The Role of Input in Acquisition of Verb Agreement in Hong Kong Sign Language: A Case Study

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1. Background

1.1. Acquisition of Verb Agreement

- While Meier (1982) and Casey (2000) both report that the first use of marked agreement verbs appears at around age 2 in early ASL, Quadros and Lillo-Martin (2007) observe that correctly-marked agreement verbs appear before age 2 when they study three children who acquire ASL as their first language and a child who acquires LSB as his first language.
- Errors:
  - a. **Overgeneralising the agreement inflection** to non-agreeing verbs: only few tokens are observed (Fischer 1973, Casey 2000).
  - b. **Co-mission error**: Meier (1982) observes that American deaf children direct the ditransitive agreement verb to the direct object instead of indirect object in adult grammar. The verb agrees with the wrong argument. Casey (2000) also reports that deaf children acquiring ASL direct the verb to the location of the subject when the location of the object is the target direction between the ages of 2;7 and 2;11. This may be due to a lack of knowledge on the linguistic space or argument types. But the number of errors is generally small (Berk & Lillo-Martin (under revision)).
  - b. **Omission error**: Deaf children initially omit the agreement markings (Meier 1982 on ASL, Morgan, Barriere & Woll 2006 on BSL).

1.2. The Role of Input in Child Language Acquisition

- Nativist view: In the generative tradition, input plays a relatively minor role in the course of acquisition. Input is generally impoverished because it contains a limited set of sentences while the target language has an infinite number of sentences. The absence of negative evidence suggests further that children could not possibly master the target language unless a biological endowment like the Universal Grammar (UG) is present.
- A number of studies on child-directed speech suggest that adults do modify their speech when they talk to children and hence the input that children received could be simplified and clean (see Saxton 2009 for a review on this perspective). Miller & Schmitt (2010) also point out that children only matter a linguistic phenomenon rapidly when the input is unambiguous and reliable. Ambiguous and unreliable input, however, cause a delay in the mastery of the linguistic phenomenon.
- Ambiguous input usually leads to the **late mastery** of a linguistic phenomenon in L1 acquisition (Miller & Schmitt 2010, Pelham 2010) and **transfer** in bilingual acquisition (Müller 1998).

2. Research Questions

- How does ambiguous input affect the acquisition of verb agreement?
- Does ambiguous input cause difficulties in acquiring a language? If yes, how does a child come to realize all the characteristics of verb agreement in HKSL?

3. Acquisition of Verb Agreement in HKSL

3.1. Verb Agreement in HKSL

- A small set of verbs, **call agreement verbs**, may be marked for overt agreement markings.
- This small set of verbs may be marked for both subject-verb agreement and verb-object agreement via **directionality** in signing space (i.e. the space in front of the signer's torso).
- Directionality refers to palm orientation change (e.g. facing outward versus facing inward), location change (e.g. near the signer's location versus near the addressee's location) and direction change (from signer's location to addressee's location versus from addressee's location to signer's location) (Meier 2002).
- Modality-specific properties:
  - a. **Not all verbs are marked overtly**. Plain verbs, for instance, cannot be marked overtly for verb agreement (Lam 2003).
  - b. **Use of space**: When the referents of the arguments are present at the time of signing, instead of directing the verb sign to the conventional space of different agreement values, signers would direct the signs to the actual locations of the referents.
  - c. **Optionality**: Agreement markings can be omitted when the subject is first or third person and when the object is second or third person. These are labeled as optional contexts for verb agreement in HKSL. When the subject is second person or when the object is first person, agreement markings are obligatory. The second person subject and/or first person object becomes the obligatory contexts for verb agreement in HKSL.

3.2. Acquisition of Verb Agreement in HKSL

3.2.1. Methodology

- The child studied is called CC. CC was diagnosed as having severe hearing loss. He was born to deaf parents who are both non-native signers.
- The major modes of communication are speech, simultaneous communication and some gestures.
- CC began to receive input of HKSL when the parents agreed to join the research project. Since then, the child is exposed to non-native HKSL input from parents and native HKSL input from the Deaf researchers.
- CC was filmed regularly from age 1;9.6. Deaf researchers of HKSL played with him, told him stories and conversed with him during the video-taping sessions. HKSL was the medium of communication in all sessions.
- Data Transcription: The native Deaf researchers who interacted with CC transcribed the data using the software ELAN developed by Max Planck Institute of Psycholinguistics, Nijmegen. Manual signs are glossed with the nearest English translations and represented with English capital letters. Symbols adapted from the CHAT format used by Child Language Data Exchange System (CHILDES) provide additional information on the nature of different signs (cf. MacWhinney 2000).
- Data are studied on a monthly basis.

