BRAVE c. MINXIONG (PLACE NAME)

Figure 1.1 Example of a compound sign with syllable contraction in TSL

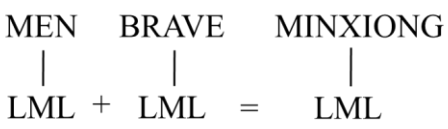
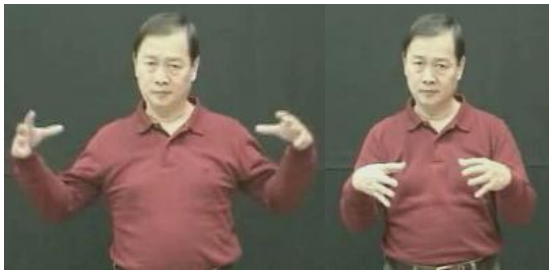


Figure 1.2 LM structure for MEN^BRAVE = MINXIONG (PLACE NAME)

On the other hand, CLASSMATE is a compound without syllable contraction. CLASSMATE is composed of TOGETHER and STUDENT, Figure1.3.



a. TOGETHER

b. STUDENT

c. CLASSMATE

Figure 1.3 Example of a compound without syllable contraction in TSL

As shown in Figure 1.4, combine TOGETHER (LML) and STUDENT (LML) will yield a compound word CLASSMATE (LMLLML) which is a disyllabic sign. Because the sign CLASSMATE keeps two syllables (i.e. two movements are retained), this is not an example of syllable contraction.

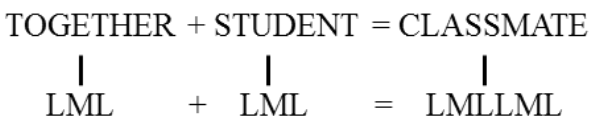


Figure 1.4 LM structure for TOGETHER^STUDENT = CLASSMATE

Sandler (1989) claimed that the non-dominant hand has two roles. 'Dominant hand' is the right hand for right-handed signers and the left hand for left-handed signers; the other hand is the 'non-dominant hand.' One role is when the non-dominant hand copies the dominant hand as a dual hand configuration (HC), as in symmetrical signs. The other role is when the non-dominant hand forms a place feature such as head or the trunk for the dominant hand. The participant in the two databases is the same person, Mr. Yushan Gu, and his dominant hand is the right hand while the non-dominant hand is the left hand.

1.5 Outline of This Study

Chapter 2 will introduce several theoretical concepts that are important to this thesis regarding spoken language and sign language. Hsu's (2003) Sonority Model, used to analyze syllable contraction in Southern Min, will be introduced first. Then, I introduce sign language syllables with Sandler's (1986, 1987, 1989) Hand Tier model. This model shows the prosody for location (L) and movement (M), to which features are associated. Finally, compounding in sign language and in TSL will be introduced.

In Chapter 3, in order to test whether does the syllable contraction occur in TSL or not, based on Hsu's (2003) Sonority Model and Sandler's (1986, 1987, 1989) Hand Tier model, I analyze the TSL compounding and syllable contraction with prosody and four phonological parameters, i.e. handshape, movement, location, and orientation. I test whether the movements with higher sonority would survive or not, and test whether other parameters would affect the syllable contraction in TSL compounding or not.

After examining sign language compounding and syllable contraction in TSL, Chapter 4 will compare the similarities and differences between TSL and Southern Min syllable contraction.

Chapter 5 will summarize the analysis of syllable contraction in TSL compounding, and the comparison of Southern Min and TSL syllable contraction. Finally, I discuss limitations of this study and implications for future research.

Chapter 2

Theoretical Background

This chapter introduces several theoretical concepts and models for analyzing syllable contraction. Section 2.1 introduces syllable contraction in Southern Min. Section 2.2 introduces sign language syllables, while section 2.3 is about compounding in sign languages. The last section summarizes the theories that are, relevant for syllable contraction in TSL compounding.

2.1 Syllable Contraction in Southern Min

Syllable contraction or segmental reduction is common phenomenon that a phonological process of contracting two syllables into one, and it appears in many spoken languages. For example, *ka 33(31)* 'let' + *laŋ 13* 'people' → *kaŋ 33* in Southern Min (Chung 1996); *zhe 51* + *yang 51* → [*tɕiaŋ 51*] 'this' in Mandarin Chinese (Tseng 2005); and in German, the reduction of the definite article 'dem' to [m], such as *in* 'in'+ *dem* 'the' → *im* 'in the', and *zu* 'to'+ *dem* 'the' → *zum* 'to the' (Kohler 1990). In this thesis, Southern Min represents the spoken language while TSL represents the sign language. Syllable contraction in Southern Min is discussed below.

According to Chung (1996), there are two types of syllable contraction in Southern Min: (1) contract two successive syllables into one; and (2) contract the first two syllables of a trisyllabic adjective reduplication. To take *ka 31(33)* 'let'+ *laŋ 13* 'people' as an example of the contraction of two successive syllables, the contracted form would be "kaŋ 33." An example of a trisyllabic form would be the input form *sin 35 sin 33 sin 55* 'new' changing into the output form "*si-in 353 sin 55*." Tseng (1999) pointed out that many factors contribute to syllable contraction in Southern Min: (1) segmental makeup of syllables, (2) rhythmic pattern, (3) speaking rate, (4)

prosodic boundary, (5) phonotactic constraint, (6) lexical category, and (7) lexical frequency.

In terms of the phonological process of syllable contraction in Southern Min, Hsu (2003) modified Chung's (1996) theory, proposing a Sonority Model. Her processes are almost the same as Chung's theory. First, every Southern Min syllable is assumed to have a three-X-slot template. Two syllables contract into one. The rule of the syllable contraction is formulated as the Figure 2.1. (N = nucleus)

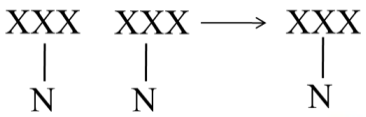


Figure 2.1 Syllable contraction (Chung 1996, p.149)

Then, the edge-in process is to associate segments and the skeleton tier from both edges. Only the onset and the consonantal ending would be affected. After that, Hsu (unlike Chung) claimed that the more sonorous vocoid has priority in associating to the nucleus position, as shown in (1).

(1) Vocoid Association (Hsu 2003, p. 356)

Among the vocoids, the priority of association with the nucleus position is determined by the sonority hierarchy of a > ɔ > e > o > i > u. If there is a tie, association proceeds from left to right. V-neutralization operates when necessary.

Finally, maximal linking is guaranteed to construct the largest possible syllable to link between the melodies and the skeleton tier, for example, *sio* 'mutually' + *kaŋ* 'same' = *siaŋ* 'the same' in Southern Min, as shown in Figure 2.2. Two three-X-slot

templates are contracted into only one three-X-slot template. The onset of the first syllable is linked to the first X slot, while the coda of the second syllable is linked to the third slot. Then, the most sonorous vocoid, which is *a* in the second syllable, is associated to the nucleus position. Maximality makes *i* in the first syllable be linked to the nucleus position to create the largest possible syllable.

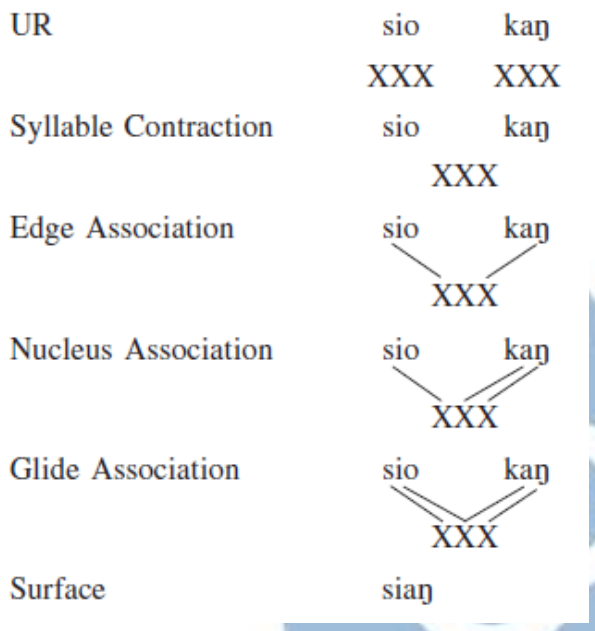


Figure 2.2 Syllable contraction of *sio* 'mutually' + *kaŋ* 'same' = *siaŋ* 'the same' in Southern Min (Hsu 2003, p. 365)

There are key properties of this model to test in TSL. First, we must test whether the first nucleus or the second nucleus would be preserved after compounding. Second, we must test whether the output fits a legal syllabic template or not. Finally, we must test whether the movement with higher sonority would be associated to the nucleus position or not.

2.2 Sign Language Syllables – Hand Tier Model

Stokoe (1960) identified three phonological parameters — handshape, location, and movement. Battison (1978) suggested the fourth parameter — orientation. According to Sandler (1993), movement is the dynamic element, and is analogous to vowels which are crucial to form a syllable in spoken language. Many phonologists (Liddell 1984; Sandler 1986, 1987, 1989; Perlmutter 1992) have developed models of sign language syllables. Because Sandler's Hand Tier model both shows the prosody like LML and shows the features in signs, I will introduce this model.

Sandler (1986, 1987, 1989) proposes the Hand Tier model positing three major categories: hand configuration (HC), Location (L), and Movements (M). The canonical form of a sign is LML (Sandler 1993), and most are monomorphemic signs with a single hand configuration throughout. In addition, the timing units are locations (Ls) and movements (Ms) in the Hand Tier model, as shown in Figure 2.3.

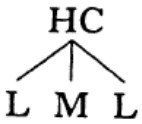


Figure 2.3 The canonical form LML (Sandler 1993)

Locations, holds or positions are analogous to the consonants in spoken language. Location is the place of articulation such as head, body, or hand. It is important to decide whether signs have path movement or not. In other words, locations often determine the features of the path movement between two locations. In addition, the unity with other phonologists is that movement, which is analogous to the vowel in spoken language, is the most sonorous in sign language. Movements include (1) movement with path, that is to move from one location to another with a plain straight

movement from L1 to L2; and (2) movement without path, i.e. internal movement, which means movement of fingers or wrists in only one location. Movements also signify dynamic change of state and trigger nucleus projection implying that each syllable has only one movement (M), as in (2). In the canonical template, LML, features are associated to L and M timing slots. Movements have branching root nodes associated to the surrounding locations. When the whole sign has handshape change, the feature of the first handshape is on the leftmost and the feature of the handshape after change is on the right branch.

(2) Nucleus projection (Sandler 1993, p.254)

Project a nucleus over a segment with a branching root node.

The nucleus projection implies that signs are characterized by sequences of location and movement segments, and movements are crucial for syllabicity. In a syllable, the sonority peak is the nucleus. It goes from less sonorous L to the more sonorous M, and then goes back to the less sonorous L. Motion enhances the perception, and some sign language phonologists (Brentari 1993; Perlmutter 1992) propose sonority hierarchy in sign language, as in (3).

(3) Sonority hierarchy in sign language:

a. Perlmutter (1992):

Movements (M) are more sonorous than positions (P).

b. Brentari (1993):

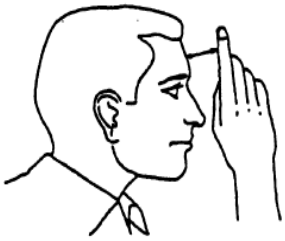
Path features > handshape change > orientation change > secondary movement

Sandler also proposes a sonority scale where the movement within a sign is correlated with the degree of sonority, as in (4). The contacting L is the least sonorant while the path movement with trilled internal movement is the most sonorous. The minimum requirement for a well-formed sign is trilled L. This indicates that the trilled L is the minimum sonority value to form the nucleus of a well-formed syllable. HAND-INTERNAL MOVEMENT (IM) means signs with hand configurations involving two finger positions in sequence. Handshape change signs and orientation change signs are the other two types of sign in which movement internal to the hand is repeated rapidly. The feature [trill] characterizes all signs with rapidly repeated hand-internal movement, or trilled internal movement (TIM). Trilled movement is also called 'local movement' (Liddell and Johnson 1989) or 'secondary movement' (Corina 1990; Perlmutter 1992).

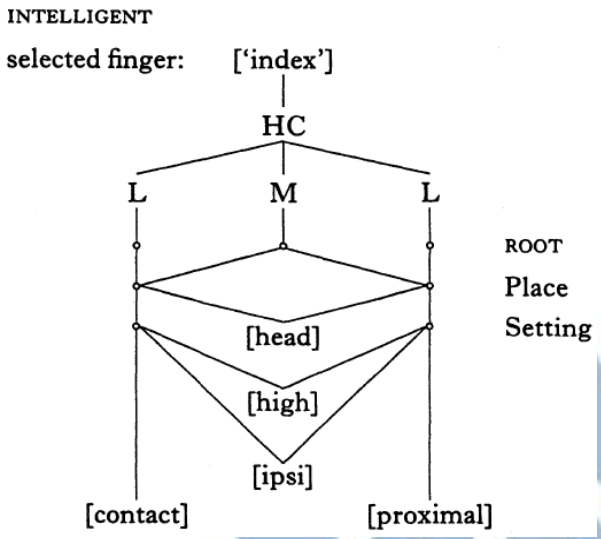
(4) Sonority hierarchy in ASL (Sandler 1993, p.254):

1: contacting L < 2: plain L < 3: L with TIM < 4: contacting M < 5: non-path M with IM < 6: path M < 7: path M with IM < 8: path M with TIM

To take INTELLIGENT in American Sign Language (ASL) as an example in Figure 2.4a (Sandler 1993), the major body area is the head, so the place feature is [head], as in Figure 2.4b. The hand moves from high, ipsilateral to the dominant hand, and in contact with the location, to a proximal distance away from the high, ipsilateral, head location. These get the setting features [high], and [ipsi]. The class of setting features may characterize any place. The feature [contact] characterizes the firs L, and the feature [proximal] characterizes the second L. M spreads to connect the two Ls. That is, this sign is moved from the first location to another.



a. ASL INTELLIGENT (Sandler 1993, p. 245)

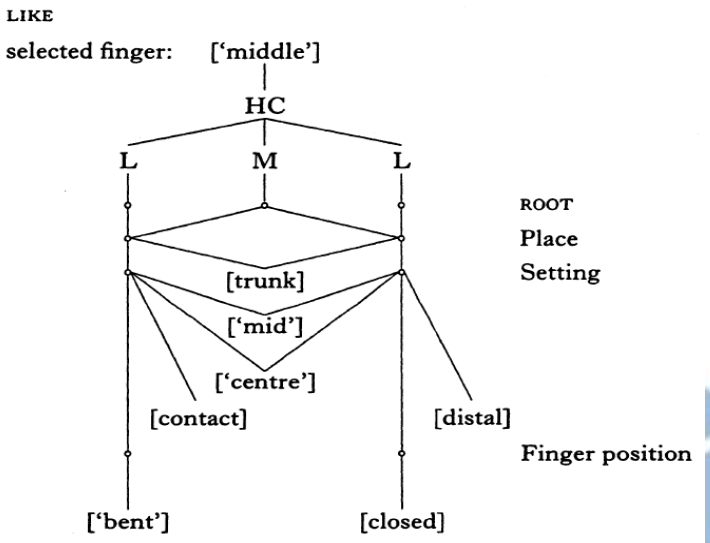


b. Feature with selected finger of INTELLIGENT (Sandler 1993, p. 247)

Figure 2.4

The Figure 2.5a LIKE is an example of hand-internal movement (IM), while the hand moves from contacting the body to be away from the body, and the thumb and middle finger are closing. The first finger position [bent] is temporally aligned with the first location, and the second finger position [closed] is aligned with the second location, as shown in Figure 2.5b.

a. ASL LIKE (Sandler 1993, p.248)

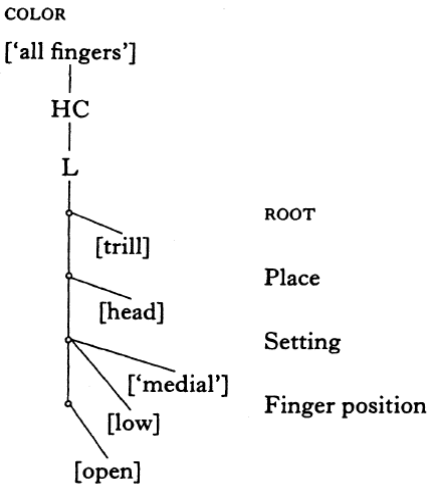


b. Feature with selected finger of ASL LIKE (Sandler 1993, p. 248)

Figure 2.5

If there is no path movement in a sign with finger wiggling in which two hand configurations are signed repeatedly and sequentially, alternating reaction at the base joint of the selected fingers (Brentari 1996), it will be presented as the template L. Take COLOR in ASL as an example in Figure 2.6a, there is no path movement and only with finger wiggling. In Figure 2.6b, wiggling is the only movement, and the feature [trill] stands for wiggle.

a. ASL COLOR (Sandler 1993, p.251)



b. Feature of COLOR (Sandler 1993, p.252)

Figure 2.6

In summary, the key points needed for syllable contraction are that Sandler's Hand Tier model can show the prosody of syllable contraction in compounding process, and it also shows features to examine what features would be retained or deleted after contraction. Finally, the sonority hierarchy is used to test whether the movement with higher or lower sonority would be dropped in syllable contraction.

2.3 Compounding in Sign Languages

In spoken language, compounding is a kind of word formation which is involves

the combination of two free morphemes (Bauer 1983; Downing 1977). Sign languages also have the morphological process of compounding.

According to Meir et al., 2010, most compounds in sign languages combine words sequentially, like compounds in spoken languages. Because the manual modality has two articulators, i.e. two hands, compound signs may also be formed simultaneously. There are two properties which are characteristic of sign language sequential compounds and which distinguish compounds from phrases (Klima and Bellugi 1979). First, if a compound is opaque, we can be sure it is compound and not a phrase. For example in ASL, the compound BLUE^SPOT means 'bruise' instead of 'a blue spot'. Second, compounds are lexicalized in a form that has the phonological appearance of a single sign rather than of two signs. Liddell and Johnson (1986) and Sandler (1993) claimed that because that the movements in the first component signs of the compound signs are usually deleted, compounds are shorter than phrases. Sometimes, movements in the second component signs are also deleted, and then the transitional movements become the only movement of the compound, now a monosyllabic sign. In terms of the morphological structure of sequential compounding which has advantage of linear structure and involves reorganization and restructuring, there are three types. The first type is endocentric compounding with a head which represents the core meaning of the compound and which determines the lexical category. Another type is exocentric compounding where the word class is determined lexically for each compound. In ASL, many compound signs are exocentric (Klima and Bellugi 1979, p. 205), such as SURE^WORK 'seriously', WILL^SORRY 'regret.' Other cases are difficult to determine whether they are endocentric or exocentric, e.g., THINK^ALIKE 'agree', FLOWER^GROW 'plant.' The third type is coordinate compounds (or co-compounds) whose members are equal rank. A special type of coordinate compound is called *dvandva* compounds, whose

members are basic category-level terms of a superordinate term, and whose meaning is the superordinate term. For example, the basic category-level terms CAR^PLANE^TRAIN means ‘vehicle’ which is a superordinate term in ASL.

In simultaneous compounding, signs are produced by both hands, and two handed signs are symmetrical or asymmetrical (Meir et al., 2010). In symmetrical signs, the two hands have the same handshape, movement, and the same location (or at the mirror locations on each side of the body). In asymmetrical signs, one hand articulates the sign with movements while the other hand is static and function as the location of the sign. In these signs, each handshape may be transparent meaning of the sign.

Tsay and Myers (2009) also claimed that compound in TSL can be divided into serial compounding and parallel compounding. There are three types in serial compounding. The first one is the word order [modifier^noun] or [noun^noun]. For example, the component signs of APPLE are RED and FRUIT whose word order is [modifier^noun], and the order of the compound sign JUDGE is [noun^noun] in LAW^MALLET. The second type in serial compounding is semantic opacity such as COFFEE = BROWN^STIR, and DEFICIT = RED^HIGH LEVEL. The third type seems to follow templates such as [X^PLACE] and [Y^LEADER]. The examples for [X^PLACE] are TRAIN STATION = TRAIN^PLACE and COURT = LAW^PLACE, while examples for [Y^LEADER] are PRESIDENT = NATION^LEADER and PRINCIPAL = SCHOOL^LEADER.

In terms of the parallel compounding, they claim that some examples may be historically derived from serial compounds through fossilized phonological operations, while others are standardly treated as if they were monomorphemic. Take BUY as an example. In BUY, which is combined by HAND (moving inward) ∪ MONEY (moving outward), one hand with the sign of MONEY moves outward as if giving out

money, while the other hand with the open palm facing up moves simultaneously inward as if accepting goods being purchased.(“ ∪ ” indicates that the two roots are produced simultaneously.)

Compounds are lexicalized in that they combine two signs into one sign. Klima and Bellugi (1979) divided compounds into three parts: the first sign and the second sign, and the transition between the signs. They claimed that compounds in ASL have a regular weak-strong stress pattern. The first sign always weakens in stress and the second sign always remains normally stressed or receives additional stress. They also emphasized the rhythmic properties of the compounds and their changes in form by measuring the duration of the signs, both compound components in isolation and then as parts of the compound. They claimed that the mean duration of each of the compound signs are not significantly different from the mean duration of the individual signs. In addition, the duration of the initial sign of the compound is shorter than the final sign. It means that most of the reduction of movements or holds to brief contacts occurs in the first sign of the compound. Other changes include the loss of repetition of the second sign, the reduction in transition time, movement time, and the total duration of compound words. Transition in the two signs is made more smoothly. Besides, Svaib (1992) claimed that the first sign must be with a place of articulation higher on the body than the second sign in ASL.

Liddell and Johnson (1986) developed the schematic representation which has the segment and articulatory bundle attached together with the autosegmental attachment lines. The segment may be movement (M) or hold (H), and the articulatory bundles represent the features of the sign such as handshape, location and orientation. They use this schematic representation to show the compound formation. In Figure 2.7, take THINK^SELF ‘use one’s own judgment’ as an example of compound formation processing, that sign is the combination of two signs THINK

and SELF containing both M and H parts, as in Figure 2.8.

