國立中正大學語言學研究所碩士論文

M.A. Thesis

Graduate Institute of Linguistics

National Chung Cheng University

台灣手語動詞形態:分散構詞之分析

Verbal Inflection in Taiwan Sign Language: A Distributed Morphology Approach

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中華民國九十五年十一月

November 2006

ABSTRACT

This thesis explores the potential of a structural analysis in Taiwan Sign Language (henceforth TSL). Two syntactic phenomena are discussed in this thesis. The first is verbal inflection, more specifically, verb agreement in TSL under the framework of Distributed Morphology (Halle and Marantz 1993; Harley and Noyer 2003; Embick and Noyer 2005).

Within the analysis, all three types of verbs (so-called plain verbs such as LIKE, agreement verbs such as BELIEVE, and spatial verbs such as RUN) in TSL are shown to have agreement properties (either manually or non-manually). In the analysis, the three verb types in TSL have the same syntactically derivational processes with different richness of the verbal root.

In addition, for pursuing the structural idea further, this thesis also provides a syntactic analysis for another phenomenon in the DM framework: noun-verb pairs. The noun-verb pairs in TSL do not have a clear formal distinction between nouns and verbs, unlike that of American Sign Language (ASL) studied by Supalla and Newport (1978). In the DM analysis, the noun-verb pairs in TSL are syntactically derived by a category assigning f-morpheme node.

Keywords: Taiwan Sign Language (TSL), Distributed Morphology, verb agreement, noun-verb pairs

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LIST OF ABBREVIATIONS

1, 2, 3 = First, second, third person

N = Noun

V = Verb

Adj = Adjective

Adv = Adverb

Aux = Auxiliary

Conj = Conjunction

Sub = Subject

Obj = Object

Loc = Location feature

Loc_x = Location features specified as x (a variable) in signing space

x, y = variables

TREE = A sign of Sign Language with meaning of tree

TSL = Taiwan Sign Language

ASL = American Sign Language

BSL = British Sign Language

ISL = Israeli Sign Language

DGS = Deutsche Gebärdensprache (German Sign Language)

NGT = Nederlandse Gebarentaal (Sign Language of Netherlands)

M = Movement

HS = Handshape (not including the orientation)

L = Location

HC = Hand configuration (including the orientation)

Chapter 1 Goals of the Exploration

1.1 Linguistics and Sign Languages

Since many studies in sign languages have established that sign languages are fully-fledged natural human languages (Corina 1990; 1993; Engberg-Pedersen 2002; Fischer and Siple 1990; Hoiting and Slobin 2002a, b ; Klima and Bellugi 1979; Liddell 2003; Lucas 1990; Padden 2002; Schembri 2002; Stokoe 1960; 2001; Sutton-Spence and Woll 1999; Wilbur 2002; Wilcox 2002; Woll 2002), the study of sign languages tells us not only the structure of a given sign language in particular, but also sign languages in general. Recently, many studies on sign languages (Chang, Su and Tai 2005; Chen 2003; van Gijn 2004; Glück and Pfau 1999; Kuan 2005; Lai 2005; Lee 2003; Liu 2004; Liu 2005; Meir 1998; 2002; Su 2004; Sandler et al. 2005; Taub 1997; Tsou 2004; Zeshan 2004; Zwitserlood 2003a, b; to name just a few), are explored.

In addition, the study of sign languages can shed some light on the linguistic theory in spoken languages. Since the modality of spoken languages is mainly oral-auditory, while the modality of sign languages is mainly visual-manual, it is interesting to discover what is the universal between them and what is the particular characteristics of each modality (Glück and Pfau 1999; Lillo-Martin and Klima 1990; Meir 1999, 2002; Neidle et al. 2000).

The present study attempts to give a descriptive and formalized linguistic analysis of verb agreement in Taiwan Sign Language (henceforth TSL) since there is only a few literature on TSL verbal inflection (Smith 1989). Besides, verbal inflection is a pervasive phenomenon in both spoken (Spanish, English, Polish), and signed (TSL, ASL, BSL, ISL, DGS, NGT) languages. Thus, verbal inflection is a worthwhile issue to explore.

The subject of this study will be discussed in more detail in the following section, and, following van Gijn (2004), I will argue that structural analysis of sign language is possible

and also desirable. The working framework (i.e. the Minimalist Program and Distributed Morphology) for the analysis will be introduced in section 1.3. A brief description about the grammar of sign languages is given for the understanding of the analysis later on.

1.2 Subject of this Study

What is verbal inflection in sign languages? It refers to variation in the form of a word or a sign (i.e. verbs), typically by means of changing the structure of signs (Valli and Lucas 2000; Sandler and Lillo-Martin 2000), which expresses a grammatical contrast for the stem's word class in some given grammatical context.[1] This is different from spoken languages (such as Spanish), which tends to add things on to the stem using an affix (i.e. -o, -as, -a, -amos, -ais, and -an) as illustrated in (1).

(1) Verb root: Estudi-ar 'study'
1 Sg: Estudi-o
2 Sg: Estudi-as
3 Sg: Estudi-a
1 Pl: Estudi-amos
2 Pl: Estudi-ais
3 Pl: Estudi-an

Inflectional operations ground the semantic content of a verb root according to place, time, and participant reference, without substantially affecting the basic semantic content of the verb root. They often specify when an event or situation took place, who or what were the participants, and sometimes where, how or whether an event or situation really took place (Payne 1997). In other words, it typically involves person and number agreement, as well as sequential, temporal or epistemological grounding such as tense, aspect, and mode (Bybee 1985; Glück and Pfau 1999).

[1] However, such grammatical contrast is not obligatory for the stem's word class.

According to Bybee (1985), characteristics of inflectional operations include the following:

> "They are grammatically required in certain syntactic environments, e.g., the main verb of an English sentence must be inflected for subject and tense.
> They tend to be regular and productive (at least in comparison to derivational operations).
> They tend to occur in paradigms, i.e., sets of forms of which one form must be selected in certain environments. For example, there are two morphological tenses in English, one of which must be specified for all independent verbs."

This investigation is confined to the verbal inflections in a simple sentence in Taiwan Sign Language. The complex sentences such as serial verb constructions (Benedicto, Cvejanov, and Quer 2004; Slobin and Hoiting 1994; Supalla 1990) and relative clauses (Liddell 1980) are excluded due to the limitations of collected data.

1.3 Structural Analysis of Sign Language

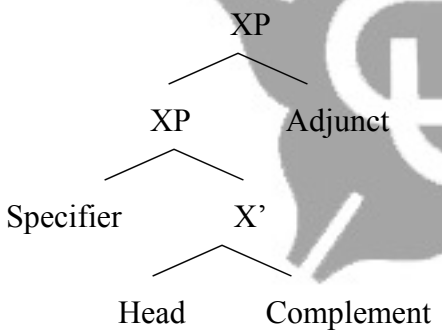
Although a large number of the studies of the grammar of signed language are descriptive in nature, they all assume at least implicitly a hierarchical linear structure (Fischer 1996; Liddell 1980; Supalla 1990; Sutton-Spence and Woll 1999; Valli and Lucas 2000). As van Gijn (2004:9-15) has provided the arguments for the structural analysis of sign languages, this paper takes the same position and gives a syntactic analysis for verb agreement, noun-pairs, and compound signs in TSL under a Distributed Morphology framework with the Minimalist Program syntax, which will be discussed next.

1.3.1 The Minimalist Program

The Minimalist program (MP) is a syntactic theory in generative grammar from Chomsky (1993; 1995). It is motivated not only by the search for explanatory adequacy but also for a certain level of formal simplicity and elegance. What is outlined here is by no means complete, but is meant to give a basic understanding of how it works in the later analysis of the rest thesis.

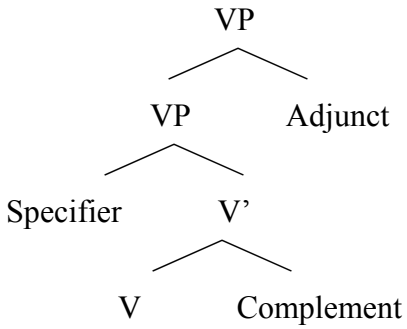
Firstly, every sentence is organized in terms of constituents, be it a verb phrase, or a noun phrase, or an adjective phrase, etc. An X-bar theory specifies the structure of constituent in the following structure. X in (2) can be a lexical category (like a verb, noun, adjective, and adverb) or a functional category (as a determiner, a preposition, a conjunction, or an auxiliary, and the like).

(2) Basic Phrase Structure



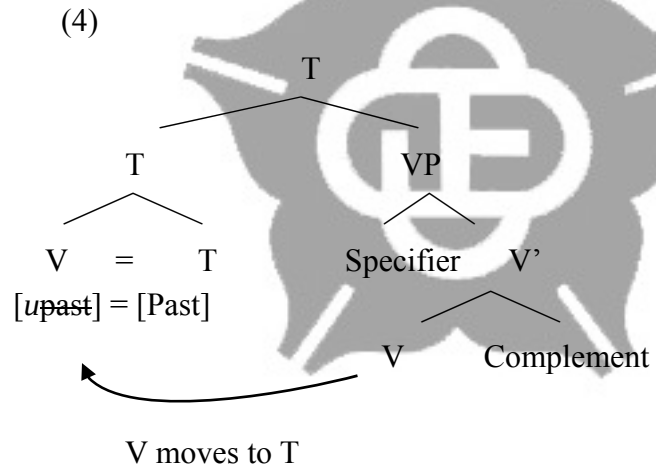
The structure in (2) is built by a simple rule, called Merge. It begins first from selecting a lexical head (be it a noun or verb) to merge the complement and in turn merging a specifier to form an XP, and an adjunct is adjoined to the XP if any. For instance, a VP has the following basic structures in (3).

(3) Structure of VP



Another important operation, Move, is taking a structure formed by applications of Merge, and then moving one of the elements of that structure into another position in the syntactic tree for the checking requirement of interpretable features in the other head. The checking is under sisterhood as in (4) as follows.[2]

(4)



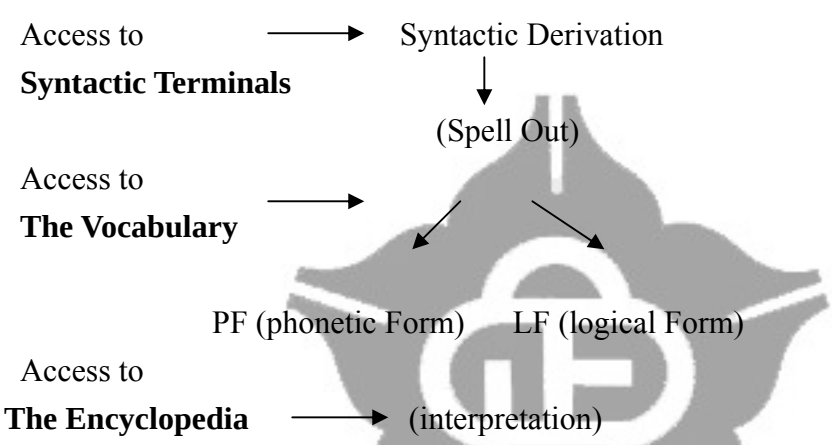
To sum up, MP has the structure-building operations of Merge and Move in the sentence structure.

[2] Please note here that the projection of vP is omitted for the convenience of illustration.

1.3.2 Distributed Morphology

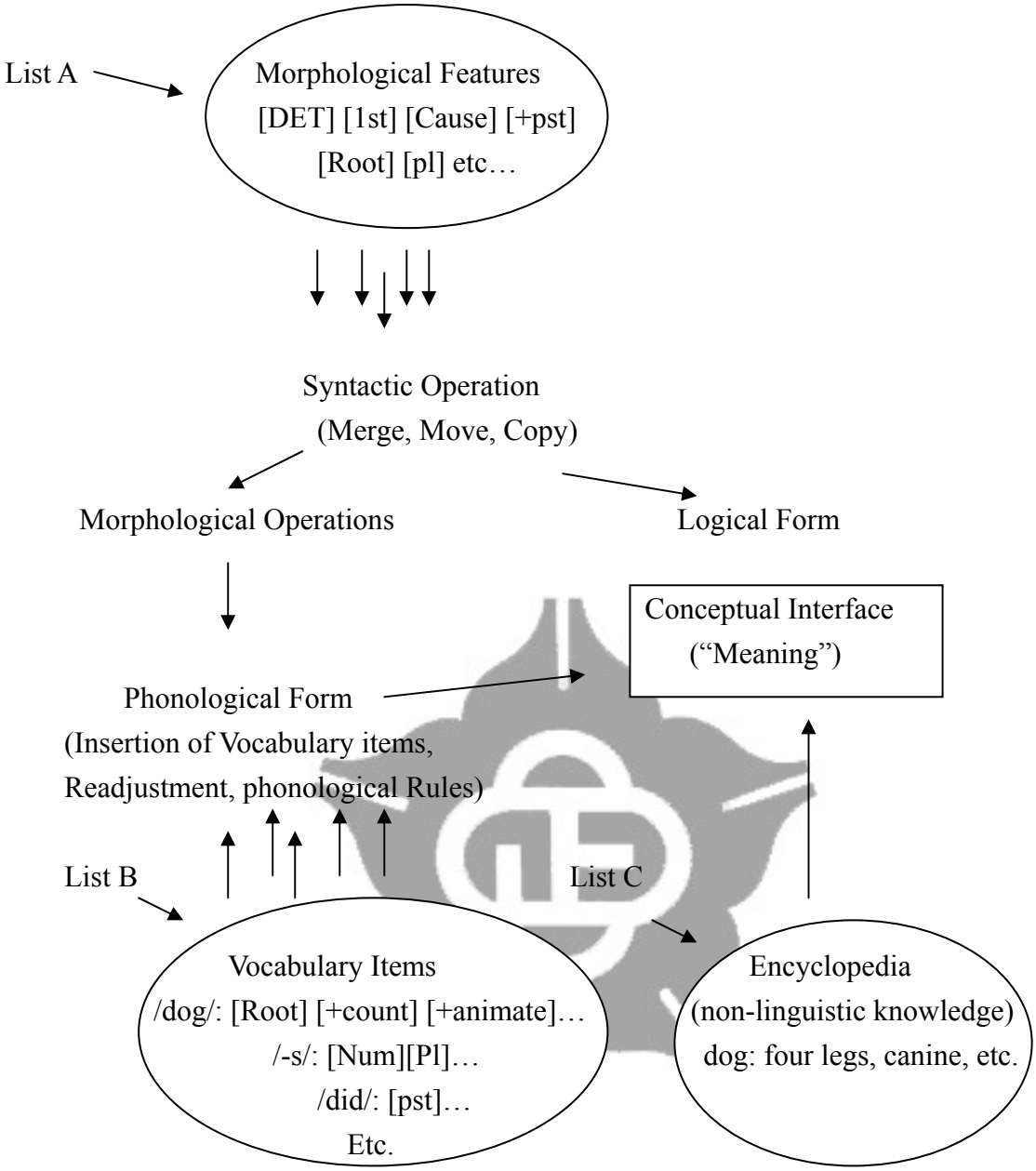
Distributed Morphology (henceforth DM), proposed in Halle and Marantz (1993), is a theory of the architecture of grammar. In the current version of the DM (Embick and Noyer 2005), it has got rid of DS, and SS as shown in (5). The DM claims that there is no lexicon in the traditional sense in generative grammar. What there is in the grammar is a list of morphemes, words, and phrases that have a meaning and phonological features.

(5) The DM model (Embick and Noyer 2005:10)



In the DM, meaning, phonological features, and morphemes are in the separate lists. List A contains roots and morpho-syntactic features (also called lexical items), such as [Root], [Plural], [Determiner] [Pronoun], and the like. List B contains phonological features (called Vocabulary Items), which is connected to morpho-syntactic features. For example, in English the phonological string /dɔg/ is connected to the morpho-syntactic feature bundles [Root, +Count, +Animate] and List C contains non-linguistic knowledge (the Encyclopedia) such as that a dog is a kind of canine animal that has four legs. The lists are illustrated in (6) as follows.

(6) Structure of the grammar in DM (Harley & Noyer 2003:465)



The DM has three distinct properties: (a) Late Insertion. (b) Underspecification, and (c) Syntactic Hierarchical Structure All the Way Down. Late Insertion refers to that phonological features (also called Vocabulary Items) are inserted into terminal nodes after syntax, in a process called Spell-Out. This operation is understood as cyclic, such that more deeply embedded morphemes are spell-out first.

Underspecification says that the Vocabulary Items (the phonological feature bundles) are not linked to fully specified morpho-syntactic features, but to underspecified ones. For instance, the agreement affixes in English as shown in (7) are linked to those features that are minimally necessary as shown in (8).

(7) The English Agreement markers present tense

	Singular	Plural
1 person	eat-Ø	eat-Ø
2 person	eat-Ø	eat-Ø
3 person	eat-s	eat-Ø

(8) a. -Ø $\longleftrightarrow$ [+pres]
b. -Ø $\longleftrightarrow$ [+sg, +pres]

Moreover, Vocabulary Items compete for insertion, which means that a given bundle of morpho-syntactic features in a terminal node in syntax is inserted with that Vocabulary Item that shares most of these features without resulting in feature clash. For English, the late insertion of an agreement affix for third person singular present tense will result in -s, because this Vocabulary Item matches at least the singular and tense features and there are no feature clashes. On the other hand, insertion of -Ø does not meet the requirement of insertion of the most specified Vocabulary Items, and therefore resulting in a feature clash.

Syntactic Hierarchical Structure All the Way Down says that all composition is syntactic composition. That is, the terminal nodes where Vocabulary Items are inserted are hierarchically structured according to principles and operations of the syntax. One specifically concerned operation that is similar to merge in MP is called merger, which adds a new terminal node to the existing structure. Lexical Items are merged into a hierarchical structure, in which no distinction is made between derivation and inflection, as we will see in the analysis of Chapter 3 and Chapter 4 later on.

In DM, morphemes are the atoms of morpho-syntactic representations. The term morpheme refers to a syntactic or morphological terminal node and its content, not to the phonological expression of that terminal, which is provided as part of a Vocabulary Item.

Thus, according to (6), items from list A enter syntactic operations (Merge, Move, Copy) and the resulting derivations in turn move into LF and, via MS, to PF. Meanings are negotiated only after the derivation is shipped off to LF. The morpheme in the terminal nodes of a derivation does not receive phonological features until after syntax (Late Insertion). Only at PF, these morphemes are spelled out with phonological features (called Vocabulary Items). Vocabulary Items need not be fully specified for terminal nodes in which they will be inserted (i.e., they are underspecified), and they compete for insertion, which means that the vocabulary item that matches most of the morpho-syntactic features in a terminal node without violating any of them wins over other possible Vocabulary Items.

In addition, Harley and Noyer (2003) suggest that morphemes are of two basic kinds: f-morphemes and l-morphemes, corresponding approximately to the conventional division between functional and lexical categories, or closed-class and open-class categories.

An f-morpheme is defined as a morpheme for which there is no choice as to vocabulary insertion. In other words, f-morphemes are those whose content suffices to determine a unique phonological expression. The spell-out of an f-morpheme is said to be deterministic.

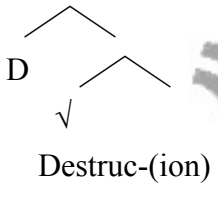
In contrast, an l-morpheme is defined as one for which there is a choice in spell-out. For example, in an l-morpheme whose syntactic position would traditionally define it as a “noun”, any of the vocabulary items such as dog, cat, fish, etc. might be inserted.

Note the controversial distinction between derivational and inflectional morphology has no explicit status in DM. The different “parts of speech” can be defined as a single l-morpheme or Root (terminology of Pesetsky 1995), in certain relations with

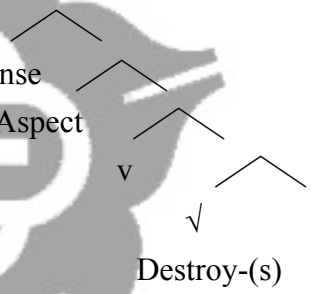
category-defining f-morphemes. For instance, a “noun” is a root whose nearest c-commanding f-morpheme is a determiner, while a “verb” is a Root whose nearest c-commanding f-morphemes are v, Asp and T.

Therefore, the same vocabulary items may appear in different morphological categories depending on the syntactic context that the item’s l-morpheme (or Root) occurs in. For example, the vocabulary item *destroy* is realized as a noun *destruction* when its nearest c-commanding f-morpheme is a determiner, but the same vocabulary item *destroy* is realized as a verb *destroys* when its nearest licensers are v, Aspect, and Tense as shown in syntactic trees (9) and (10). Note that morpho-syntactic features of an l-morpheme DESTROY is represented as √ in the trees below.

(9)



(10)



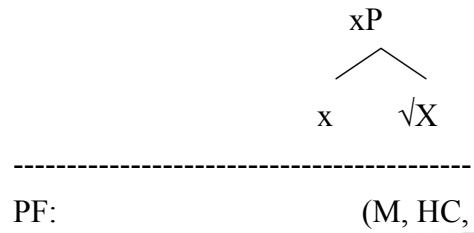
In sum, the theory of DM has three core properties: late insertion, underspecification, and syntactic hierarchical structure all the way down.

1.3.3 A Schema of Formation of Word Categories in the DM Framework

In the DM framework, as previously mentioned in section 1.3.2, the derivation of categories depends on the category of nearest c-commanding f-morpheme (Barner and Bale 2002; Halle and Marantz 1993; Harley and Noyer 2003). If the nearest commanding f-morpheme is determiner (abbreviated as D), then the category of l-morpheme is noun. On the other hand, if the nearest commanding f-morpheme is Tense, Aspect and v, and then the

category of l-morpheme is verb. The other categories have the same mechanisms as nouns and verbs, which can be diagrammed as in (11): x represents the f-morpheme of category of words (be it a Verb, Noun, Adjective, Adverb, or other categories.), whereas the √X represents the l-morphemes consisting of the phonoloical features of words (be it a movement feature (abbreviated as M), a hand configuration feature (abbreviated as HC), or a location feature (abbreviated as L)).

(11) The schema of word categories in TSL under DM framework



Thus, according to (11), the categories of lexical items will be derived in the syntax depending on the environment in which they occur as we will see in chapter 4.

1.4 Data Collection

The presented data in this thesis were divided into two categories. One is the data of TSL and the other is that of other sign languages in the world.

The data of TSL in this thesis were collected mainly from two resources: one is the elicitation of picture books from the TSL signer Yu-San Gu, and the recorded corpus data from TSL Project which is directed by Prof. Tai and funded by a National Science Council grant: The Study of Taiwan Sign Language: Phonology, Morphology, Syntax, and Digital Graphic Dictionary (NSC 90-2411-H-194-025(I), NSC 91-2411-H194-130(II), NSC92-2411-H-194-007(III), NSC 93-2411-H-194-001(IV)), and the other is from the publications such as sign language textbooks (Chao 2001a,b; 2004; Chen 2000; 2001; Chen

1998; Smith and Ting 1979; 1984; Tang 1998; Zhao 1999), papers in journals (e.g. *Language and Linguistics*), or academic publications (i.e. thesis, dissertations) about TSL.