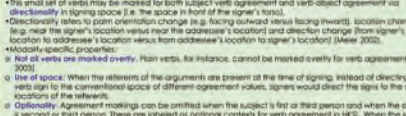
3.2.2. Major Findings

- CC does not produce agreement markings on non-agreement verbs.
- CC produces unmarked, spatially-marked and marked agreement verbs:

(1) GIVE CL:BISCUIT_STICK. (2;6.17) (2) GIVE_ELDER_BROTHER EAT CANDY. (3;3.23)
'Give [me] a biscuit stick.' 'Mother] gives elder brother a candy to eat.'

(3) W-obj. [w. umbrella] UMBRELLA TAKE_UMBRELLA. (2;1.9)
'That umbrella, take the umbrella.'

- Most agreement verbs (61.74%) are unmarked. A small portion of agreement verbs (33.26%) are spatially-marked. **Only 5.00% of agreement verbs are marked for verb agreement**



- Agreement verbs remain bare until age 2;1.9 where the first spatially-marked verb is observed. This type of agreement verbs occurs more often since age 3. The first clear use of marked agreement verbs is observed at **age 3;4.13.** Agreement markings are produced more **since age 4,** however they **remain rare.**
- Previous studies report that children acquiring ASL do better under obligatory contexts (Meier 1982). In their case study of CC from age 2;6.17 to 5;7.20, Tang et al. (2008) point out that more instances of marked form are observed under obligatory contexts as far as the agreement verb GIVE in HKSL is concerned.

Table 1 Forms of CC's Agreement Verbs in Obligatory Contexts

Obligatory Contexts	Unmarked	Marked for spatial locations	Marked for verb agreement
1_1	10/16 (62.50%)	5/16 (31.25%)	1/16 (6.25%)
2_2	4/18 (22.22%)	14/18 (77.78%)	0/18 (0.00%)
3_3	3/9 (33.33%)	6/9 (16.67%)	0/9 (0.00%)
Total	19/43 (47.50%)	20/43 (50.00%)	1/43 (2.50%)

- The rate of unmarked and spatially-marked agreement verbs combined is as high as **97.5% (39/40).** This rate is much higher than that observed from both signed and spoken languages. Children acquiring ASL as their first language from birth rarely produce unmarked agreement verbs when the contexts require obligatory agreement (Berk 2003, Quadros & Lillo-Martin 2007). The rate in child Italian, Spanish, Catalan and Japanese is less than 5% (See Pizzuto & Cassili 1992 for Italian, Tomeny 1993 for Catalan and Spanish and Sugisaki 2007 for Japanese). In child English the rate of inappropriately inflected verb forms is around 40-60% (Brown 1973). Though the rate is a bit higher in child English, it is still much lower than what is observed in child HKSL. The only correct instance of marked agreement verb occurs with second person subject and first person object.

(4) Context: CC told a story in which a monkey asked his mother for a box of matches.
IX-obj MONKEY IX-obj. (4;2.25)
[assume the role of the monkey]
CAN MATCHES GIVE_
[assume the role of the monkey's mother]
CANNOT. NOT. FIRE
'This [picture], monkey, this [picture], can you give me the matches, no, no, [it would cause] fire.'

- The other 39 verbs are either unmarked or spatially-marked:
(5) IX-2p GLADYS HELP_2 GLADYS KEY HELP_1. (3;9.24)
'You, Gladys help (me). Gladys helps (me to open the door) with the key.'

(6) NOT HIT_ (3;1.15)
'[You] do not hit (me).'

- CC does not distinguish obligatory contexts from optional contexts.

4. Input in HKSL

4.1. The notion of Input Ambiguity

- The term ambiguous input itself is ambiguous as different researchers may have different interpretations on this term.
  - a. Parametric ambiguity/cross-grammar ambiguity (Gibson and Wexler 1994, Yoder 2001)
  - b. **Within-grammar ambiguity (Yoder 2001)**
    - Two possible (artifactic positions for elements from the same category:

(7) a. Ich mag Nebensätze, weil sie so kompliziert sind.
I like subordinate clauses because they that complicated are.
'I like subordinate clauses because they are so complicated.'
b. Ich mag Nebensätze, weil sie sind so kompliziert.
I like subordinate clauses because they are that complicated.
'I like subordinate clauses because they are so complicated.'