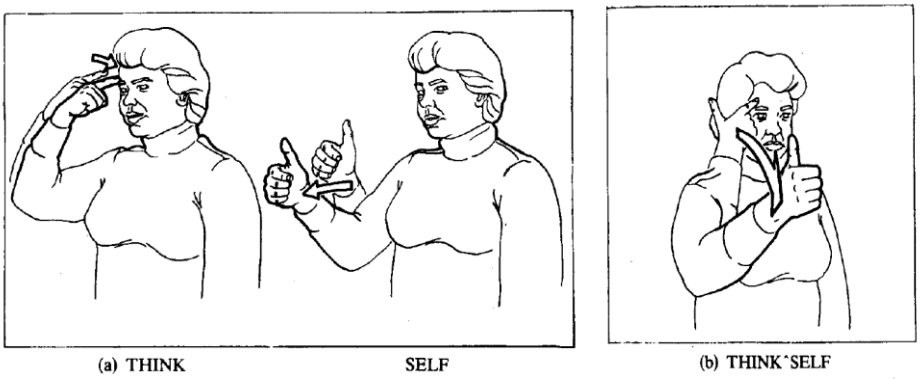


Figure 2.7 The individual signs and the compound THINK^SELF (Liddell & Johnson 1986, p.458)

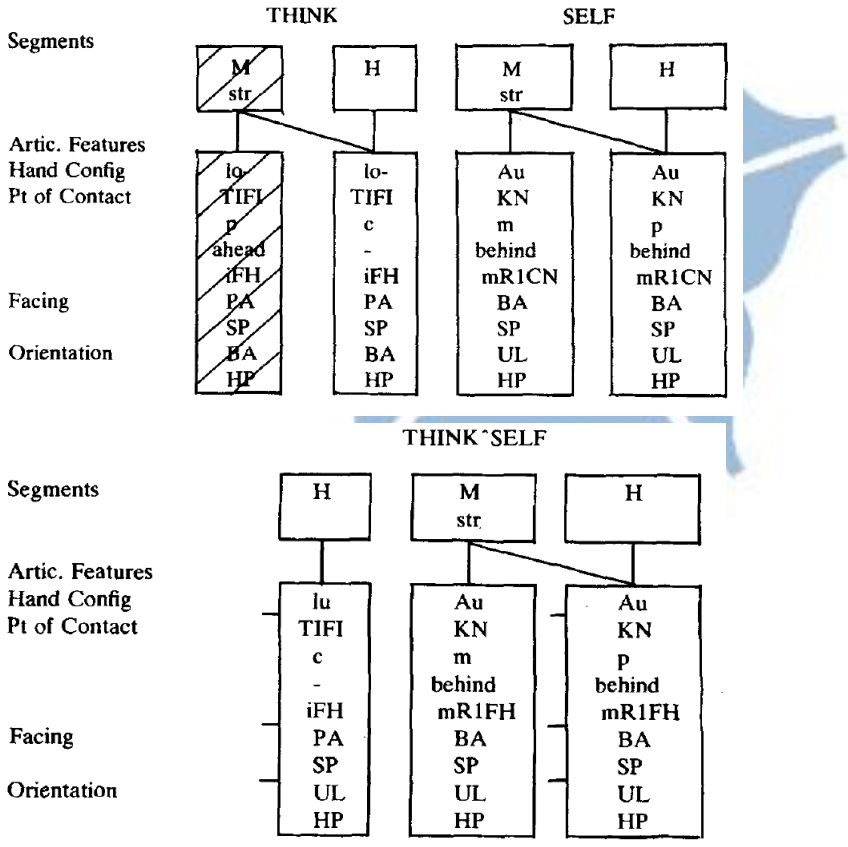
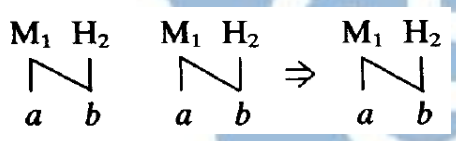


Figure 2.8 Two parts of HINK^SELF and the compound (Liddell & Johnson 1986, p.459)

Figure 2.8 shows that after the two signs THINK and SELF merged to form a single sign as the THINK^SELF, the first segment M and its articulatory bundle in the first sign are deleted. Besides, some features in the articulatory bundles are also changed to have a closer agreement with other features. The remaining segments and feature bundles are recombined to form a new single sign.

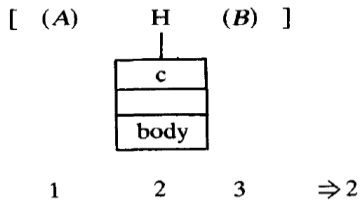
Liddell and Johnson (1986) also provided four rules to analyze the compounding process. First, they observed that signs in compounds lose repetition. By the structural effects of loss of repetition they provided the morpho-phological rule which is called the Single Sequence Rule, whose effect is to eliminate one of the two sequences, as in (5). This rule only applies to those signs in compounds that contain two identical MH sequences.

(5) Single Sequence Rule (Liddell and Johnson 1986, p. 465)



The other structural effect is the retention of contacting holds. Liddell and Johnson found that the initial H is survived while making contact with a location on the body. However, if signs do not make contact with a location on the body, the second H will survive. Hence, there is another rule called Contacting Hold Rule which applies to the initial sign in a compound containing an H with body contact, as shown in (6). Its effect is to delete everything except the body contacting H and its associated articulatory bundle.

(6) Contacting Hold Rule (Liddell and Johnson 1986, p. 468)



In some signs, more phonological information is altered more than would be predicted by the two rules mentioned above. Two additional processes are Movement Epenthesis, and Hold Deletion. Movement Epenthesis inserts a movement between two continuous distinct signs, moving the hand from the ending segment of the first sign to the beginning segment of the next sign. It always applies between the two parts of a compound. Movement Epenthesis often creates the environment for the other phonological process: Hold Deletion Rule. The Hold Deletion Rule deletes holds that occur between two movements in a string. It only deletes the segmental bundle and does not delete the articulatory bundle to which the H is attached. These two phonological rules not only apply to contexts, but also apply at word boundaries.

2.4 Summary

This chapter first introduced the syllable contraction in Southern Min. Many factors cause reduction of the syllables in Southern Min. Hsu (2003) modified Chung's (1996) theory, and proposed a Sonority Model. The crucial rules are edge-in association of segments on the edges of the skeletal tier, and vocoid association where the higher sonority has priority to associate to the nucleus position. There are several reasons why this Sonority Model is used in this study. First of all, the timing units, locations (L) and movements (M), in Sandler's (1986, 1987, 1989) Hand Tier model are analogous to the consonants and vowels in spoken language. Because most signs are monosyllabic signs, the canonical LML template is like the three-X-slot template

in Southern Min. Second, the fact that movements can be projected to the nucleus position means that the nucleus of the three-X-slot template of the syllable contraction in TSL compounding should be a movement instead of location without any movement. Third, for the reason that signs can have path movement or internal movement with only one location, the rule of vocoid association can be applied to the syllable contraction in TSL compounding. In other words, we can test whether the movement with higher sonority would be retained after the syllable contraction. Furthermore, the Hand Tier model can show the features of sign language phonological parameters (handshape, locations, movements and orientations) to examine what features would be deleted and what features would be retained after compounding. More precisely, except for the movement, which is associated to the nucleus position, both edges would be defined by the other three parameters. By presenting those features, we can test whether the handshapes, location or orientation would be retained in both edges.

To conclude, we test the following crucial properties of the sonority hierarchy and Sandler's hand tier model in TSL syllable contraction: (1) whether the movement in the first input signs or the second input signs would be preserved after compounding; (2) whether the output signs fit the legal syllabic templates or not; (3) whether the movement with higher sonority would be associated to the nucleus position or not; (4) which sign language phonological parameters would be associated to the two edges of the L slots.

Chapter 3

Analyzing Syllable Contraction in TSL Compounding

In this chapter, I follow Sandler's Hand Tier model to analyze syllable contraction in TSL data. Section 3.1 shows the influences of the prosody in the processes of compounding and contraction, including edge-in, and nucleus association. Section 3.2 examines the place features that also affect the compounding and contraction in TSL.

3.1 Prosody in TSL Compounding

As mentioned in Chapter 2, Chung's (1996) theory postulates that each syllable in Southern Min has a three-X-slot template. I propose that each syllable in TSL also has a three-X-slot template like Southern Min, as shown in Figure 3.1.

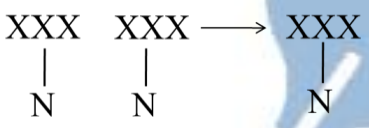


Figure 3.2 Syllable contraction (Chung 1996, p.149)

In sign language, each sign has at least one movement which is projected to the nucleus position (N). In sign languages, trilled movements (Ltri) are like the syllabic consonants in spoken language, and according to Perlmutter (1992) that a position (P) (L is adopted in this thesis.) can be project to the nucleus position if it is not adjacent to an M, as in Figure 3.2a. Ltri is when signs have trilled internal movement without path movement in only one position. In addition, because signers should move hands

to the location, and because some signs without movement can be strung together into sentences and connected by transitional movements (Sandler and Lillo-Martin 2006), there is an epenthetic movement before L in those signs without movement, as in Figure 3.2b. The epenthetic transitional movement is associated to the nucleus position. The M in the LML moving from one location to another is projected to the nucleus position, as shown in Figure 3.2c. The M with trilled movement is marked as Mtri, as shown in Figure 3.2d. This can be applied in other cases in TSL, but not used in this thesis.

a. Ltri structure b. ML structure c. LML structure d. Mtri structure

Figure 3.2 Ltri, ML, LML and Mtri structures in TSL

Data show that most compound signs with syllable contraction follow the LML template by deleting syllables in two component signs into one after compounding and contraction. This confirms with Sandler's (1986, 1987, 1989) claim that most signs have only one movement and have canonical LML template. Forms of syllable contraction in TSL are given in Figure 3.3. No matter whether it is Ltri, ML, or LML combining with LML, the output form would be LML.

a. Ltri + LML = LML b. ML + LML = LML c. LML + LML = LML

Figure 3.3 Syllable contractions in TSL

In addition, data shows that these signs with compounding and syllable contraction almost all follow the same processes as syllable contraction in Southern Min introduced in Chapter 2, as shown in Figure 3.4. I will introduce them with examples in the following subsections. Section 3.1.1 analyzes the edge-in association in TSL, and section 3.1.2 examines the nucleus projection in the contraction process. Finally, 3.1.3 introduces the movement epenthesis in TSL compounding and contraction.

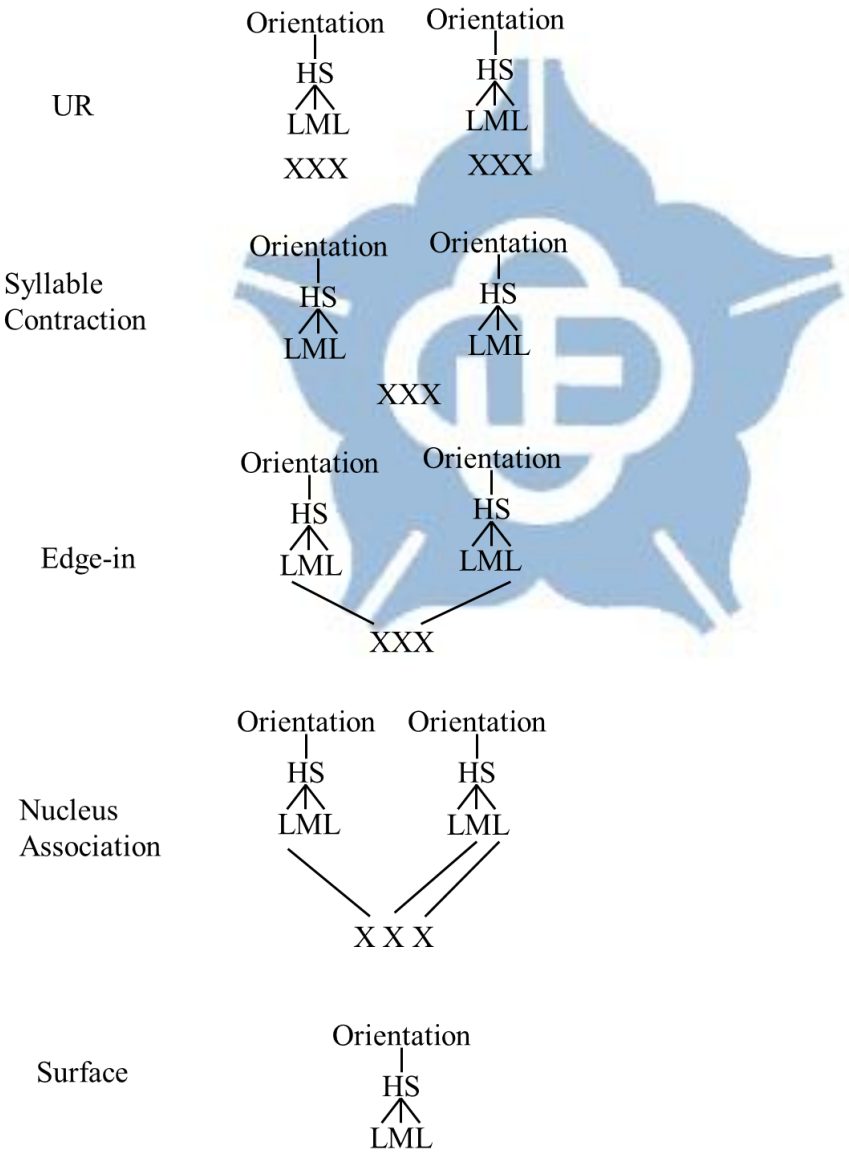


Figure 3.4 Syllable contraction in TSL

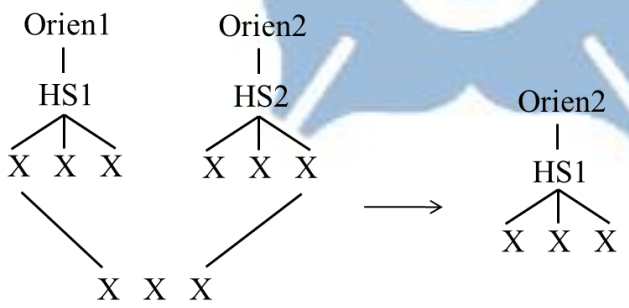
3.1.1 Edge-in: Handshapes and Orientations

The first basic rule for the phonological process of the syllable contraction in Southern Min is edge-in (melodies with skeletal slots), as in (7). Edge-in means that the first segment of the first syllable and the last segment of the second syllable have the priority to associate to the first timing slot and the third timing slot respectively.

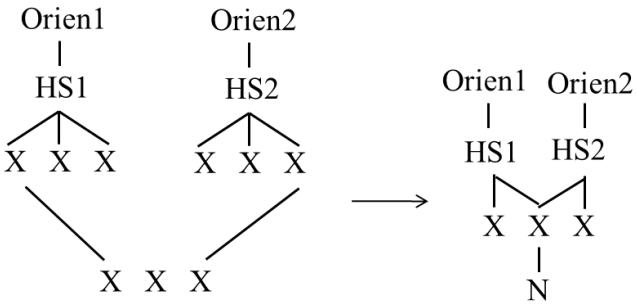
(7) Edge-in (Chung 1996, p. 136)

The association between the melodies and the skeleton begins with the two edges of each tier.

In TSL, sometimes only the handshape in the first component sign (HS1) with the orientation of the second component sign (Orien2) are linked to the edges, as in Figure 3.5a, while sometimes both the handshapes and orientations in two component signs would be linked to the edges, as in Figure 3.5b.



a. HS1 and Orien2 are linked to the edges



b. Both handshapes and orientations are linked to the edges

Figure 3.5 Edge-in process in TSL compounding with HS1 and Orien2

In the first condition, the first handshape (HS1) and the second orientation (Orien2) are saved and linked to the edges after compounding and contraction. (See handshapes in TSL in Appendix B.) To take DISCOUNT_A as an example in Figure 3.6, the handshape /F/ in the first component sign MONEY and the orientation [sideward] of the second component sign HALF are retained after compounding. That is, the compound sign DISCOUNT_A keeps HS1 and Orien2, which are associated to the first timing slot and the third timing slot, as shown in Figure 3.7.

a. MONEY b. HALF c. DISCOUNT_A

Figure 3.6 Before and after compounding of the sign DISCOUNT_A

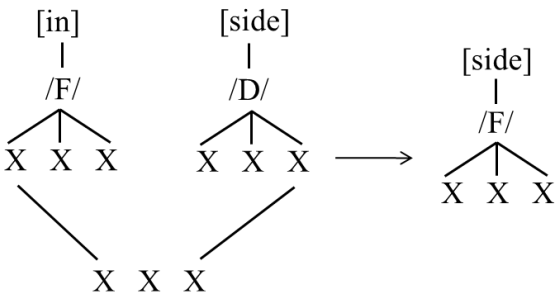
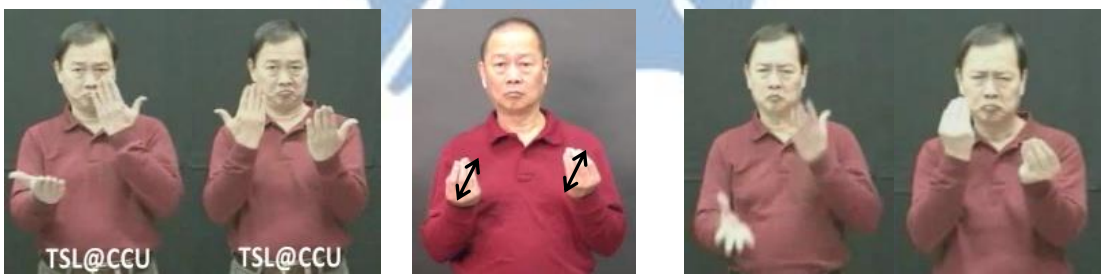


Figure 3.7 Edge-in process in DISCOUNT_A (MONEY^ HALF)

Second, if both handshapes are retained, both orientations survive, too. They will be associated to the edge slots, and the path movements will be projected to the nucleus position, too. That is, when both HS1 and HS2 are kept, Orien1 and Orien2 would not be dropped, but linked to the both edges after compounding. For example, both handshapes /Open B/ and /Flat O/ and orientations [in] [up] in the two component signs CLEAR and NOT_HAVE_A are saved and associated to the edges after being combined as the compound sign UNCLEAR, as shown in Figure 3.8 and Figure 3.9.



a. CLEAR b. NOT_HAVE_A c. UNCLEAR

Figure 3.8 Before and after compounding of the sign UNCLEAR

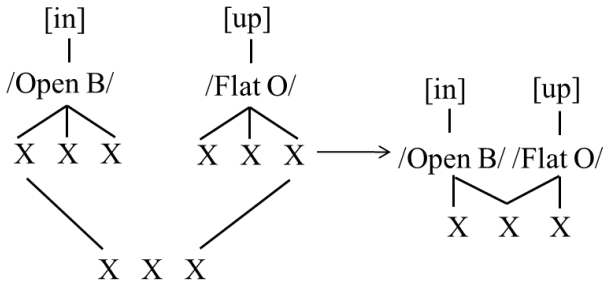
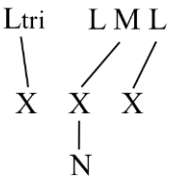


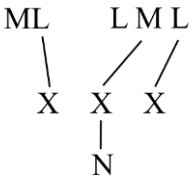
Figure 3.9 Edge-in process in UNCLEAR (CLEAR^NOT_HAVE_A)

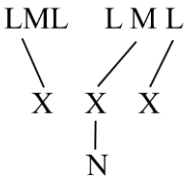
In summary, no matter whether the handshape in the first component sign with the orientation in the second sign survive after compounding or both handshapes and orientations in the two component signs survive, they all follow the edge-in process. The HS1 associates to the first X-slot, and Orien2 associates to the third X-slot.

3.1.2 Nucleus Association: Movements

According to Sandler (1993), the sonority in a syllable goes from the less sonorous location (L) to the more sonorous movement (M), and back to the less sonorous L. Based on her sonority hierarchy, the sonority in this thesis is M (movement with change of states) > Ltri (internal movements) > L. The movement which moves from one location to another is more sonorous than the movement which has internal movements but without change of locations. In other words, movement is more sonorous than location, and it is usually the sonority peak and projected to the nucleus position, as shown in Figure 3.10.







a. Ltri + LML → LML b. ML+ LML → LML c. LML + LML → LML

Figure 3.10 Nucleus projections in TSL

Figure 3.10a shows that the trilled movement is deleted in compounding and contraction, and the movement in the second component sign is usually retained. Besides, the sonority of M is higher than the sonority of Ltri. This agrees with Hsu's (2003) claim that the nucleus position is determined by the sonority hierarchy. In Figure 3.10b and Figure 3.10c, two movements in the component signs have the same sonority, and the movement in the second component sign has the association with nucleus position. Although Hsu (2003) claims that the sonority determines the nucleus position, she also claims that if there is a tie, the LR-scanning is still needed. However, most TSL component signs save the movement by RL-scanning.

TSL compound signs with syllable contraction agree with Sandler's (1993) claim that movement in the second component sign is usually retained after compounding and syllable contraction, and the trilled movement is deleted (Klima and Bellugi, 1979; Liddell and Johnson, 1986), as shown in Table 3.1.

However, some signs have the combination of ML + Ltri = Ltri, as shown in Table 3.1 (26) and (27). In this kind of combination, the trilled movement which has less sonority than M is retained. This problem may be solved by stress. The heavy syllable gets stress. ML is heavier than Ltri, so the ML gets stress. However, the transitional epenthetic M to enhance the sonority in the onset position cannot bear stress which agrees with the previous study that epenthetic vowels tend to avoid stress (Alderete

1999). As a result, ML in the signs with combination of ML + Ltri = Ltri cannot bear the stress, and Ltri gets stress and hence survives. Stress can also be used on other cases in Table 3.1. The generalization of the nucleus projection in TSL compounding is that the movement in the more stressed syllable is associated to the nucleus position. If the two syllables are equally in sonority and stress, scan the melody from right to left.