Also, the data of other sign languages are from the published sign languages textbooks, and papers in the journals (e.g. *Sign Language Studies*, *Sign Language and Linguistics, Studies in Language, Lingua*, to name only a few.) , or academic publications (i.e. thesis, dissertations).

1.5 What is Known about Sign Language Grammar and TSL

In this section, something about sign language grammar such as basic components of signs, localization, verb agreement, Tense, Aspect, Manner, Mode, non-manual marking and iconicity are addressed briefly, which is related to the later discussion, and examples will be illustrated from other sign languages studies and with particular reference to TSL.

1.5.1 Basic Components of Signs

Signs have parts (Battison 1980). In ASL or in most sign languages if not all, there are five basic parts (also known as parameters in Stokoe's terms) in a sign (Taub, 2001).[3] These five elements are handshapes (HS), movements (M), locations (L) (also called place of articulation), orientations (ORI), and non-manual signals (so-called facial expressions) (Valli and Lucus 2000).[4][5] The minimal pairs for each component are provided as follows: First set of minimal pairs is the ASL signs SUMMER vs. DRY illustrated in (12) (taken from Klima and Bellugi 1979:42). They share the same handshapes, orientations, movements, but differ only in locations (the sign SUMMER is at the forehead position, while the sign DRY is at the

[3] Stokoe refers to these parameters as cheremes, form the Greek word *cheir*, for hand. Stokoe uses the term DEZ standing for handshapes, TAB standing for locations, and SIG for movements. In the later studies, ORI are added for orientation (Smith and Ting 1979; 1984; Cheng 2003).
[4] ASL handshapes are in the appendix 2.
[5] The term handshapes (HS) is used to refer to selected fingers only, while the term hand configuration (HC) is used to refer to the selected fingers including palm orientations in this thesis.

chin position).

(12) Location parameter in ASL

SUMMER

DRY

In the second set of minimal pairs in ASL, CANDY vs. JEALOUS illustrated in (13) (taken from Klima and Bellugi 1979:42), they differ only in handshapes (the sign CANDY is 1 handshape, while the sign JEALOUS is I handshape).

(13) Hand configuration parameter in ASL

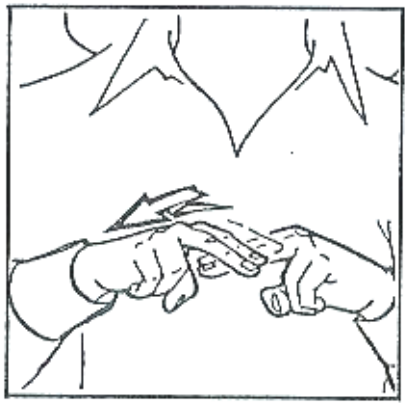
CANDY

JEALOUS

The third set of minimal pairs in ASL such as TRAIN vs. CHAIR illustrated in (14) (taken from Klima and Bellugi 1979:42) differs only in their movements (the sign TRAIN is sideward movement, while the sign CHAIR is downward movement).

(14) Movement parameter in ASL

CHAIR



TRAIN

In the fourth set of minimal pairs in ASL, the sign SHORT vs. TRAIN illustrated in (15) (taken from Valli and Lucus 2000:20), they differ only in the orientations of palm of non-dominant hand (The palm orientation of left hand in the sign SHORT is inward, while that of the sign TRAIN is downward).

(15) Orientation parameter in ASL

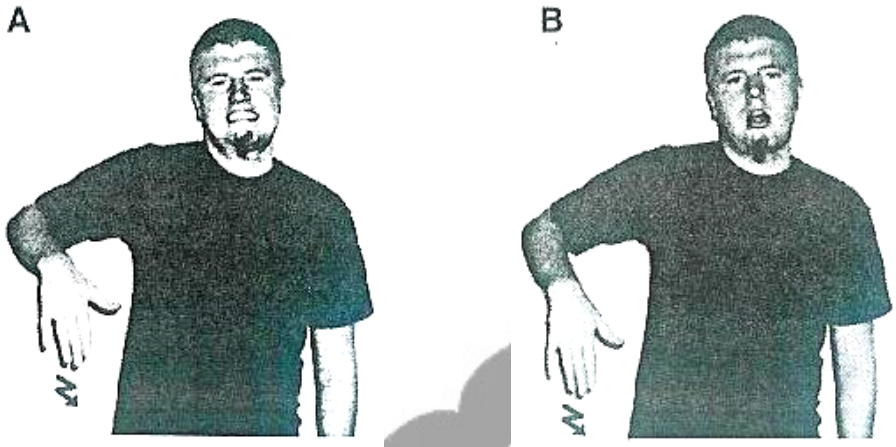
SHORT

TRAIN

An example of minimal pair for non-manuals in ASL is LATE vs. NOT YET illustrated in (16) (taken from Taub 2001:28). The sign LATE is executed with the obligatory mouth open and the teeth closed while the sign NOT YET is produced with the obligatory mouth open and the tongue slightly out. The signs will not be correct without these non-manual

markers. Another example of minimal pair (HOT vs. BE SILENT) for non-manual marking in Indopakistan Sign Language (IPSL) is identified as shown in (17) (taken from Zeshan 2000:48). The sign HOT has the non-manual configuration accompanied with mouth wide open, while the sign BE SILENT with mouth closed.

(16) Non-manual Parameter in ASL



LATE NOT-YET

(17) Non-manual Parameter in IPSL

HOT BE SILENT

Similarly, Su (2004:21) finds that TSL signs have four basic components: Handshapes (NOW vs. HEALTHY), locations (CHEAT vs. LANGUAGE), movements (UNCLEAR vs. SUDDENLY or RACE vs. TEST), and orientations (LOCATED vs. HEALTHY). These four

elements are handshapes, movements, locations (place of articulation), orientations; in addition to that, she also finds that meaningful contrast between one handed sign and two handed sign in TSL (e.g. UNDERSTAND vs. EXERCISE) as in ASL (Klima and Bellugi 1979). However, the pair of non-manual parameter has not been mentioned in her thesis, but such non-manual parameter pairs have been pointed out in Chao (1998), Gu (2001), and Kuan (2005). The non-manual marking will be discussed in more detail in 1.5.6.

Overall, TSL has five basic components of signs (handshapes, locations, movements, orientation, and non-manuals) as in ASL.

1.5.2 Localization

Sign languages make use of a particular location in signing space to signal the subject and object of a verb.[6] A sign is made at a certain location in a space or on the body parts (e.g. head, neck, or truck) of the signer. Such space is called signing space or natural space. It is a space approximately a visual half sphere in front of the signer.

Space is used linguistically (van Gijn 2004; Glück and Pfau 1999; Janzen 2004; Meir 1998; 2002; Sandler et al. 2005; Neidle et al. 2000; Zwitserlood 2003 a, b). Space in sign languages can provide the information about the location of a person or object by morphological uses of verbs. For instance, in the TSL sentence I BELIEVE YOU 'I believe you'. The handshape *ZONG* 'brown', (19) of predicate BELIEVE moves from the space associated with the 1 person to the space of 2 person. Consider sentence (18).

[6] The subject here refers to the highest thematic role in lexical conceptual structure of a verb (Jackendoff 1990), while the object refers to the second highest thematic role in lexical conceptual structure of a verb. The hierarchy is Actor>Patient/Beneficiary>Theme>Location/Source/Goal. They are linked to syntactic position by linking principle. Syntactically, there is no unitary subject position in which all subject properties are expressed and licensed. Rather, subject properties are distributed over a sequence of derivationally linked positions (McCloskey 1997:216).

(18) Agreement verbs in TSL

‘I BELIEVE YOU’

(19) Handshape ZONG ‘brown’

In (18), the space (or location) near the signer is identified as first person ‘I’ in the signing space, and the space (or location) toward the addressee is identified as second person ‘YOU’. The predicate BELIEVE is produced from the position of signer toward the position of addressee and represents the meaning for ‘I BELIEVE YOU’. The uses of space along with the directionality of predicates make the sentence grammatical.

In sum, signers can use space to localize things such as objects, persons, and places in the signing spaces and identify their grammatical relationship such as subject or object via the morphological production of verbs.

1.5.3 Verb Agreement

In sign languages, for a large set of verbs, subject and object are not necessarily distinguished from each other by word order or case marking. Rather, they are marked by movement of the verb in relation to specific points in signing space. This spatially expressed syntactic system has been called ‘verb agreement’ by researchers working on sign languages. Example (18) above has shown how locations in signing space work in the verbal agreement system. The TSL verb BELIEVE in (18) has no fixed locations (Smith 1989). The

phonological specification of the roots of these verbs (so-called agreement verbs) stores the information that they move from one location in signing space to another (van Gijn 2004; Smith 1989; Zwitserlood 2003a, b), and that beginning location refers to the subject and the end location to the object.

More specifically, "Verb agreement is defined as a phenomenon where the verbal element (a verb or an auxiliary) matches its syntactic argument(s) in their referential features." (Meir 2002:417). A verb is said to agree with its arguments if the form of the verb is determined by the pronominal features of its argument. In sign languages, nominals in a clause are associated with a certain location in signing space, called 'R(referential)-loci'. This association is done by pointing to, or directing the eyes gaze towards, a specific point in signing space. If the referent is present, the pointing is directly to the referent. On the other hand, if the referent is not present, it is assigned to a certain point in the signing space (e.g. signing a NP and then pointing to a certain point in the space for the invisible referent or gazing at the specific point in signing space).

Verb agreement in sign languages is usually expressed in two types. One is expressing agreement by R-loci while the other one is using classifiers (Zwitserlood 2003a:204). The TSL sentence in (20) is agreement by R-loci in that the verb BELIEVE agrees with R-loci of its arguments (i.e. MOTHER only). That is, the handshape of the predicate BELIEVE agrees neither with subject (i.e. FATHER) nor object (i.e. MOTHER).[7] The agreement with subject or object is accomplished by moving from initially the position in front of the signer's trunk to the position where the argument MOTHER (object) is located finally in signing space. On the other hand, the TSL sentence in (21) provides an example of the agreement using classifier. The BUDAIXI 'puppet' HC of classifier predicate RUN ABOUT itself is agreeing with the nominal subject DOG, and the SHOU 'hand' HC of nominal classifier in the

[7] The word 'handshape' used here does not include orientation, but it includes orientation in the discussion of the Meir (1998) on 2.1.2.

non-dominant hand agree with the nominal object ROOM.

However, beside these two types of agreement, many researchers (Bahan 1996; Neidle et al. 2000; among others) suggest that non-manual agreement is also one strategy for agreement mechanism.[8] They claim that plain verbs are agreeing non-manually either by head tilt or eye gaze. In other words, plain verbs also use R-loci. R-loci are locations in space, which can be indexed the hands (for agreement verbs) or the eyes (for plain verbs). In the case of plain verbs, in TSL sentence (22), the predicate such as LIKE seems not to morphologically agree with either subject or object by locus agreement or by classifier agreement, but the signer can identify the relationship of subject or object by eye-gaze and body tilt toward object from the subject position. Therefore, it appears that all verbs in sign languages share agreement features to some extent.

(20) Examples for agreement by R-loci (taken from Chang, Su and Tai 2005:253)
MOTHER $MOTHER_{pro}$+ FATHER BELIEVE. (Agreement verb)
'(MY) father believes (my) mother.'

a. MOTHER

b. $MOTHER_{pro}$+FATHER

c. BELIEVE

[8] Although the experimental evidence of Thompson, Emmorey and Kluender (2006) shows that eye gaze functions as an independent feature checker in ASL, it is still unclear whether the case holds for TSL as well for now and deserves further study. I basically take the positions of Chang et al. (2005) and Neidle et al. (2000) here.

(21) Examples for agreement by Classifiers (taken from Chang, Su and Tai 2005:254)
ROOM DOG ROOM$_{pro}$+ANIMAL-RUN.ABOUT. (Spatial verb)
'The dog is running about in the room.'

a. ROOM b. DOG c.ROOM$_{pro}$+ANIMAL$_{pro}$-RUN.ABOUT

(22) Examples for agreement by non-manuals (taken from Chang, Su and Tai 2005:252)
DOG BROTHER LIKES. (Plain verb)
'(My) brother likes dogs.'

a. DOG b. BROTHER c. LIKE

In sum, verb agreement in TSL is realized by R-loci or by Classifier or by non-manual features in three verb types. That is, three types of verbs (agreement verbs, spatial verbs, or plain verbs) all represent agreement properties in a certain way.

1.5.4 Null Arguments

Most signed languages seem to have the possibility not to express the arguments of a predicate overtly, if these arguments can be recovered from the context as Chinese example (23).[9] That is, both subject and object can be unexpressed. The omission of both subject and object can occur in the sentence with agreement verbs as the example shown in sentence (24) in TSL and (25) in Israeli Sign Language, ISL (Meir 2002:421).

[9] This is based on my informant Yu-Shan Gu.

(23) Chinese Example

A: Ni_{35} Shu_{55} $Nian_{51}$ Wan_{35} le ma 'Did you finish the reading?'
You Book Read finished asp Question-particle

B: $Nian_{51}$ le 'Yes, I did.'
Read asp

(24) Agreement verbs in TSL

' I BELIEVE YOU' (from TSL project)

(25) Agreement verbs in ISL

'I help you'

(from Meir 2002:421)

The sentence (24) 'I BELIEVE YOU' can be simply accomplished by signing the agreement verb BELIEVE moving from the position of signer to the position of addressee if under recoverability.[10] The same is true of ISL case in (25).

To sum up, TSL (and other sign languages in general) behaves likes the so-called "Pro-drop languages" in that its subject and object can be null under the given context.

1.5.5 Tense, Aspect, Manner, Mode

As mentioned in 1.2, verbs of sign language contain a considerable amount of morphological information. The four types of information described in TSL here (Tense, aspect, manner, and mode) are usually provided in English through the use of separate

[10] This is mentioned in Smith (1989: 111).

adverbs *tomorrow*, *often*, *quickly*, and *may*, respectively. In sign languages, this information is often incorporated into the verb itself.

Tense (so-called external aspect), is a way of locating events in time. TSL uses lexical time markers to express the time such as the temporal adverbials NOW, TOMORROW, YESTERDAY (Liu 2005).

Aspect, also called internal aspect, refers to the internal time of events. It focuses on when something happens relative to another event. TSL can either use verb inflection, or separate lexical markers such as MIDDLE, ALWAYS, OFTEN, OCCASIONALLY.

Manner tells us how an action is done. Examples of manner expressed by separate lexical markers in TSL would be FAST, SLOWLY. It can also be conveyed by using a change of motion speed or extension of verbs (so-called *aspectual modulation*) (Liu 2005).

Mode (also called mood) is about the speaker's attitude to the information in the sentence (Saeed 2003). Although there have not been any studies on the issues of modes in TSL, there are lexical marker such as MUST, MAY, SHOULD (Liu 2005; Smith and Ting 1979).

1.5.6 Non-manual Markings

Face talks. Many studies have found (Corina 1989; Corina, Bellugi, and Reily 1999; Sutton-Spence and Woll 1999) that non-manual marking in sign languages has a dual function: an affective function and a linguistic function (Baker and Padden 1978; Binns-Dray 2005; Liddell 1978).

Affective function refers to the emotional expression. People can use facial expressions to show their feeling such as being happy, angry, sad, and hungry. On the other hand, for signers, the facial expression not only has an affective function, but it has a linguistic function as well for communicating with each other.

Non-manual markings have been extensively studied in ASL (Baker and Padden 1978; Binns-Dray 2005; Corina, 1983; Liddell 1978; 1980; Neidle et al. 2000) with fewer studies in other sign languages (Lawson 1983; Smith 1977; 1981; Sutton-Spence and Woll 1999). Some non-manual features such as eyebrows raising may be used to mark the questions or topics in sentences, while some non-manual features such mouth opening or brow knitting may be used to express the degree of intensity of meaning of signs.

In recent TSL studies (Chang et al. 2005; Li 2003; Liu 2005; Su 2004; Tsou 2004), the meaningful contrast of non-manual marking is not much discussed except by Kuan (2005). She concludes that non-manual features are crucial in TSL for the distinction of minimal-pair signs.

However, earlier studies of TSL (Chao 1998; Gu 2001; Smith 1977; 1981) suggest that non-manual markers play a crucial role at the syntactic level and at the lexical level as well. The reason for not many people discussing non-manual markers recently may be due to some reasons: First, non-manual markers do not always occur in sentences or signs. Second, the facial expression may be too subtle to discern since the recording often takes the upper body rather than only the face (close up) in the video tapes. That is to say, the optionality of non-manual markers makes the discussion of syntactic non-manual expressions not easy (if not impossible).

Nevertheless, here, I take the view that the non-manual markers at the sentence level, in addition to the prosodic matters (van Gijn 2004), and leave prosodic matters for further studies. In fact, there are some lexical items that are contrastive in terms of only non-manual differences such as TEASE, EXAMINE, CRITICIZE in TSL as shown in (26), (27) and (28) (Gu 2001:232), respectively.

(26) TEASE

(27) EXAMINE

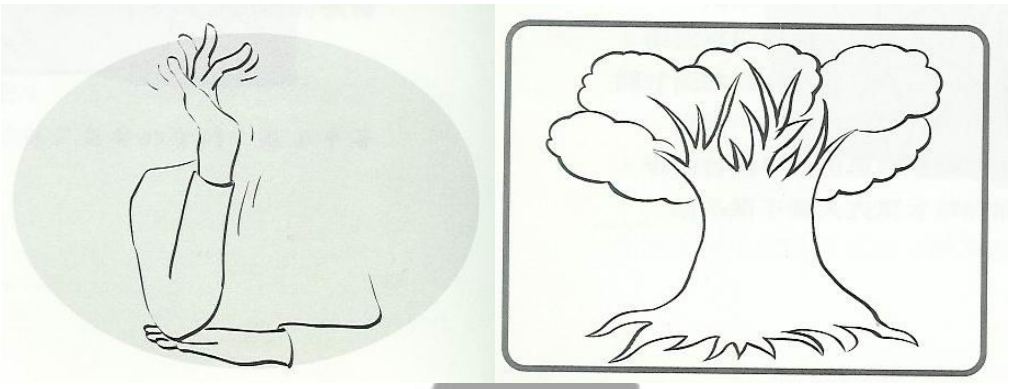
(28) CRITICIZE

In the two-handed sign TEASE, the non-manual marker is lip pursed with a teasing face, the dominant hand (also called strong hand or active hand) is sweeping back and forth in the palm of the other hand (called non-dominant or weak hand or passive hand). In the two-handed sign EXAMINE, the articulation of hands is the same, except that the non-manual marker is lip closing with a serious face. Furthermore, the two-handed sign CRITICIZE is performing the same action of hands movement, but it is accompanied with mean facial face of frown.

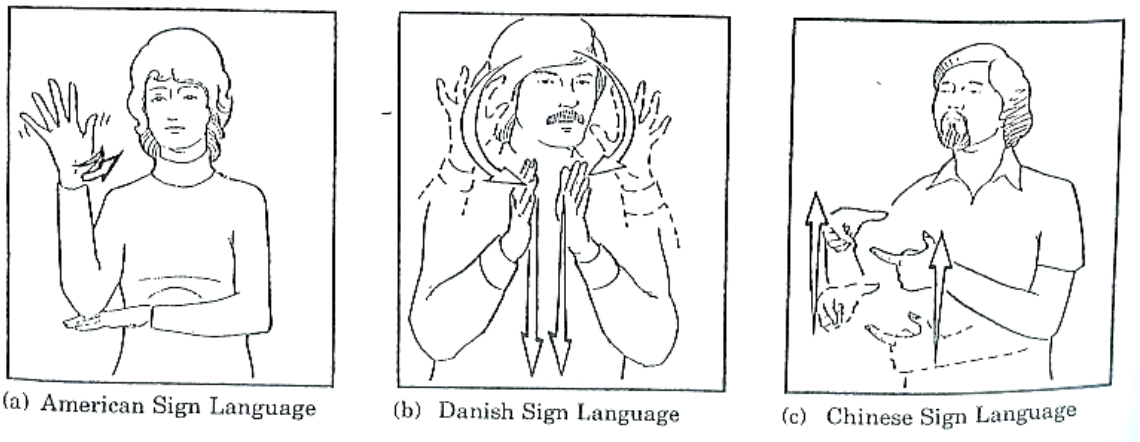
1.5.7 Iconicity in Signs

Iconicity refers to a characteristic of language in which a sign resembles its referent (Armstrong 1983; Chang et al. 2005; Channon 2002; Klima and Bellugi 1979; Mandel 1977;

Meier 1987; Meir 1998; Taub 2001; Zeshan 2000; Zwitserlood 2003b). That is, the elements of the form of a sign are related to visual aspects of what is denoted. As illustrated in (29) (Tang 1998:30), the sign TREE in TSL is iconically shape-represented by using two hands. However, such lexical iconicity varies across different sign languages as illustrated in (30) below.



(29) TSL sign for TREE



(30) The sign for TREE in three different sign languages (Klima and Bellugi 1979:21)

Channon (2002:106) defines two categories of iconicity: lexical and predictable. Lexical iconicity is defined as in (31), and the examples of this category are illustrated in (29) and (30) above. Channon claims that all predictably iconic elements have no phonological representation and the inflections are predictably iconic.

(31) “Lexically iconic elements of a sign vary across languages, must be learned by the signer as part of a particular language, cannot be reliably produced by someone who does not know the language, and obey the phonological constraints of the language”.

On the other hand, predictable iconicity is defined as in (32) and the examples of this category are the verb agreement and classifier inflections as illustrated in (33) and (34) in ASL and (18) and (21) in TSL.

(32) “Predictably iconic elements of a sign do not vary across languages, are not learned by the signer as part of a particular language, can be produced by someone who does not know the language, and do not always obey the phonological constraints of the language”.

(33) SAY-NO-TO ‘I say no to you’ (Channon 2002:15)

(34) Classifier Predicate: ‘vehicle goes up a hill’ (Channon 2002:15)

In (33), SAY-NO-TO is moved from signer and oriented with fingertip toward the addressee, showing the relations of subject and object to mean ‘I say no to you’. The opposite movement will result in the meaning ‘You say no to me.’ In (34), it presents a classifier predicate where the handshape represents a vehicle. The motion of a classifier predicate is iconic here. To show a car moving up the hill, the classifier handshape 3 for vehicle in ASL (Handshape 3 in Appendix 3) moves in an upward arc.

In this section, we see some basic properties about sign language grammar, including basic components of signs, localization of argument in the signing space, verb agreement, null arguments, aspectuality, non-manual marking, and iconicity in signs. In the following section, the organization of this thesis is addressed.

1.6 The Organization of This Thesis

The organization of this thesis is as follows. In chapter 2, I will give a brief overview of literatures on verb agreement in different sign languages. In chapter 3, the analysis for the verb agreement in TSL is presented in the DM framework, which provides a unified account for the observation of agreement phenomena exhibited in different types of verbs in TSL and the clause structure of TSL as well. In chapter 4, the formation of word classes such as nouns and verbs is provided, and the analysis of noun-verb pairs and compound signs in TSL is addressed. In chapter 5, a summary of this study is given, followed by its implications.