- The same phonetic form for two lexical items
Personal pronouns associating with different cases may share the same phonetic form in both German and English (Pelham 2010). You and it in English, for instance, may show nominative case when they are in subject position, but objective case when they are in object position. Similar phenomenon can be found in German. The first person singular personal pronoun appears in different forms with different cases: nominative, accusative inch and dative mir. The first person plural personal pronoun, by contrast, is in the same form uns with accusative and dative case. Personal pronouns like you in English and sie in German are known as case-ambiguous pronouns. The same form that denotes different cases is viewed as a kind of ambiguous input.
- Variable input
Miller & Schmitt (2010) report that Chilean Spanish and Mexican Spanish (i.e. Spanish spoken in the Mexico City) differ in the use of plural morphology. Mexican Spanish has overt morphology for plural but not for singular. Chilean Spanish differs from Mexican Spanish in that the plural morpheme [s] may be realized as other morphemes [h] and [Ø] due to the lenition process, **causing sociolinguistic variation synchronically.** When the plural morpheme is realized as [Ø], the nouns, determiners or adjectives in the noun phrases look no different than the singular nominals. The synchronic variation displayed in the plural morphology in Chilean Spanish is viewed as a kind of ambiguous input in Miller & Schmitt's study.

4.2. The Effects of Input Ambiguity

- **In the acquisition of German subordinate courses, monolingual children do not seem to have any difficulties even though the input itself is ambiguous.** Though monolingual children acquiring German do omit complementizer introducing the subordinate clause, the word order within the clause is an error-free area (Müller & Penner 1996).
- Generalizing from a number of previous studies, Pelham (2010) points out that acquisition of case is not uniform in all categories.
- While children acquiring English make a lot of case errors, children acquiring German don't as far as personal pronouns are concerned. German-speaking children also make a lot of errors with German articles. Her input study on German personal pronouns, English personal pronouns and German articles shows that the number of case errors produced by children may be explained by the number of case-ambiguous personal pronouns and articles the adults produced.
- As noted, children make a lot errors with English personal pronouns and German articles. It is observed that adults' use of case-ambiguous personal pronouns and German articles are as high as **63.3%** and **77.0%** respectively. Adults' production of case-ambiguous German personal pronouns, by contrast, is as low as **7.6%**.
- Pelham (2010) claims that **the more ambiguous the input data, the higher the frequency of case errors.**
- Miller & Schmitt (2010) also report that ambiguous input does affect the acquisition process.
- Assuming the **Variational Learning Model (Yang 1999, 2002)**, Miller & Schmitt claim that there would be **three possible outcomes** due to the presence of variable input:
  - **(i) positive regularization.**
    - The children can identify the plural morpheme and use them overtly.
  - **(ii) negative regularization and**
    - The children cannot make the singular/plural distinction and plural morphology cannot be seen.
  - **(iii) grammar competition.**
    - children assume two grammars such that they make distinction between singular and plural at one time but not at another time.

- Which grammar does a child choose at a point depends on which grammar is more dominant and how frequent the grammar is rewarded (i.e. conforms to the limits of UG). The comprehension and production results in Miller and Schmitt (2010) suggest that the grammar competition hypothesis is right as children who are exposed to more reliable input tend to make distinction between singular and plural at one time but not at another time.

- Ambiguous input not only affects L1 acquisition. It also causes transfer in bilingual acquisition. A bilingual child acquiring German as one of his/her first language tends to produce nontarget subordinate clause (Müller 1998). Yet the deviant subordinate clause conforms to the grammar of another language (i.e. French, Italian, English) the bilingual child acquires. This phenomenon makes Müller suggest that bilingual children transfer the rules from language A where input is unambiguous to language B which contains ambiguous input.

Ambiguous input may cause high frequency of errors and prolonged acquisition process in L1 acquisition and transfer in bilingual acquisition.