Table 3.1 TSL compound signs have the canonical LML templates.

	Component signs	Compound signs	Template		
			Input 1	Input 2	Output
1	EAT^HAVE_DONE	HAVE_EATEN	Ltri	LML	LML
2	EAT^EXCELLENT_A	DELICIOUS_B	Ltri	LML	LML
3	NOT_HAVE_A^PROBLEM	NO_PROBLEM_A	Ltri	LML	LML
4	WHAT^PLACE	WHERE	Ltri	LML	LML
5	RELATIVES^FLOWER	OVERSEA_CHINESE	Ltri	LML	LML
6	KEY^PLACE	CHIAYI (PLACE NAME)	Ltri	LML	LML
7	EAT^LOUSY	NOT_DELICIOUS (難吃)	Ltri	LML	LML
8	EAT^LOUSY	NOT_DELICIOUS (不好吃)	Ltri	LML	LML
9	NOT_HAVE _A^METHOD	NO_WAY_A (沒有辦法)	Ltri	LML	LML
10	NOT_HAVE _A^METHOD	NO_WAY_A (無法)	Ltri	LML	LML
11	ENOUGH_N^NOT_HAVE_A	NOT_ENOUGH_C	LML	Ltri	LML
12	CLEAR^NOT_HAVE_A	UNCLEAR	LML	Ltri	LML
13	ONE^SNAP_A	90%_OFF_A	ML	LML	LML
14	ONE^SNAP_B	90%_OFF_B	ML	LML	LML
15	TU^CITY	TUCHENG_2 (PLACE NAME)	ML	LML	LML
16	LOOK_N^NOT_GOOD	BAD_LOOKING	ML	LML	LML
17	MONEY^HALF	HALF_FARE	ML	LML	LML
18	LOOK_N^HAVE_DONE	HAVE_LOOKED	ML	LML	LML
19	MONEY^HALF	DISCOUNT_A	ML	LML	LML
20	MONEY^BANK	BANK	ML	LML	LML
21	OUTSIDE^COUNTRY	FOREIGN_COUNTRY	LML	LML	LML
22	MEN (CHINESE SUFFIX FOR PLURALITY)^BRAVE	MINXIONG_2 (PLACE NAME)	LML	LML	LML
23	TOMORROW^YEAR	NEXT_YEAR	LML	LML	LML
24	BUY^HAVE_DONE	HAVE_BOUGHT	LML	LML	LML
25	FRAGRANT^NOT_GOOD	BAD_LUCK_B	LML	LML	LML
26	LOOK_N^NOT_HAVE_A	DO_NOT_DISCOVER	ML	Ltri	Ltri
27	MONEY^HOW_MANY	HOW_MUCH	ML	Ltri	Ltri

(“^” indicates two roots are produced sequentially, i.e. sequential compound.)

The cases from 1 to 10 in Table 3.1 are Ltri + LML = LML. The compound sign in Figure 3.11c NO_PROBLEM_A is combined from the signs in Figure 3.11a

NOT_HAVE and Figure 3.11b PROBLEM. Both component signs are two-handed signs and are signed in front of the body symmetrically. The first input sign NOT_HAVE does not have path movement, but the second input sign PROBLEM has. After compounding and contraction, the sign keeps the two-handed signs in front of the body with two symmetrical hands. In this compound sign, the trilled movement in the first component sign NOT_HAVE is deleted, while the movement of the second sign PROBLEM is retained. The compound sign NO_PROBLEM_A has the same movement with the second sign PROBLEM and has handshape change from closed to open.

a. NOT_HAVE b. PROBLEM c. NO_PROBLEM_A

Figure 3.11 Before and after compounding of the sign NO_PROBLEM_A

The process of the syllable contraction here is shown in Figure 3.12. Both handshapes /Flat O/ and /5/ and orientations [upward] and [inward] in the component signs are associated to the edges. Syllable of PROBLEM is heavier and more stressed, and hence the movement is projected to the nucleus position. Finally, the prosody in NO_PROBLEM_A is LML.

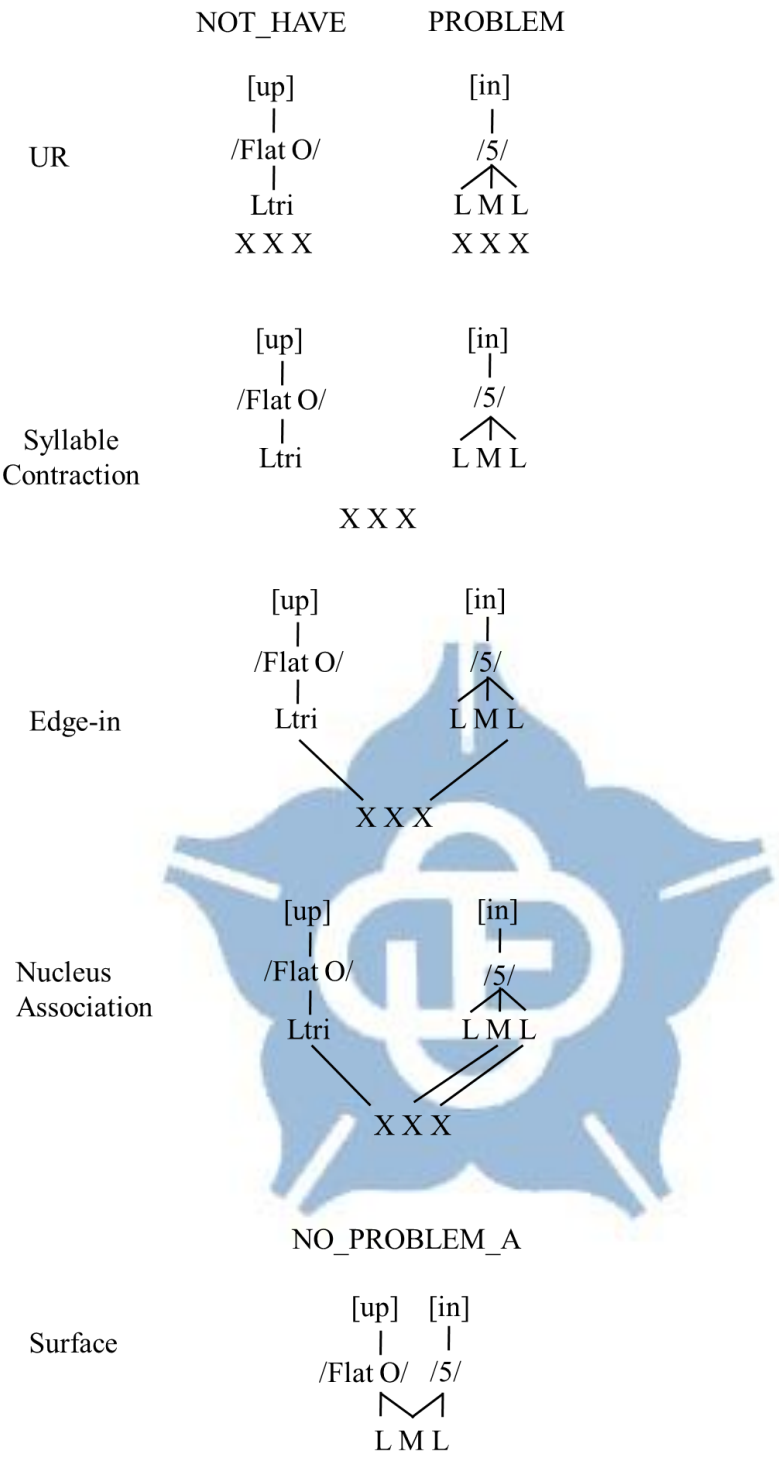


Figure 3.12 Syllable contraction of NO_PROBLEM_A (NOT_HAVE^PROBLEM)

Table 3.1 (13)-(20) are cases with the prosody of ML + LML = LML. To take DISCOUNT_A as an example in Figure 3.13, it is combined by MONEY and HALF, as mentioned above. Handshape /F/ in the first component sign MONEY and the

orientation [sideward] of the second component sign HALF are retained after compounding. The epenthetic transitional movement in MONEY is deleted, while the path movement in HALF is retained after compounding and syllable contraction.

a. MONEY b. HALF c. DISCOUNT_A

Figure 3.13 Before and after compounding of the sign DISCOUNT_A

Figure 3.14 shows the syllable contraction of the sign DISCOUNT_A which is combined from MONEY and HALF. In the Edge-in process, the handshape /F/ in the first component sign and the orientation [lateral] in the second component sign are associated to the first and the third timing slots respectively. The movement of the second component sign is associated to the nucleus position because the syllable with epenthetic transitional movement cannot bear the main stress and hence the syllable of HALF is more stressed. In the surface form, the orientation in the first component sign (Orien1) is assimilated by the orientation in the second component sign (Orien2) and the handshape changes by opening the thumb and the index finger.

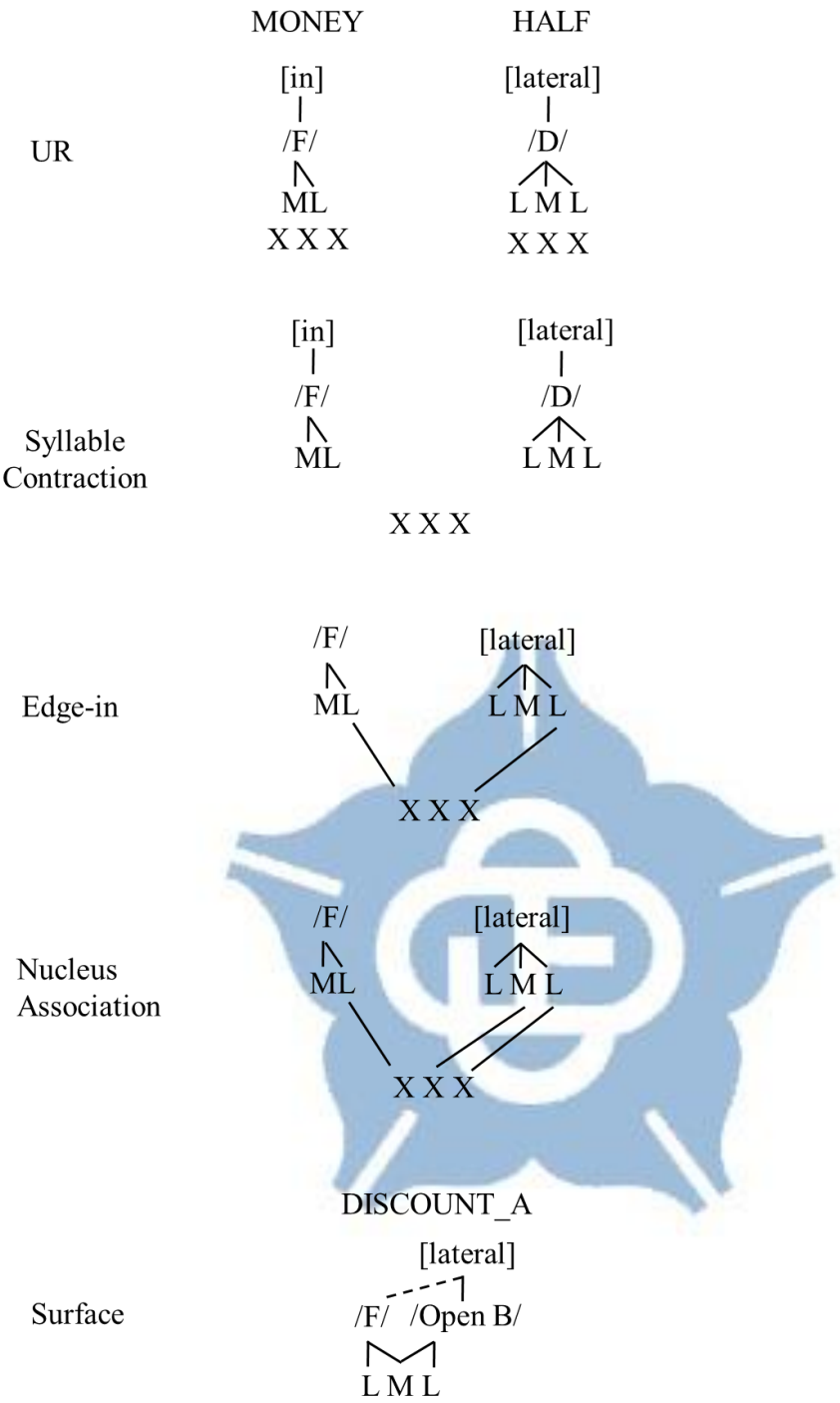


Figure 3.14 Syllable contraction of DISCOUNT_A (MONEY ^ HALF)

In terms of the signs whose timing slots are LML + LML = LML, movements in the two component signs are path movements, and both of them are heavy syllables. As mentioned above, if there is a tie, scan the melody from rightward. Then, the second movement will be associated to the nucleus position. This follow the claim by

Liddell and Johnson (1986) and Sandler (1993) that movements in the first component signs of compounds are usually deleted.

Take MEN (CHINESE SUFFIX FOR PLURALITY)^BRAVE = MINXIONG (PLACE NAME), which is mentioned in Chapter 1, as an example. In Figure 3.15, MEN (CHINESE SUFFIX FOR PLURALITY) is a symmetrical sign which is signed by handshape /Y/ with palm [sideward], and two hands are moved from contacting each other in the center of the higher body to the each side of the body. BRAVE is also a symmetrical sign which is signed by handshape /L/ with palm in, and has the same movement with the first component sign MEN (CHINESE SUFFIX FOR PLURALITY) at lower body. The compound sign MINXIONG (PLACE NAME) saves the handshape /Y/ of the first component sign, and saves the movement, orientation, and place of the second component sign.

a. MEN (CHINESE SUFFIX FOR PLURALITY)

b. BRAVE c. MINXIONG (PLACE NAME)

Figure 3.15 Before and after compounding of the sign MINXIONG (PLACE NAME)

In Figure 3.16, handshape /Y/ is linked to the first timing slot, and the orientation

[inward] is associated to the third timing slot. Because movements in the two component signs have the same sonority and syllables are equal heavy, the priority of the nucleus projection should be scanned from rightward to leftward. The movement in the second component sign then is associated to the nucleus position.

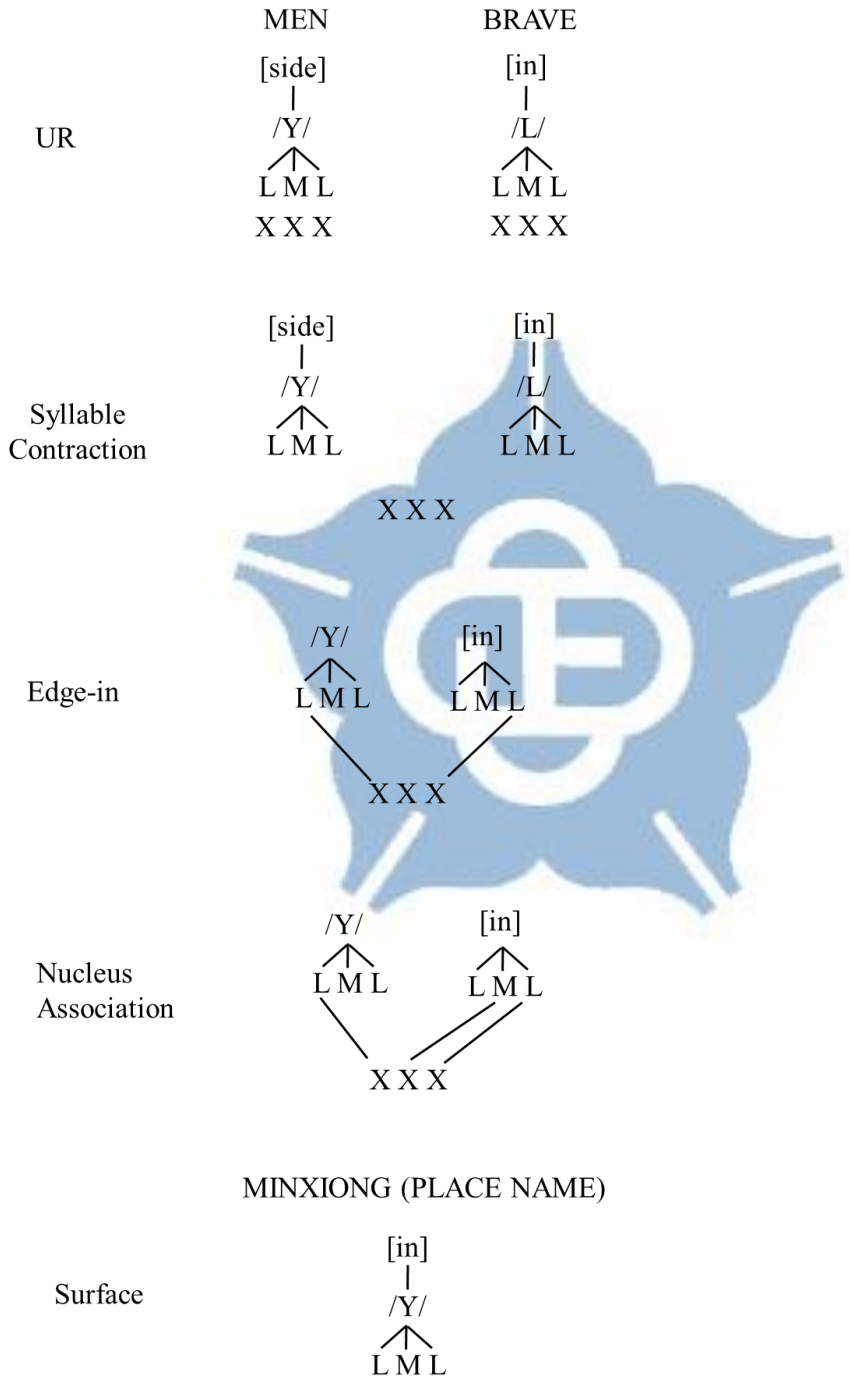


Figure 3.16 Syllable contraction of MINXIONG (PLACE NAME) (MEN (CHINESE SUFFIX FOR PLURALITY)^BRAVE)

Other cases in Table 3.1 (26) and (27), LOOK_N^NOT_HAVE_A = DO_NOT_DISCOVER in Figure 3.17 and MONEY^HOW_MANY = HOW_MUCH in Figure 3.19 have the prosody ML + Ltri = Ltri. In Figure 3.17, the first component sign LOOK_N is signed by the handshape /F/ with palm [sideward] in front of an eye, and has an epenthetic transitional movement. The second component sign NOT_HAVE_A is signed by the handshape /Flat O/ with palm up in front of the body, and has internal movement. After they combine together, the compound sign DO_NOT_DISCOVER has the hand internal movement by changing the handshape from /F/ to /Flat O/ with the palm [sideward] in front of an eye.

a. LOOK_N b. NOT_HAVE_A c. DO_NOT_DISCOVER

Figure 3.17 Before and after compounding of the sign DO_NOT_DISCOVER

The handshape /F/ and orientation [sideward] are associated to the first timing slot, while the orientation /Flat O/ is assoiated to the third timing slot in the edge-in process. Ltri in the second component sign gets stress, because the M in the first component sign is the epenthetic transitional movement which cannot bear the main stress. The Ltri is more stressed and hence is associated to the nucleus position, as in Figure 3.18.