Chapter 2 Previous Studies of Verb Agreement in Sign Languages

2.1 Introduction

Following the introduction in chapter 1, previous studies in verbal agreement across different sign languages are given in this chapter. These sign languages are British Sign Language (BSL), American Sign Language (ASL), Israeli Sign Language (ISL), German Sign Language (DGS), Sign Language of Netherlands (NGT), and TSL sequentially. Some other information needed such as basic components of signs will be given if necessary.

2.2 British Sign Language (BSL)

In this section, some basic knowledge about BSL verb types will be given only based on Sutton-Spence and Woll (1999) (hereafter S-S&W).

There are three types of verbs in BSL as well as in ASL. They stated the properties of these three verb types in BSL in (35) as follows:

(35) Properties of three verb types in BSL (S-S&W:135)

(a) Plain verbs: They can be modified to show manner, aspect, and class of direct object.
(b) Agreement verbs: They can be modified to show manner, aspect, person, number, and class of direct object.
(c) Spatial verbs: They can be modified to show manner, aspect and location, movement and related noun.

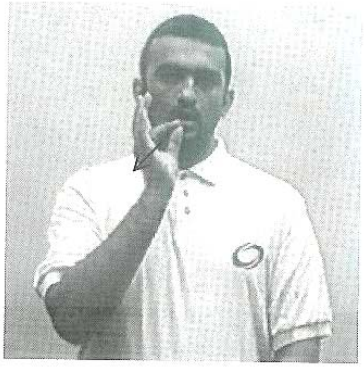
One example of plain verbs with manner and aspect modification in BSL is THINK-HARD. In BSL, manner and aspect are marked on the verbs by the speed of the repetition of the verb and presence of non-manual features. The sign THINK-HARD is

produced by a small circling repetition of the sign, with an ‘effortful’ facial expression as shown in (36) below.

(36) THINK-HARD (S-S&W:136)

Other information about class of direct object may be included in the plain verbs. This can be represented by the handshape. For example, the sign SMOKE can have the handshape changed to show SMOKE-PIPE, SMOKE-CIGAR, other than SMOKE-CIGARETTE.

As for the example of agreement verbs in BSL is ASK. In addition to be capable of being modified to show manner, aspect, and even direct object as plain verbs, it can also agree with person, and number. For instance, the verb I-ASK-YOU starts moving from the subject location (near the signer) to the object location in the end (near the addressee). The agreement verb ASK agrees with the 1 person (i.e. I) and 2 person (i.e. YOU) in the signing space as shown in (37).



(37) I-ASK-YOU (S-S&W:56)

Another characteristic of agreement verbs in BSL is that they may agree with number. Number agreement in agreement verbs in BSL is quite complex. Some verbs express information about number by movement of the verb. Sometimes, a pronoun is used for the information as well, which will be seen in examples shortly.

There are singular, collective plural, dual, trial, and exhaustive number agreement in BSL, which will be exemplified as follows.

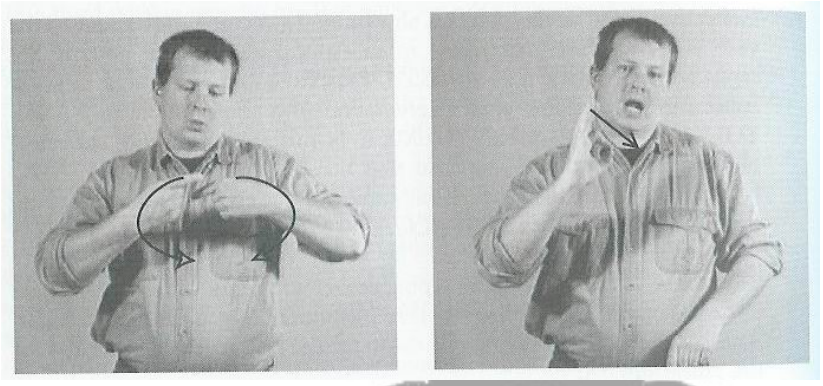
The singular number agreement is inflected by a single movement from the subject position towards the object position (e.g. I-ASK-YOU in (37)).

The collective plural number agreement is produced by a sweeping movement of the verb across an arc that refers to the plural object position. The example such as I-ASK-YOU-ALL is illustrated in (38). One thing to be noted here is that it is not possible to show collective plural for subject agreement in BSL so that the verb form WE-ALL-ASK-HIM is ungrammatical as the example shown in (39).[11] Instead, the signer will use a sweeping proform for the collective plural subject as in (40) to make the sentence grammatical.

(38) I-ASK-YOU-ALL (S-S&W:140)

[11] This is also true for ASL (Mathur 2000).

(39) Ungrammatical form of *WE-ALL-ASK-HIM (S-S&W:140)



(40) Grammatical form of WE-ALL ASK HIM (S-S&W:140)

Dual number agreement is produced in three ways in the example of I-ASK-TWO-OF-THEM, given that object is plural and SISTER and BROTHER have been located on the right and left side of the signing space, respectively. The first way is to move the verb twice from subject to each of the two objects once at a time and end the movement at the location of the second object (BROTHER in this case) as shown in (41).

(41) ASK-TWO-OF-THEM: one hand moves to each object position (S-S&W:141)

The second way is that if the verb is one-handed sign such as ASK, signer can also make it into two handed sign and move simultaneously, or sequentially to express the idea ‘I asked my sister and brother’ in (42).

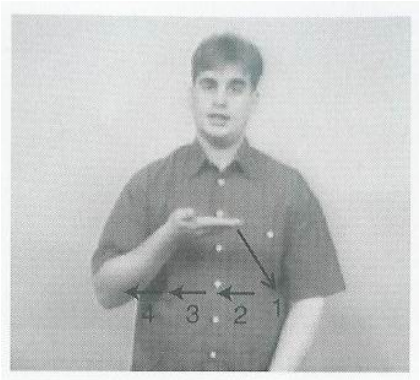
(42) ASK-TWO-OF-THEM: each hand moves to an object position (S-S&W:141)

The third way is to use a single movement of verbs from subject position towards one of the dual objects position, and then uses pronouns such as TWO-OF-THEM as exemplified in (43) below.

(43) ASK-TWO-OF-THEM: separate pronoun shows the object (S-S&W:141)

Trial number agreement differs from dual number agreement only in that it uses a triple end point to the verb stem. It can have the same three options as dual number agreement does.

Exhaustive number agreement (i.e. more than three) is produced by the repetition of verb stem at least for three times, with the end points moved as in (44).



(44) I-GIVE-TO-EACH-OF-THEM (S-S&W:142)

Spatial verbs in BSL can be produced to show manner, aspect, and location of the referent, but do not inflect for person or number as agreement verbs do. They can also be used to give information about the class of noun of either the subject or the object.[12] For instance, 'I walked from left to right' in (45), the G handshape in BSL (i.e. index finger extended) is used to be represented as a class of subject and moves from left to right side in signing space. In addition, the speed of movement can be modified as either quick or slow to show the manner or aspect of motion.

(45) WALK-FROM-LEFT-TO-RIGHT (S-S&W:146)

[12] This type of spatial verb has been called 'verbs of motion and location' by Ted Supalla (1986), and also called 'classifier verbs/predicate' among other linguists (Chang et al. 2005; Schembri 2003).

To summarize, S-S&W (1999) have explicitly described the phenomena for each verb type, but no formal analysis of verb agreement as far as I know in my collected data about BSL has been provided.

2.3 American Sign Language (ASL)

In this section, some preliminary information about ASL verb types are given first, and then the analysis of verb agreement in ASL by Mathur (2000) will be provided, which regards verb agreement as a re-adjustment rule in the DM framework; the role of space in sign languages is addressed as well.

2.3.1 ASL Verb Types

American Sign Language (ASL) is the most comprehensively studied (Benedicto and Brentari 2004; Braze 2004; Emmorey and Brenda 2004 ; Emmorey et al. 2004; Hoiting and Slobin 2002a, b; Liddell and Johnson 1985; Mathur 2000; Singleton and Newport 2004). It has an inventory of 41 handshapes (see appendix 3 from Tennant and Brown 1998).

As mentioned in chapter 1, verb agreement in sign languages takes the following form: the starting and ending points of the agreement verb are associated with the points in signing spaces established for the arguments of the verb. These points have been called referential loci or R-loci by Lillo-Martin and Klima (1990). Therefore, the direction of the path movement of the verb is determined by the locations in signing space associated with the verb's argument.

The verb agreement system has three classes of verbs identified by Padden (1990) in ASL. These are plain verbs, agreement verbs and spatial verbs. Plain verbs have invariant starting and ending points and direction of path movement of these verbs are not determined by the R-loci of verbs' arguments. Examples include LIKE, TASTE, LOVE, THINK and the

like (see online ASL Browser: http://commtechlab.msu.edu/sites/aslweb/browser.htm).

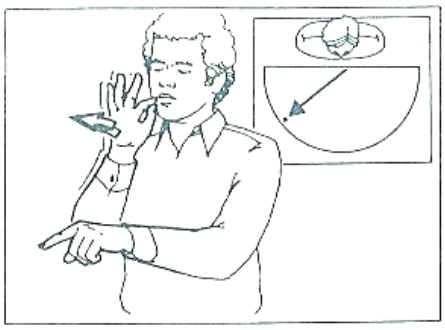
On the other hand, agreement verbs' beginning and ending points typically are determined by the R-loci of their arguments.[13] Agreement verbs can further be divided into regular and irregular (backward) verbs. Regular verbs are those with the thematically most prominent argument as subject, whereas backward verbs are those with the Source role as subject. This issue is addressed in more detail below in 2.4.2, where ideas from Meir (1998) and Jackendoff (1987; 1990) are discussed. Examples of regular verbs in ASL include GIVE, ASK, TELL. Examples of backward verbs in ASL include INVITE, ADVISE, and so forth. Spatial verbs are verbs that beginning and end points are determined by spatial locations. Examples include CARRY-BY-HAND, MOVE, PUT, PERSON-MOVE and so forth.

Lillo-Martin (1986) gave the following examples for agreement verb and so-called plain verbs (non-agreement verbs) in ASL illustrated in (46) and (47) as follows.

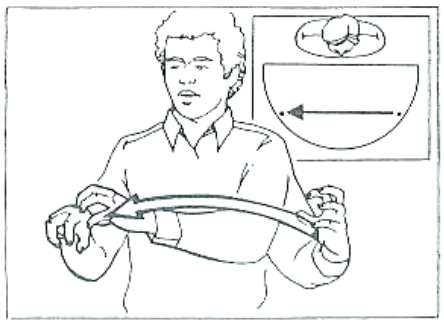
[13] However, there are some agreement verbs which are not determined by the R-loci of their argument because of pre-specification of phonological form, as shown in (67) in ISL.

(46) Agreement Verbs in ASL (Lillo-Martin 1986:419)

DOG-$_a$INDEX



CAT-$_b$INDEX



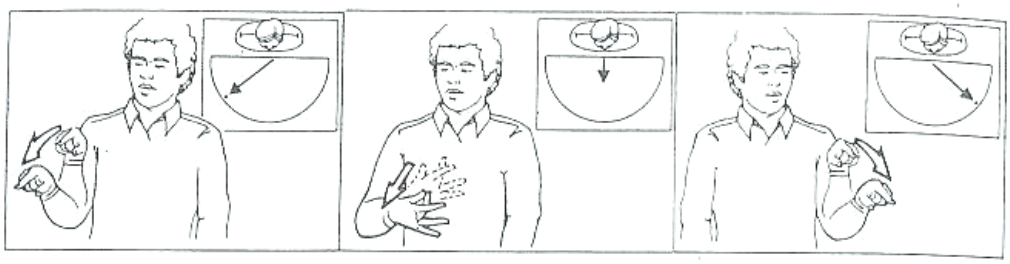
$_a$BITE$_b$

(The dog) bites (the cat).

(47) Plain verbs (non-agreement Verbs) in ASL (Lillo-Martin 1986:420)

DOG-$_a$INDEX

CAT-$_b$INDEX

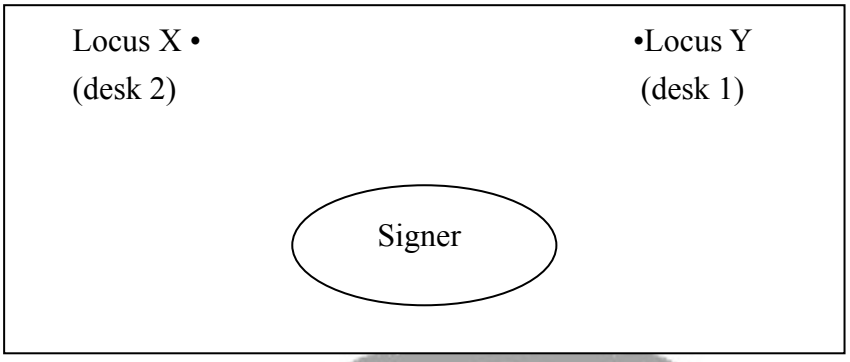


$_b$INDEX LIKE $_a$INDEX

He (the cat) likes her (the dog).

Mathur (2000:44) has provided a diagram for the spatial verbs in ASL in (48) as follows: The difference between agreement verbs and spatial verbs here are that the points (R-loci) in space are used to represent locations rather than people or animated entities. The point Locus X can represent the location of one desk, and the location of another desk on the point Locus Y.

(48) The diagram of spatial verbs (Mathur 2000:44)



To sum up, there are traditionally three types of verb in verb agreement system in ASL. The starting and ending of direction of non-agreement verbs do not determined by its argument, while agreement verbs and spatial verbs are. One important difference between agreement verbs and spatial verbs is that the arguments of agreement verbs are person, while that of spatial verbs are locations (Mathur 2000).

2.3.2 Re-Adjustment Rule Analysis (Mathur 2000)

Based on the ternary classification of verbs in ASL by Padden (1990), Mathur (2000) gives a phonological implementation of verb agreement by proposing the concept of 'alignment' as a re-adjustment rule in the DM framework for the different phonological manifestations of verb agreement in ASL.[14] The phonological re-adjustment rule, which Mathur called Align-Stem, is specified in (49) as follows:

[14] This can be seen as a reply to the challenge of Liddell (2000).

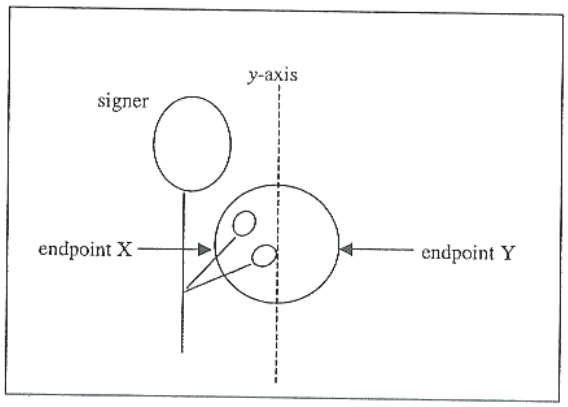
(49) Align Stem (Mathur 2000:83)

Stem ⟶ Align stem/ X___

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

(i) rotating the whole sign with respect to the y-axis so that endpoint X is aligned with the AgrS locus and endpoint Y is aligned with AgrO locus.

(ii) where endpoints X and Y are defined as in the following diagram:



Mathur (2000) gives an analogy to understand the concept of alignment. Consider a drawing software like the one in Microsoft Word. The program has several 'Autoshapes' which are limited to certain configurations, for example, straight lines, rectangles and circles. The program allows several operations. One operation is to 'group' these images and rotate the whole unit in some way. As a subcase of rotation, one can flip the image with respect to the vertical or the horizontal axis. The verb stems are like the pre-loaded autoshape images: their properties (including movement and orientation) are encoded within the image, and can be subject as a whole unit to further operations.

The verb is within an abstract sphere. The verb stem is anchored to the inside of the sphere at two points. One is closer to the signer (endpoint X) and the other, farther away from the signer (endpoint Y). The whole sign is then rotated in a way that endpoint X is aligned

with the locus standing for the subject and endpoint Y is aligned with the locus representing the referent of the object.

In addition, Mathur (2000) argues that such a re-adjustment rule is applied in the following order within the DM framework: an impoverishment rule, vocabulary insertion, a default rule, a re-adjustment rule, and phonetic constraints. The examples for each are shown in (50) through (53), respectively.

(50) Impoverishment rule: (Mathur 2000:80)
For Agr-S, delete the feature [-singular] in the context where Agr-O has the feature [-singular]

This rule, according to Mathur (2000), is used to account for the generalization that Padden (1983) and Supalla (1997) have noted for restriction on plural agreement in ASL. The generalization is that a verb cannot mark two plural arguments at the same time. In such case, the verb marks the subject as if it were singular (but still marks the number of the object. This impoverishment rule says that when the object agreement node has a plural feature (such as dual, exhaustive, or multiple), any plural feature in the subject agreement node is deleted.

(51) Vocabulary Items: (Mathur 2000:80-81)
(A) For verbs:
For each verb, vocabulary item includes information about:
a. handshape (including orientation)
b. location
c. movement if it is not a straight path away form the body

(B) For AgrS:
[+dual] ⟷ DUAL: two rapid reduplications across horizontal plane
[+exhaustive] ⟷ EXH: two or three rapid reduplications across horizontal plane
Else ⟷ Ø

(C) For AgrO:

[+dual] ⟷ DUAL: two rapid reduplications across horizontal plane

[+exhaustive] ⟷ EXH: two or three rapid reduplications across horizontal plane

[+multiple] ⟷ MULT: horizontal arc convex outwards

Else ⟷ Ø

In (51), there is only one difference between the vocabulary items for AgrS and AgrO. That is, AgrO has a vocabulary item for the feature [+multiple], while AgrS does not. This is used to account for the fact that verbs cannot mark the multiple features for subject in ASL. According to the impoverishment rule in (50), the closest match would be the elsewhere option, i.e. a null morpheme.

(52) Default rule: (Mathur 2000:82)

Insert straight movement away from the body (where the movement is unspecified)

According to (51), the vocabulary items for verbs have no need to specify the movement if it is a straight path away from the body as Sandler (1989) has suggested and can be formulated as default rule in (52).

An example of a re-adjustment rule is already provided in (49) above. The example of phonetic constraints, which filter any output of re-adjustment rule Align-Stem that is otherwise ill-formed, is provided in (53) from Mathur (2000:84) as follows.

(53) Phonetic constraints: (Mathur 2000:84)

a. * [Shoulder] [elbow] [radio-ulnar]
Inward rotation flexion supination

b. * [radio-ulnar] [wrist]
pronation sideways extension

In Mathur's (2000) analysis, the verb agreement in ASL is construed as manifested through vocabulary insertion and then through re-adjustment rule in (49), and finally go through the phonetic constraints in (53).

2.3.3 The Role of Space in Sign Language

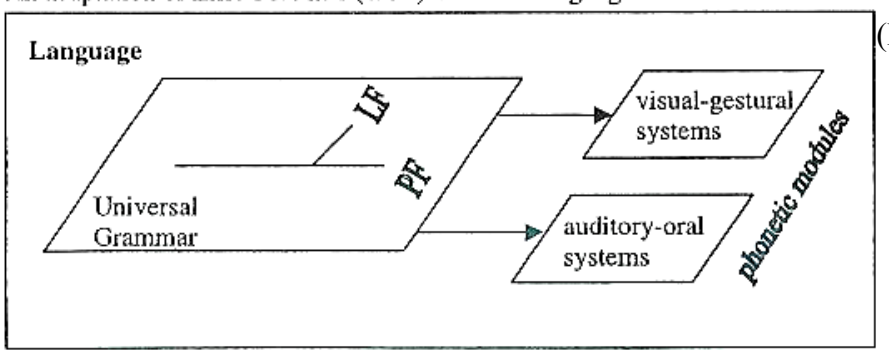
Also, Mathur addresses the issues of locus shape (height) raised by Liddell (2000) by distinguishing two different uses of space: articulatory and referential.

> "The articulatory space means the space in which the signer articulates signs in general. For example, to articulate the ASL sign WALK, one moves the two hands, both in the B handshape and palms facing down, back and forth in the space. There is no need to make any reference to the space in the representation of WALK. It is sufficient to provide the specifications for the movement of the joints, i.e. from the perspective of the signer rather than from the perspective of the viewer. For example, the movement in the sign WALK can be described as alternating outward rotation of the arms from the elbow. Here, there is no need to use space as an articulatory location." (Mathur 2000:72-73)

On the other hand, the referential space is the space which the signer uses to articulate particular referents represented by loci around the signer. These loci may be used in the subsystems of the grammar, such as classifier and agreement systems. According to Mathur (2000), the space may also be used for other complex purposes, such as showing the spatial relation between two entities.

Mathur (2000:73) adapts the Lillo-Martin's (1997) model of language, and maintains the assumption that spoken and signed languages share the same architecture of grammar provided by Universal Grammar. The only difference between them is the phonetic modules as shown in (54).

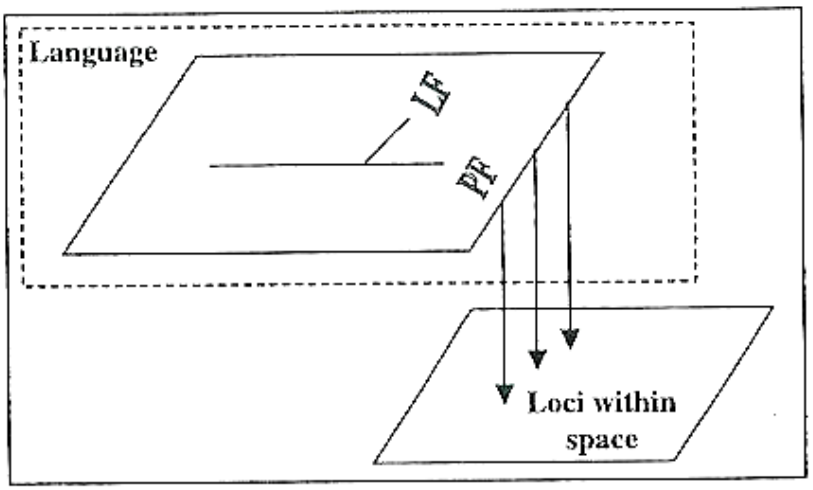
(54) An adaptation of Lillo-Martin's (1997) model of language



(Mathur 2000:73)

In (54) there are two phonetic modules: one is visual-gestural systems for sign languages, while another is auditory-oral systems for spoken languages. The grammar may be linked to either system if not both. Furthermore, Mathur (2000:74-75) assumes that such uses of space (either articulatory or referential) are not part of the formal grammar of sign languages but act as an interface between a cognitive module that governs conceptualization of the world. The space's relationship with the grammar is given in (55) below.

(55) The relationship between language and space



(Mathur 2000:75)

According to Mathur (2000:75), separating the use of space from the domain of grammar and into an interface with a cognitive module has the following three results. "First, it is possible to extract of the gestural part of sign language and assimilate it to the gestures accompanying spoken language that also use space to show relations" (Mathur 2000:75).