4.3. Input on Verb Agreement in HKSL

4.3.1. The adult grammar

- The modality-specific properties demonstrated in HKSL can be viewed as ambiguous input.
- That the alternation of verb forms may either denote locations of the referents (i.e. location-marking) or person values (i.e. agreement marking) is similar to the case-ambiguous pronouns in German and English discussed above.
- The omission of agreement markings under optional contexts also resembles the variable input in Chilean Spanish. Hence there are at least two forms of ambiguous input in the acquisition of verb agreement in HKSL.

4.3.2. Child-directed signing

- Input data are collected from the same video sessions of CC's data. Totally 28 sessions were studied. Native deaf signers were the main investigators in all sessions, non-native signers, including the mother, the non-native deaf helpers and hearing researchers, occasionally interact with CC in HKSL.

Table 2 Adults' Production of Agreement Verbs in Input Data

Researchers	No. of utterances	No. of Agreement verb
ED (M 9;)	2537/1420 (55.53%)	161/1398 (86.95%)
HD (F 9;)	3611/420 (12.34%)	41/1398 (2.51%)
BH (M 9;)	1227/1420 (8.94%)	136/1398 (8.52%)

- The number of agreement verbs used by the adults outnumbers CC's production of agreement verbs. The type of agreement verbs used by the adults also shows a broader range. While the adults produced 44 types of agreement verbs, CC produced 18 types and only one verb PUNISH is not observed in the adult input data.
- Most verbs produced by the adults are marked for verb agreement. The remaining tokens fall into two major groups: marked for spatial locations of real or imagined referents and unmarked. Note that adults also produce verb forms which are absent in the child data. These verb forms are usually marked for spatial locations of a real referent and for person of the object argument.

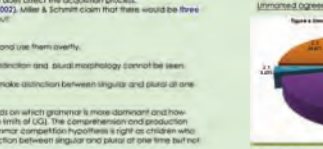


Table 3 Different Forms of Agreement Verbs in Input Data

Types of Agreement Verb Forms	No. of tokens
Marked for verb agreement	192/1398 (13.78%)
Marked for spatial locations	875/1398 (62.51%)
Marked for both verb agreement & spatial locations	30/1398 (2.19%)
Unmarked	301/1398 (16.42%)

(8) Marked for verb agreement
gesture [= get someone's attention] _GIVE_ gesture [= give me]
'Hey, (you) give (it) to (me).'

(9) Marked for spatial locations
a. Real referent
TAKE_THROW_
'[You] take (the empty box of drink) and throw (it to the rubbish bin).'
b. Imagined referent
IX-loc (i.e. a picture in the storybook) MONKEY CL:MONKEY_WALK TAKE_PLAY MATCH PLAY.
'[Look at] this picture, the monkey walks and then it takes some matches and plays with them.'

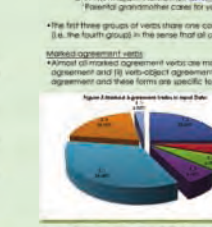
(10) Marked for both spatial location and verb agreement
IX-1p _GIVE_ EAT GOOD_NOT_GOOD?
'I give (this) to you to eat, yes or no?'

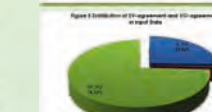
(11) Unmarked
a. THANK IX_1
'[You] thank me.'
b. PARENTAL_GRANDMOTHER CARE_FOR IX_2.
'Parental grandmother cares for you.'

- The first three groups of verbs share one common property. All of them contrast with the unmarked verbs. [i.e. the fourth group] in the sense that all of them involve a change in verb form.

Marked agreement verbs

- Almost all marked agreement verbs are marked for (i) both-subject-verb agreement and verb-object agreement and (ii) verb-object agreement: Yet 3 tokens of the verb SAY are just marked for subject-verb agreement and these forms are specific to one particular native signer only.



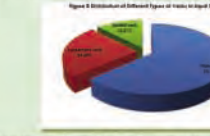


- The omission of subject-verb agreement is not common.
- When the person combinations are taken into consideration, signers tend to omit subject agreement markings when the subject is third person and when the object is second or third person (i.e. 3_2, 3_3).