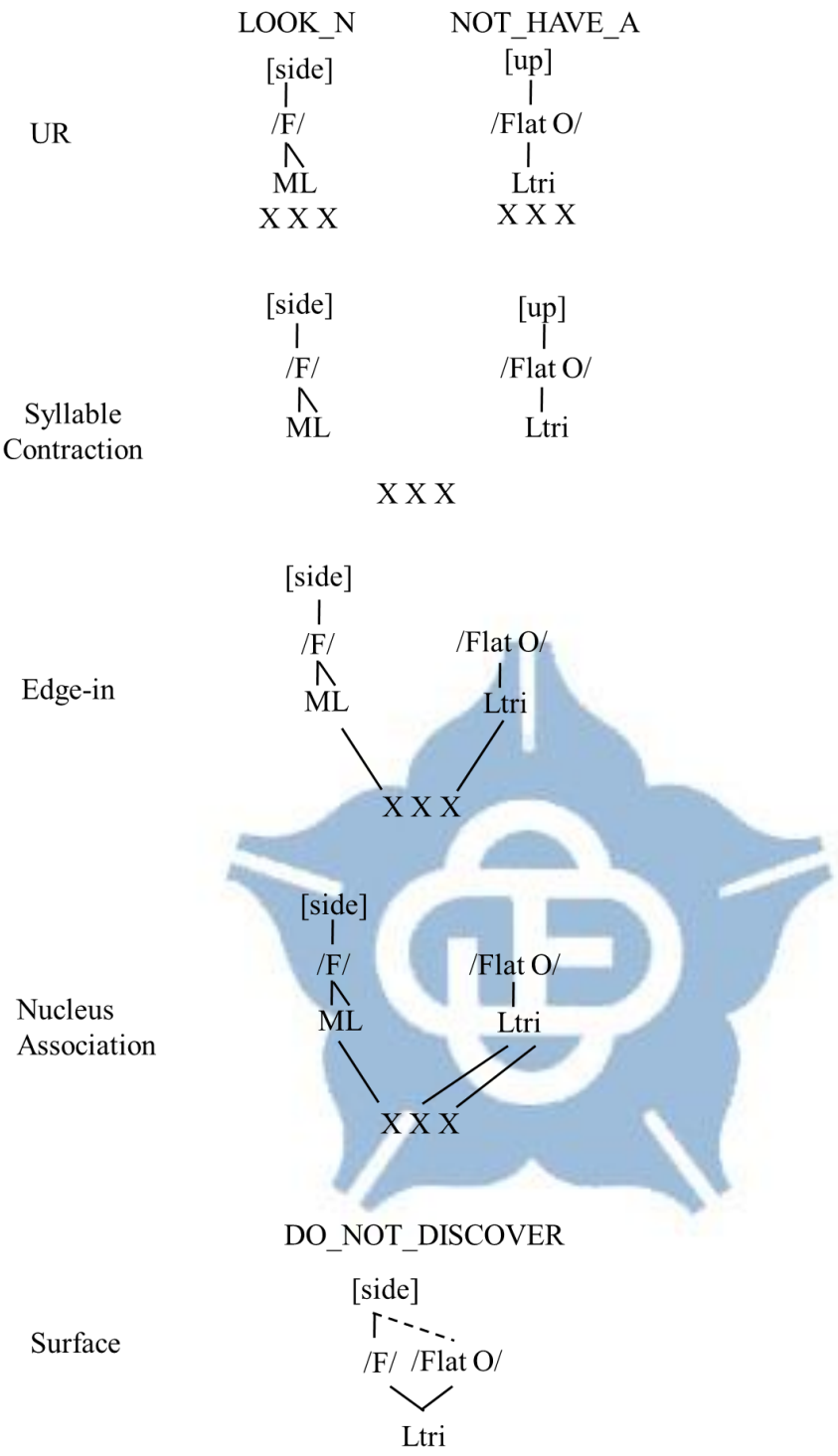
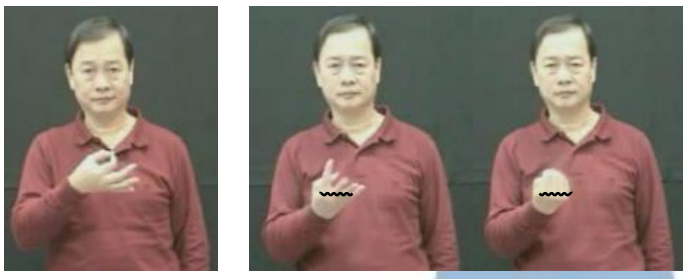


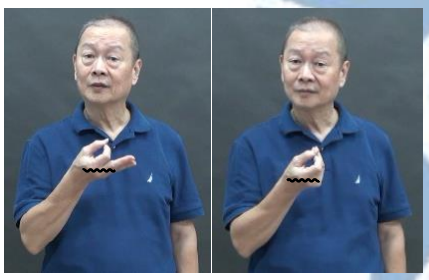
Figure 3.18 Syllable contraction of DO_NOT_DISCOVER (LOOK_N^NOT_HAVE_A)

As to the Figure 3.19, where the sign also has the prosody of ML + Ltri = Ltri, the first component sign MONEY is static and has an epenthetic transitional movement before L. As shown in Figure 3.20, the handshape /F/ of MONEY is

associated to the first timing slot. The handshape /S/ and orientation [upward] of the second component sign HOW_MANY are linked to the third timing slot. HOW_MANY has internal mvoement with fingers changing from open to closed sequentially, and is projected to the nucleus position. After compounding and contrction, HOW_MUCH is signed by handshape /F/ with fingers changing from open to closed as /S/.



a. MONEY b. HOW_MANY



c. HOW_MUCH

Figure 3.19 Before and after compounding of the sign HOW_MUCH

In summary, the syllable of the second component signs is usually more stressed than the syllable of the first component signs, which is thus deleted. If there is a tie, scan the melody by RL scanning to project the movement to the nucleus position. In addition, TSL compound signs also show that the feature [trill] would be deleted after compounding in serial compounding, and this agrees with the previous studies (Klima and Bellugi, 1979; Liddell and Johnson, 1986) that claim that the repeated movement would be lost.

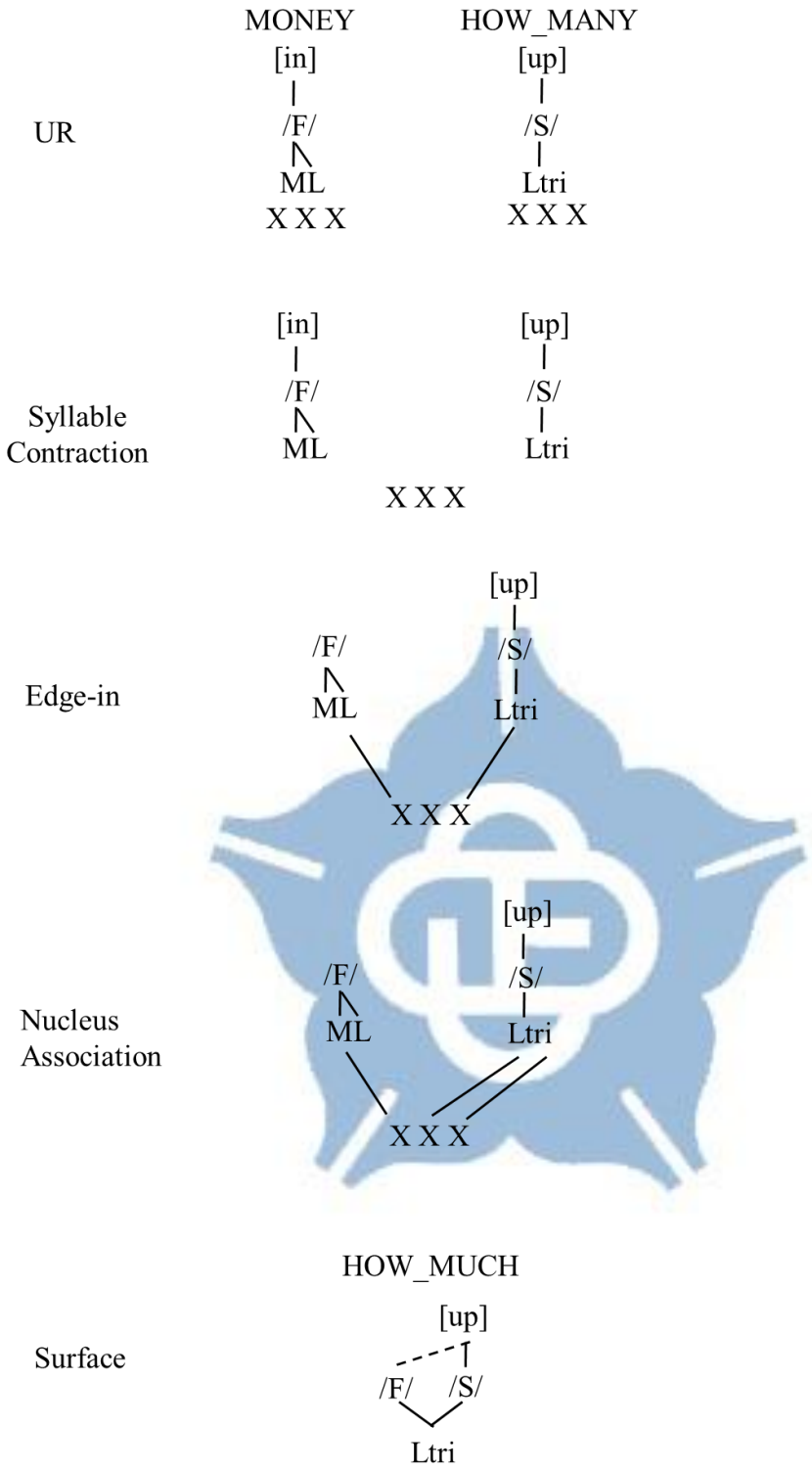


Figure 3.20 Syllable contraction of HOW_MUCH (MONEY^HOW_MANY)

3.1.3 Movement Epenthesis

In 3.1.2, data show that many compound words retain the movements of the more stressed syllable in the component signs. However, some compound words with syllable contraction delete all movements in the component signs, and then add a new movement between them, as in Table 3.2. This is because when two signs are combined together, there is a transition between them. Then, a movement is inserted after being lexicalized.

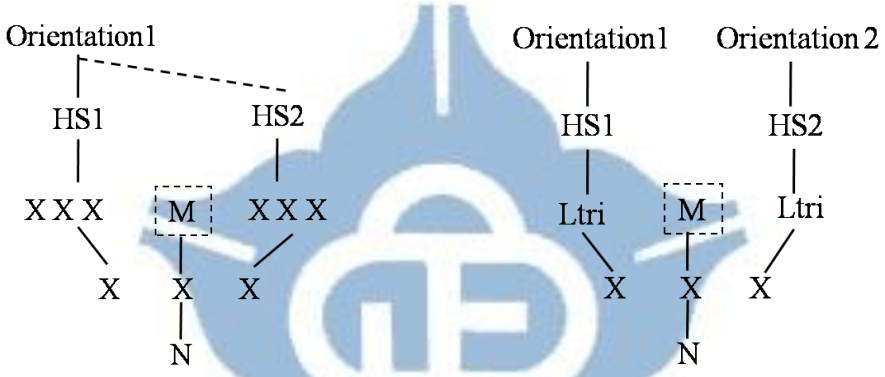
Table 3.2 TSL with Movement Epenthesis

	Component signs	**Compound signs**	**Template**		
			Input 1	**Input 2**	**Output**
1	MIDDLE^HISTORY	ZHONGLI_2 (PLACE NAME)	ML	LML	LML
2	HEART_A^EXCELLENT_A	KIND	ML	LML	LML
3	GOD^SICK	OUT_OF_MIND	ML	LML	LML
4	CLOUD^LIN (SURNAME)	YUNLIN (PLACE NAME)	LML	ML	LML
5	LUCK^EXCELLENT_A	LUCKY	Ltri	LML	LML
6	SAY^NOT	DID_NOT_SAY_SOMETHING_A	Ltri	Ltri	LML
7	THINK^SAME	AGREE_A	Ltri	Ltri	LML
8	NOT_HAVE _A^AFFAIRS	NOTHING_TO_DO	Ltri	Ltri	LML
9	SAY^NOT_HAVE_A	DID_NOT_SAY_SOMETHING_B	Ltri	Ltri	LML

This agrees with Liddell and Johnson's (1986) proposal of a Movement Epenthesis rule whose function is to add a movement into two signs for the compound formation:

> "Movement Epenthesis inserts a movement between articulatorily distinct contiguous segments. Its most common function is to move the hand from the ending configuration of one set of segments to the beginning configuration of the next set of segments." (Liddell and Johnson 1986, p. 469)

In TSL compounding with syllable contraction, there are two environments for them to have a movement epenthesis. First, a new movement is inserted between two component signs, and both handshapes survive but only the first orientation (Orien1) survives, as shown in Figure 3.21a. Second, a movement is added with both handshapes and orientations saved, and both movements are internal movements, as in Figure 3.21b. HS1 and Orien1 are the handshape and orientation in the first component signs, and HS2 and Orien2 are the handshape and orientation in the second component signs.



a. HS1, HS2, and Orien1 survive b. HS1, HS2, Orien1, Orien2 with both Ltri

Figure 3.21 Movement epenthesis in TSL compounding

Let's first examine the case where both handshapes and the first orientation survive. In a case of OUT_OF_MIND in Figure 3.22, HS1 is /8/ with Orien1 [sideward], and HS2 is /Open B/ with Orien2 [outward]. There is an epenthetic transitional movement in the first component sign with handshape change from open to close while there is a path movement in the second component sign. After compounding and syllable contraction, both handshapes and Orien1 survive. The handshapes in two component signs, /8/ and /Open B/, are associated to the edges, as is Orien1, as in Figure 3.23. Then, both movements in the component signs are

deleted, and a transitional movement is inserted between them and projected to the nucleus position. The dominant hand moves from the lower position to the higher position with handshape change by opening the middle finger and the thumb from /8/ to /Open B/.

a. GOD

b. SICK

c. OUT_OF_MIND

Figure 3.22 Before and after compounding of the sign OUT_OF_MIND

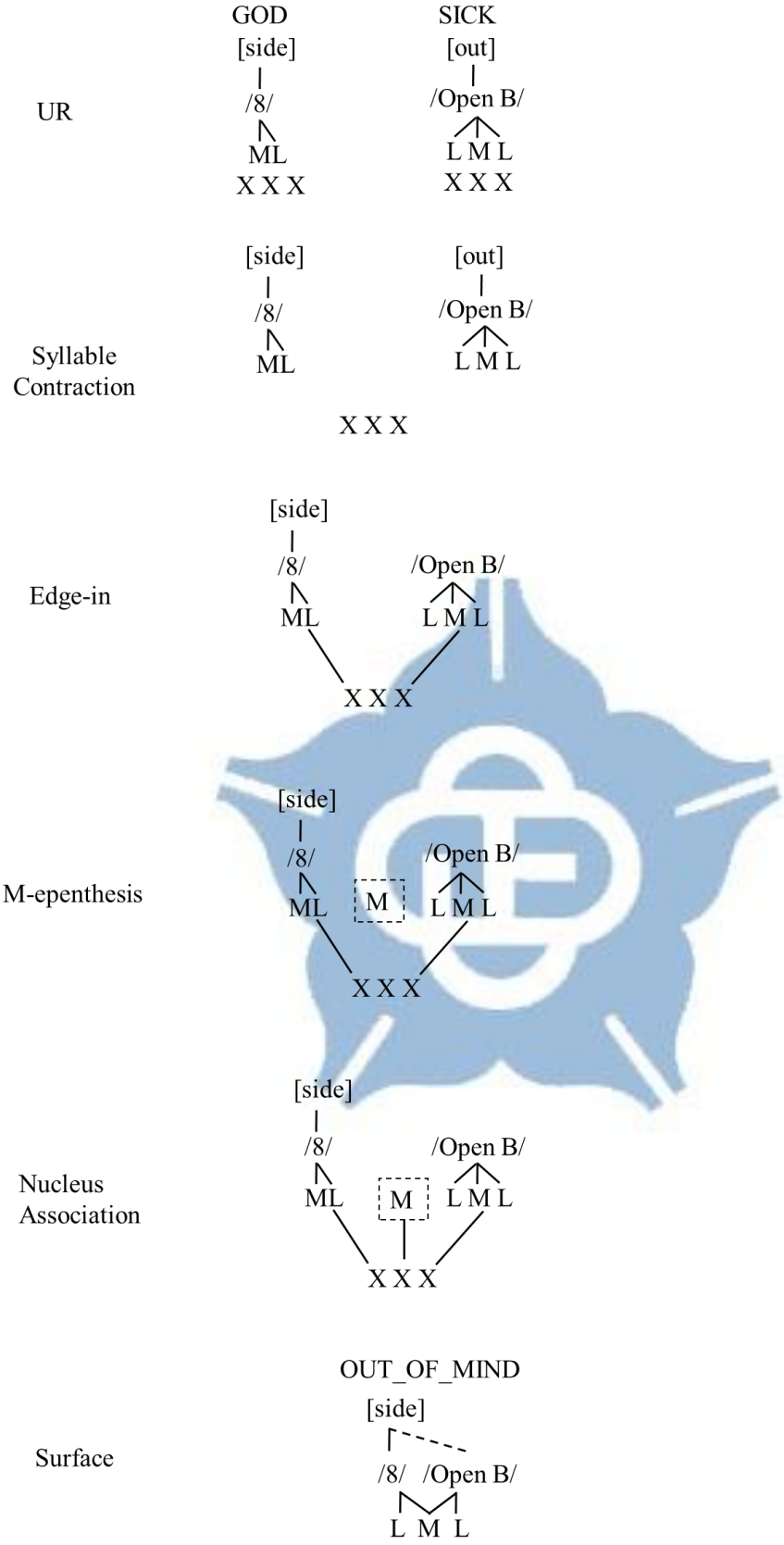


Figure 3.23 Prosody of the compound sign OUT_OF_MIND (GOD^SICK)

The second type of environment for movement epenthesis is where both handshapes and both orientations in the two component signs are retained, and both original movements are trilled movements. Take the sign THINK^SAME = AGREE_A as an example, as shown in Figure 3.24. THINK has internal movement with the handshape /D/ contacting the temple and turning the wrist repeatedly, while SAME also has internal movement that opens and closes the thumb and the index finger repeatedly. Both handshapes and orientations of the component signs are saved. However, the trilled movements in both component signs are deleted, and a new movement is inserted between two component signs as transitional movements.

a. THINK b. SAME c. AGREE_A

Figure 3.24 Before and after compounding of the sign AGREE_A

Figure 3.25 shows the process of syllable contraction in AGREE_A. Handshapes /D/, /Bent-baby O/ and orientations [sideward], [upward] in two component signs are associated to the edges. The trilled movements are deleted, and a transitional movement is inserted and projected to the nucleus position. The result is a canonical LML template in the compound sign after the syllable contraction process.

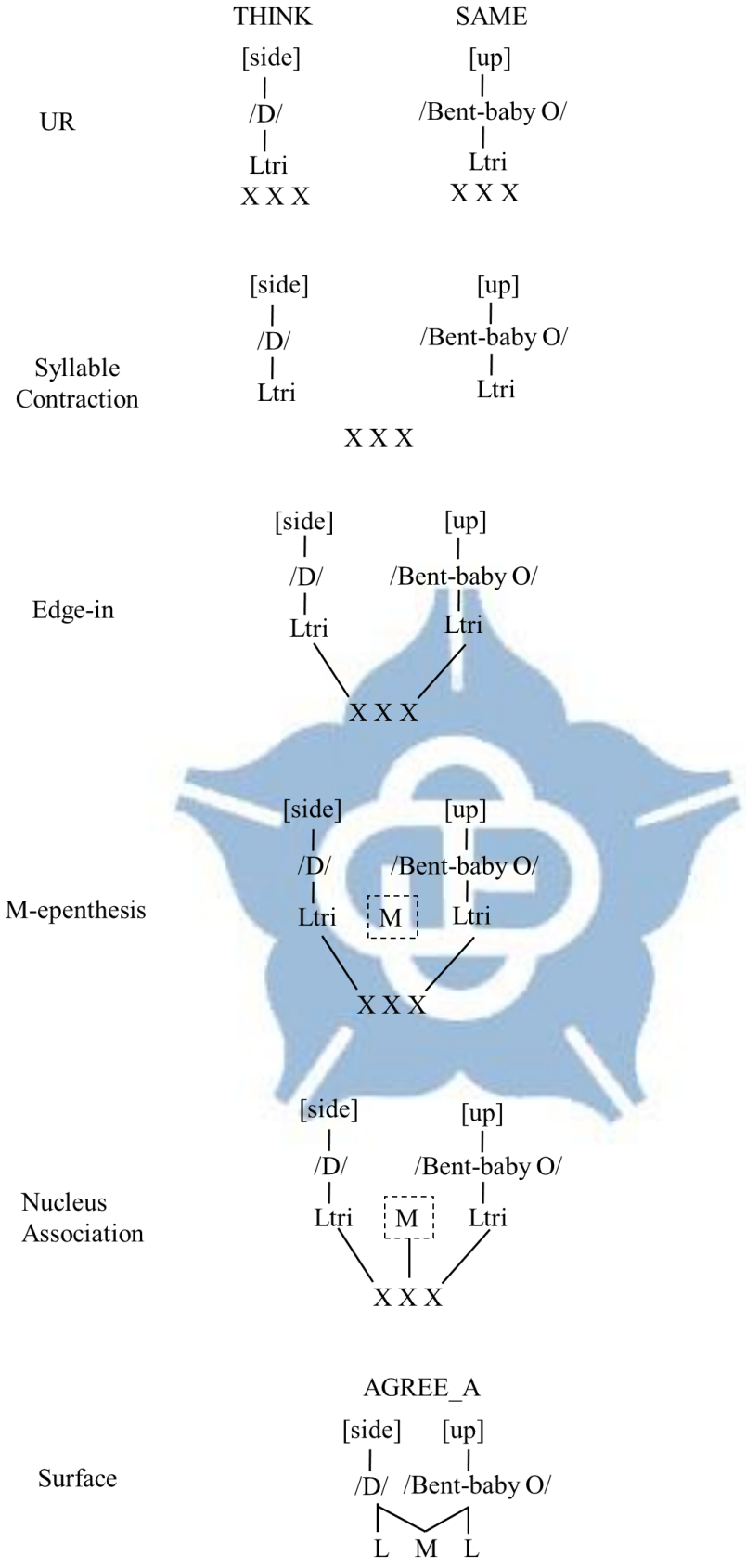
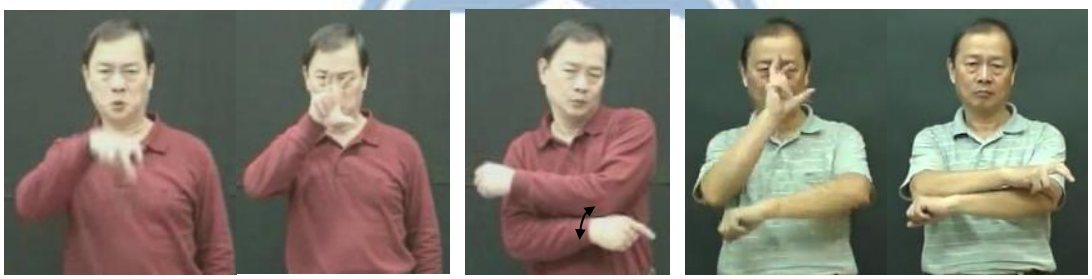


Figure 3.25 Prosody of the compound sign NOTHING_TO_DO (THINK^SAME)

Table 3.3 TSL with Movement Epenthesis in other cases

	Component signs	Compound signs	Template		
			Input 1	Input 2	Output
1	TIGER^TAIL	HUWEI_2 (PLACE NAME)	LML	Ltri	LML
2	DOG^HARBOR	KAOHSIUNG (PLACE NAME)	Ltri	LML	LML
3	MIDDLE^PLACE	TAICHUNG_3 (PLACE NAME)	LL	LML	Ltri

In addition to the cases of movement epenthesis like the above, other environments also have movement epenthesis, as shown in Table 3.3. The first two cases are HUWEI_2 (PLACE NAME) = TIGER^TAIL in Figure 3.26, and KAOHSIUNG (PLACE NAME) = DOG^HARBOR in Figure 3.27. In these two cases, the compound signs neither save the HS1 and Orien2, nor save the Orien1 and HS2. When they save HS1 and Orien1, they will save the location in the second component sign such as HUWEI_2 (PLACE NAME), showed in Figure 3.28. Or when they save the HS2 and Orien2, they will save the first location such as KAOHSIUNG (PLACE NAME), as in Figure 3.29. It means that these two compound signs save at least one feature of each component sign on the edges.



a. TIGER b. TAIL c. HUWEI_2 (PLACE NAME)

Figure 3.26 Before and after compounding of the sign HUWEI_2 (PLACE NAME)

a. DOG

b. HARBOR

c. KAOHSIUNG (PLACE NAME)

Figure 3.27 Before and after compounding of the sign KAOHSIUNG (PLACE NAME)

In HUWEI_2 (PLACE NAME) = TIGER+TAIL, handshape /Curved 3/ in TIGER is moved from palm down to out in front of the face, while handshape /D/ in TAIL has internal movement by circling the index finger at the elbow of the non-dominant hand with palm in. After compounding and contraction, the handshape /Curved 3/ with palm out in front of the face goes down to the lower arm of the non-dominant hand with palm down. HS1 and Orien1 are associated to the first timing slot, and the place feature of the second component sign is associated to the third timing slot. The epenthetic transitional movement between two component signs is associated to the nucleus position. The surface form of the compound sign HUWEI_2 (PLACE NAME) has the prosody LML, as shown in Figure 3.28.