Second, one can distinguish a truly linguistic universal principle from sign language between sign language universal properties from the use of the space, such as the fact that every signed language uses the same system for agreement. Finally, the issue of representing the infinite points within the grammar (Liddell 2000) in the space can be resolved. Here, I take the same view of space with Mathur in my analysis.

To sum up, verb agreement is ASL is analyzed by Mathur (2000) as a re-adjustment rule called Align-Stem in the DM framework and the space is not part of formal grammar of sign language.

2.4 Israeli Sign Language (ISL)

In this section, some preliminary information about ISL is given first, and then the analysis of verb agreement in ISL by Meir (1998) will be provided, which involves the componential analysis of verb agreement in the lexical-semantic theory of Jackendoff (1990).

2.4.1 Preliminaries about ISL Verb Types

According to Meir (1998), Padden's (1990) classification of verb classes in ASL holds of ISL (i.e. plain verbs, agreement verbs, and spatial verbs) as well and is discussed as follows.

"Plain verbs are verbs which do not inflect for pronominal features. That is, the form of the verb is not determined by the phi-features of the arguments" (Meir 1998:72). Examples include BEG, BEGIN, BUY, CRY, DECIDE, EAT, FINISH, HAVE-FUN, KNOW, LIKE, LOVE, ORDER, POSTPONE, THINK, WAIT. Some are body-anchored, such as EAT illustrated in (56) below, while others are not, such as EXAMINE in (57).

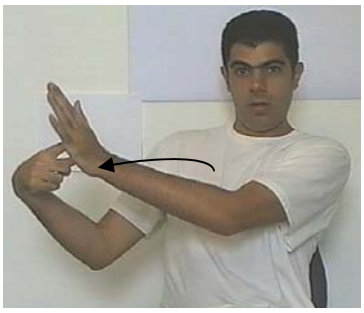
(56) EAT (Meir 1998:72)

(57) EXAMINE (Meir 1998:72)

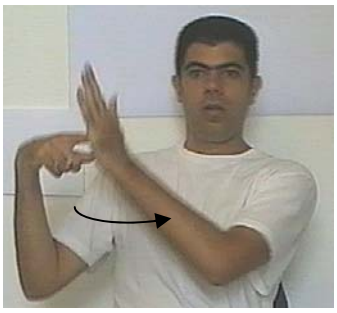
Agreement verbs can be described as consisting of a linear movement on the horizontal plane, with the subject agreement marker and object agreement marker on either end of the verb. That is, the beginning point of the verb is the subject agreement marker, and the end point is the object agreement marker. Examples are illustrated by the verb SHOW in (58) below.

(58) a. $_1$SHOW$_2$ 'I show you.' (Meir 1998:73)

b. $_2$SHOW$_1$ 'You show me.' (Meir 1998:73)



c. $_1$SHOW$_3$ ‘I show him.’ (Meir 1998:73)



d. $_3$SHOW$_2$ ‘He shows you’ (Meir 1998:74)

The verb forms in (58a-d) all share the same ‘root’ (i.e. handshapes, locations, and movements), and a mutable part (i.e. the direction of the path movement). The direction of the path movement is in accordance with arguments of the verb. That is, it begins at the subject locations and ends at the object locations. For instance, in (58a), the path movement moves from 1 person subject location to the 2 person object location. In (58b), the direction of the path movement is reversed. Similarly, in (58c), the path movement goes from 1 person subject location to 3 person object location. In (58d), the path movement traverses from 3 person subject location toward 2 person object location.

Spatial verbs are verbs which carry locative affixes (Meir 1998:75-76). That is, the beginning and end points of the verb forms are associated with actual locations (i.e. the source of motion as beginning point and the goal of motion as end point). One example is in (59) as follows:

(Meir 1998:75)

(59) CUP $INDEX_a$ I $_aCL:C_b$ ‘ I moved the cup from location A to location B.’

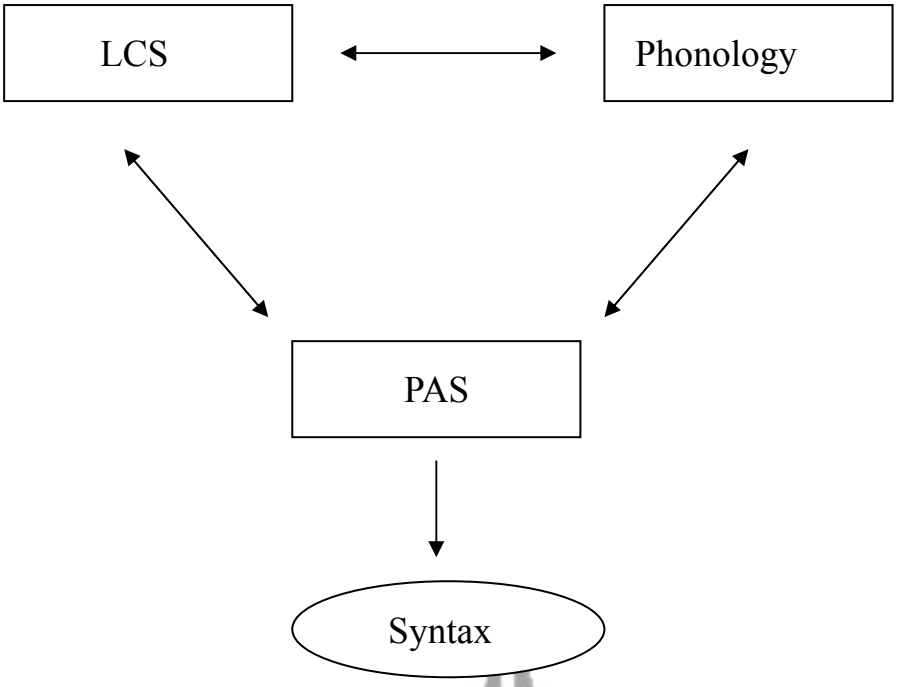
According to Meir (1998), the important point here is that in all spatial verbs, the location specifications of the path of movement are determined by R-loci of the source and goal arguments of the verb, while the R-loci of the subject and object are irrelevant for determining the form of spatial verbs.[15]

To summarize, the ISL verbs have ternary classification of verbs classes as in ASL or BSL. They are plain verbs, agreement verbs, and spatial verbs. Plain verbs are verbs which do no inflect for agreement morphologically (e.g. the verb EAT). Agreement verbs are verbs which inflect for agreement by the R-loci of arguments of the verbs (e.g. the verb SHOW). Spatial verbs are verbs which inflect for agreement by the R-loci of locative arguments of the verbs (e.g. the verb CL:C).

2.4.2 A Thematic Agreement Analysis (Meir 1998)

Meir (1998:27) provides an analysis of verb agreement for ISL. Her main claim is that it is the lexical-semantic structure of a verb that determines its agreement pattern. The model of grammar can be illustrated in (60).

[15] This is the distinction between agreement verbs and spatial verbs in the use of space. Agreement verbs use space discretely, while spatial verbs use space continually as Meir (1998) mentions.



(60) The model of grammar (Meir 1998:24)

She regards the structure of the lexicon as consisting of three components: a component specifying the semantic structure of a lexical entry (i.e. lexical conceptual structure (LCS) in (60) above), a component containing its syntactically argument-taking properties (i.e. predicate argument structure (PAS) in (60) above), and a component specifying its phonological form (i.e. phonology).

Meir (1998) assumes that lexical-semantic information is represented at a lexical conceptual structure (LCS), and that the argument-taking properties are stored at the level of Predicate Argument Structure (PAS). The phonological specifications of a lexical entry are stored in the phonological component of the lexicon. Furthermore, the three components can interact with each other as show in (60).

Meir adopts Jackendoff's (1987; 1990) theory of lexical conceptual structure. The theory draws a distinction between two types of thematic roles: spatial thematic roles and action thematic roles, and it puts each type of thematic role into a different tier in the LCS representation. For example, in the English sentence *The car hit the tree* can have the

following LCS representation as in (61).

(61) The car hit the tree.
Spatial tier: [BE ([α], [AT [β]])]
Action tier: $_{event}$[AFF ([CAR]$^{\alpha}$, [TREE] $^{\beta}$)

In (61), the spatial tier deals with information of motion and location, while the action tier handles actor-patient relations (where the first being the actor and the second the patient). The binder argument is represented by a Greek superscript (i.e. [X]$^{\alpha}$), whereas the bindee is marked by a Greek letter within the square brackets (e.g. [α]). The positions that are linked to the syntax are the positions of the binders, not the bindee since the action tier positions 'provide a more regular mapping to the syntactic positions than the thematic tier'(Jackendoff 1990:145).

As can be read from this LCS, *the car* is the argument of BE and first argument of AFF. Thus it is both theme and actor.[16] On the other hand, *the tree* is both a goal and patient. Only two positions (the *car*, and the *tree*) are linked to the syntax since there are two binders in this LCS representation.

However, such LCS representations are not directly linked to the syntax, but to the level of Predicate Argument Structure (PAS) instead, as shown in (60) above.

PAS representation contains a list of all the arguments that a lexical item (i.e. predicate) licenses in the syntax only without concerning theta roles. Rather, syntactic operations are sensitive to the hierarchical relationship between the arguments, and such information is encoded in PAS representation. The hierarchy can be directly derived from the LCS representations by a means of a linking principle. That is, the least embedded arguments are more prominent than deeply embedded ones, and positions on the Action tier are more

[16] Under Jackendoff's theory, thematic roles are defined as structural position in the LCS. The thematic role 'goal' is defined as the position of the argument of TO, and 'theme' is defined as the first argument of the Event-functions GO, STAY, or BE in the spatial tier. The thematic role 'actor' is defined as the first argument of function AFF ("affect"), and 'patient' is defined as second argument of AFF ("affect") in the action tier.

prominent than positions on the spatial thematic tier (Meir 1998). The hierarchy is given in (62) as follows:

(62) Linking Hierarchy (Meir 1998:31)
Actor>Patient/Beneficiary> Theme> Location/Source/ Goal.

Accordingly, the PAS of (61) can be represented as follows.

(63) The car hit the tree. (Meir 1998:32)
LCS: Spatial tier: [BE ([α], [AT [β]])]
Action tier: $_{event}$[AFF ([CAR]$^{\alpha}$, [TREE]$^{\beta}$)
PAS: hit <$\underline{\alpha}$, β>[17]

Similar analysis applied to the verbs in ISL as well. Meir (1998; 2001a) considered agreement verbs as complex verbs, consisting of two predicates: TRANSFER, and PATH. A TRANSFER predicate denotes 'causing a change of possession', or 'transfer', and PATH predicate denotes 'path'. These two predicates are overtly represented by the facing of the hands and the direction of the path movement, respectively.

In the analysis of Meir (1998), spatial verbs contain a PATH predicate only, which denotes spatial relations. Plain verbs are verbs which do have neither the TRANSFER nor the PATH.

TRANSFER and PATH predicates each have their own argument structure and they will merge at some point of the derivation of agreement verbs since each agreement verb is realized as one unified element phonologically, syntactically, and semantically. Furthermore, they will have a process of argument fusion for the sharing arguments. The process is shown in (64).

[17] Following the notational conventions of Rappaport and Levin (1988) and Williams (1984), the external argument is underlined, and the internal arguments are hierarchically ordered.

(64) Merger of PATH and TRANSFER[18] (Meir 1998:185)

TRANSFER < agent $_i$ patient $_j$ *e* (PATH SC)> ⎫

⎬⇒TRANSFER+[ ]$_i$PATH[ ]$_j$

[ ]$_i$ PATH [ ]$_j$ <u>theme</u>, source[ ]$_i$ goal[ ]$_j$ > ⎭ ⇓

< agent$_i$ patient $_j$ theme source $_i$ goal $_j$ >
(ABL) (ALL)

Argument fusion

< agent/source $_i$ patient/goal $_j$ theme>

In (64), the argument structure of TRANSFER predicate takes three arguments; the first argument has the theta role of agent, the second argument the patient, and the third an event argument, which is taking PATH predicate as an argument. Similarly, the argument structure of PATH predicate selects three arguments with the first argument being the theme, the second as source, and the third as goal. The sharing arguments are notated by subscripts in (64).

In (64), the process of argument fusion merges the agent role and source as one argument, and patient and goal role as one argument within the PAS of resulting complex verbs.

Besides the interaction between LCS and PAS, the phonology component also plays a role in the manifestation of agreement verbs in ISL. Meir (1998:240-245) uses the Hand Tier (HT) model of Sandler (1989) to discuss ISL agreement verbs and using the concept of 'underspecification' and 'blocking' to account for the various phonological manifestations of predicted agreement signs as the result of features clashes. For example, a typical agreement

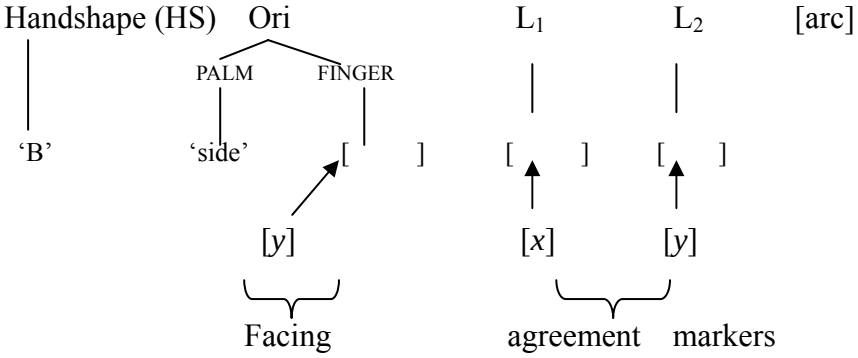
[18] ABL refers to ablative case and ALL refers to allative case in Meir (1998:342). SC is not specified in Meir (1998:185).

ISL verb HELP has the underlying representation and surface representation in (65).

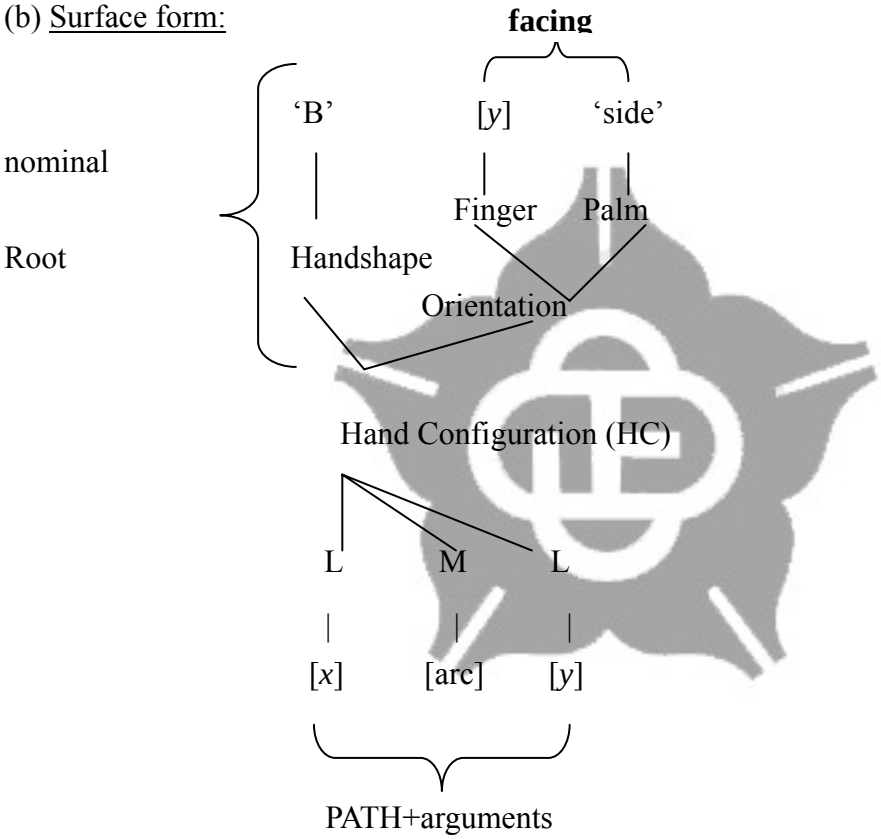
In (65), the empty square brackets represent slots for location specification of a sign. The model used in Meir (1998) departs from HT model of Sandler (1989) in that one respect: whereas Sandler's Orientation refers only to the palm, Meir adds a additional node for finger orientation because facing of the hand is realized phonologically as palm orientation, and/or finger orientation and suggests that orientation features which mark agreement should be referred to as facing (Meir 1998:85).

(65) HELP: (Meir 1998:243-244)

(a) Underlying representation:



(b) Surface form:

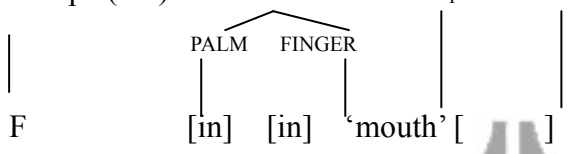


(66): HELP (Meir 1998:245)

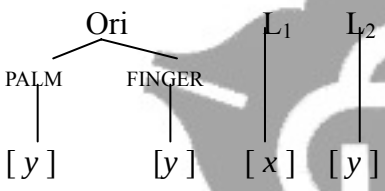
However, there are verbs which fail to agree with one argument. ASK in (67) is an example. It has, in addition to the nominal hand configuration (HC) specification, location specification for either of its end points in the underlying representation. Since this L slot is no longer open, the specification of the argument's R-locus features cannot be inserted. This results in a verb which fails to express agreement with one of two arguments as shown in (67).

(67) ASK (Meir 1998:246-247)

(a) Handshape (HS) Ori L_1 L_2 [ARC]

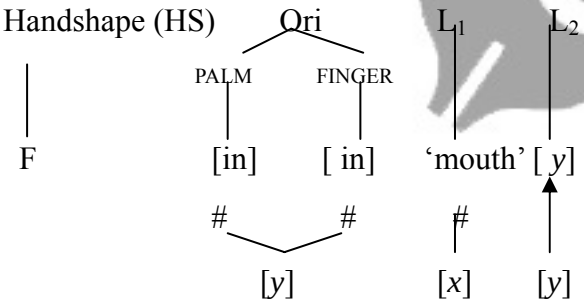


(b) PATH+arguments, TRANSFER:



(c) The verb ASK:

Handshape (HS) Ori L_1 L_2 [ARC]



(68): ASK (Meir 1998:247)

To sum up, according to Meir (1998), the interaction of LCS, PAS, and phonology determines the verb agreement patterns in ISL.

2.5 German Sign Language (DGS)

In this section, the analysis of verb agreement in DGS under the DM framework by Glück and Pfau (1999) (hereafter G&P) will be provided, and the comparison of the analysis of Mathur (2000) and G&P (1999) is to be discussed.

2.5.1 The Analysis of Verb Agreement in DGS (Glück and Pfau 1999)

Some literature about DGS has been documented. G&P (1999) provides a distributed morphology account of verb inflection in DGS. They provide a list of verb types for DGS as follows in (69):

(69) a. Plain verbs: Do not show person or number agreement at all; e.g. ZAHLEN 'pay', MÖGEN 'like'

b. Agreement verbs:

i. verbs agreeing with their subject and object; agreement established via beginning and ending point of the path movement; e.g. FRAGEN 'ask', ZEIGEN 'show', GEBEN 'give'

ii. classifying verbs which agree with subject or direct object; agreement established via handshape change; e.g. ROLLEN 'roll', GEBEN 'give', WERFEN 'throw'[19]

(iii Spatial verbs which agree with a locative; agreement established via beginning and/or ending point of the path movement; e.g. STELLEN 'put down' , ZUWERFEN 'throw to'.)

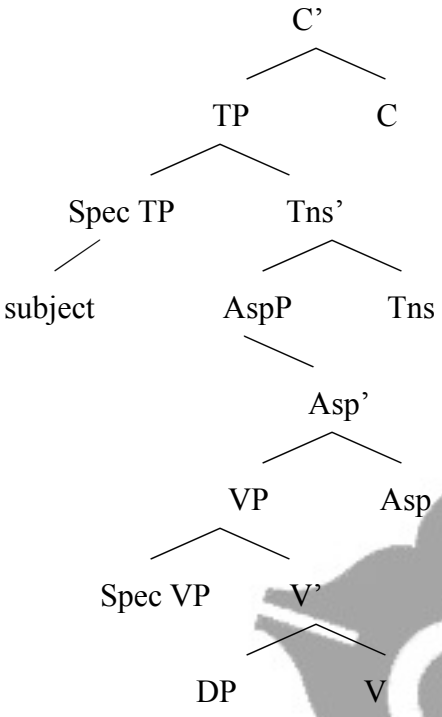
(G&P 1999:4)

They proposed a clause structure in (70) as in DGS. In the syntax the verb will move to the Asp (=aspect) head and then to the T (=tense) head. When the verb raises, it adjoins to the

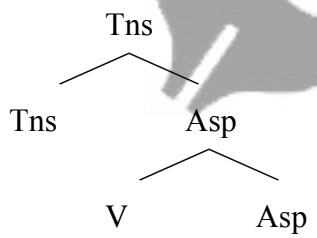
[19] The meaning of handshape in G&P (1999) includes the orientation.

next head in the tree and resulting a complex structure under T as the one in (71). The T node is marked as prefix, while Asp is a suffix.

(70) Clause Structure of DGS (G&P 1999:9)



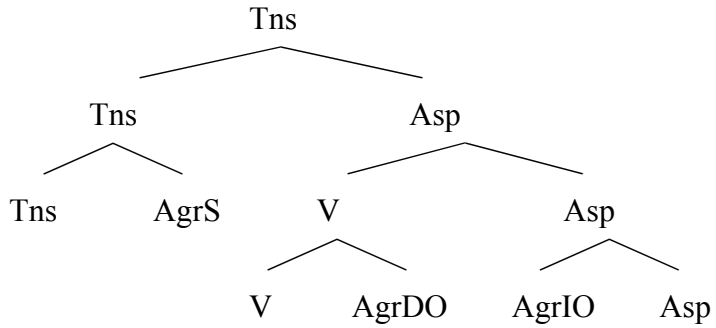
(71) Complex structure under Tense node (G&P 1999:10)



Next, Agr (=agree) nodes will attach to within this complex to pick up the features of DPs governed by these heads: AgrS attaches to Tns, AgrDO to V, and AgrIO to Asp, respectively. The tree is in (72) as follows.[20]

[20] One thing to be noted in (72) is that there is multiple adjunction to the same head. Both AgrS and Asp adjoin to Tns, while AgrIO and V adjoin to ASP. This may result in a problem for Kayne (1994) in that the Spell-Out of overtly complex Tns and Asp nodes in (72) cannot result in any order via Linear Correspondence Axiom (LCA).

(72) Complex Structure with Agreement node attached (G&P 1999:10)



Here Tns is a phonologically null morpheme, and will subsequently fuse with its sister node AgrS. The derived structure is [[AgrS [[[V]AgrDO]AgrIO]]Asp].

Next, Glück and Pfau (1999) propose two different structures for agreement verb class (69bi) and (69bii) as shown in (73).