Unmarked agreement verbs

- Though adults omit more agreement markings under optional contexts, a considerable portion of unmarked verbs appears in obligatory contexts.
- A study on the input data here shows that not all agreement verbs demonstrate a full agreement paradigm like GIVE, BRING, SAY. LOOK_FOR are some examples of verbs that do not have a full agreement paradigm. The occurrence of this type of agreement verbs constitutes the majority of unmarked verbs. The remaining verbs may be marked for plural object but not for person. Or they occur in Signed Chinese utterances.
- **The child-directed signing is not simplified and clear as what input studies suggest.**

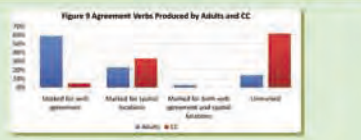
- Agreement verb is not the only verb type in HKSL. Plain verb and spatial verb are two other verb types. The number of plain verbs is generally high in conversation (see Lam 2003).



- The adults produced totally 6396 tokens of verbs and plain verbs take up the majority of verbs.
- In acquisition of agreement verbs, CC needs to know which verb may express verb agreement and which doesn't. The fact that agreement markings are omitted even in obligatory contexts inflates the number of verbs which appear as plain verbs. If the number of plain verbs and the number of unmarked agreement verbs are added up, **the number of verbs that do not undergo alternation of the verb form will become 67.13% (4427/6596).**
- The high frequency of plain verbs together with the unmarked agreement verbs serve as ambiguous input. It has been reported in the literature that one-exemplar learning may not be correct in the acquisition process. Instead, the frequency of the exemplar in the input has to be robust enough to trigger the learning of a particular construction ? evidence contributes to learning (cf. Fodor & Crowther 2002, Miller & Schmitt 2010, among others).
- This argument, however, needs a second thought. HKSL is not the only language where only a small set of verbs shows verb agreement. ASL and Basque are also types of languages where not all verbs are marked for verb agreement. ASL also demonstrates optionality of agreement markings as far as subject-verb agreement is concerned.
- **Why does the presence of plain verbs pose problem to acquisition of verb agreement in HKSL, but not in other signed languages?**
- It could be the case that the presence of plain verbs does not really cause the prolonged acquisition of verb agreement. Rather, it is the shared form of location marking and agreement marking and optionality of agreement markings that lengthen the process in which CC comes to realize the nature of agreement markings in the target language.

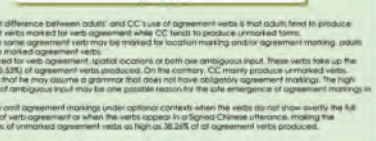
4.4. Does input story in rate?

- A number of previous studies point out that frequency matters in the course of language acquisition (Miller & Schmitt 2010, Pelham 2010, Yang 2010, among others).
- Yang (2010) suggests that the time when a linguistic phenomenon emerges has not only to parameter setting but also to the frequency of the linguistic phenomenon in the input. The frequency required for language acquisition varies among different structures and different languages.



- The biggest difference between adults' and CC's use of agreement verbs is that adults tend to produce agreement verbs marked for verb agreement while CC tends to produce unmarked forms.
- Though the same agreement verbs may be marked for location marking and/or agreement marking, adults tend to use marked agreement verbs.
- Verbs marked for verb agreement, spatial locations or both are ambiguous input. These verbs take up the majority (85.53%) of agreement verbs produced. On the contrary, CC mainly produce unmarked verbs, suggesting that he may assume a grammar that does not have obligatory agreement markings. The high frequency of ambiguous input may be one possible reason for the late emergence of agreement markings in HKSL.
- Adults may omit agreement markings under optional contexts when the verbs do not show overtly the full paradigm of verb agreement or when the verbs appear in a Signed Chinese utterance, making the occurrences of unmarked agreement verbs as high as 38.26% of all agreement verbs produced.

Figure 10 Distribution of Agreement Verbs in Obligatory and Optional Contexts



- By comparing the agreement verbs produced by the adults and CC, it appears that CC may hypothesize that HKSL is a language like ASL or a language that does not have overt morphology for verb agreement. This is similar to what Miller & Schmitt terms as negative regularization.
- However, though agreement markings emerge late and are rarely used, one cannot deny its presence. It follows that the acquisition of verb agreement in HKSL provides further support to the grammar competition hypothesis in which a child assumes two grammars such that both marked and unmarked verb forms are allowed.