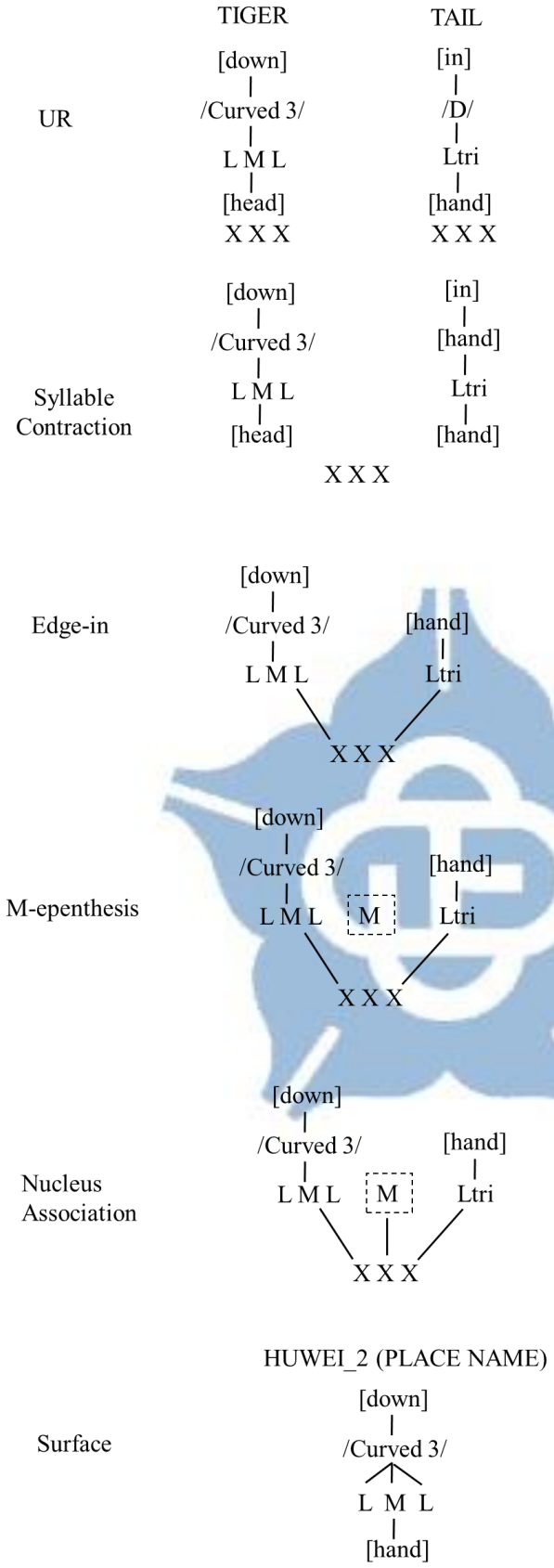


Figure 3.28 Syllable contraction with M epenthesis in other cases: HUWEI_2 (PLACE NAME) (TIGER^TAIL)

As to KAOHSIUNG (PLACE NAME), there is an internal movement in the first component DOG while the path movement in the second component sign HARBOR is from up to down. After combining these two signs together, the place feature [head] in the first component sign is linked to the first timing slot while HS2 and Orien2 are associated to the third timing slot, as in Figure 3.29. In addition, neither of the two movements in component signs are saved, nor is a transitional movement inserted between [head] and [trunk]. Movement in the compound sign is a path movement, but the hand is moved from contacting the head to far away it. Then, the two movements in the component signs are deleted, and the new movement is associated to the nucleus position. Finally, both of these two compound signs, HUWEI_2 (PLACE NAME) and KAOHSIUNG (PLACE NAME), get a LML template that contracts two syllables into only one syllable.

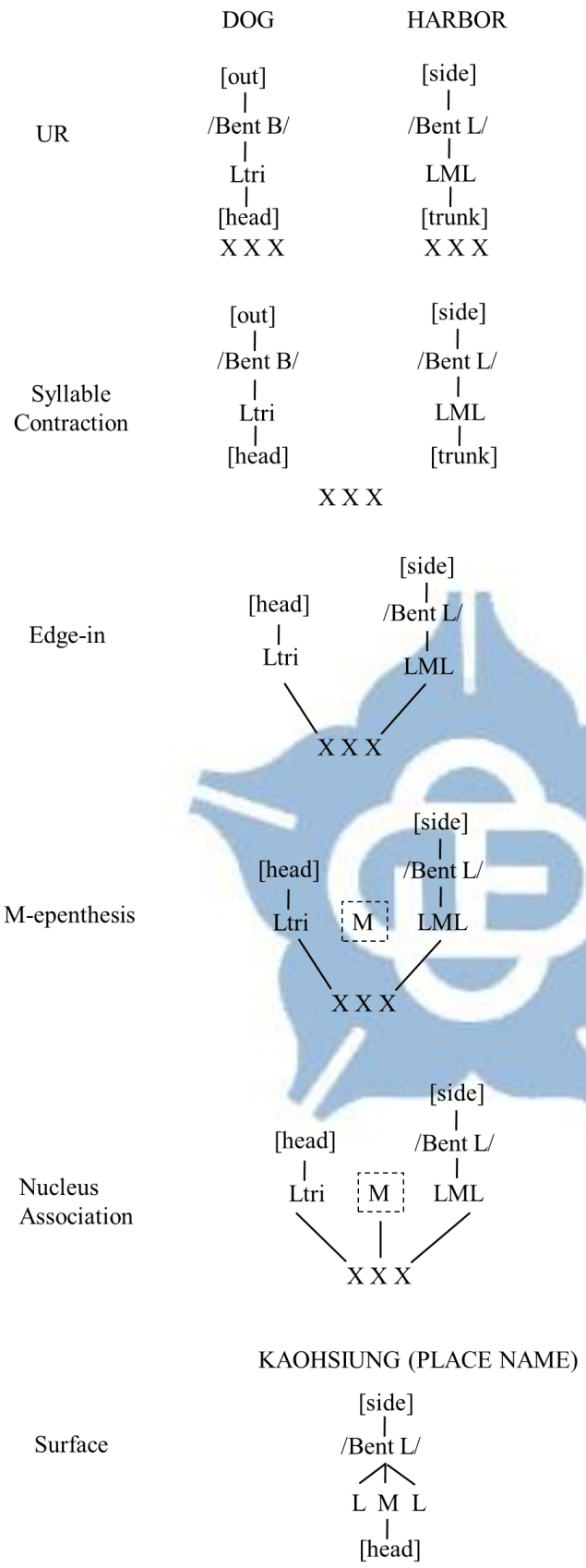


Figure 3.29 Syllable contraction with M epenthesis in other cases: KAOHSIUNG (PLACE NAME) (DOG^HARBOR)

The last case in Figure 3.30 is CHUNG (CHARACTER SIGN)^PLACE = TAICHUNG_3 (PLACE NAME) with ML + LML = Ltri. Researchers (Liddell and Johnson 1986; Sandler 1993) claim that movement in the first sign is usually deleted in the compounding seems not to be applied on this case. Both ML and LML in the component signs are deleted. The Ltri is added and projected to the nucleus position.

a. CHUNG b. PLACE c. TAICHUNG 3 (PLACE NAME)

Figure3.30 Before and after compounding of the sign TAICHUNG 3 (PLACE NAME)

TAICHUNG 3 (PLACE NAME) is combined from CHUNG (CHARACTER SIGN) and PLACE. The sign CHUNG (CHARACTER SIGN) is signed with handshape /D/ and the palm orientation sideward. There is an epenthetic movement in the first component sign. The movement in the second component sign is from the higher position to the mid position in front of the body with the handshape /Bent 5/ whose orientation is [downward]. After combining CHUNG and PLACE, TAICHUNG 3 is signed by the handshape /8/ with the palm orientation sideward on the mouth. The thumb and middle finger which are selected fingers are moved from curved to open repeatedly.

There may be the reason why the output form has the Ltri template. The location assimilation makes ML syllable structure impossible, so the Ltri is required. CHUNG (CHARACTER SIGN) is signed with handshape /D/ and orientation [sideward] at

mouth, and does not have path movement, while PLACE is signed by handshape /Bent 5/ and orientation [downward] with path movement in front of the body. If combine two signs together, the original form would have two movements that one is the hand moving from mouth to the body, and the other is the path movement of the sign PLACE. After syllable contraction, there should be only movement in the compound sign. The location assimilation makes ML impossible. In addition, if the ML syllable structure is impossible and the sonority of L is too weak, trilled movement then should be added to have the high enough sonority. Therefore, both ML and LML in the component signs are deleted, and a trilled movement syllable is created.

3.2 Place Features in TSL Compounding

Place features are also affected by compounding and syllable contraction in sign language, and they determine whether there is a movement and if so, the types of movement. This section divides data into serial compounding and parallel compounding.

3.2.1 Place Features in Serial Compounding

According to Sandler (1993), a monomorphemic sign only has one place feature. The difference between the two locations (Ls) is only in a feature of height, laterality, proximality, or contact. The process of compounding and syllable contraction in TSL follows her claim, and one of the place features in the two component signs is deleted. Data shows that different combinations of the place features in the component signs would save different place features after compounding and contraction:

(8) The sign is signed on the head or hand in the first component sign.

a. [head] + [trunk] = [head]

b. [hand] + [trunk] = [hand]

(9) Both component signs are signed on the body.

a. [trunk] + [trunk] = [trunk]

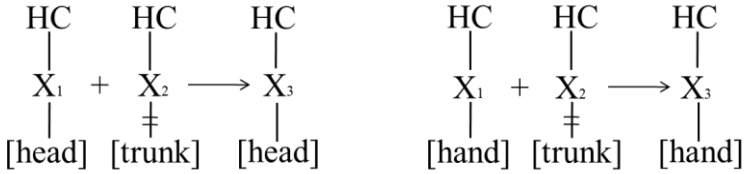
b. [trunk] + [trunk] = [hand]

In (8a) and (8b), place features of head such as [ear] and [chin], and the place feature of hand in the first component sign would be saved, while the place feature [trunk] in the second component sign would be deleted after compounding and contraction. It also could be said that the place feature in the second sign is deleted in this pattern. In (9a) and (9b), the place features are all [trunk] in the two component signs. After compounding and contraction, if both hands in compound sign are symmetrical, the place feature is [trunk]; it is [hand] if the non-dominant hand is the place of the dominant hand.

By these, we could predict when the place feature in the first or second sign would be dropped. Because many patterns of the place feature in serial compounding are found in the data, I divide them into different subsections with more details.

3.2.1.1 The Place Feature of Head or Hand in the First Input Sign Remains.

Place feature in those signs signed on the head or hands will be retained after compounding. No matter whether the place feature of head or hand is in the first sign, if the place feature of the second sign is [trunk], the place feature [trunk] in the second sign is dropped after compounding and contraction, as in Figure 3.31.



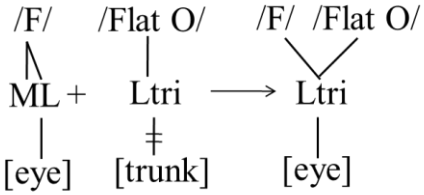
a. [head] + [trunk] = [head] b. [hand] + [trunk] = [hand]

Figure 3.31 Representation of place feature for head/[hand] + [trunk] = head/[hand]

Take DO_NOT_DISCOVER as an example which has been mentioned above, as shown in Figure 3.32. The place feature of the first sign is [eye] while the place feature of the second component sign is [trunk]. After compounding and contraction, the place feature [trunk] is deleted, as in Figure 3.33.

a. LOOK_N b. NOT_HAVE_A c. DO_NOT_DISCOVER

Figure 3.32 Before and after compounding of the sign DO_NOT_DISCOVER



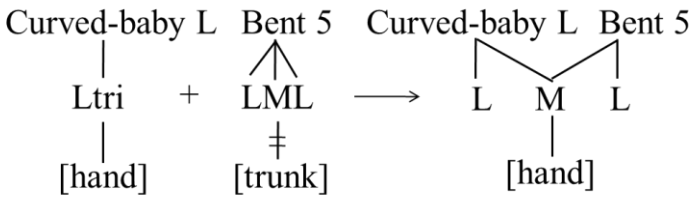
LOOK_N^NOT_HAVE_A = DO_NOT_DISCOVER

Figure 3.33 Representation of place feature for [eye] + [trunk] = [eye]

Take CHIAYI (PLACE NAME) as an example of [hand] + [trunk] = [hand], as in Figure 3.34. CHIAYI (PLACE NAME) is combined by KEY and PLACE. In the sign KEY, the dominant hand signed with the handshape /Curved-baby L/ turns the wrist down repeatedly at the palm of the non-dominant hand. The place feature of the first component sign is [hand]. The handshape of the second component sign PLACE is /Bent 5/ with the palm orientation downward with path movement from higher position to lower position in front of the body, and it has the place feature [trunk]. After combining these two signs in the compound sign CHIAYI (PLACE NAME), the dominant hand has a path movement with a handshape change from /Curved-baby L/ to /Bent 5/ near the palm of the non-dominant hand. The place feature of the compound sign is [hand], as shown in Figure 3.35.

a. KEY b. PLACE c. CHIAYI (PLACE NAME)

Figure 3.34 Before and after compounding of the sign CHIAYI (PLACE NAME)



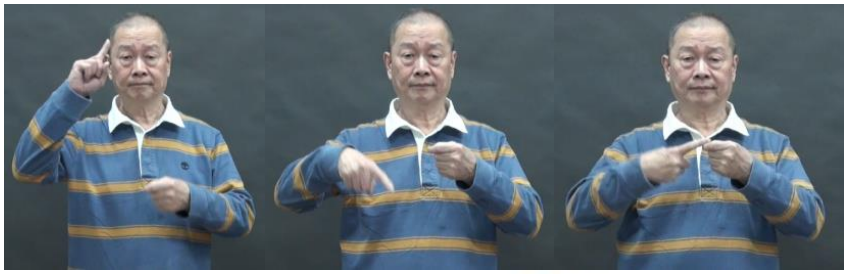
KEY^PLACE = CHIAYI (PLACE NAME)

Figure 3.35 Representation of the place feature for [hand] + [trunk] = [hand]

In addition, both NEXT_YEAR in Figure 3.36 and HUWEI_2 (PLACE NAME) in Figure 3.37, as cited above, has place the feature [head] + [hand] = [head] + [hand]. In NEXT_YEAR, there is path movement in the first component sign TOMORROW, and at the same time, the orientation is changed from palm in to palm out (through a wrist turn). In addition, a movement with a circle is in the second component sign. In the compounding process, in order to combine the movement of turning the wrist and a circle, the wrist does not turn the palm out but only to the [sideward] which is followed by the circle, as shown in Figure 3.38a. Regarding HUWEI_2 (PLACE NAME), a transitional movement is inserted between the component signs, as mentioned above. There are two orientations in the first component sign that turn the wrist from palm down to palm out. After compounding and contraction, only the palm out in the first component sign is saved, as in Figure 3.38b. Then, the dominant hand is moved from mouth to the elbow of the non-dominant hand. If both orientations in the first component signs are saved, there would be two movements in the compound sign, and it would become a disyllabic sign. Both these two compound signs move from the higher position to the lower position. The sonority for [head] and [hand] may be the same since both are saved after compounding and contraction.

a. TOMORROW

b. YEAR

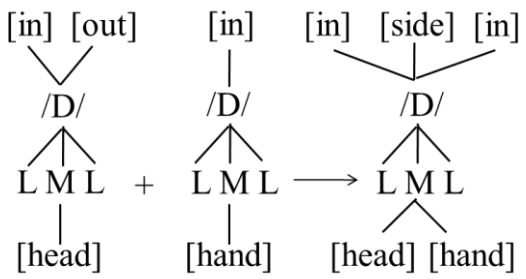


c. NEXT_YEAR

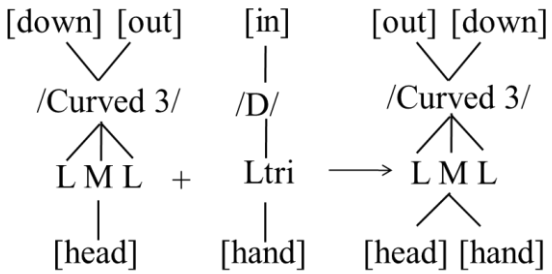
Figure 3.36 Before and after compounding of the sign NEXT_YEAR

a. TIGER b. TAIL c. HUWEI_2 (PLACE NAME)

Figure 3.37 Before and after compounding of the sign HUWEI_2 (PLACE NAME)



a. NEXT_YEAR (TOMORROW^ YEAR)



b. HUWEI_2 (PLACE NAME) (TIGER^TAIL)

Figure 3.38 [head] + [hand] = [head] + [hand]

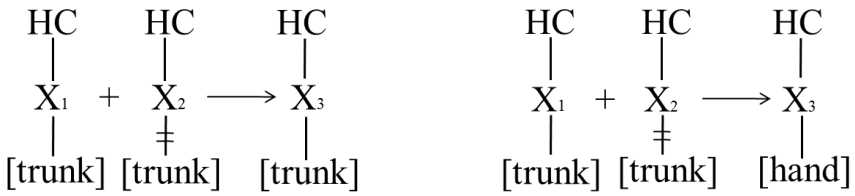
From the two place feature combinations shown in this subsection (head/[hand] + [trunk] = head/[hand] and [head] + [hand] = [head] + [hand]), we may propose that the sonority of the head and hand is the same, and they are more sonorant than the body, as shown in (10). While the combination of place feature is head/[hand] and [trunk], head/[hand] has priority to survives. While the combination of place feature is [head] and [hand], both of them are saved.

(10) Sonority of the place features:

{[head] = [hand]} > [trunk]

3.2.1.2 Both Place Features in Component signs Are [trunk].

If the place features in the two component signs are both [trunk], then they would keep the [trunk] feature or become the [hand] feature. In two handed signs, if both hands in compound sign are symmetrical, the place feature is [trunk], as shown in Figure 3.39a. It is the place feature [hand] if the non-dominant hand is the place of the dominant hand, as shown in Figure 3.39b.



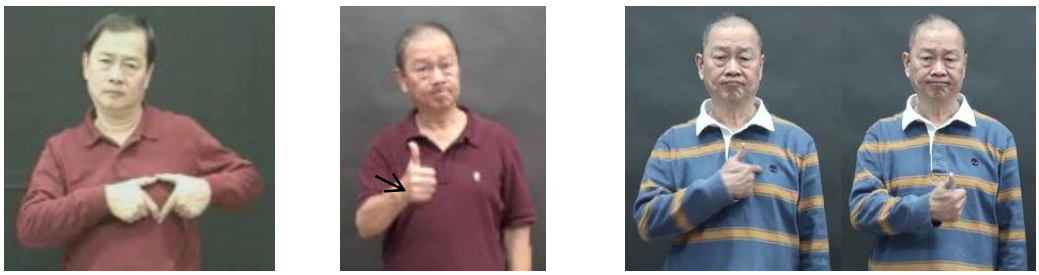
a. [trunk] + [trunk] = [trunk] b. [trunk] + [trunk] = [hand]

Figure 3.39 Representation of place feature for [trunk] + [trunk] = [trunk]/[hand]

First, in [trunk] + [trunk] = [trunk], some compounds are one-handed signs while some are two-handed signs. In one-handed compound signs, WHERE and KIND have path movement in front of the body, as shown in Figure 3.40 and Figure 3.41. Their prosody with place features is shown in Figure 3.42 where both before and after compounding they have the [trunk] feature.