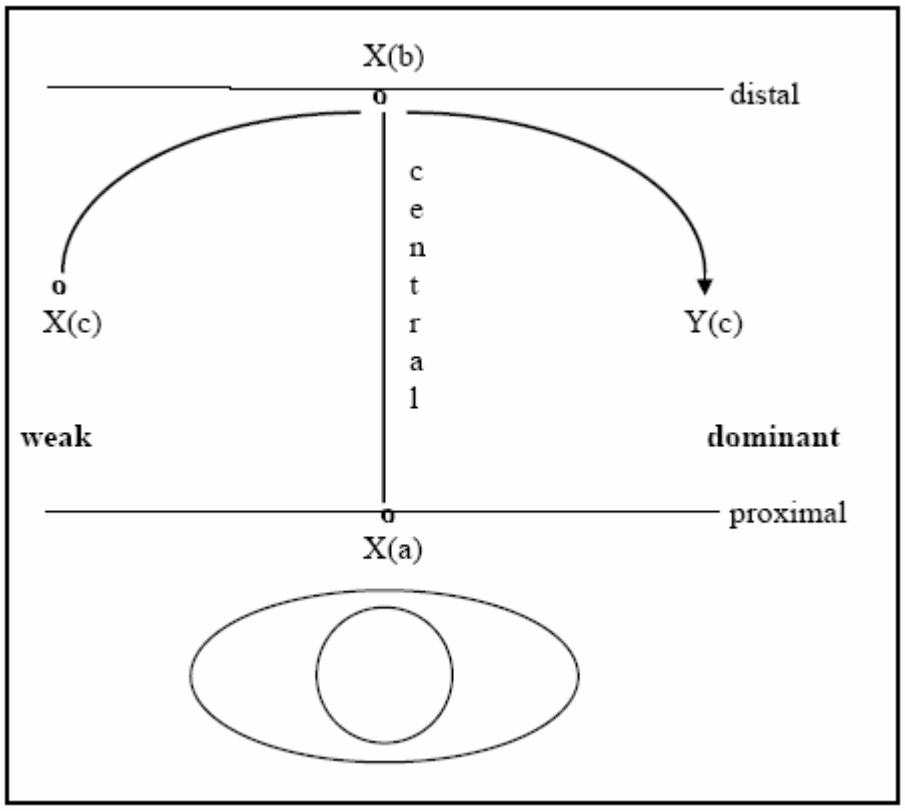
(73) a. [[Agrs [[Verb] AgrDO]] Asp] (e.g. SEHEN 'see', FRAGEN 'ask') (G&P 1999:12)
b. [[AgrS[[[Verb] AgrDO(=CL)]AgrIO]] Asp] (e.g. GEBEN 'give', ZUWERFEN 'throw to')

Then, they gave a list of some of relevant vocabulary items as shown in (74)

(74) a. [+1sg] $\Leftrightarrow$ [$X_{prox.body\text{-}central\text{-}neutral}$] (G&P 1999:12)
(where X is a point in the signing space)
b. [+2sg] $\Leftrightarrow$ [$X_{dist.body\text{-}central\text{-}neutral}$]
(where X is a point in the signing space)
c. [2pl] $\longleftrightarrow$ [$_{x\text{-}weak}$ $ARC_{x\text{-}dominant}$] / [Y___$_{obj}$]
(weak/dominant determined by signer's handedness, X is a pont in the signing space, and Y= verbs of Class I or II)
d. [3sg] $\longleftrightarrow$ [$X_{dist.body\text{-}dominant\text{-}central}$]
(where X is a point in the signing space)
e. [3sg] [a] $\longleftrightarrow$ [$X_{dist.body\text{-}a}$]
(where a is a position between the central and the left or right neutral points in signing space)
f. [+Cl-F] $\longleftrightarrow$ Ø
g. [+iter] $\longleftrightarrow$ Ø
h. [+habit] $\longleftrightarrow$ Ø

In addition, they provide the picture (75) to illustrate the above mentioned vocabulary items. The small letters such as X(a) refers to the points in the signing space mentioned in the vocabulary items.

(75) (G&P 1999:13)



Besides, they also provide the readjustment rules in (76) for classifier agreement (74f) and for aspectual modification (74g) and (74h), which are null morphemes. The readjustment rules in (76a-c) explain for stem modification in case of affixation of aspect and classifier morphemes. The aspectual inflection in (76a) is accomplished by reducing and reduplicating the movement while (76b) by adding an arc movement and reduplicating the movement. In (76c), the classifier agreement occurs as handshape change. Moreover, readjustment rules may change features in the node as (76d) and (76e), which show that no morphological difference between the realization of the first and third person singular and plural.

(76) a. movement → movement / [+iter] (G&P:14)

[reduce]
[redupl]

b. movement → movement / [+habit]

[ARC]
[redupl]

c. handshape → $\text{handshape}_{\text{CL-F}}$ / Y_$[\text{+Cl-F}]_{\text{AgrDO}}$
(where Y = verbs of class I)

d. [+1pl] → [+1sg]

e. [+3pl] → [+3sg]

In the next section, we have the comparison of Mathur (2000) and G&P (1999).

2.5.2 The Comparison of Mathur (2000) and Glück and Pfau (1999)

Mathur (2000:84) has reviewed the analysis of G&P (1999) in DGS, and states three differences regarding the analysis of verb agreement. First, Mathur regards the verb agreement as the re-adjustment rule, which affects the overall orientation of the sign, while G&P (1999) take verb agreement as the insertion of vocabulary items.

Second difference is that Mathur (2000) considers classifier constructions to be subsumed under the set of spatial verbs, independently of agreement verbs, while G&P (1999) subsume classifier constructions under the category of agreement verbs. However, Mathur (2000) leaves the question open for how such spatial verbs may be handled under his model.

The third difference is that Mathur (2000) treats aspectual modulation derived from overt vocabulary insertion which is subject to the readjustment rule for agreement in (49) in section 2.3.2 above, whereas G&P (1999) analyze the aspectual modulation in terms of re-adjustment rules. Mathur (2000) concludes that analysis of aspect inflection of G&P (1999) can be incorporated into his analysis as long as the re-adjustment rules for aspect occur

before the re-adjustment rule for agreement. Similarly, Mathur leaves open which analysis is preferable.

To sum up, three differences between the analysis of Mathur (2000) and G&P (1999) can be summarized in (77) below.

	Sign Languages	Verb agreement	Aspect modulation	Classifiers
Mathur (2000)	ASL	As re-adjustment rule	As morphological insertion	Under the subset of spatial verbs
Glück and Pfau (1999)	DGS	As morphological insertion	As re-adjustment rule	Under the subset of agreement verbs

(77) Analysis Difference of Mathur (2000) and Glück and Pfau (1999)

The analysis of G&P (1999) seems promising. However, it appears that the derivation steps violate the extension condition, which prohibits any insertion inside a constituent after the merging process has completed, in Minimalist Syntax, and needs some modification.

2.6 Sign Language of the Netherlands (NGT)

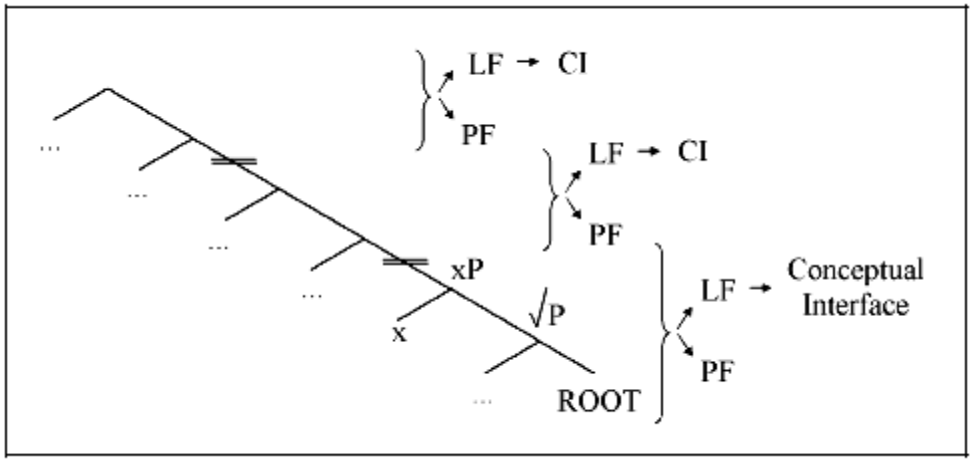
Zwitserlood (2003a:204) points out that there are two types of agreement systems: agreement by means of loci, and agreement by means of classifiers.[21] Zwitserlood combines several sign researchers' claims (Glück and Pfau 1999; Meir 2001; Padden 1998) to give a unified proposal about verb agreement provided by meaningful hand configurations and loci in signing space.

[21] Zwitserlood (2003a) distinguish three types of classifier predicates in NGT. They are Verbs of motion, location, and existence (VELMs), contour signs (called tracing SASSes in Supalla 1986), and verbs of manner of motion. Zwitserlood (2003a) focused mainly on VELMs here.

Zwitserlood (2003a:205) assumes that all uttered signs have at least one place of articulation, a particular hand configuration, a particular hand orientation, and a movement.[22] With these facts, the prediction about verb agreement can be given.

Zwitserlood assumes that Verbs of motion, location, and existence (VELMs), which are unaccusative, consist of a root, selecting an obligatory internal argument and one or two optional arguments. Recall that in DM, this root does not have a syntactic category or phonological material until merges with little x (an f-morpheme), creating a little x phrase.[23] The merger of little x establishes a cyclic domain for sending the structure derived so far shipped off to PF, LF and the conceptual interface to get vocabulary items inserted and an interpretation assigned. Such process can be illustrated in (78) as follows.

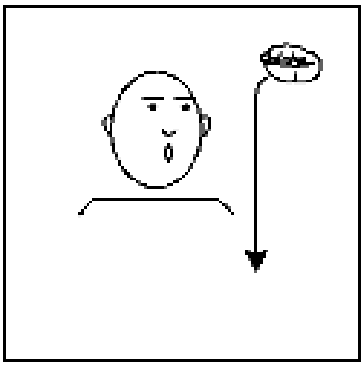
(78) (Zwitserlood 2003a:201)



If a VELM is intransitive as the example (79), it will have the following representation in the derivation as shown in (80) below.

[22] Non-manual components are disregarded in the analysis of Zwitserlood (2003a).
[23] The little x in Zwitserlood (2003a) is equal to x in my analysis, and little x phrase is equal to xP in my analysis later on in Chapter 3 and chapter 4.

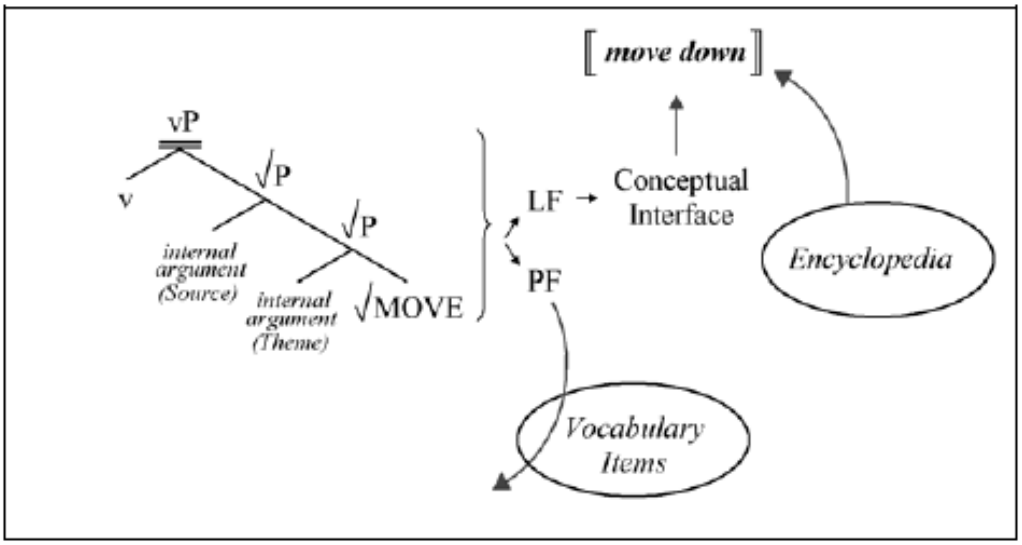
(79) (Zwitserlood 2003a:206)



LOC_{shelf}-move.down-CL:flat ent

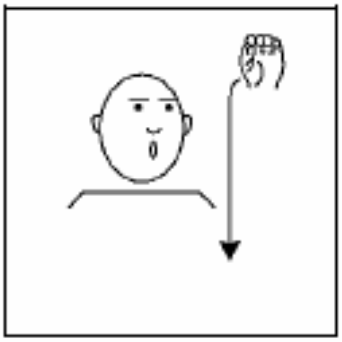
'The book falls down from the shelf.'

(80) (Zwitserlood 2003a:207)



On the other hand, if a VELM is transitive such as in (81), it will need a voice head, which selecting an external argument, merged with vP in the derivation as shown in (82) below.

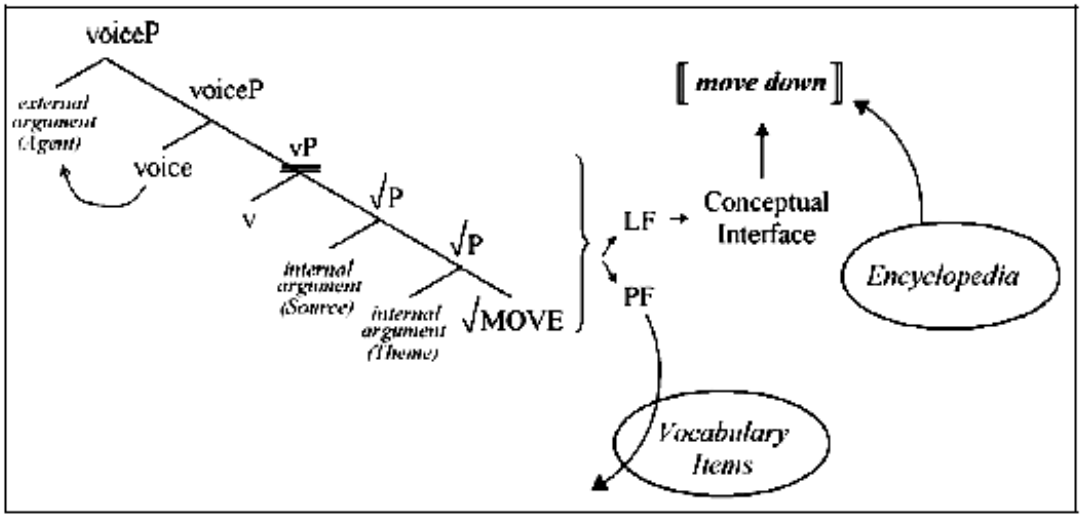
(81) (Zwitserlood 2003a:210)



x-LOC_{shelf}-move.down-CL:flat ent

'(Someone) takes the book down from the shelf.'

(82) (Zwitserlood 2003a:211)



The relevant vocabulary items competing for insertion in the agreement morphemes are in (83) as follows.[24]

(83)

a. ↔ [+straight, +flat, +volume] (Zwitserlood 2003a:208)

b. ↔ [+straight, +flat] / [+voice]

c. $[loc_{shelf}]$ ↔ $[+loc_x]$

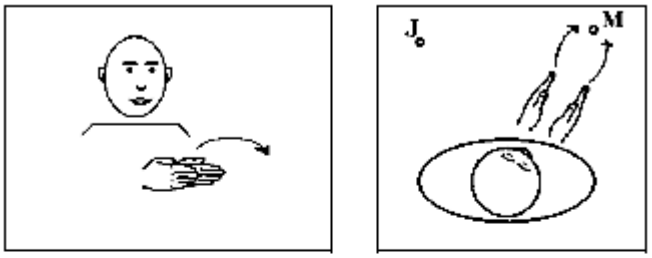
d. $[loc_{book}]$ ↔ $[+loc_y]$

[24] [-volume] indicates that handshape (including orientation) represents the outline of the referent, not its volume, while [+volume] does (Zwitserlood 2003a:193).

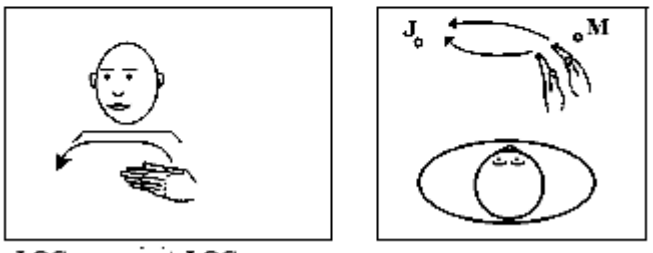
Following the principle of Syntactic Hierarchical Structure All the Way Down, vocabulary insertion starts from the innermost embedded morphosyntactic feature bundle. During the competition, the theme argument agreement marker is spelling out with meaningful handshape (83a) since it is highly specified and there are no feature clashes. When it comes to the vocabulary insertion of source argument, the locus agreement marker [loc_{shelf}] is spelling out since the sign has already had a handshape specification of theme argument and no two feature specification for one phonological parameter within one sign. The same is true for the vocabulary insertion of goal argument.

Similarly, for agreement verbs, they contain roots whose vocabulary item has a specification for handshapes and movement, but lack of specification of place of articulation. After merging with v, the vocabulary insertion operates on it. Since the sign language interface prohibits double specification for hand configuration, thus, the sign are spelled out with locus features as the NGT sign 'to visit' shown in (84) below.

(84) (Zwitserlood 2003a:212)



LOC_{signer}-visit-LOC_{Mary}
'(I) visit (her)'



LOC_{Mary}-visit-LOC_{John}
'(she) visits (him)'

To summarize, Zwitserlood (2003a) analyzed meaningful hand configuration (so-called classifiers or classifier predicates) in NGT based on a DM framework and point out that there are two agreement systems: one is agreement by classifiers; another one is by loci, which seems to provide evidence for the idea to consider classifiers under the category of agreement verbs as classified by G&P (1999).

2.7 Taiwan Sign Language (TSL)

In this section, some studies about TSL will be given. The information includes the verb types and word orders.

2.7.1 Verbs Types in TSL (Smith 1989)

Smith (1989) identifies three types of verbs in TSL, non-agreement verbs, agreement verbs and spatial-locative verbs. Each verb class corresponds to plain verbs, agreement verbs, and spatial verbs in Padden's terms (1990), respectively.

Smith (1989) finds that in TSL, like ASL (Johnson and Liddell 1984), there are two major structural types of morphemes in TSL signs: s-morphs and p-morphs. "The phonological essence of [s-morphs] is carried in a set of phonological segments, each composed of a number of phonological features that detail the behaviors involved in producing the signed token" (Smith 1989:3). S-morphs can be divided into two subgroups: either completely specified or incompletely specified s-morphs. One completely specified s-morph is a segment and can be articulated in isolation, while incompletely specified s-morphs cannot. Their empty feature cells need to be filled by other morphemes. These filled morphemes are called p-morphs.[25]

[25] The p-morphs are bound morphemes, while completely specified s-morphs are free morphemes.

The examples of completely specified s-morphs is class of the non-agreement verbs in TSL such as AFRAID, THINK since all their features are completely specified, while the examples of incompletely s-morphs is that of agreement verbs such as BELIEVE (Smith 1989). The notion of complete or incomplete morphs is adopted in my analysis in Chapter 3.

2.7.2 Word Orders in TSL

Smith (1981) has discussed the word order of TSL, he identifies three attested word orders: SVO, SOV, OSV, and suggests that the basic word order is probably SVO based on his data collection.[26] Examples of SVO are provided in (85) and (86) as follows.

hn
(85) SHE LOVE ME ME[27] (Smith 1981:6)
'She loves me'

(86) YOUR FATHER DO WHICH (Smith 1981:6)
'What does your father do?'

For Smith (1981), the OSV word order is more like object topicalizations rather than passives in English on the one hand. On the other hand, another interpretation is that such OSV word order is used to maintain the negative verbs tendency to occur in the sentence-final position.[28] The examples of OSV are illustrated in (87) and (88) below:

(87) HE NAME (I) NOT-KNOW (Smith 1981:6)
'I don't know his name.'

(88) THAT SIGN (I) SEE NOT-KNOW (Smith 1981:6)
'I see but don't understand that sign.'

[26] The impossible combinations identified by Smith (1998) are OVS, VOS, and VSO word order.
[27] The hn over the sign ME in sentence (85) means that the sign was produced simultaneously with a non-manual marking: head nod. The second ME is a pronoun copy in the sentence.
[28] See recent study of Ke (2006) on negation in TSL.

The SOV sentences have two possible explanations, one is called the physical manipulation hypothesis, and another is called the auxiliary hypothesis posed by Smith (1989). The physical manipulation hypothesis is that in general the verb involves physical manipulation of a concrete object will be first to specify what object one are dealing with, and then follows what one do to that object.[29] On the other hand, the auxiliary hypothesis has the same motivation. In (89), the verb LIKE typically appears after its object, which is a verbal noun.[30] Smith (1981) calls it auxiliary since it usually functions in conjunction with a verb and appears sentence finally.

(89) THAT GIRL SLEEP LIKE (Smith 1981:7)
'That woman likes to sleep.'

In our collected data, most sentences tend to be SOV or OSV order, I will use the SOV as my base of analysis for TSL sentences.

Although there is some literature about TSL so far (Ann 1993; 2005; Chang et al 2005; Chen 2003; Duncan 2005; Ke 2006; Kuan 2005; Lee 2003; Liu 2005; Myers, Lee, and Tsay 2005; Smith 1989; 1990; 2005; Su 2004; Tai and Su 2006 ; Tsou 2004), a formal analysis of verb agreement has not been fully explored yet. Such analysis of verb agreement will be given in chapter 3.

2.8 Summary

In this chapter, I have provided an overview about verb agreement in several sign languages across the world. Each analysis has tried to explain the phenomena of verb agreement. They have basically agreed that three are three types of verbs in sign languages, but treat them differently under the different frameworks.

[29] This is also argued along the same lines in Yau (1982) for Chinese Sign Language (CSL).
[30] Other verbs are HAVE, FINISH, KNOW, MAY, CAN, ABLE, NOT HAVE, NOT-YET, NOT-KNOW, etc.

Chapter 3 A Syntactic Analysis of Verb Agreement in TSL

3.1 Introduction

This chapter gives an analysis of verb agreement in TSL under the DM framework with the minimalist program of syntax. Firstly, the three classes of verbs in TSL and the phenomenon of verb agreement in TSL will be introduced. Next, an analysis for verb agreement in TSL will be given in terms of the DM framework.

3.2 Verb Agreement in TSL

In this section, I will address the verb classes in TSL and introduce what is verb agreement in TSL.

3.2.1 Verb Classes of TSL

Traditionally classified by Smith (1989), TSL has three verb classes in terms of Padden (1990): plain verbs, spatial verbs, and agreement verbs.[31] For Smith, the basic dichotomy is between verbs that do not inflect for agreement (i.e. plain verbs) and those that do (i.e. agreement verbs and spatial verbs). Verbs that inflect for agreement are further divided into those agreeing with subject and object (i.e. agreement verbs) and those agreeing with locations in the signing space (i.e. spatial verbs).

For Smith (1989), plain verbs do not inflect for agreement.[32] That is to say, the form of the verb is not determined or influenced by the referential features of its argument. The plain verb FEAR, for instance, has the same form regardless of the referential loci of its argument.