5. Discussion

- **How does CC crack the codes and come to realize that a small set of verbs in HKSL have to be marked under obligatory contexts?**
- The parameter theory is one way of explaining the acquisition process under the generative framework (cf. Hyams 1986, Roeper & Williams 1987, among others). Once triggered by the input, the UG would guide the child to fix one of the binary values of the parameter.
- Ambiguous input, however, poses a problem to the parameter theory (cf. Weissenborn et al 1992, Penner 1992, among others).
- The explanatory power of the parameter theory comes from the fact that the binary values of the same parameter can capture different patterns in different languages. Head parameter, for instance, makes use of the head-initial value and the head-final value to capture the English-type language and the Japanese-type language respectively.
- Ambiguous input contains evidence which conform to both values of a parameter. How can a child come to realize the fact that their native language does not need to choose between the two values?
- Assume that children are conservative learners. They may stick to the default value of the parameter if the parameter theory is correct.

HKSL consists of verbs which can be optionally marked for verb agreement. The right parameter setting would then be both positive and negative. When both positive and negative values conform to the adult grammar,children may not be able to find the correct value of the parameter.

- The problem that ambiguous input posed on the parameter theory leads to a maturational account (cf. Borer & Wexler 1987). Wexler (1994, 1999) proposes that certain formal features are initially unspecified and hence nontriviile verb forms appear. Yet these features would mature at certain point in the course of acquisition. Tense, for instance, matures at the age of 2.5 (cf. Wexler 1994).

When HKSL verbs in CC's data are considered, one would need to address why agreement (as a subcomponent of finiteness) does not appear earlier. The data observed in the present study may not lend further support to this maturational account.

- Alternatively, the late emergence of agreement markings may be captured by Yang's (1999, 2002) Variational Learning Model.

A proposal:
- ***Default parameter value = negative (Children generally start from using unmarked verbs or both marked and unmarked verbs (i.e. Optional Infinitive Stage))***
- ***Children who acquire a language that display verbal morphology overtly will need to reset the parameter to positive value.***

- Consider the case of CC. Most verb-containing sentences from the input confirm initial parameter value. Though some verb-containing sentences does demonstrate overt agreement markings with the agreement verbs, **the optionality of agreement markings in most cases, location marking and the variations on the person values on agreement verb may show are all factors that could delay the process of disconfirming the *initial parameter setting*.** The data shown in this study suggests that CC is a conservative learner. Being conservative, he does not reset the parameter to a positive value even though the adults tend to produce marked agreement verbs in the obligatory contexts.

- Recall that ambiguous input leads to more errors in L1 acquisition and transfer in bilingual acquisition. Another possible way of interpreting CC's data is to treat him as a bilingual. The deaf community is surrounded by the hearing community. It is undeniable that language contact occurs all the time as deaf people would always meet hearing people. Intensive speech training for deaf children in Hong Kong would be a channel from which a deaf child obtains Cantonese input, though limited due to hearing loss. Comparing Cantonese verbs and HKSL verbs, Cantonese verbs are unambiguously unmarked for verb agreement. **CC may transfer the linguistic property of Cantonese verbs to HKSL verbs such that HKSL verbs are unmarked.** That signed Chinese utterances are rarely observed and are occasionally observed in child-directed signing suggests that **CC may grow up as a bilingual acquiring HKSL naturally and Cantonese in a relatively restricted way.** The high frequency of unmarked verbs produced by CC is therefore due to the fact that he assumes the Cantonese grammar where the value of the parameter for agreement markings is negative.

6. Concluding Remarks

- The complexities demonstrated by HKSL agreement markings may serve as ambiguous input to a deaf child acquiring HKSL as his/her first language. Unmarked agreement verbs and plain verbs may guide CC to hypothesize that HKSL verbs do not demonstrate verb agreement.
- Alternatively, it is the unmarked Cantonese verbs that make CC think HKSL does not show verb agreement overtly when CC is considered as a bilingual child.
- In any event, the parameter setting process would be prolonged and this explains the late emergence and scarcity of marked agreement verbs in CC's data.

Acknowledgements

I would like to thank CC and his family for joining this research project. Thanks also go to researchers who have given me invaluable comments throughout the preparation of this paper. They are: Gladys Tang, Diane Lillo-Martin, Felix Sze, Jolie Lee, Prudence Lau, Carl Yung and Joe Mak. I am also indebted to the research team of the Child HKSL Corpus and the Deaf informants, Kenny Chu, Brenda Yu and Poppen Wong. This research project was supported by the RGC grant (4378/01H) and Dr Alex Yaumanta's Donation.