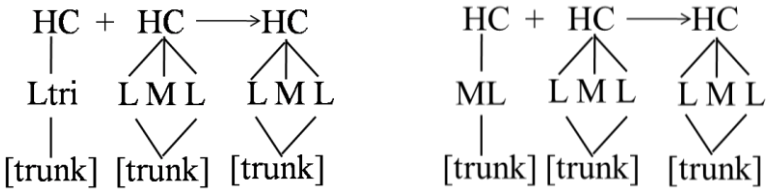
a. WHAT b. PLACE c. WHERE

Figure 3.40 Before and after compounding of the sign WHERE



a. HEART_A b. EXCELLENT_A c. KIND

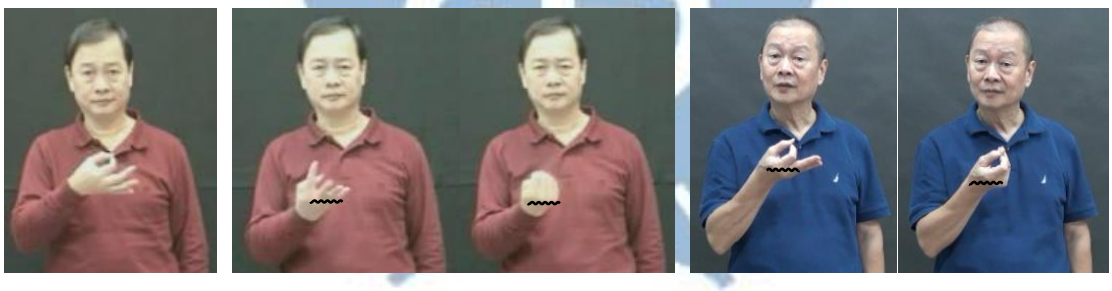
Figure 3.41 Before and after compounding of the sign KIND



a. WHERE (WHAT^PLACE) b. KIND (HEART_A^EXCELLENT_A)

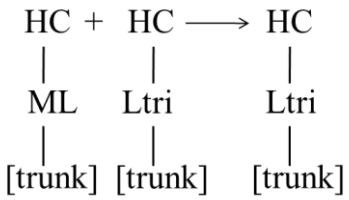
Figure 3.42 Representation of feature place for [trunk] + [trunk] = [trunk] in one-handed signs which has path movement in compound signs

Other one-handed compound signs such as HOW_MUCH do not have path movements, but have internal movements, as shown in Figure 3.43, as mentioned above. Place features in the both component signs are [trunk]. After compounding and contraction, the place feature of the compound sign is still the feature [trunk], as shown in Figure 3.44.



a. MONEY b. HOW_MANY c. HOW_MUCH

Figure 3.43 Before and after compounding of the sign HOW_MUCH



MONEY^HOW_MANY = HOW_MUCH

Figure 3.44 Representation of feature place [trunk] + [trunk] = [trunk] in one-handed signs which has internal movements in compound signs

The cases with two-handed compound signs are symmetrical signs with two symmetrical component signs. In many two-handed symmetrical compound signs, one of the movements in the component signs is deleted, and the compound sign keeps both handshape in the component signs with handshape change. This is due to handshape assimilation. A case whose both place features are [trunk] in the component signs is NO PROBLEM_A which is combined from NOT_HAVE and PROBLEM, Figure 3.45, as cited above. NOT_HAVE has the handshape /Flat O/ with orientation [upward], and has repeated hand internal movement. PROBLEM has the handshape /5/ with orientation [inward], and has a path movement. Both of them are two handed signs and are signed in front of the body symmetrically. After compounding and contraction, the compound sign retains the movement of PROBLEM with handshape change from closed to open. The handshape change might come from the handshape perseverative assimilation from the first component sign, as shown in Figure 3.46.

a. NOT_HAVE b. PROBLEM c. NO_PROBLEM_A

Figure 3.45 Before and after compounding of the sign NO_PROBLEM_A

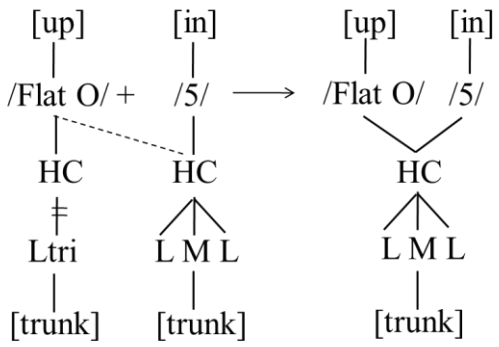


Figure 3.46 Representation for NO_PROBLEM_A (NOT_HAVE^PROBLEM)

BANK is the case that has two-handed symmetrical sign which does not have any movement in component signs and compound signs, as in Figure 3.47. Its prosody is ML + ML = ML. The HC1 in one-handed MONEY is /F/ with palm orientation [inward], while the HC2 in the symmetrical two-handed sign HOUSE is /Open B/ with palm orientation [sideward]. The place features in component signs and in compound signs are all [trunk]. In addition, component signs and the compound sign all have epenthetic movements. None of the movement in the component signs can bear main stress. A movement should be inserted to make the syllable more stressed after combining them together. However, no movement is inserted. This is because handshape assimilation that the two component signs are signed at the place [trunk] without any movement, and HS1 and Orien2 are saved which prevent hand internal movement or path movement from occurring, as shown in Figure 3.48.

a. MONEY b. HOUSE c. BANK

Figure 3.47 Before and after compounding of the sign BANK

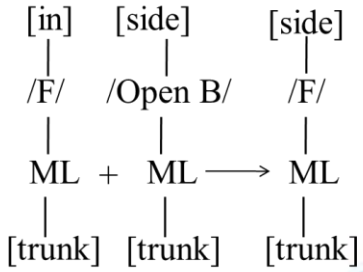
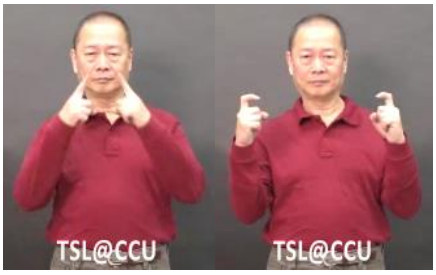


Figure 3.48 Representation for BANK (MONEY^ HOUSE)

Regarding the [trunk] + [trunk] = [hand] cases, which agree with Sandler's (1989) claim that the non-dominant hand becomes the place feature of the dominant hand. In many cases, this might because of assimilation. The case TUCHENG (PLACE NAME) in Figure 3.49 is combined by TU (CHARACTER SIGN) and CITY, both of the component signs are two-handed signs. Because two hands in the asymmetrical sign TU (CHARACTER SIGN) do not have path movement, the place feature is [trunk], as shown in Figure 3.50. In addition, since the two hands in the sign CITY have a symmetrical path movement in front of the body, the place feature is [trunk], too. Because the non-dominant hand is static while the dominant hand moves, the non-dominant hand becomes the place of articulation of the dominant hand after compounding and contraction. (In HC_{R1}, HC_{R2}, HC_{L1}, HC_{L2}, HC = hand

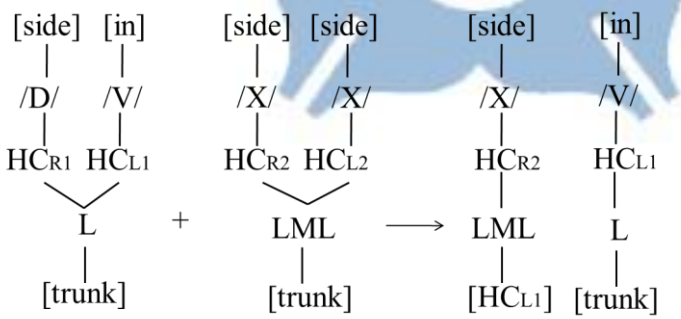
configuration, R = right hand, L = left hand, 1 = the first component sign, 2 = the second component sign.)



a. TU (CHARACTER SIGN) b. CITY

c. TUCHENG (PLACE NAME)

Figure 3.49 Before and after compounding of the sign TUCHENG (PLACE NAME)



TU (CHARACTER SIGN) + CITY = TUCHENG (PLACE NAME)

Figure 3.50 Representation for [trunk] + [trunk] = [hand]

In summary, when place features in the two component signs are [trunk], they would be [trunk] or [hand] after compounding and contraction. If both two-handed

component signs are symmetrical signs, the two-handed signs would be symmetrical compound signs with place feature [trunk]. If one of the component signs is asymmetrical, they would not be the symmetrical compound signs and have place feature [hand], as shown in Table 3.4.

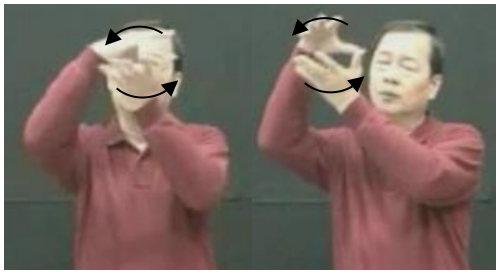
Table 3.4 Facts for place features [trunk] in both component signs

Input	**Output**		**Prosody (output)**	**Symmetry (output)**
trunk+trunk	trunk	one-handed sign	LML	×
			Ltri	×
		two-handed sign	LML	✓
trunk+trunk	hand	two-handed sign	LML	×

3.2.1.3 Puzzles

The case of the two-handed compound sign CLOUD+LIN (SURNAME) = YUNLIN (PLACE NAME) is a little complex. Pictures are given in Figure 3.51. The first component sign CLOUD is a symmetrical sign that is signed with handshape /Bent 5/ and moves from left to right with circles. The second component sign LIN (SURNAME) is an asymmetrical sign where the dominant hand is handshape /V/ orientation [outward] and circles on the wrist of the non-dominant hand. After combining them together, the handshape in the dominant hand is changed from /Bent 5/ to /V/ with palm orientation [outward], while the handshape in the non-dominant hand is changed from /Bent 5/ to /S/ with palm orientation [inward]. In addition, both of them are signed in front of the body so that the dominant hand is moved from a higher position to a lower position while the non-dominant hand is moved from a lower position. That is, there is a handshape change during the movement, and the

movement of two hands is the opposite direction. The prosody and features are shown in Figure 3.52.

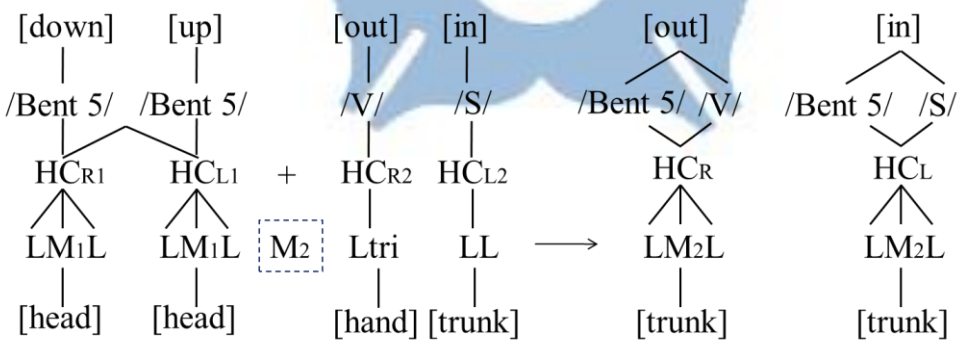


a. CLOUD

b. LIN (SURNAME)

c. YUNLIN (PLACE NAME)

Figure 3.51 Before and after compounding of the sign YUNLIN (PLACE NAME)



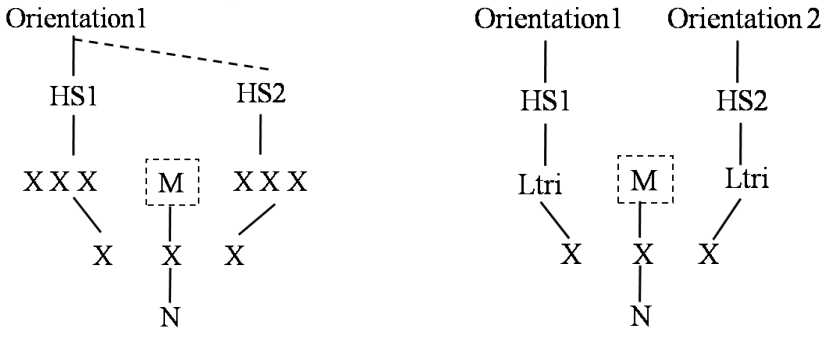
CLOUD+LIN (SURNAME) = YUNLIN (PLACE NAME)

Figure 3.52 Prosody of the compound sign YUNLIN (PLACE NAME)

The compound sign YUNLIN (PLACE NAME) violates two of the generalizations we made above. First, the data above showed that [head] + [hand] in

both component signs would be kept in the compound signs. However, the place feature in the compound sign YUNLIN (PLACE NAME) does not save both [head] + [hand], but instead saves [trunk]. That is, the place feature of CLOUD+LIN (SURNAME) = YUNLIN (PLACE NAME) is [head] + [hand] = [trunk] which violates the generalization that [head] + [hand] = [head] + [hand].

In terms of the movement, both hands moved from left to right with circles in the first component sign CLOUD, while the second sign LIN (SURNAME) circles in only one location, i.e. the non-dominant hand. However, the movements in these two component signs are deleted, and a new path movement is inserted as the transition between two component signs after compounding, moving the dominant hand from the higher position to the lower position in front of the body. This violates the generalization which has been mentioned above, as shown in Figure 3.53 that in the cases with both handshapes and Orien1 associating to the edges a transitional movement is inserted. However, Orien1 is not saved, but Orien2 survives in YUNLIN (PLACE NAME), and there is a transitional movement which is associated to the nucleus position.



a. HS1, HS2, and Orien1 survive b. HS1, HS2, Orien1, Orien2 with both Ltri

Figure 3.53 Movement epenthesis in TSL compounding

The reason that these two problems occur in the compound sign YUNLIN (PLACE NAME) might be the effects of location and handshape changes. Handshape /Bent 5/ in the dominant hand of the first component sign is signed in front of the head, while handshape /V/ in the dominant hand of the second component sign is signed on the non-dominant hand which is in front of the body. In other words, /Bent 5/ is signed at the higher location, and /V/ is signed at the lower position. In order to save two locations and handshapes in the component signs, the dominant hand should be moved from the higher position to the lower position with handshape change /Bent 5/ to /V/. At the same time, because the non-dominant hand is affected by the handshape /Bent 5/ in the first component symmetrical sign, it should have a movement from the lower [trunk] to the higher [trunk] with handshape change /Bent 5/ to /S/. The non-dominant hand is the place of articulation in the second component sign, but it has a movement from the lower position to the higher position after compounding. This makes the [head] + [hand] = [head] + [hand] impossible.

3.2.3 Syllable Contraction in Parallel Compounding

Syllable contraction also occurs in parallel compounding. Table 3.5 shows the three parallel compounds with syllable contraction in TSL, in which the component signs are signed by only one hand, i.e. the dominant hand, before compounding. One of the same two component signs is signed by the dominant hand while the other is signed by the non-dominant hand.

Table 3.5 Three parallel compound signs in TSL

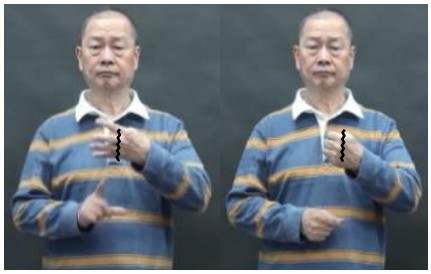
Component signs	**Compound signs**
WHICH_MONTH	HOW_MANY∪MOON
JANUARY	ONE∪MOON
SUN_MOON_LAKE_1	SUN+MOON∪LAKE

("∪" indicates that the two roots are produced simultaneously.)

HOW_MANY∪MOON = WHICH_MONTH in Figure 3.54 and ONE∪MOON = JANUARY in Figure 3.56 are similar in that HOW_MANY and ONE are signed by one hand in the higher position while MOON with path movement is signed by the other hand in the lower position. In the compound sign WHICH_MONTH, the handshape of HOW_MANY is /S/ with fingers changing from open to closed in a sequential way. MOON is signed with the handshape /Bent-baby O/ in front of the body. While closing the two selected fingers, the palm orientation is from out turning to the side. After combining the sign HOW_MANY and MOON, WHICH_MONTH is signed in front of the body, so that one hand signs HOW_MANY while MOON is signed by the other one hand at the same time. The prosody is shown in Figure 3.55. There are two differences in the handshape /S/ between its form in the component sign and its form in the compound sign. First, orientation becomes [inward] from [upward]. Second, the location of the hand in the compound sign is higher than in the component sign. In addition, MOON is signed in the lower position in the compound sign than in the component sign.

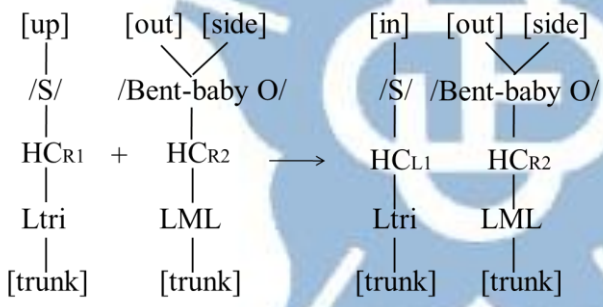
a. HOW_MANY

b. MOON



c. WHICH_MONTH

Figure 3.54 Before and after compounding of the sign WHICH_MONTH



HOW_MANY∪ MOON = WHICH_MONTH

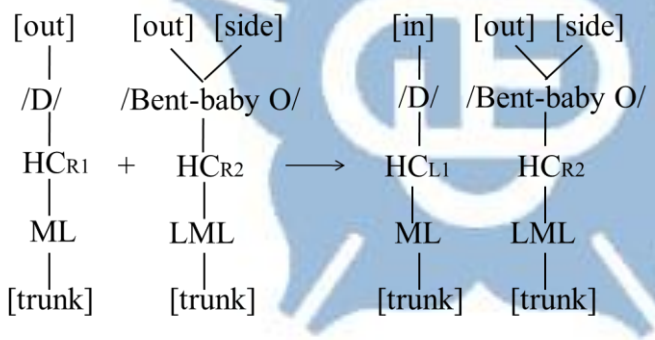
Figure 3.55 Representation for the prosody of WHICH_MONTH

Syllable contraction in WHICH_MONTH and JANUARY is almost the same. The difference between them is that the handshape of JANUARY in the first component sign is /YI/ with the palm out and the index finger pointed upward, as in Figure 3.56. After compounding and contraction, the palm orientation of this hand becomes [inward], and the index finger points to the side. The prosody is shown in Figure 3.57.

a. ONE b. MOON

c. JANUARY

Figure 3.56 Before and after compounding of the sign JANUARY



ONE∪MOON = JANUARY

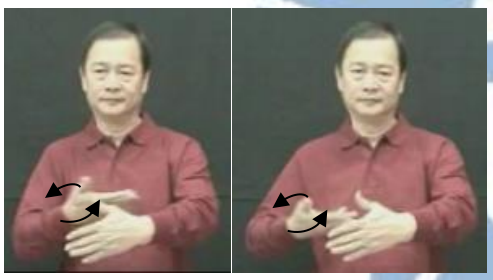
Figure 3.57 Representation for the prosody of JANUARY

In the case of SUN_MOON^LAKE, which is combined from SUN, MOON, and LAKE, SUN and MOON have syllable contraction, as in Figure 3.58. SUN is signed by /Bent 5/ without any movement, and the orientation is [inward]. Its prosody is ML, in Figure 3.59. As mentioned in the previous case, the prosody is LML. After combining together, SUN is signed by the non-dominant hand while MOON is signed

by the dominant hand. SUN stays in one location with palm orientation in, and MOON is signed on the arm of the non-dominant hand, i.e. the non-dominant hand becomes the place of articulation of the dominant hand. MOON keeps its original handshape and movement, but has palm orientation [inward]. This case also has the non-dominant hand signed in the higher position and the dominant hand signed in the lower position.

a. SUN

b. MOON



c. LAKE

d. SUN_MOON^LAKE

Figure 3.58 Before and after compounding of the sign SUN_MOON^LAKE

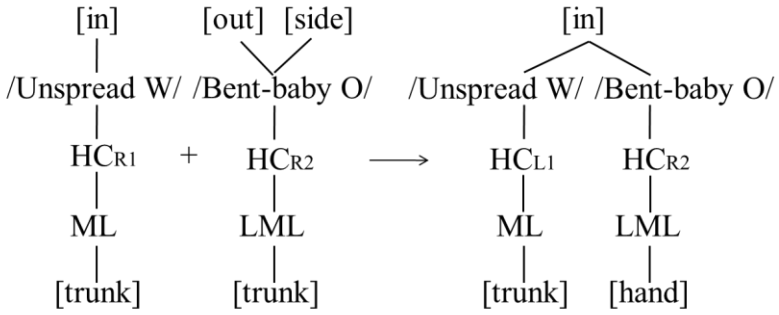


Figure 3.59 Representation for the prosody of SUN_MOON

That two syllables are contracted into one contributes to the change of the prosody. In these three parallel compound signs, they all have the less syllables in the first component signs, and have the more sonorous syllables in the second component signs. After compounding and contraction, the syllables with higher sonority are signed by the dominant hand at lower position, while the syllables with less sonority are signed by the other hand at higher position. Then, they are also cases where two syllables contracted into one with both hands representing different meanings at the same time.

3.3 Summary

To summarize, data show that most compound signs follow the canonical LML template, and the more stressed syllable would be retained and projected to the nucleus position after compounding and syllable contraction. In addition, different conditions in the component signs decide which handshapes and orientations should be associated to the edges in the timing slots of the compound signs. Then, we can decide whether a transitional movement would be inserted between two component signs or not. Table 3.6 shows the key facts for TSL compounding and syllable contraction.

Table 3.6 Facts for TSL compounding and syllable contraction

	Edges		**M-epenthesis**
	First slot	**Third slot**	
Handshapes (HS) & Orientations (Orien)	HS1, Orien1	HS2	✓
	HS1, Orien1 (*Ltri)	HS2, Orien2 (*Ltri)	✓
	HS1	Orien2	×
	HS1, Orien1	HS2, Orien2	×

(*Ltri: movement in the component signs should be Ltri.)

When two signs are combined together, place feature also plays an important role. Place features may cause handshape changes, orientation assimilation, or lexical blocking, and then further affect the movement type, i.e. prosody in the compound signs. Based on the data, I proposed the sonority hierarchy for place features: {[head] = [hand]} > [trunk]. Table 3.7 shows that the place feature with higher sonority would be remained and they further influence other phonological parameters in the process of compounding and syllable contraction.

Table 3.7 Combinations of place features

	head	**hand**	**trunk**
head	(head)	head+hand	head
hand	head+hand	(hand)	hand
trunk	head	hand	trunk / hand

(): not found in TSL compounding

Chapter 4

Comparing Syllable Contraction in Southern Min and in TSL

This chapter points out the factors contributing to syllable contraction in Southern Min and in TSL. Then, I compare them from the phonological view, with focus on prosody and sonority. The end of this chapter summarizes the similarities and differences in syllable contraction in Southern Min and TSL.

4.1 What Causes Syllable Contraction in Southern Min and TSL?

Previous studies claim that many factors cause syllable contraction in Southern Min. Chung (1996) divided syllable contraction in Southern Min into two types. The first type contracts two successive syllables into one. People may contract syllables in ordinary occasions while people would not contract syllables in deliberate speech, as shown in (11a) and (11b), respectively.