[31] These verb classes were identified by Padden (1990) with respect to ASL. Actually, Smith (1989) uses the term non-agreement verbs, agreement verbs, and spatial-locative verbs in the thesis, which is corresponding to plain verbs, agreement verbs, spatial verbs in Padden (1990).

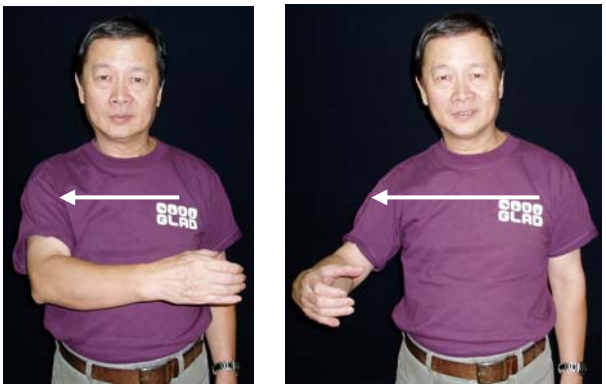
[32] Chang et al. (2005) consider eye gaze as an agreement marker for plain verbs. That is, plain verbs inflect for agreement non-manually.

Examples of plain verbs in TSL include FEAR, THINK, LAUGH, DON'T LIKE, LIKE, TOLERATE, DON'T KNOW, DOUBT. The plain verbs like LIKE and FEAR are shown in (90) and (91), respectively.

(90) LIKE (from TSL project)

(91) FEAR (from TSL project)

Spatial verbs agree with spatial-locative referents in signing space. In other words, the starting and end points of these signs are associated with actual locations, the source of motion (the starting point) and goal of motion (the end point). For example, in the TSL sentence meaning *I moved the cup from location A to location B*, the verb MOVE-CUP agrees with location A and B. The verb's path movement is from location A to location of B, as shown in (92).

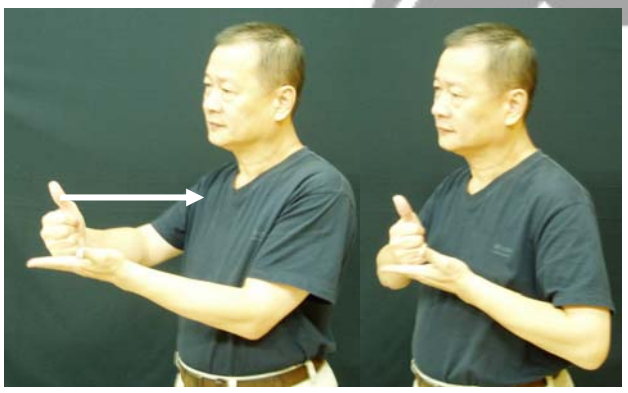


(from TSL project)

(92) MOVED-CUP FROM Location A (LEFT) TO Location B (RIGHT)

Agreement verbs agree with their subject and object. For example, in the TSL sentence meaning 'John gave Mary the book', the verb GIVE agrees with JOHN and MARY. The path is specified or influenced by the loci of the subject and object arguments. Agreement verbs are sub-classified into two groups: regular verbs (e.g., GIVE, SEND, BELIEVE, TELL, TEACH) are those with thematically most prominent argument as subject, while backward verbs (e.g. GRAB, INVITE, LEARN) are those with the Source role as subject.[33] Examples of GIVE (regular verb), and INVITE (backward verb) are shown in (93) and (94), respectively.

(93) GIVE (from TSL project)



(94) INVITE (from TSL project)

[33] Regular verbs are subject-to-object (s-o) verbs, while backward verbs are object-to-subject (o-s) verbs in Smith (1989:111). I disagree with Smith.

In sum, in TSL there are three verb types (plain verbs, spatial verbs, and agreement verbs) classified based on their morphological properties to inflect for agreement or not. Plain verbs do not inflect for agreement, while spatial verbs and agreement verbs do.

3.2.2 Verb Agreement in TSL

According to Meir (2002), "Verb agreement is defined as a phenomenon where the verbal element (a verb or an auxiliary) matches its syntactic argument(s) in their referential features." A verb is said to agree with its arguments if the form of the verb is determined by the pronominal features of its arguments. In sign languages, nominals in a clause are associated with a certain location in signing space, called 'R(eferential)-loci' (Lillo-Martin and Klima 1990). This association is done by pointing to, or directing the eye-gaze towards, a specific point in signing space. If the referent is present, the pointing is directly to the referent. On the other hand, if the referent is not present, it is assigned a certain point in the signing space (e.g. signing a NP and then pointing to a certain point in the space for the invisible referent or gazing at the specific point in signing space).

Verb agreement in sign languages is usually expressed in two ways. One is by agreement using R-loci (or locations) while another one is using classifiers (Zwitserlood 2003a:204). The TSL sentence in (95) is agreement by R-loci in that the verb BELIEVE agrees with R-loci of its arguments (i.e. MOTHER only). That is, the handshape (HS) of the predicate BELIEVE agrees neither subject nor object. The agreement with object is accomplished by moving firstly from the position in front of the signer's trunk to the position where the argument MOTHER (object) is located in signing space.

In addition, the TSL sentence in (96) provides an example of the verb agreement using classifiers. The HC of the spatial verb classifier predicate RUN ABOUT of the dominant hand itself is a nominal classifier standing for a class of animals. It agrees with the subject

nominal DOG. Similarly, the HC of nominal classifier ROOM of non-dominant hand agrees with the object ROOM in (96c).

In addition to the two types of agreement above, many sign language researchers (Bahan 1996; Chang et al. 2005; Neidle et al. 2000; among others) suggest that verbs can agree non-manually either by head tilt (for subjects) or eye gaze (for objects). In other words, plain verbs also use R-loci. R-loci are locations in space, which can be indexed by the hands (for agreement verbs) or the eyes (for plain verbs).[34] Thus, in the case of plain verbs, such as in TSL sentence (97), the predicate LIKE seems not to agree morphologically with either subject or object by locus agreement or by classifier agreement. However, it agrees by eye-gaze toward the object nominal locus (i.e. DOG). Under this view, all the classes of verbs in TSL seem to all share agreement features to some extent.

(95) Examples for agreement by R-loci and by Classifier (Chang et al. 2005:253)
MOTHER MOTHER$_{pro}$+ FATHER BELIEVE. (Agreement verb)
'(MY) father believes (my) mother.'

a. MOTHER

b. MOTHER$_{pro}$+FATHER

c. BELIEVE

[34] I thank Prof. Billings for pointing this out to me.

(96) Examples for agreement by Classifier (Chang et al. 2005:254)

ROOM DOG ROOM$_{pro}$+ANIMAL-RUN.ABOUT. (Spatial verb)

'The dog is running about in the room.'

a. ROOM b. DOG c.ROOM$_{pro}$+ANIMAL$_{pro}$-RUN.ABOUT

(97) Examples for agreement by non-manuals (taken from Chang, Su and Tai 2005:252)

DOG BROTHER LIKES. (Plain verb)

'(My) brother likes dogs.'

a.DOG b. BROTHER c. LIKE

In sum, unlike ISL, verb agreement in TSL is attested in three types: agreement using R-loci, classifiers, and non-manual features, which correspond to three types of verbs (agreement verbs, spatial verbs, or plain verbs). They all represent agreement properties as shown (98) below.

(98) Types of agreement in TSL

	Non-manuals	Path movement	Classifiers
Plain Verbs (PVs)	✓	×	×
Agreement verbs (AVs)	×	✓	×
Spatial Verbs (SVs)	×	×	✓

✓= required

× = not allowed

In the following section, the analysis for the verb agreement in TSL is presented in the DM framework, which provides a unified account for the agreement phenomena exhibited in different verb types in TSL that have been described in (98).

3.3 A Syntactic Analysis of Verb agreement

In this section, a syntactic clause structure is proposed for TSL. It adopts the DM and Minimalist frameworks.

3.3.1 Feature Lists of TSL

In the DM framework, the syntactic nodes are a bundle of morpho-syntactic features in syntax as addressed in Chapter 1. All morphemes are represented by phonological features. In this section, I will provide these features in TSL for the ease of exposition of analysis later on. There are three lists of phonological features in TSL in my analysis. They are hand configurations (HC), locations (L), and movements (M), which will be discussed accordingly.

3.3.1.1 Hand Configuration Features

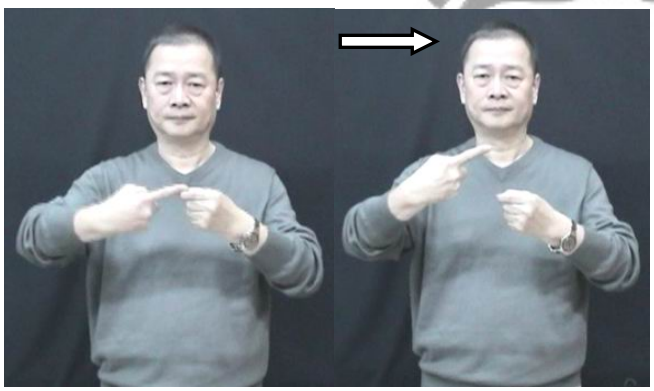
According to Chang et al. (2005), there are 60 handshapes in TSL, which is provided in appendix 1.[35] I use the term 'hand configuration' (HC) in this thesis, in the sense that includes the orientation, which is different from the sense of word 'handshape' (HS) used in Chang et al (2005).

[35] See Lee (2003) for a different view: that the current inventory of handshape in TSL is fifty-seven handshapes in that the handshape of GUA 'melon' (which is not listed in Chang et al. 2005),GUO 'fruit' and TONG 'same' are not phonemically distinctive and therefore should be considered as a single handshape in the inventory, and the handshape of JIANG 'ginger' is excluded from the inventory because it is no longer used by young signers, and the handshape of BO 'doctor' and NAN 'difficult' are excluded from the inventory for the same reason . I agree with Lee's position.

One thing to be noted is that these phonological features are subject to other operations such as fusion or fission or re-adjustment rules at Morphological Structure (MS) before spell out. One example for fusion will be that a numeral incorporation of TSL time sign such ONE YEAR, TWO YEARS, THREE YEARS, and so forth. The TSL sign of ONE YEAR is produced with two hands. [LÜ] 'Chinese family name' HC is on the weak hand (left hand), and [YI] 'one' HC is on the strong hand (right hand). Then the [YI] 'one' HC moves in a circle around the [LÜ] 'Chinese family name' HC and holds on the [LÜ] HC for a moment and moves up as shown in (99). Similarly, with the TSL sign for TWO YEARS, this time, only the feature specified on the strong hand is changed as [ER] 'two', and the feature specified on the weak hand remains the same. The [ER] 'two' HC moves in a circle around the [LÜ] HC and holds on the [LÜ] HC for a moment and moves up as shown in (100).

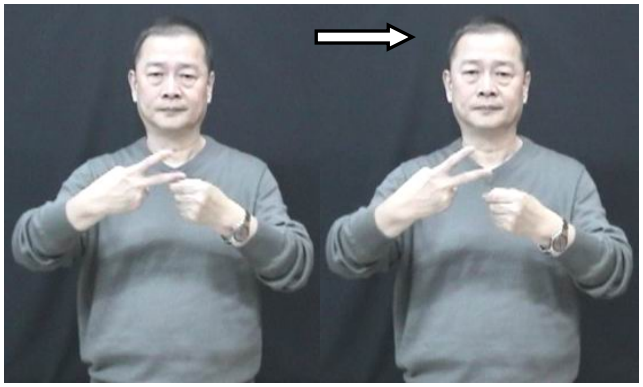
As shown in (99) and (100), numbers are incorporated into the signs. We can hypothesize the structure for (99) and (100), which is shown in (101). In (101), the NP node contains the feature of location (i.e. neutral space (NS)), and movement feature (i.e. CIRCLE). The Num node contains the feature of HC such as YI 'one' or ER 'two'.

(99) Picture of ONE YEAR (from TSL project)



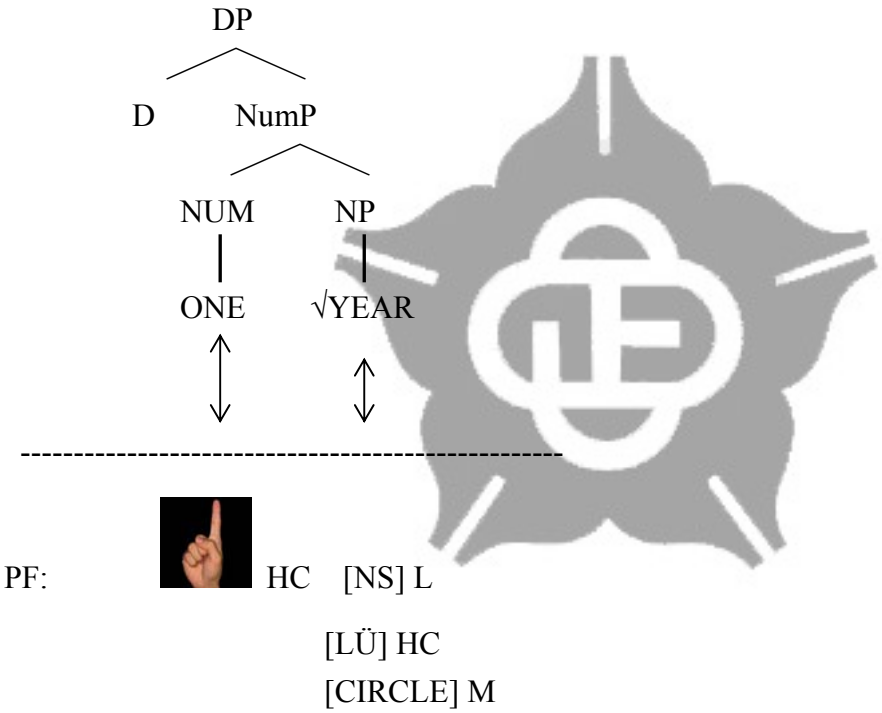
ONE YEAR

(100) Picture of TWO YEARS (from TSL project)



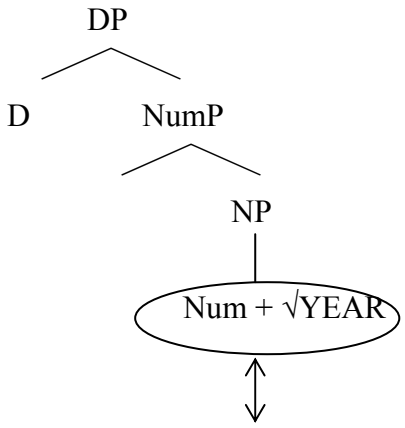
TWO YEARS

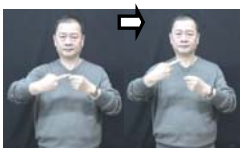
(101) Hypothesized structure of DP in TSL



Once a DP is completed, and a merger (a lowering operation) occurs at MS which makes NUM move to the head of NP, and follows a fusion as shown in (102), the whole structure is send to PF, and results in the phonetic form in picture (99) and (100).

(102) Fusion of NUM and N



PF: 

'one year'

3.3.1.2 Location Features in TSL

Similarly, there are location (L) features specified in TSL as well. According to Kuan (2005) and Smith and Ting (1979), there are twenty four locations used for TSL signs. They are specified in the appendix 3.

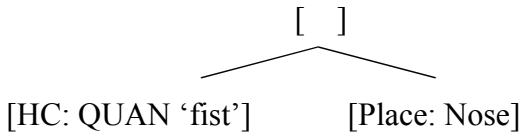
3.3.1.3 Movement Features in TSL

Scholars have different viewpoints about movement (M) features in TSL. Smith (1989) identifies 22 movement features among phonological tiers.[36] However, in Zhao (1999), only fourteen movement features are used, while according to Kuan (2005), the movement

[36] They are the features [straight], [round], [seven], [zig-zag], [U-shaped] in the contour tier; features [HP] (horizontal plane), [SP] (surface plane), [VP] (vertical plane), [MP] (midline plane), [OP] (oblique plane) in the Direction/plane tier; features [long], and [short] in the temporal quality tier; features [sm] (small), [lg] (large), [tns] (tense), and [touch] (touch) in physical movement quality tier; and features [wg] (wiggling), [cir] (circling), [osc-h] (oscillating handshapes), [osc-l] (oscillating locations), [osc-o] (oscillating orientations), and [osc-s] (oscillating spatial relationships) in local movement tier. These features are defined in Smith (1989:37-42).

features in TSL is thirty-one. By examining their data, I found most movement features are phonetic details in nature and phonologically predictable by itself in the sense of Channon (2002). Take the sign GOOD, for example. Its phonological representation may be simply represented as in (103) based on the notation of Channon (2002).

(103) Phonological Representation of Sign for GOOD in TSL



This representation indicates that the sign for GOOD needs a QUAN 'fist' HC, and its place is on the nose. So, what signers need to do is to have a QUAN 'fist' HC and put this HC on the nose. The movement feature of this sign has not been specified in the underlying representation, but is predictably carried out on the surface form.

Therefore, I suggest that many movement features identified in Kuan (2005), Smith (1989) and Zhao (1999) are underspecified phonologically. On the other hand, syntactically, there are five basic movement features based on Kuan (2005), Smith (1989), and Zhao (1999). They are specified in (104) as follows.

(104) Movement Features in TSL

Phonological features	Vocabulary Insertion Items	TSL examples
[STRAIGHT]	Direct straight path	GO, MARRY
[ROUND]	Indirect, smooth path resulting in either an arc or a circle	MOON, ALL-DAY
[SQUARE]	Indirect path with a single or double corner	DESK, PAPER
[ZIG-ZAG]	Repeated angular oscillation while moving on a path	LIGHTENING, WRITE
[REVERSE]	Repeated straight path	RACE

To sum up, there are three lists of phonological features in TSL. They are HC, L, and M features, which can undergo the fusion or fission operation after syntax operation. In the following section, the clause structure of TSL will be proposed and discussed.

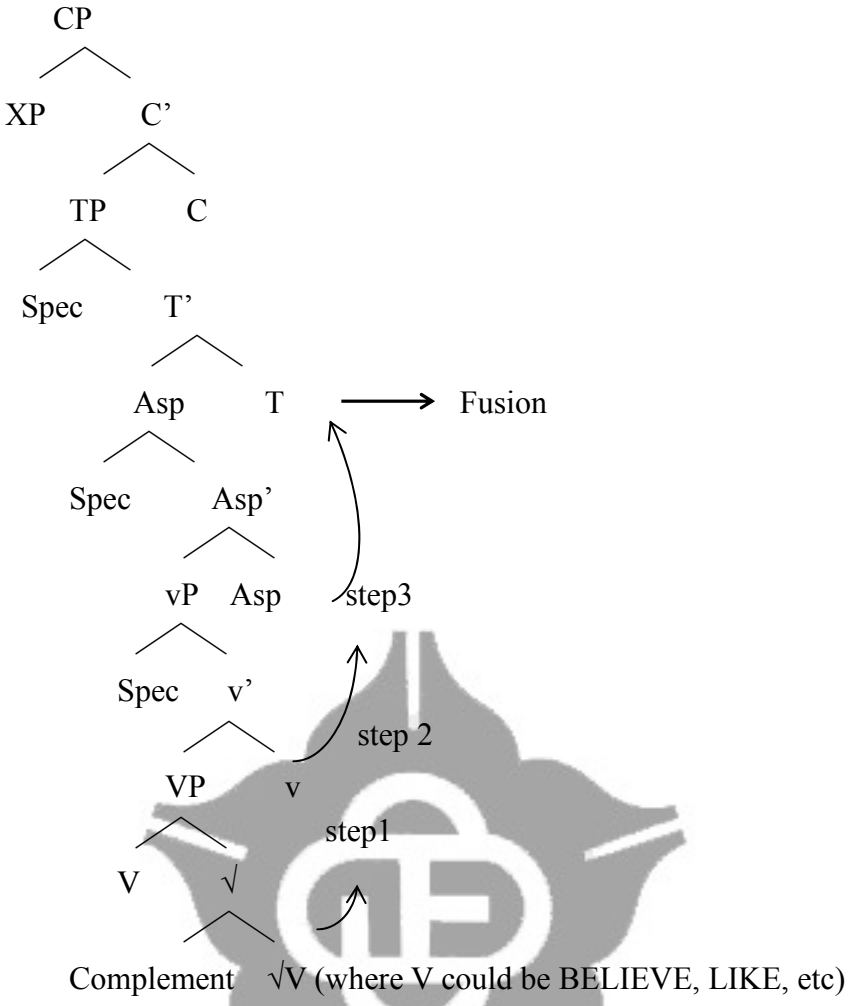
3.3.2 Clause Structure of TSL

First, based on studies of other sign languages such as ASL (Neidle et al. 2000) and DGS (G&P 1999), a basic syntactic structure for TSL is proposed in (105).[37] My analysis goes as follows: First, the verbal root √V will move to the little v head to satisfy an object agreement requirement, and then move to the Asp head to get aspectual information if any, then raise to the T head to fulfill its subject-agreement requirement. After such a derivation, a complex verb [T[[v+√BELIEVE]Asp]] will be derived. After the syntactic operation, then in MS, the complex verb will be undergo fusion, and then go to Vocabulary Insertion and to PF.

On the other hand, according to an analysis of Meir (2002), she suggests there are two types of agreement systems shown by agreement verbs in ISL. One is subject-object relationship, and the other is source-goal relationship. I use the general term Agrα and Agrβ to represent these two types of agreement relationships in the analysis. A motional verb such as RUN will only have source-goal agreement relationship, while a transitive verb such as LIKE, or BELIEVE will have subject-object relationships. That is, the realization of Agrα and Agrβ is licensed by verb types.

[37] The word order issue is not relevant in the derivation here because I assume that each word order represented on the surface such as SOV, OSV and SVO is base-generated. The analysis here takes the SOV word order for illustration.

(105) Derivation Steps of structure in TSL



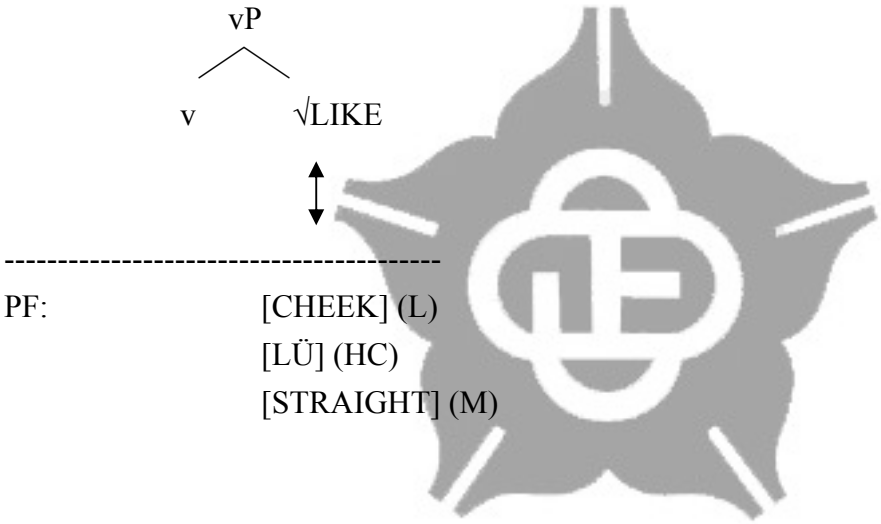
In (105), the verbal root is √V (following Zwitserlood 2003b:497-499); it can carry certain inherent phonological features such as M, HC, and L. A sign in sign languages needs to have at least all these three features together for a complete sign (Meir 2001b).

