The numeral system of Japanese Sign Language from a cross-linguistic perspective

by

Keiko Sagara

A thesis submitted in partial fulfilment for the requirements for the degree of Master of Philosophy at the University of Central Lancashire

July 2014

Student Declaration

I declare that while registered as a candidate for the research degree, I have not been a registered candidate or enrolled student for another award of the University or other academic or professional institution.

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Abstract

This thesis investigates how the Japanese Sign Language (JSL) numeral system can be characterised with respect to aspects of the linguistic structure of JSL numerals at the phonological and morphological levels; to typological comparisons with other sign languages; and, finally, to sociolinguistic variation. Data for JSL were collected, using various elicitation games, from a total of 37 participants from the Kanto and Kansai regions of Japan. Data for other signed languages were taken from the Sign Language Typology Project, based at the University of Central Lancashire and also from various academic sources. The study examines the semantic motivation prevalent in JSL numerals due to influence from the writing system of Japan, Kanji. Three main historical developments affecting JSL numeral signs include increased reliance on Kanji-based representations, a decrease in forms motivated by visual iconicity, and increased standardisation of forms due to a reduction in school-based variants. The analysis makes reference to four groups of sign languages and aims to carry out a comparison of each group with JSL. Group 1 consists of the JSL language family and includes South Korean Sign Language (SKSL) and Taiwan Sign Language (TSL). Group 2 comprises Chinese Sign Language, which shares similarities with JSL by way of the Kanji writing system. Group 3 contains the following urban sign languages: British Sign Language, Czech Sign Language, Ugandan Sign Language, Greek Sign Language, Argentine Sign Language, Indo-Pakistani Sign Language, Indonesian Sign Language, and Turkish Sign Language. Finally, Group 4 includes village sign languages such as Alipur Sign Language, Chican Sign Language and Mardin Sign Language. A higher level of similarity is found across JSL, SKSL and TSL, and the findings suggest considerable borrowing between TSL, SKSL and JSL in the domain of numerals.

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Acknowledgements

When I moved to the UK in May 2010, I never imagined that I would end up writing an MPhil thesis. My intention was only to work as a research officer at iSLanDS (the International Institute for Sign Languages and Deaf Studies) for four years; however I was fortunate enough to be given a great opportunity to carry out a fascinating study into sign language linguistics, including two fieldwork trips. I would like to offer immense gratitude to Professor Ulrike Zeshan, my line manager and first supervisor, without whom I would have been wholly unable to even begin such a project. Her support and the wonderful working environment she has created at iSLanDS have been incredibly beneficial to my research. Her vast theoretical knowledge and her ability to impart this visually, through signed communication, opened up the field of linguistics to me for the first time. I would also like to thank her for giving me the chance to attend a summer school at Hamburg University on the DGS corpus project. It was highly relevant to my own project in terms of how to collect data and the different methodologies available. Therefore, I would like to express my thanks to Hamburg University for providing me with the knowledge and ideas that helped me with my own research. Tremendous thanks are also due to Dr Junhui Yang for her assistance throughout the production of my thesis, as my second supervisor and also as a deaf Asian colleague. Her expertise enabled me to explore comparisons between the numeral systems of JSL and CSL, which were highly enlightening. I particularly enjoyed our collaboration on a poster presented at a conference in Hong Kong. To my third supervisor Nick Palfreyman I am equally indebted, both for his academic guidance and, at an earlier stage, his support with my written English. Despite being in the midst of his own PhD project and heavy workload, he has repeatedly gone out of his way to make time to assist me with any issue or query; his stalwart encouragement has allowed me to push through many difficult obstacles.

I am very grateful for the support received from the Daiwa Foundation, who provided the funds to conduct the initial fieldwork in Japan, and the Sasakawa Foundation, who made it possible to revisit Japan and collect more valuable data. Without their financial support, this fieldwork would not have been possible. Thank you also to Akira Yokkaichi, professor at the University of Tsukuba, for being a positive influence in my career and for encouraging me to study in the UK, even when I was not sure about it at first.

Thanks also to Gail Caudrelier and Jenny Webster, who have provided language support during my studies and helped me become a much better writer of English, which is not my first language. They have both unfailingly met me for tutorials, including late in the evening at times, even though they have very busy working schedules both within and outside the

university. I also would like to thank Akbar Sikder and Sarah Lucas for also providing language support for my thesis on an ad hoc basis, and Robert Piggot for help with the photographic enhancements. Thank you also to the BSL and Deaf Studies team at the University of Central Lancashire for kindly lending me their interpreters and support staff.