(11) ka 33(31) ‘let’ + laŋ 13 ‘people’ → kaŋ 33. (Chung 1996, p. 132)

a. in ordinary occasions: kaŋ 33

b. in deliberate speech: ka 33(31) laŋ 13

The other type is where the first two syllables of a trisyllabic adjective reduplication would be contracted into one, as shown in (12).

(12) Example in trisyllabic forms (Chung 1996, p. 134)

A. Trisyllabic Forms				B. Contracted Forms		
a. sin 35	sin 33	sin 55	→	si-in 353	sin 55	'new'
b. tit 35	tit 31	tit 55	→	it-ti 351	tit 55	'straight'
c. kaw 35	kaw 31	kaw 33	→	ka-aw 351	kaw 33	'thick'

According to Tseng (1999), many factors affect syllable contraction in Southern Min:

a. Segmental makeup of syllables. The intervocalic consonants and less sonorous vowels tend to be lost in syllable contraction.

b. Rhythmic pattern. Weak syllables such as unstressed syllables and short syllables tend to be deleted in syllable contraction.

c. Speaking rate. Syllable contraction is likely to occur in fast speech.

d. Prosodic boundary. Syllable contraction tends not to apply across the boundary of a Phonological Word or a Clitic Group of a Phrase.

e. Phonotactic constraints. Those partially contracted forms violating phonotactic constraints tend to observe the advancing contraction pressure and become a grammatical syllable.

f. Lexical category. Function words and grammatical morphemes tend to get involves in syllable contraction.

g. Lexical frequency. High frequency words tend to have syllable contraction.

In my study, the less sonorous movements and the unstressed movements tend to be lost in syllable contraction. As in Southern Min, those partially contracted forms violating phonotactic constraints is likely to observe the advancing contraction pressure and become a grammatical syllable. In addition, syllable contraction is likely

to occur in compound signs, and the grammatical morphemes tend to get involves in syllable contraction. Besides, function words such as perfect tense and negation also get involves in syllable contraction. Finally, high frequency compound signs tend to have syllable contraction, e.g. KIND. (From Appendix examples, place names may tend to be lower frequency, so that is why they contract less.) As to the ordinary communication, people only delete the repetition in the trilled movement, or the hold sign without path movement would become the short contact of the body. They just simplify the movement, but do not contract two syllables into one.

4.2 Syllable Contraction in Southern Min and TSL Phonology

This section compares TSL compounding with the syllable contraction in Southern Min in phonology based on the Sonority Model (Hsu 2003).

a. Syllable Template

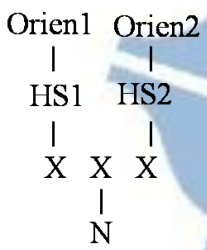
Chung (1996) claimed that each Southern Min syllable has a three-X-slot template with the nucleus in the middle. In TSL, Ltri, ML, and LML all have a three-X-slot template respectively.

b. Syllable Contraction

In Southern Min, after two three-X-slot templates combine together and have syllable contraction, there is only one three-X-slot template in the output form. That is, two syllables contract into one. TSL is the same as Southern Min in that each syllable has a three-X-slot template before compounding and contraction, and compound signs also have a three-X-slot template after lexicalization.

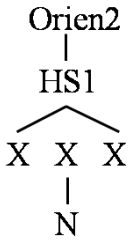
c. Edge Association

Associating segments and the skeleton tier begins with both edges, and this only affects the onset and the consonantal ending in Southern Min. TSL is the same in that associated segments and the skeleton tier begins with both edges. The only difference is that in Southern Min the whole onset and consonantal segment would be associated to the edges, but in TSL only two parameters, handshape and/or orientation, of each component sign would be linked to the edges in. There must be at least one handshape and one orientation associated to each edge at the same time. Figure 4.1 shows the possible handshapes (HS) and orientations (Orien) that would be saved after compounding and contraction.



a. Both handshapes and orientations

b. Both handshapes and Orien1



c. HS1 and Orein2

Figure 4.1 Handshapes and orientations are linked to edges after compounding

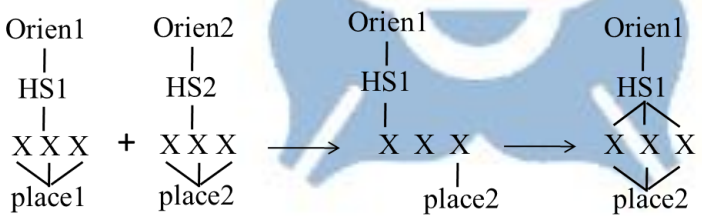
Because handshape and orientation should show up together, a grammatical sign must contain at least one handshape and one orientation at the same time. Then, the slot on the one edge should be handshape, while the slot one the other edge should be

orientation. Neither that edges containing both handshapes but without any orientation is impossible, nor that edges containing both orientations but without any handshape is impossible, as shown in Figure 4.2.

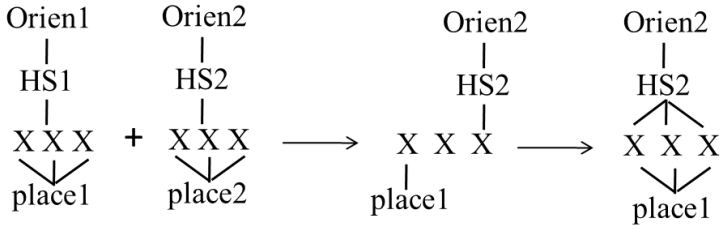
a. *Both handshapes without orientation (b) *Both orientation without handshape

Figure 4.2

Data show that it is possible for both handshape and orientation to be associated to the same edge, but the other edge should be associated with the place feature in the other component sign, which is shown in Figure 4.3a and Figure 4.3b.



a. HS1, Orien1, Place 2

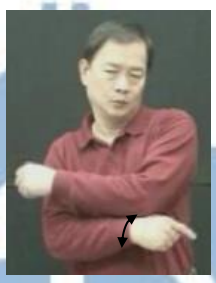


b. Place1, HS2, Orien2

Figure 4.3 handshape and orientation in the one edge, place feature in the other edge

Each of these two structures has only one attested example, HUWEI_2 (PLACE NAME) and KAOHSIUNG (PLACE NAME), as mentioned in Chapter 3, and shown in Figure 4.4 and Figure 4.5, respectively. Handshape and orientation in the first component sign of HUWEI_2 (PLACE NAME) are saved, and they are associated to the first timing slot. The place feature in the second component signs is associated to the third timing slot, as in Figure 4.6a. Figure 4.6b KAOHSIUNG (PLACE NAME) is the case where both handshape and orientation are associated to the third timing slot, and the place feature is associated to the first timing slot.

a. TIGER



b. TAIL

c. HUWEI_2 (PLACE NAME)

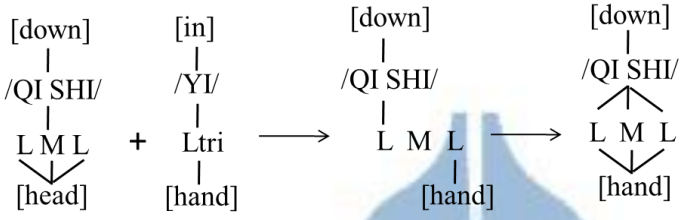
Figure 4.4 Before and after compounding of the sign HUWEI_2 (PLACE NAME)

a. DOG

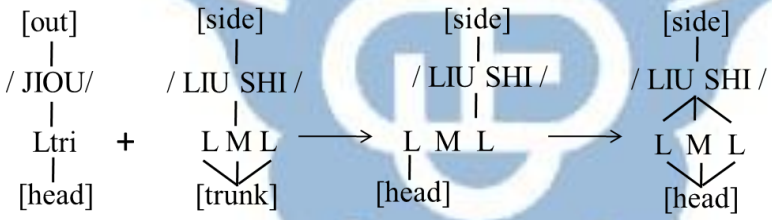
b. HARBOR

c. KAOHSIUNG (PLACE NAME)

Figure 4.5 Before and after compounding of the sign KAOHSIUNG (PLACE NAME)



a. HUWEI_2 (PLACE NAME) (TIGER^TAIL)



b. KAOHSIUNG (PLACE NAME) (DOG^HARBOR)

Figure 4.6 Cases of handshape and orientation in the one edge, place feature in the other edge

d. Vocoid Syllabification

In Southern Min, the N-placement is preceded by rising diphthong and is followed by falling diphthong. Although TSL does not have diphthong, TSL compounding is similar to Southern Min that the sonority goes from the less sonorant L to the sonority peak M and then back to the less sonorant L.

e. Vocoid Association

Among the vocoids, the priority of association to the nucleus position is determined by the sonority: a > ɔ > e > o > i > u. Data shows that the priority of the nucleus projection in TSL that the movement in the more stressed syllable is associated to the nucleus position. The epenthetic transitional movement in those signs without any movement cannot bear the main stress.

f. Maximality

Maximal linking between the segments and the skeleton tier is guaranteed to construct the largest possible syllable assuming that the No Crossing Line Constraint, Phonotactic Constraints, the Non-identity Constraint, and Glide Transfer are all met. Take *sio* 'mutually' + *kaŋ* 'same' = *siaŋ* 'the same' as an example in Southern Min. Because the sonority hierarchy in this case is *a* > *o* > *i*, the most sonorous vocoid *a* is projected to the nucleus position. Under Maximality, *i* joins the syllable contraction to produce the largest syllable, as in Figure 4.7.

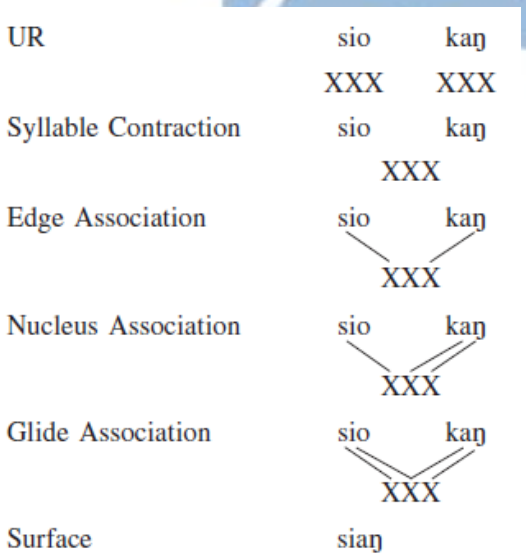
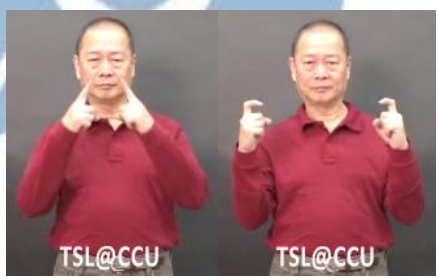


Figure 4.7 Syllable contraction of *sio* 'mutually' + *kaŋ* 'same' = *siaŋ* 'the same' in Southern Min (Hsu 2003, p. 365)

Maximality is applied on TSL compounding and contraction. Although TSL has nothing parallel to glides, the maximal combinations in a syllable is LML. Table 4.1 shows the observed combination of the prosody in TSL compounding, and it also shows that the prosody in TSL compound signs is usually LML. Those examples are shown from Figure 4.8 to Figure 4.16.

Table 4.1 Possible combinations of the prosody in TSL compounding

	Component 1	**Component 2**	**Compound**
1	ML	LML	LML
2	ML	LML	Ltri
3	LML	ML	LML
4	ML	Ltri	Ltri
5	ML	ML	ML
6	Ltri	LML	LML
7	LML	Ltri	LML
8	Ltri	Ltri	LML
9	LML	LML	LML



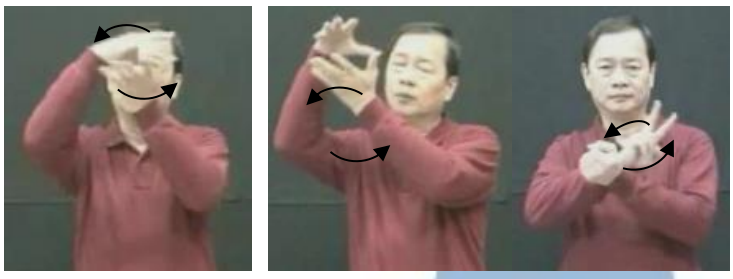
a. TU (CHARACTER SIGN) b. CITY

c. TUCHENG (PLACE NAME)

Figure 4.8 ML+ LML = LML

a. CHUNG b. PLACE c. TAICHUNG 3 (PLACE NAME)

Figure 4.9 ML+ LML = Ltri



a. CLOUD b. LIN (SURNAME)

c. YUNLIN (PLACE NAME)

Figure 4.10 LML + ML = LML

a. LOOK_N b. NOT_HAVE_A c. DO_NOT_DISCOVER

Figure 4.11 ML+ Ltri = Ltri

a. MONEY b. HOUSE c. BANK

Figure 4.12 ML+ ML = ML

a. KEY b. PLACE c. CHIAYI (PLACE NAME)

Figure 4.13 Ltri + LML = LML

a. ENOUGH_N b. NOT_HAVE_A

c. NOT_ENOUGH_C

Figure 4.14 LML + Ltri = LML

a. THINK b. SAME c. AGREE_A

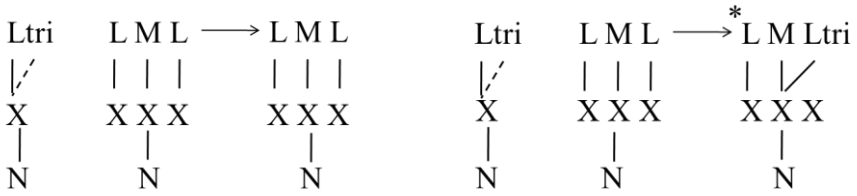
Figure 4.15 Ltri + Ltri = LML

a. MEN b. BRAVE

c. MINXIONG (PLACE NAME)

Figure 4.16 LML+ LML = LML

If the prosody in the component signs derives from Ltri and LML, the path movement with trilled movement associated to the nucleus position in the compound sign is impossible, as shown in Figure 4.17. Path movement co-occurs with trilled movement may happen in other monomorphemic signs, but it has not been found in the TSL compound signs yet.

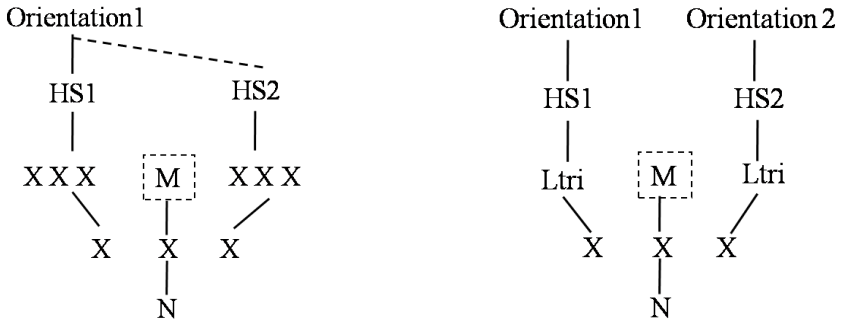


(a) Ltri + LML = LML (b) *Ltri + LML = LMLtri

Figure 4.17 Maximality cannot be applied on TSL compound signs.

g. Movement Epenthesis

Besides the six points mentioned above, TSL data also show that movement epenthesis occurs in some compounding and contraction. That is, both movements in the component signs are deleted, and the inserted transitional movement is projected to the nucleus position. There are two environments causing movement epenthesis. The first one is that the orientation in the first component sign and the handshape in the second component sign are saved, the transitional movement would be inserted between two signs and associated to the nucleus position, as in Figure 4.18a. The other environment for movement epenthesis is that handshapes and orientations in two component signs are saved, and the two movements are trilled movements in the component signs. After compounding and contraction, the two trilled movements would be deleted, and then a path movement would be inserted and associated to the nucleus position, as in Figure 4.18b.



a. HS1, HS2, and Orien1 survive b. HS1, HS2, Orien1, Orien2 with both Ltri

Figure 4.18 Movement epenthesis in TSL compounding

4.3 Summary

This chapter compares syllable contraction in Southern Min and TSL. Table 4.2 shows the similarities in syllable contraction between these two languages.

a. They occur in compounds.

b. They tend to occur in two successive syllables.

c. Southern Min has trisyllabic adjective reduplication, and TSL also has syllable contraction in trisyllabic reduplication.

d. Each syllable in both of two languages has a three-X-slot template, both in the component signs and in the compound signs in TSL.

e. They both contract two three-X-slot templates into one three-X-slot template.

f. They tend to associate the segments and timing slots beginning with edges.

g. The sonority gets higher gradually to the nucleus position, and then goes back to weak sonority after the nucleus position.

h. The nucleus position may be dependent on the degree of sonority or stress. If there is a tie, scanning the melody would be applied.

Table 4.2 Similarities between Southern Min and TSL syllable contraction

			Southern Min	TSL
Compounds			✓	✓
Two successive syllables			✓	✓
Trisyllabic reduplication			✓	✓
Syllable Template	input	three-X-slot	✓	✓
	output	three-X-slot	✓	✓
Syllable Contraction			✓	✓
Edge Association			✓	✓
Vocoid Syllabification			✓	✓
Vocoid Association			✓	✓
Maximality			✓	✓

The differences are that the whole segments in Southern Min would be associated to the edges, while only handshapes, orientation, and place features would be associated to the edges. In addition, although scanning the melody would be applied in both languages, LR-scanning is applied in Southern Min while RL-scanning is applied in TSL. Moreover, TSL has Movement epenthesis that inserts a transitional movement between two component signs and project to the nucleus position in the compounding and syllable contraction.

Chapter 5

Conclusions

5.1 Summary

In this study, I analyzed syllable contraction in TSL compounding based on Sandler's (1986, 1987, 1989) Hand Tier model for sign language prosody to study which features are associated, and also based on Hsu's (2003) Sonority Model for syllable contraction in Southern Min.

Similar to Southern Min, TSL also has syllable contraction and has almost the same processes. Data showed that most compound signs with syllable contraction followed the canonical LML template which Sandler (1993) claimed for ASL. This implies that a compound sign after syllable contraction would fit a legal syllabic template. In addition, compound signs always preserve the second part of a syllable in the component signs and preserve the more stressed syllable in which the movement is projected to the nucleus position. When the two component signs have a trilled movement and a path movement, the trilled movement would be dropped after compounding and contraction, which also agreed with other researchers' claim (Klima and Bellugi, 1979; Liddell and Johnson, 1986) for ASL.

The difference between syllable contraction in Southern Min and TSL is that some signs in the processes of compounding and contraction involve movement epenthesis. There are two environments that have movement epenthesis. Data shows that if the first one is that both handshapes and Orien1 are associated to the edges, the transitional movement would be inserted and associated to the nucleus position. The second environment is that while preserving the both handshapes and orientations in two component signs whose movements are Ltri, a new path movement would be inserted and projected to the nucleus position.

In terms of place features that would also influence the syllable contraction in TSL compounding, data also showed that there might be four patterns for different place features that have syllable contraction in TSL.

1. [head] + [trunk] = [head]
2. [hand] + [trunk] = [hand]
3. [trunk] + [trunk] = [trunk]
4. [trunk] + [trunk] = [hand]

The first two environments are that if there is a place feature on head or hand in the first component sign while there is the place feature on the body in the second component sign, the [trunk] feature would be dropped after compounding. In addition, if the sonority of the head or hand is higher than the body, this result would be consistent with Svaib's (1992) claim that the first sign must be with a place of articulation higher on the body than the second sign in ASL.

The other two environments for syllable contraction are that while [trunk] features are in two component signs, the compound sign would either keep the [trunk] feature or become the feature [hand]. This agrees with Sandler's (1989) claim that the non-dominant hand always copies the dominant hand or becomes the place of the dominant hand in ASL.

In parallel compounding, component signs are each signed by only the dominant hand, but signed by both hands at the same time as a two-handed sign after compounding. One hand is signed in a higher position, while the other is signed in a lower position, and the two hands have different meanings. Finally, there is only one syllable in the compound sign.

To conclude, the generalizations of the syllable contraction in TSL is almost the

same as the Southern Min. Two syllables would be contracted into one, and movement in the more stressed syllable would be preserved and projected to the nucleus position. Then, the output would be a legal syllable after lexicalization. It implies that just like spoken language, sign language has phonological processes and morphological processes.

5.2 Implications

Many compound signs in TSL do not have syllable contraction. Because sign languages have four phonological parameters (handshape, location, movement, and orientation) they would affect each other. For example, the handshape and location would affect the orientation, or affect the movement types. Other reasons are that many TSL compound signs do not have syllable contraction because they are place names which are mostly signed by character signs, and so they are affected by Mandarin which is spoken in Taiwan. In addition, compounding is a well-known process to create new lexicon as items, and TSL is a new language. People will contract two syllables into one in the compounding in the future. Researchers (Sandler et al. 2011) have claimed that conventionalization triggers the development of phonology in a new language. The words with high frequency are more likely to undergo reduction, and reorganization is possible.

Finally, although the Sonority Model seems to be applied on the TSL compounding and syllable contraction, there are many cases that are explained by both syllable contraction and assimilation. In the future, it might be better to have further constraints or rules to account for them.