Following Zwitserlood (2003b), I assume that word formation involves two levels, one is below little x, and the other is above the little x. An example of the former is LIKE, as shown in (106), and has the following syntactic structure. In (107) below, the verbal root √LIKE (an instance of √V) merges a functional head category (f morphemes), which is a verb, to project a vP in a derivation. After vP is projected, the whole vP is shipped off via, MS, to PF for spell out.

(106) TSL sign LIKE (from TSL project)

LIKE

(107) Word Formation of the Verb LIKE



An example for the word formation above little x will be verb agreement, which will be discussed in the next section.

In short, in this subsection, a syntactic structure for TSL is proposed and a verbal root (with a HC feature, an L feature, an M feature specified) will merge with a functional category v node to from a complete sign (either a noun or a verb) for spell out.

3.3.3 An Analysis for TSL Verb Agreement

In this section, based on the structure proposed in (105) of section 3.3.2, a syntactic analysis for TSL verb agreement will be exemplified.

Recall that √V moves successively through the various head positions. For instance, in the derivation of sentence (95), repeated in (108), the verbal root √BELIEVE, which already has been spelled out for its HC feature and M feature but leaves L feature unspecified, firstly raises to little v for object agreement. At this time, the verb root √BELIEVE gets its object-agreement location feature Loc_y that is agreeing with the location of the object MOTHER. Next, the verbal root √BELIEVE moves to Asp to get its Asp features, if any. In this case, the verbal root √BELIEVE gets its Asp features underspecified, and finally the verbal root √BELIEVE head-moves to T to get subject-agreement features. In this movement, the verbal root √BELIEVE gets subject-agreement feature which is agreeing with the location of subject FATHER in signing space. The derivation of (108) is structurally represented in (109) as follows.

(108) TSL Sentence of agreement verb (Chang et al. 2005:253)

MOTHER $MOTHER_{pro}$+ FATHER BELIEVE. (Agreement verb)

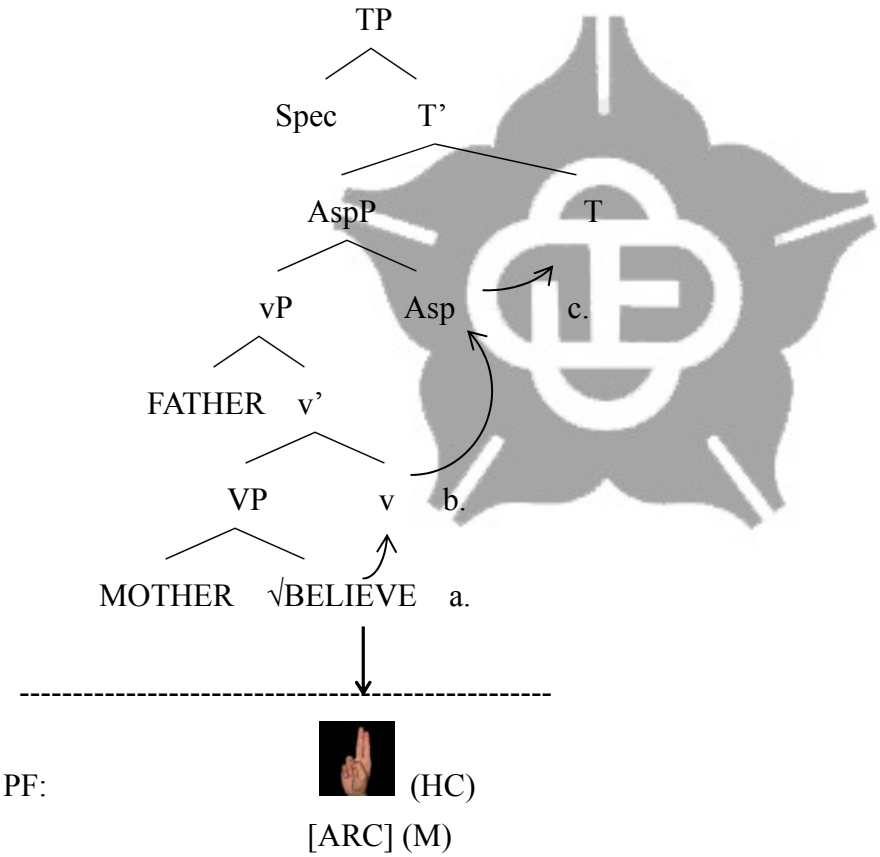
'(MY) father believes (my) mother.'

a. MOTHER

b. $MOTHER_{pro}$+FATHER

c. BELIEVE

(109) Derivation Steps of structure in TSL



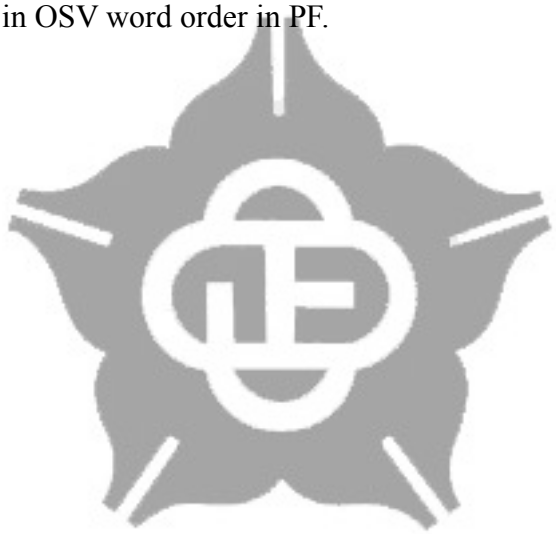
PF: (HC)

[ARC] (M)

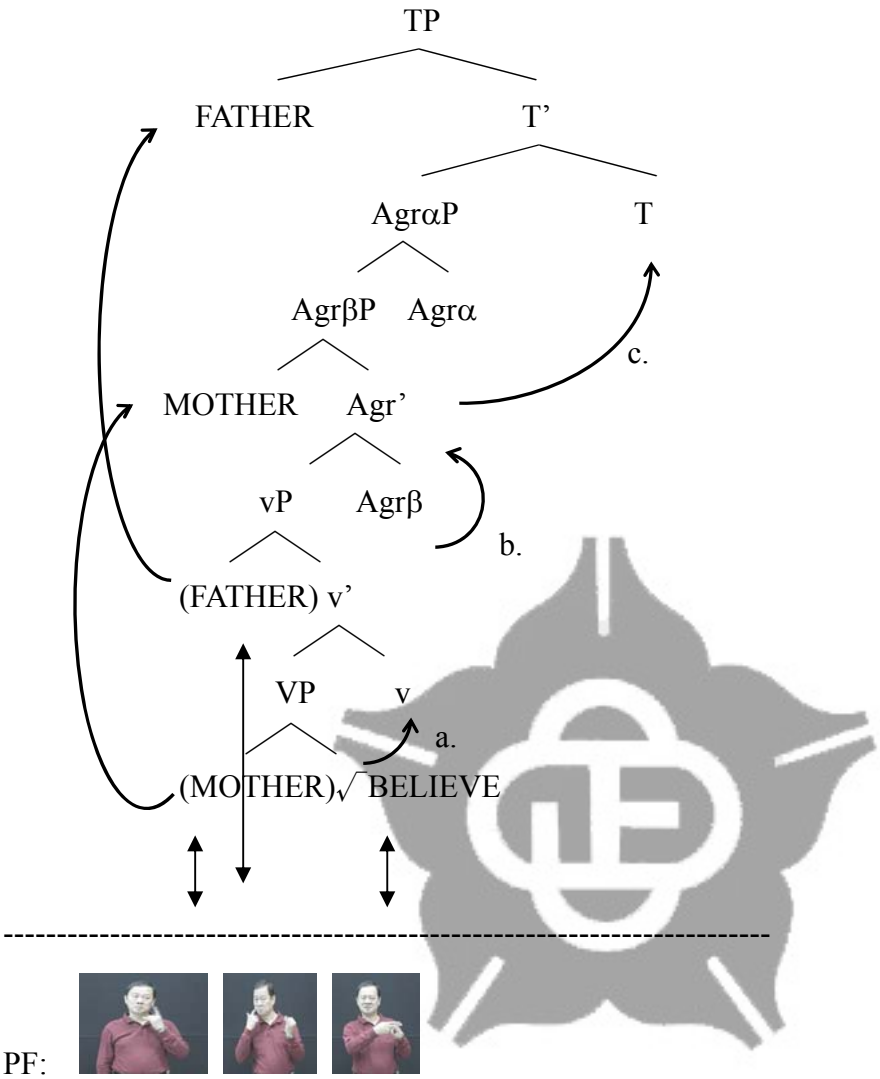
In (109), when the verbal root √BELIEVE raised to the T head finally, a complex verb is derived as [T[[v+√BELIEVE]Asp]]. This verbal complex contains information about subject agreement or object agreement, and aspectuality. This verb complex merges with a subject and project a TP. After TP is projected, the whole TP is shipped off to LF, and, via MS, to PF

for spell out.

In MS, the Agrα node and Agrβ node are projected for agreement. It can be illustrated in (110) below. In (110), the morpho-syntactic features in the specifier position of TP spell out as the sign of FATHER, the T head is realized as zero, the subject-agreement feature in Agrα is realized as zero because of the pre-specified initial slot in the predicate BELIEVE, which specifies the L feature of the verbal root v+√BELIEVE, the v+√BELIEVE spells out as the ZONG 'brown' HC with a arc M, the object agreement features in Agrβ are realized as a locational object-agreement marker Loc_y , and the aspect feature in Asp is realized as zero (i.e. null morpheme) in this case. In addition, the object MOTHER is topicalized according to Smith (1989) and results in OSV word order in PF.



(110) Derivation of structure in TSL



According to Halle and Marantz (1993), the vocabulary items for each node can be written in (111) as follows:

(111)

a. Agrα

[ ] ⟷ Ø-/ _[pre-specified initial slot verbs]

b. Agrβ

[3sg] ⟷ -LOC_{mother} / [only movement and hand configuration specified verb] _

c. Tense

[ ] ⟷ -Ø

One piece of evidence for supporting this statement is the distribution of non-manual marking. As can be seen in (108), the signer begins the sign MOTHER with a non-manual marking mouth protruding. The intensity of this non-manual marker is greater at the sign FATHER, and most intense at the sign BELIEVE. In our structural analysis in (110), the complex verb will be fused in MS before spell out. When the complex verb is fused, it is fused as single T node and c-commands the other nodes below it. The non-manual feature mouth protruding is an associate property of BELIEVE, such non-manual feature, like non-manuals in ASL (Neidle et al 2000), will optionally spread to its c-command domain. Since both the subject and object are on the domain of T, they will have non-manual features and the differences in degrees are due to that the subject are less embedded than objects in the syntactic structure. The more embedded, the less non-manuals in degrees occurs.

The analysis for the sentence (96) and (97), repeated in (112) and (115) below, respectively, is along the same lines. What is different is in the numeration of verbal root. The derivation of these two examples is illustrated as follows. Note that in the derivation of (96)/(112), unlike derivations of agreement and plain verbs, the verbal root of spatial verbs only carries a M feature at first, then it merges with the voice v head, and subsequently moves to head of T, the verbal root gets an object-agreement feature and subject agreement feature, respectively. The M feature will combine with subject agreement handshape feature because it is compatible with the s-selection of verbal root. In (113), the position of specifier of TP is realized as the sign DOG, the position of T spells out as zero, and the subject agreement feature in the Agrα is realized as a classifier HC BUDAIXI ‘puppet’ standing for

ANIMAL, the HC merges with the movement feature of verbal root after spell out. The verbal root √RUN is realized as a straight M. The object agreement feature in Agrβ is realized as a classifier HC SHOU ‘hand’ agreeing with the nominal object ROOM. The aspect feature in the Asp realizes the RUN-ABOUT movement. TSL sentence of (96) is repeated again in (112) and structurally represented in (113) below. Similarly, the object ROOM is topicalized according to Smith (1989) and results in OSV word order in PF.

(112) TSL sentence of spatial verb (Chang et al. 2005:254)

ROOM DOG ROOM$_{pro}$+ANIMAL-RUN.ABOUT. (Spatial verb)

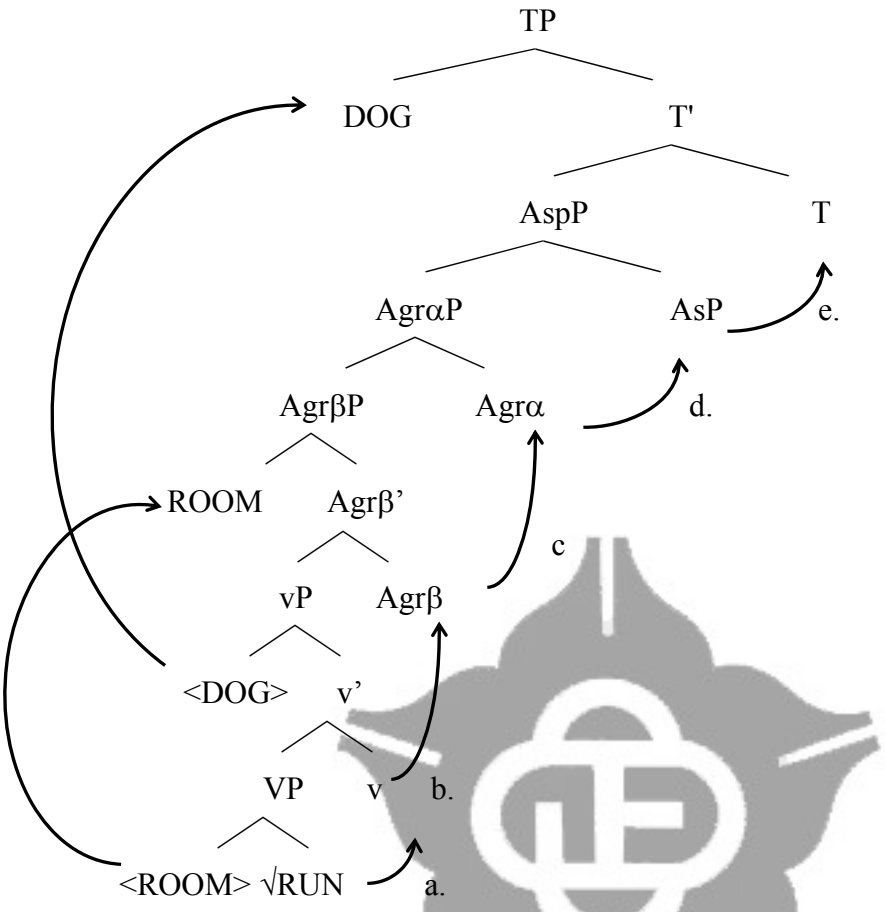
‘The dog is running about in the room.’

a. ROOM

b. DOG

c.ROOM$_{pro}$+ANIMAL$_{pro}$-RUN.ABOUT

(113) Derivation of the sentence of spatial verb RUN



PF:

Also, the vocabulary items for each node can be written in (114) as follows:

(114)

a. Asp

[RUN-ABOUT] ⟷ RUN-ABOUT aspectuality

b. Agrβ

[inanimate, flat] ⟷ SHOU-CL-HC$_{house}$ / [only movement specified verb] _

c. Agrα

[animate, small] ⟷ BUDAIXI-CL-HC_{dog} / _ [only movement specified verb]

d. Tense

[ ] ⟷ -Ø

On the other hand, in (97) the verbal root has all the three phonological features (HC, L, and M feature) already (as mentioned in Smith 1989:206). Since the verbal root has these three phonological features to spell out, the verbal root becomes a fully specified sign. The verbal root √LIKE also moves to v to get the object-agreement feature and in turn to asp to get the asp features, and finally to the T for the subject-agreement feature. In (116), the position of specifier of TP is realized as the sign of BROTHER, the position of T is realized as zero form, the subject-agreement feature in Agrα is realized as non-manual expression such as head (body) tilt. The verb root √LIKE is realized as a fully specified sign. The object-agreement feature in Agrβ is also realized as non-manual feature such as eye gaze. The aspect feature in asp is realized as zero form in this sentence. TSL sentence of (97) is repeated again in (115) below. As usual, the object DOG is topicalized according to Smith (1989) and results in OSV word order in PF.

(115) TSL sentence of plain verb (Chang et al. 2005:252)

DOG BROTHER LIKES. (Plain verb)

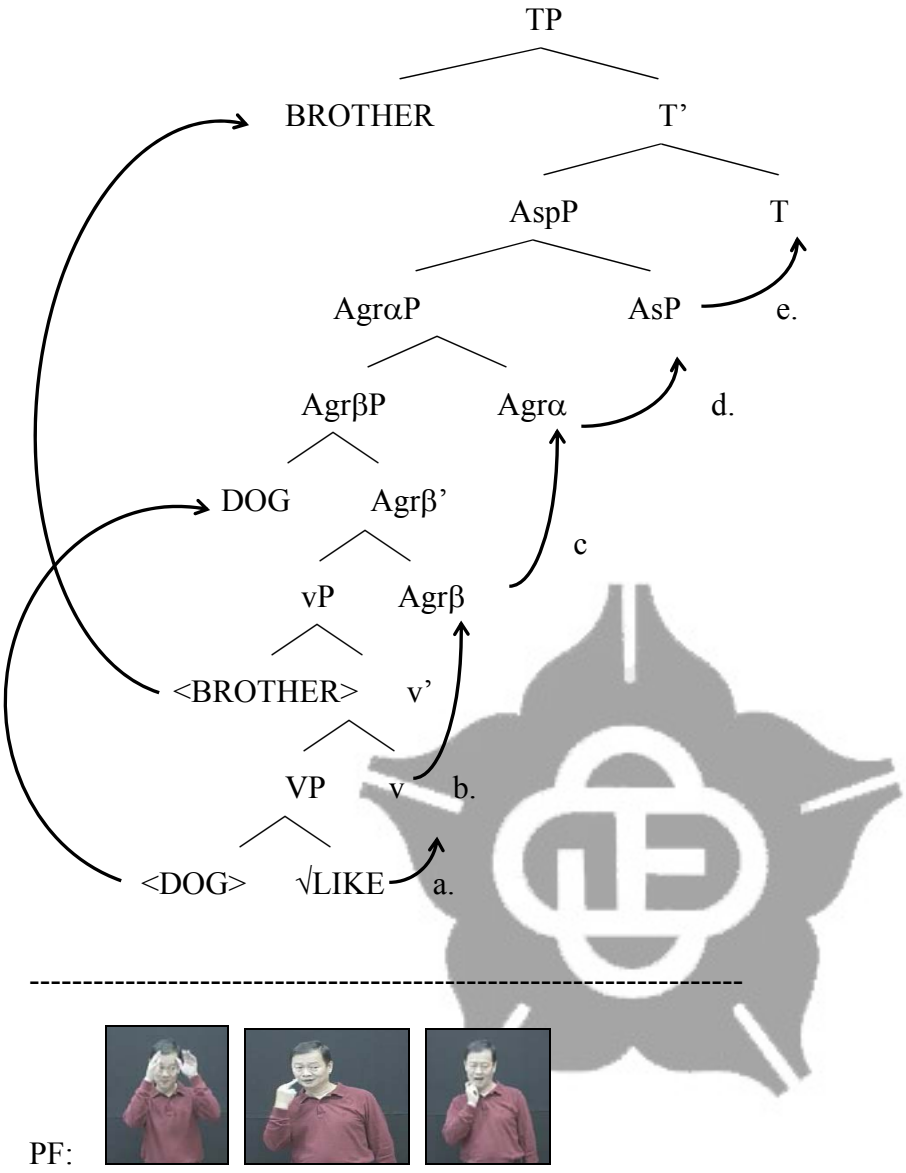
'(My) brother likes dogs.'

a.DOG

b. BROTHER

c. LIKE

(116) Derivation of plain verb LIKE



PF:

Similarly, the vocabulary items for each node can be written in (117) as follows:

(117)

a. Asp

[ ] ⟷ -Ø

b. Agrβ

[non-manual] ⟷ EYEGAZE-Loc_{dog} / [fully specified verb] _

c. Agrα

[non-manual] ⟷ HEAD TILT-$Loc_{brother}$ /_ [fully specified verb]

d. Tense

[ ] ⟷ -Ø

Under this analysis, verb agreement in TSL has a unified account for their different degrees of agreement representation in verb types. This analysis is also testable in other sign languages.

3.4 The Related Issues of This Analysis

There are several related issues to the proposed analysis. These issues are as follows: where does this model specify that both hands are used, not just one? Where does it specify that both hands have the same ZONG 'brown' HCs? Where does it specify that the two hands touch each other? Where does it specify that how they touch each other (i.e. with the extended fingers of h1 on top of those of h2)? Where does it specify the facing?

One suggestive answer could be that they are specified on the PF component since the output of MS will be sent to the PF. PF operates on phonological details as shown in the Hand Tier (HT) model of Sandler's (1989) as in Meir (1998). In other words, it is determined on the phonological component in DM and deserves further study.

3.5 Summary

To sum up, this chapter has discussed the verb classes and verb agreement in TSL. The syntactic analysis for verb agreement in TSL based on the framework of DM gives a unified account for the verb agreement in TSL.

Chapter 4 Other Implications of the Syntactic Analysis in TSL

4.1 Introduction

In this chapter, the syntactic formation of word categories will be addressed in the DM framework. In section 4.2, formation of categories of nouns and verbs are illustrated, and follows the issues of noun-verb pairs in TSL in section 4.3. Section 4.4 concludes the chapter.

4.2 The Formation of Categories in TSL

In this section, the derivation of nouns, verbs will be addressed under the schema of word categories provided in (11) above in section 1.3.3.

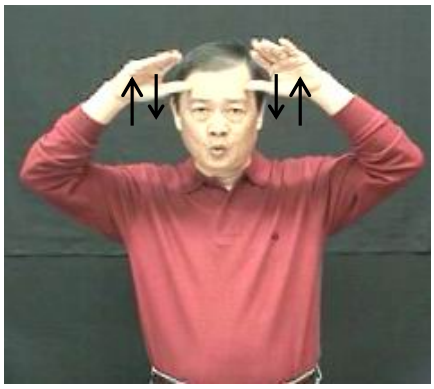
4.2.1 Nouns

In TSL, one example of a noun is DOG, which is shown in (118). In the DM framework, nouns are formed when the nearest c-commanding f-morpheme is an N for l-morphemes occurs in as the example DOG given in (119) as follows.