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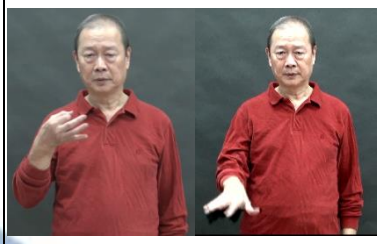
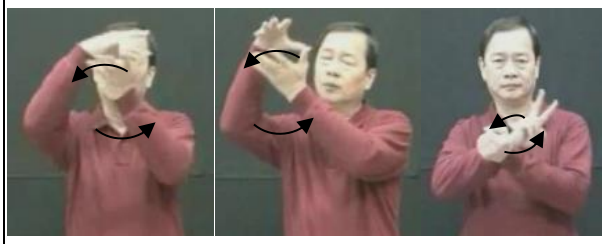
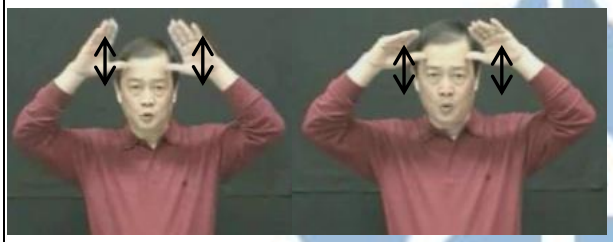
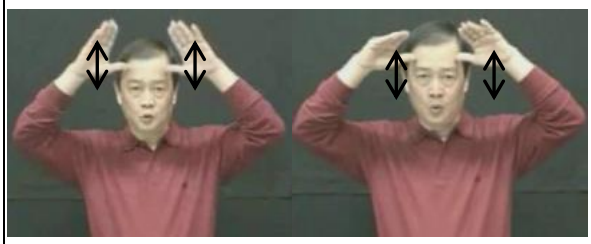
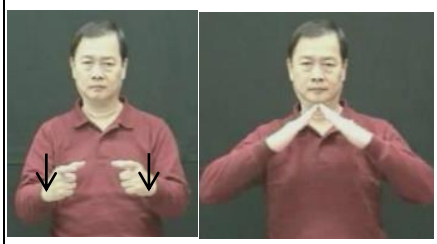
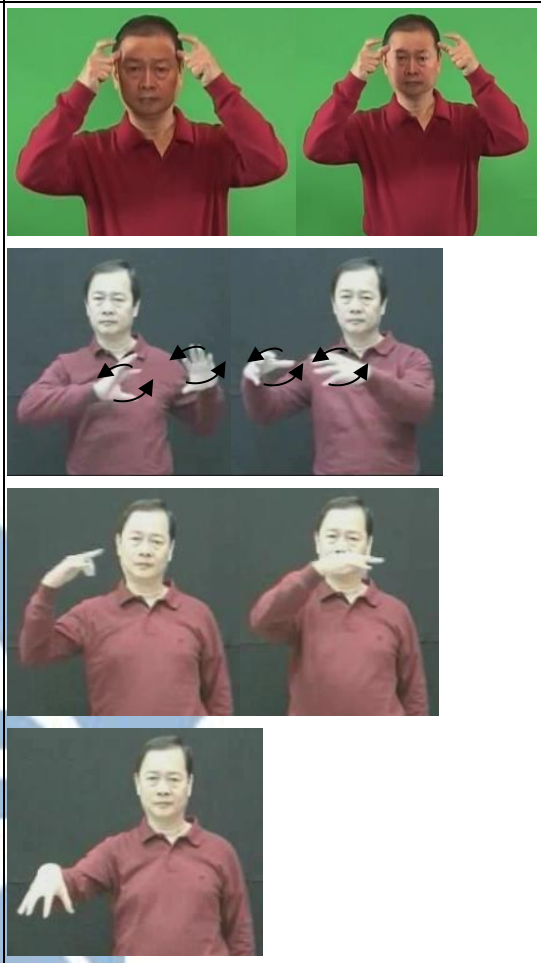
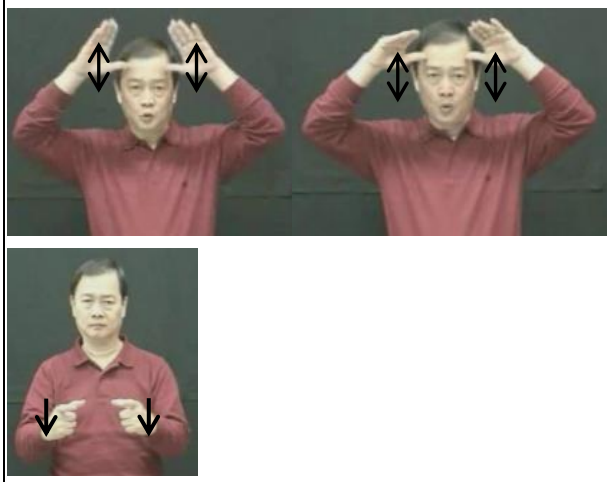
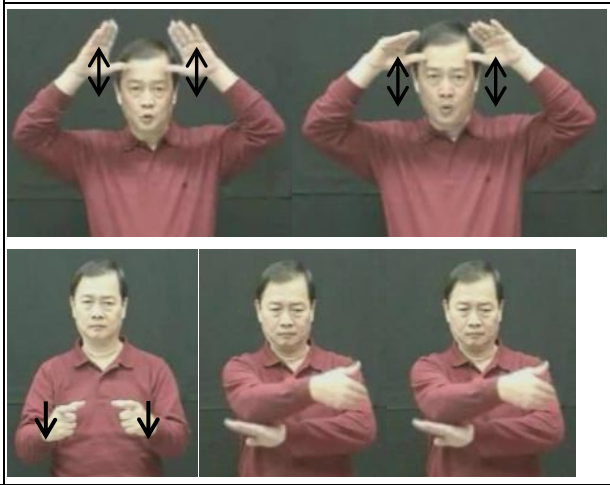
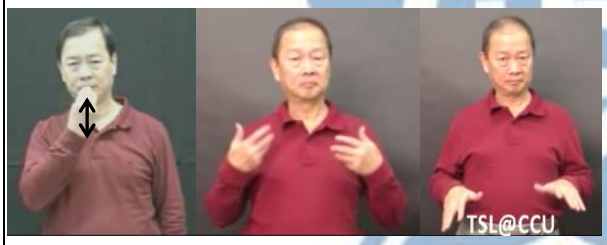
Appendix A

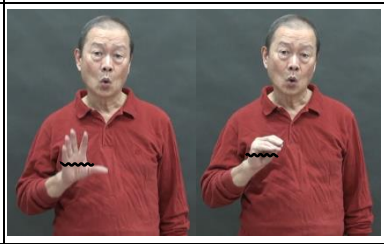
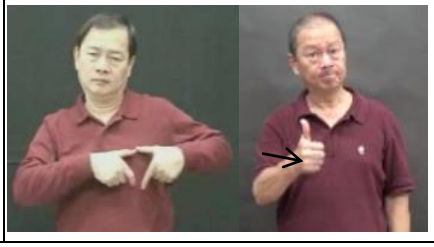
Pictures of compound signs with syllable contraction and their component signs (Chang 2011; Tsay, et al. 2015)

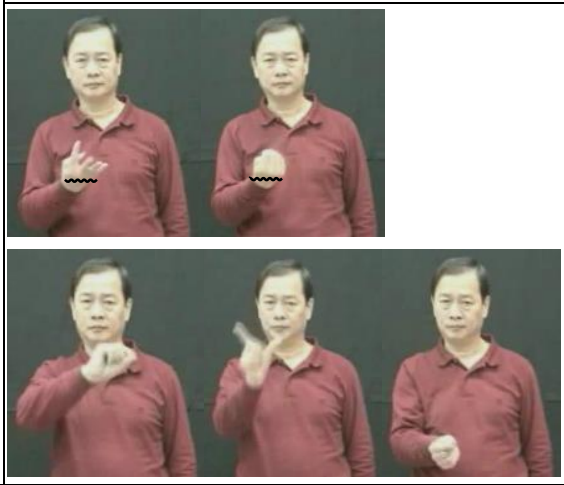
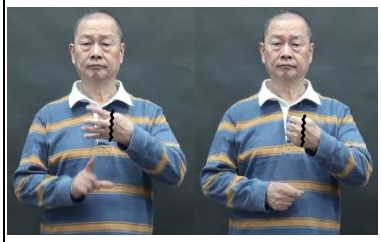
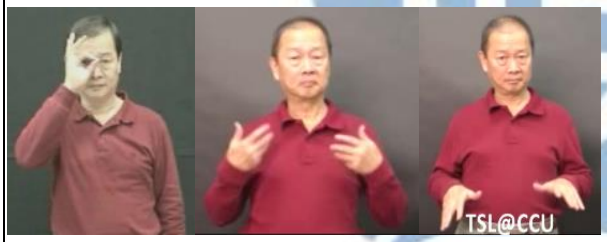
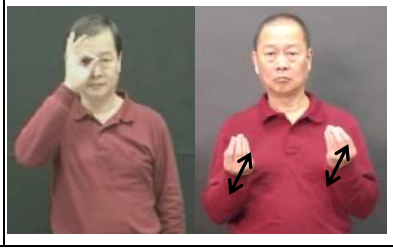
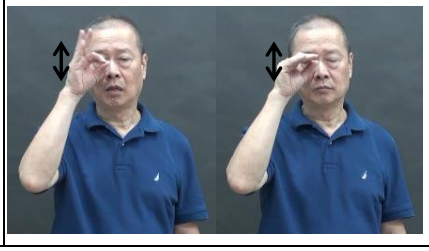
	Component Signs	**Compound Signs**
1	BUY+HAVE_DONE	HAVE_BOUGHT
		
2	CLEAR+NOT_HAVE_A	UNCLEAR
3	CLOUD+LIN (SURNAME)	YUNLIN (PLACE NAME)
		

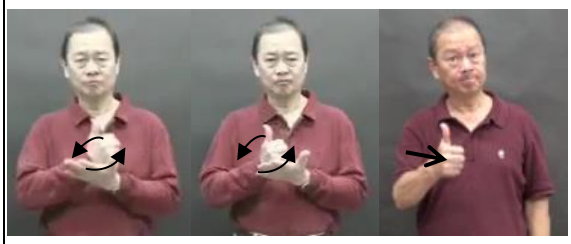
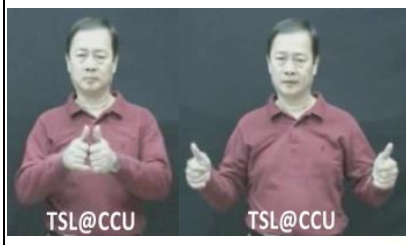
	Component Signs	**Compound Signs**
4	CRITICIZE+GOOD+NOT GOOD	EVALUATION
5	DOG+ HARBOR	KAOHSIUNG (PLACE NAME)
		
6	DOG+ HARBOR+CITY	KAOHSIUNG_ CITY (PLACE NAME)
	 	

	Component Signs	**Compound Signs**
7	DOG+ARBOR+INTERNATIONAL+AIRPORT	KAOHSIUNG_ HARBOR_INTERNATIONAL_AIRPORT (PLACE NAME)
		
8	DOG+ HARBOR+HARBOR	KAOHSIUNG_ HARBOR (PLACE NAME)
		

	Component Signs	**Compound Signs**
9	DOG+ HARBOR+COUNTY	KAOHSIUNG_COUNTY (PLACE NAME)
		
10	EAT+ EXCELLENT_A	DELICIOUS_B
11	EAT+HAVE_DONE	HAVE_EATEN
		
12	EAT+LOUSY	NOT_DELICIOUS (不好吃)
13	EAT+LOUSY	NOT_DELICIOUS (難吃)

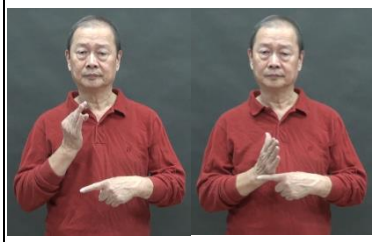
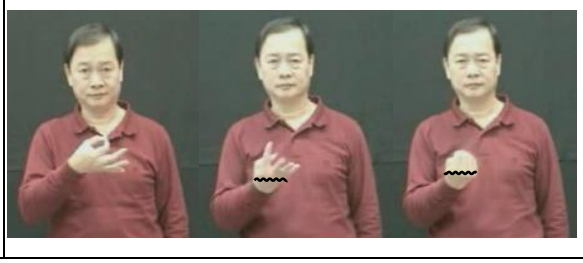
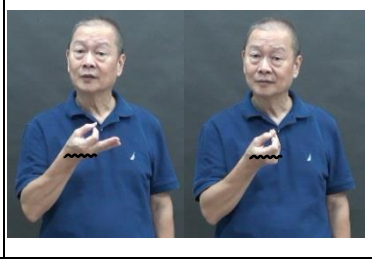
	Component Signs	Compound Signs
14	ENOUGH_N+NOT HAVE_A	NOT_ENOUGH_C
15	FRAGRANT+NOT GOOD	BAD_LUCK_B
16	GOD+SICK	OUT_OF_MIND
17	GOOD+NOT GOOD	HOW_ABOUT
18	HAVE+NOT_HAVE_A	HAVE_NOT_HAVE
		
19	HEART_A+EXCELLENT_A	KIND
		

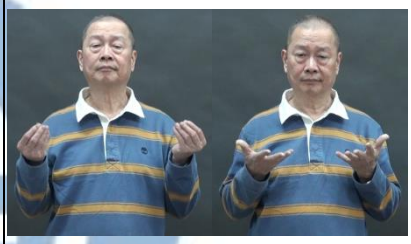
	Component Signs	**Compound Signs**
20	HOW_MANY+MOON	WHICH_MONTH
		
21	KEY+PLACE	CHIAYI (PLACE NAME)
22	LOOK_N+HAVE_DONE	HAVE_LOOKED
		
23	LOOK_N+NOT_GOOD	BAD_LOOKING
24	LOOK_N+NOT_HAVE_A	DO_NOT_DISCOVER
		

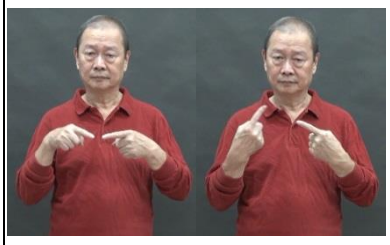
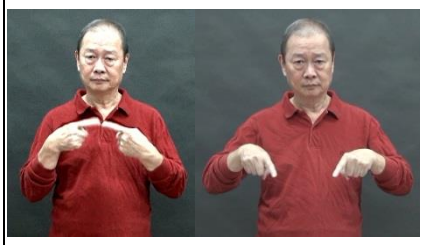
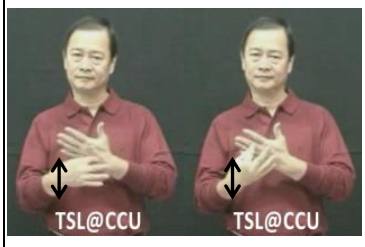
	Component Signs	Compound Signs
25	LUCK+EXCELLENT_A	LUCKY
		
26	MEN (CHINESE SUFFIX FOR PLURALITY)+BRAVE	MINXIONG_2 (PLACE NAME)
		
27	MIDDLE+HISTORY	ZHONGLI_2 (PLACE NAME)
28	MIDDLE＋PLACE	TAICHUNG_2 (PLACE NAME)

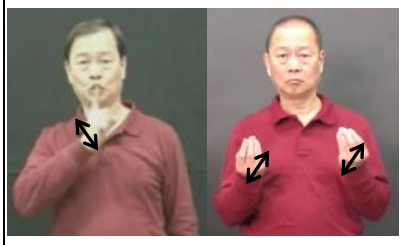
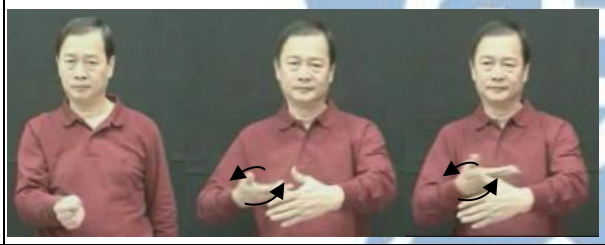
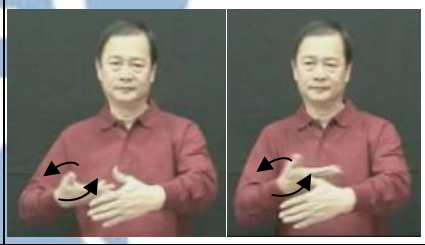
	Component Signs	**Compound Signs**
29	MIDDLE＋PLACE+COUNTY	TAICHUNG_COUNTY_4 (PLACE NAME)
30	MIDDLE＋PLACE+HARBOR	TAICHUNG_HARBOR_1 (PLACE NAME)
31	MIDDLE＋PLACE	TAICHUNG_3 (PLACE NAME)

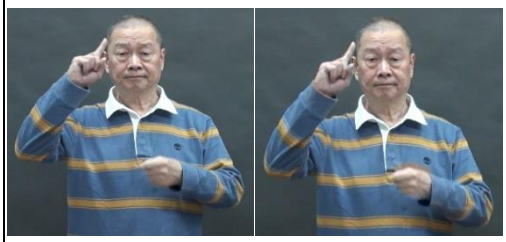
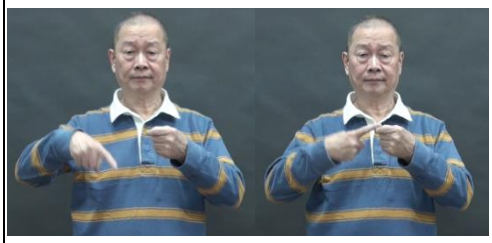
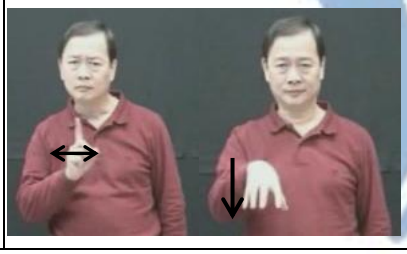
	Component Signs	Compound Signs
32	MIDDLE＋PLACE+CITY	TAICHUNG_CITY_1 (PLACE NAME)
33	MIDDLE＋PLACE+COUNTY	TAICHUNG_COUNTY_1 (PLACE NAME)
34	MIDDLE＋PLACE+COUNTY	TAICHUNG_COUNTY_3 (PLACE NAME)

	Component Signs	Compound Signs
35	MIDDLE＋PLACE+HARBOR	TAICHUNG_HARBOR_3 (PLACE NAME)
36	MONEY+HOUSE	BANK
37	MONEY+HALF	DISCOUNT_A
38	MONEY+HALF	HALF_FARE
		
39	MONEY+HOW_MANY	HOW_MUCH
		

	Component Signs	Compound Signs
40	NOT_HAVE _A + METHOD	NO_WAY_A (無法_A)
41	NOT_HAVE _A + METHOD	NO_WAY_A (沒有辦法_A)
42	NOT_HAVE _A+AFFAIRS	NOTHING_TO_DO
		
43	NOT_HAVE_A+ PROBLEM	NO_PROBLEM_A
44	ONE+MOON	JANUARY

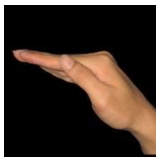
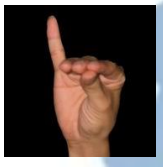
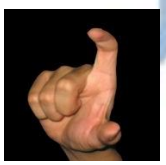
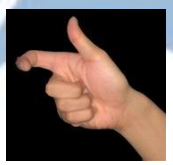
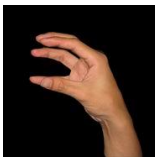
	Component Signs	Compound Signs
45	ONE+SNAP_A	90%OFF_A
		
46	ONE+SNAP_B	90%OFF_B
		
47	FOREIGN_COUNTRY	OUTSIDE+COUNTRY
48	RELATIVES+FLOWER	OVERSEA_CHINESE
		

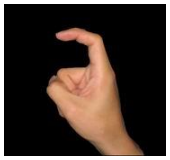
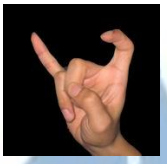
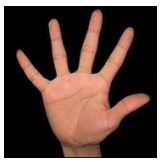
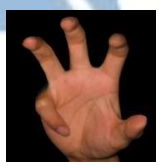
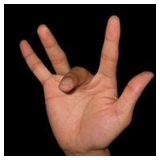
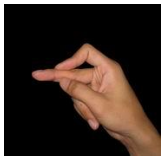
	Component Signs	Compound Signs
49	SAY+ NOT_HAVE_A	DID_NOT_SAY_SOMETHING_A
		
50	SAY+NOT	DID_NOT_SAY_SOMETHING_B
51	SUN+MOON+LAKE	SUN_MOON^LAKE_1
		
52	THINK+SAME	AGREE_A
53	TIGER+TAIL	HUWEI_2 (PLACE NAAME)

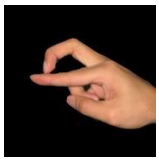
	Component Signs	Compound Signs
54	TOMORROW+YEAR	NEXT_YEAR
		 
55	TU+CITY	TUCHENG_2 (PLACE NAME)
56	WHAT+PLACE	WHERE
		

Appendix B

Handshapes in Taiwan Sign Language (Tai and Tsay 2015)

Open A (男 nan)	Flexed A (副 fu)	B (胡 hu)	Open B (手 shou)	 Bent B (九 jiu)
C (方 fang)	Bent C (紳 shen)	F (錢 qian)	Open F (WC)	G (像 xiang)
I (女 nyu)	 Flat I (千 qian)	Curved I (蟲 chong)	K (欠 qian)	Open K (布袋戲 budaixi)
L (六 liu)	 Bent L (句 ju)	 Curved L (爺 ye)	Curved-baby L (難 nan)	Flexed L (很 hen)
Extended N (鴨 ya)	O (零 ling)	 Open O (果 guo)	Flat O (萬 wan)	Baby O (呂 lyu)

Bent-baby O (雞 ji)	R (筆 bi)	S (拳 quan)	U (棕 zong)	V (二 er)
Curved V (二十 ershi)	W (三 san)	Curved W (三十 sanshi)	Unspread W (童 tong)	 X (十 shi)
Y (民 min)	L-I (守 shou)	 X-I (奶奶 nainai)	D-I (語 yu)	Flat D-I (龍 long)
D (一 yi)	3 (七 qi)	Curved 3 (虎 hu)	4 (四 si)	Curved 4 (四十 sishi)
 5 (五 wu)	Bent 5 (同 tong)	5-Curved Pinky (八 ba)	 Curved 5-Pinky (八十 bashi)	Piled 5 (薑 jiang)
8 (借 jie)	 Open 8 (菜 cai)	Crossed Thumb-Index (隻 zhi)	Thumb-Middle-Pinky (飛機 feiji)	 Curved-Index (鵝 e)

				
Curved middle (博 bo)	Middle (兄 xiong)	Curved-Index-Middle (高 gao)	Ring (姐 jie)	Ring-Pinky (百 bai)