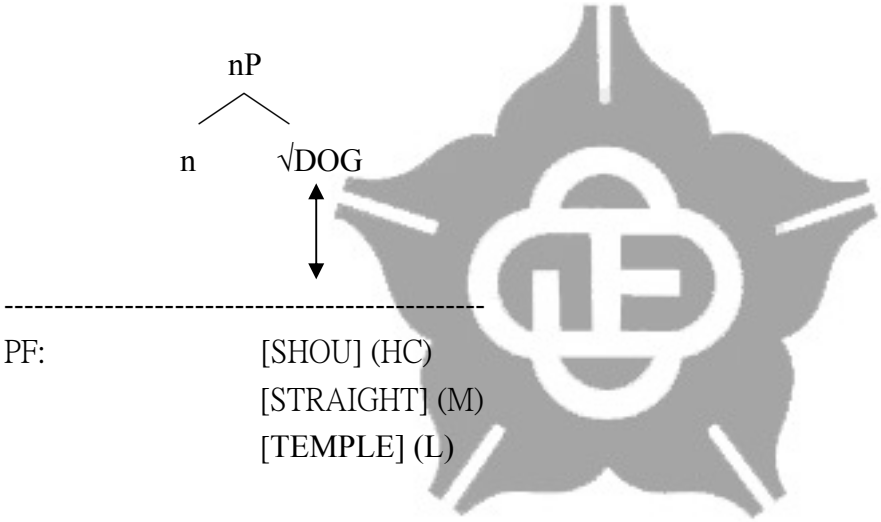
The sign in (118) is phonological complex. It has a straight movement of the hand, a SHOU 'hand' hand configuration, and the temple as the place of articulation. All of the three phonemes occur simultaneously. At this time, this sign does not have a grammatical category yet. It gets a grammatical category after merging a category node n, and is projected as a nP if no other elements are added to it as shown in (119).[38]

[38] I use a category node n and projects as an nP here because it is not clear if there is a DP projection in TSL so far (Lai 2005).

(118) The citation form of DOG (from TSL project)



(119) Formation of the noun DOG



4.2.2 Verbs

One example of verbs in TSL is to LIKE, which is shown in (120) below. Similar to the formation of nouns, verbs are formed when the nearest c-commanding f-morpheme is a V for l-morphemes occurs in as the example LIKE given in (121).

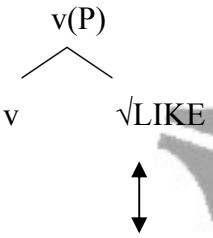
The sign in (120) is phonolgocally complex. It has a straight M of the hand (represented as [STRAIGHT] (M) in (121)), a LÜ ‘Chinese family name’ HC (represented as [LÜ] (HC) in (121)), and the cheek as the place of articulation (represented as [CHEEK] (L) in (121)). All of the three phonemes occur simultaneously. Also, after the merge of these three features,

this sign gets a grammatical category after merging a category node V.

(120) The citation form of LIKE in TSL (from TSL project)

LIKE

(121) Formation of the Verb LIKE



PF: [LÜ] (HC)
[STRIGHT] (M)
[CHEEK] (L)

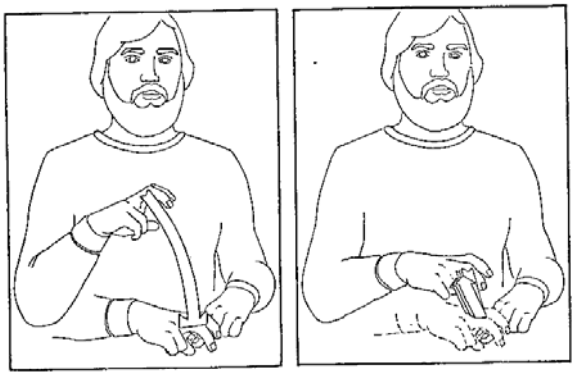
To sum up, formation of categories in TSL such as nouns and verbs are formed syntactically as in the syntactic derivation of sentences. In the following, we will turn to the issue of noun-verb pairs in TSL, opposed to the ASL cases (Supalla and Newport 1978).

4.3 Noun-Verb Pairs in TSL

According to Supalla and Newport (1978:102), noun-verb pairs need two criteria. One is that the noun and verb are semantically related in that the verb expresses the action performed with or on the object named by the noun. One example in ASL is the verb SIT,

which express the action performed on the object CHAIR. The second criterion is that the noun and the verb share formational characteristics as illustrated in (122) as follows.

(122) Noun-verb pair in ASL



(a) SIT (b) CHAIR (Supalla and Newport 1978:102)

In other words, noun-verb pairs refer to the signs which can be used as both a noun and a verb that are formally and semantically related. In their finding of ASL noun-verb pairs, Supalla and Newport (1978:118-119) report that there is a movement distinction between nouns and verbs such as SIT (V) / CHAIR (N) in (122) above. This pair is just one example of a large set in ASL. They claim that such verbs have either continuous or hold movement while nouns have more restrained movement. They suggest the nouns and verbs are derived from a common underlying form.

However, no such clear movement distinction of noun-verb pairs is found in TSL counterpart such as SIT (V)/ CHAIR (N) shown in (123).[39] How do we account for such derivational phenomenon in TSL?

[39] There are other pairs such as TEETH-BRUSHING (V) / TOOTHBRUSH (N), HAMMER (V) / HAMMER (N) studied in Wu (in prep) in TSL.

(123) Noun-Verb pair in TSL

SIT (V) / CHAIR (N) (from TSL project)

As well-known in the DM framework, the syntactic category of signs is determined by merging with functional category-determining node n or v. If the word root (which contains certain respective M, HC and L morpho-syntactic features specified as in (124)) merges with a little n, then it is a noun, while it is a verb when it merges with a v. Given DM framework, the noun-verb pairs in TSL can be accounted for straightforwardly.

(124)

PF: [ZONG] (HC)
[STRAIGHT] (M)
[NS] (L)

To summarize, using the word formation schema under the DM framework, the issue of noun-verb pairs in TSL can be explained readily. In the following section, the same structural analysis works parallel to the compound signs in TSL.

4.4 Summary

In this chapter, syntactic categories such as nouns and verbs are addressed within a DM framework. I have shown that this schema of syntactic categories gives no difficulty accounting for so-called noun-verb pairs.

Chapter 5 Conclusion

5.1 Introduction

In this chapter, firstly, the results of this study are summarized in section 5.2, and then the theoretical implications in sign language studies and practical implications are discussed in section 5.3, and 5.4. Finally the direction for future study and the conclusion of this study come in section 5.5 and 5.6.

5.2 Summary of Main Results of This Study

There are three main results of this study. Firstly, in this study, a unified account for verb agreement in TSL is discussed in Chapter 3. Under the DM framework, the three verb classes of TSL share the same syntactic operation in the derivation.

Secondly, under the DM framework, the categories of word class are derived by the merging process as the syntactic operations of verb agreement.

Finally, a structural analysis for Taiwan Sign Language (TSL) is desirable and argued for in this study.

5.3 Practical Implications

There are two practical implications which can be posited under this study. Firstly, in this study, it gives a structural understanding of verb agreement in TSL in particular and other sign languages in general. People can see the similarities of verb agreement between TSL and other sign languages across the world.

Secondly, in addition to spoken languages, TSL is a natural language as other sign languages in the world in the representation of grammar.

5.4 Theoretical Implications

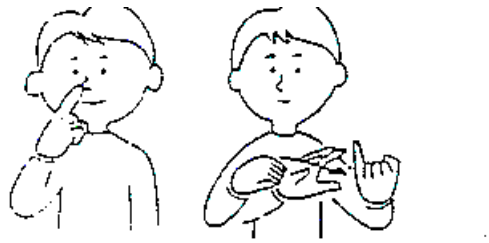
Similarly, two theoretical implications can be posited. In this study, the DM framework opens a window for seeing the nature of languages independent of two modalities (spoken-aural v.s. manual-visual) (Tai 2004). In other words, one can explore the nature of languages (either sign languages or spoken languages) within the same framework.

Also, the study of TSL attests some assumptions in DM theory about grammar, including that there is no lexicon, no difference between inflection and derivation, and syntactic hierarchy all the way down.

5.5 Directions for Further Study

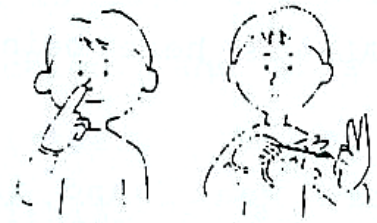
Smith (1989; Ch 4) has found that gender markers (i.e. 'MALE' (NAN handshape), 'FEMALE' (NÜ handshape), 'BROTHER' (XIONG handshape), 'SISTER' (JIE handshape) and numerals ('ONE' (YI handshape), 'TWO' (ER handshape), 'THREE' (SAN handshape), 'FOUR' (SI handshape), 'MANY' (TONG handshape), which function as a verbal affix on the weak hand, do not co-occur together on the verb as shown in sentence (125) and (126) below.

(125) TSL sentence with gender marker (Smith 1989:175)



PRO1 1-TELL-3-[I+o-]
"I told her."

(126) TSL sentence with number marker (Smith 1989:194)



PRO1 1-TELL-3-[TWO]
"I told the two of them."

This sex and animancy-based gender distributions in TSL are worth pursing in the future study.

5.6 Summary

To summarize, this thesis provides a preliminary exploration of structural analysis of Taiwan Sign Language (TSL) in DM framework, concerning verb agreement and noun-verb pairs, and suggests that a structural analysis is possible and desirable for understanding the commonality or differences between sign languages and spoken languages.

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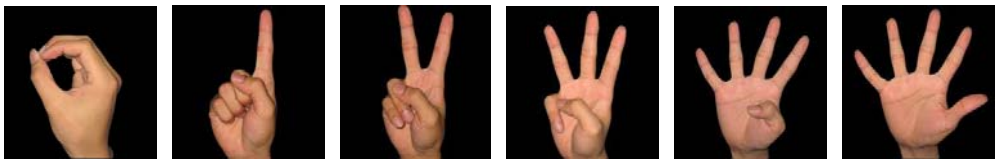
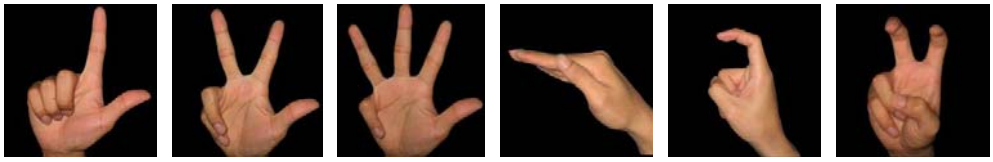
Appendix 1: TSL Handshapes (from Chang et al. 2005)

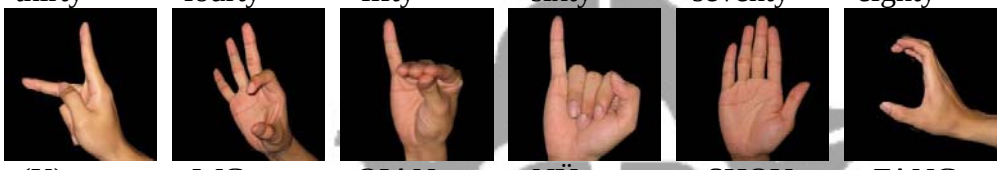


LING ‘zero’ YI ‘one’ ER ‘two’ SAN ‘three’ SI ‘four’ WU ‘five’

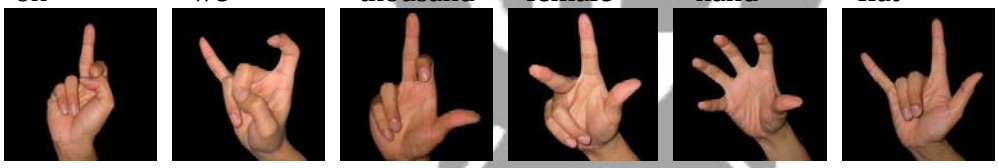


LIU ‘six’ QI ‘seven’ BA ‘eight’ JIOU ‘nine’ SHI ‘ten’ ER-SHI ‘twenty'

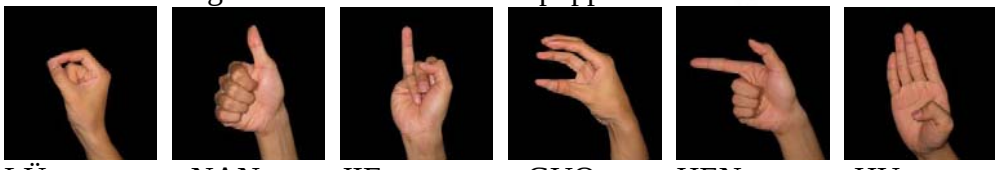
SAN-SHI ‘thirty’ SI-SHI ‘fourty’ WU-SHI ‘fifty’ LIU-SHI ‘sixty’ QI-SHI ‘seventy’ BA-SHI ‘eighty’



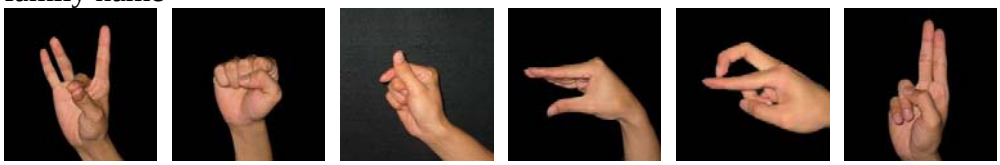
(K) ‘ok’ WC ‘wc’ QIAN ‘thousand’ NÜ ‘female’ SHOU ‘hand’ FANG ‘flat’



XIONG ‘brother’ (NAI-NAI) ‘grandmother’ (GAO) ‘tall’ (BUDAIXI) ‘puppet’ TONG ‘same’ SHOU ‘wait’



LÜ ‘Chinese family name’ NAN ‘male; JIE ‘sister’ GUO ‘fruit’ HEN ‘very’ HU ‘reckless’



JIE ‘borrow’ QUAN ‘fist’ ZHI ‘single’ SHEN ‘gentle’ BO ‘doctor’ ZONG ‘brown’

TONG
‘child’

BI
‘pen’

CAI
‘vegetable’

（YE）
‘grandfather’

(AI)
‘short’

WAN
‘ten thousand’

XIANG
‘similar’

YU
‘language’

(XI）
‘thin’

FEI-JI
‘airplane’

QIAN
‘money’

YA
‘duck’

LONG
‘long’

JIANG
‘ginger’

CHONG
‘warm’

JI
‘chicken’

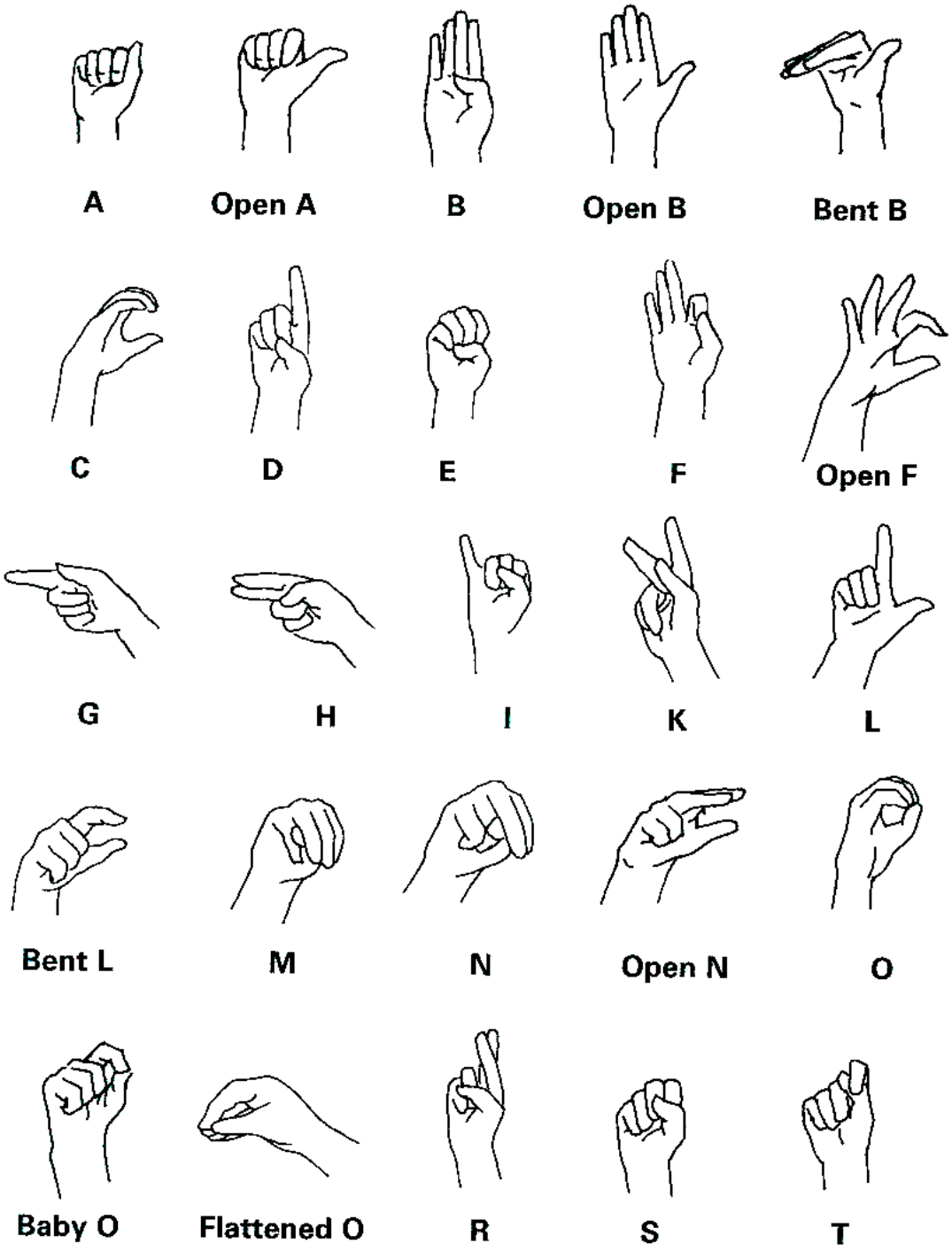
（E）
‘goose’

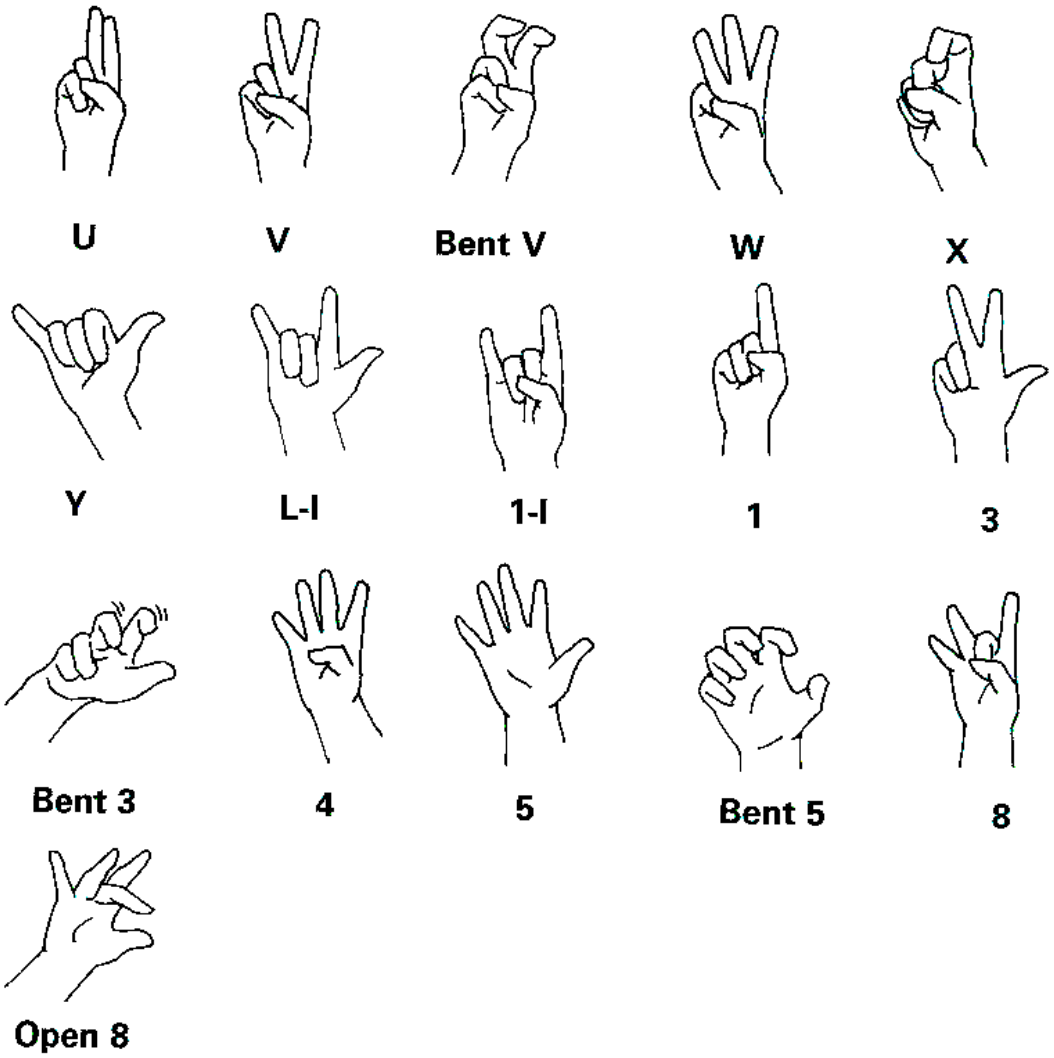
NAN
‘difficult’

MIN
‘people’

Postscript：（）means the handshapes which are not listed in the books of Smith and Ting (1979; 1984). The MIN ‘people’ handshape is not listed in Chang et al. (2005). It is added in here.

Appendix 2: ASL Handshapes (from Tennant and Brown 1998)




U
V
Bent V
W
X
Y
L-I
1-I
1
3
Bent 3
4
5
Bent 5
8
Open 8

Appendix 3: Location Features in TSL

Phonological features	Vocabulary Insertion Items	TSL examples
[NS]	front	YOU, READ
[HEAD ABOVE]	the head	SUN, TALL
[FACE]	face	FACE-WASHING, BAD
[HEAD]	top of head	HAIR, HEAD
[FOREHEAD]	the forehead	HOPE, HATE
[EYES]	at the eyes	SEE, BLIND
[NOSE]	the nose	I, GOOD
[MOUTH]	the mouth	EAT, RED
[JAW]	the jaw	POOR, MAY
[TEMPLE]	the temple	FEEL, REMEMBER
[EARS]	the ears	DEAF, EAR
[CHEEK]	the cheek	IF, WHO
[NECK]	the neck	THIRSTY, WANT-S
[SHOULDER]	the shoulder	YESTERDAY, DON'T WORRY ABOUT
[HEART]	the heart	TOLERATE, SELF
[TORSO]	the torso	KNOW, HAPPY
[WAIST]	the waist	FULL, BRAVE
[LEG]	the legs	LEG, JEANS
[ARMPIT]	the armpit	SUNDAY, FRIDAY
[ARM]	the arms	NURSE, DESIGN
[HANDBACK]	the back of hand	TREE, MONKEY
[WRIST]	the wrist of hand	WOOD, MEDICAL