I would like to thank all of the informants for Japanese Sign Language, in particular Akira Morita and Ryoichi Inoue, who coordinated the participants in the Kanto prefecture, and Yashunori Simamoto, Masanobu Nishigaki, Rumi Horitani, who coordinated those in the Kansai prefecture. I am especially grateful to Hitomi Akahori, who not only coordinated the Kanto informants but also visited the UK to impart his native signer knowledge. Here I would particularly like to thank Akira Morita again as well as Masaomi Hayashi and the other teachers from the Meisei Gakuen school for deaf children for providing native signer verifications of the JSL data and the many discussions about JSL numerals. Thank you also to Connie de Vos, Norie Oka, Michiko Takagi and anonymous reviewers for reading through my draft thesis and providing me with valuable feedback that allowed me to consider the data and theories through different eyes.

I would also like to thank both Kang Suk Byun and Yijun Chen, who have provided the data on South Korea Sign Language and Taiwan Sign Language respectively. Their input has proven valuable for future research on the Japanese Sign Language family. Without Kang Suk's generous help, it would not have been possible to collect such a variety of South Korea Sign Language data. I have also really enjoyed our discussions about the similarities and differences in number systems in South Korea and Japanese Sign Languages. Yijun Chen, whom I was very fortunate to have met in London, gave me such valuable assistance with Taiwan Sign Language, without which I would not have been able to incorporate data relating to this language into this thesis; Yijun also very kindly translated all of the participant consent forms and background questionnaires into Taiwan Sign Language. Thank you also to Juan Druetta for providing me with information on Argentine Sign Language. It has been really interesting to see how Argentine Sign Language forms numbers in comparison to other sign languages. I am grateful to Yutaka Osugi, Soya Mori, Susan Fischer, Akio Suemori and Yoshihiro Shintani, who have kindly pointed me in the right direction with regards to previous research on Japanese Sign Language and helped me to obtain a number of research papers even though I was based in the UK. Much appreciation is also due to Chien-hung Lin from the National Chung Cheng University in Taiwan for the information related to the dictionary of Taiwan Sign Language and for generously sharing your knowledge of this language.

Next, I would like to thank the members of the Institute for Sign Languages and Deaf Studies: Hasan Dikyuva, Sam Lutalo-Kiingi, Sibaji Panda, Sara Lanesman and Clark Denmark, who, as deaf researchers themselves, have been a positive influence and have made a strong

impact on me. It may have even been the case that I would not have started on my thesis if I had never met them.

Finally, thank you to my family in Japan, who have supported me during the past four years and who have often helped me to relieve some of the pressures during our Skype meetings. Thank you to everyone I have met over the past four years in both the UK and Japan. Each meeting has been valuable. I hope that this research will be influential in the field and will make a positive impact on deaf people in Japan and elsewhere.

List of sign language abbreviations

AdaSL	Adamorobe Sign Language
APSL	Alipur Sign Language
ArgSL	Argentine Sign Language
ASL	American Sign Language
Auslan	Australian Sign Language
BKSL	Ban Khor Sign Language
BSL	British Sign Language
LSC	Catalan Sign Language
ChicanSL	Chican Sign Language
CSL	Chinese Sign Language
CZSL	Czech Sign Language
DGS	German Sign Language
ESL	Estonian Sign Language
FSL	Finnish Sign Language
GSL	Greek Sign Language
HKSL	Hong Kong Sign Language
HSL	Hungarian Sign Language
ÍTM	Icelandic Sign Language
IUR	Inuit Sign Language
IPSL	Indo-Pakistani Sign Language
ISL	Israeli Sign Language
JSL	Japanese Sign Language
KK	Kata Kolok
KSL	Kenyan Sign Language
LAT	Tanzanian Sign Language
LIS	Italian Sign Language
LSB	Brazilian Sign Language
LSM	Mexican Sign Language
MarSL	Mardin Sign Language
LSE	Spanish Sign Language
NSL	Norwegian Sign Language
NGT	Dutch Sign Language
NZSL	New Zealand Sign Language
PSL	Polish Sign Language
ÖGS	Austrian Sign Language
SASL	South African Sign Language
SKSL	South Korean Sign Language
TSL	Taiwan Sign Language
TİD	Turkish Sign Language
UgSL	Ugandan Sign Language

Notational conventions

SIGN	Signs are glossed in English small caps
SIGN-SIGN	A hyphen is used when a single sign gloss consists of more than one English word
SIGN^SIGN	A circumflex is used to indicate a sequential compound
___rh-q	A line above a gloss indicates the scope of a particular non-manual marker, e.g. rh-q = rhetorical question
___q	Question with non-manual marker
{NUMERAL}{UNIT}	Numeral incorporation
++	Indicates reduplication of a sign
‘meaning’	Meaning or translation of the sign

1. INTRODUCTION

Numerals appear in all human languages, and constitute a well-researched topic within spoken language typology (e.g. Greenberg 1978; Corbett 2000; Song 2001; Hurford 2010). For sign languages, on the other hand, relatively little is known about how numerals are expressed morphologically and what features or strategies are typologically common or unusual. Similarly, though much is known about spoken Japanese, much less is known about Japanese Sign Language (JSL). Therefore this thesis endeavours to fill two gaps by contributing to knowledge on both Japanese Sign Language (JSL) as a language, and on numerals in signed languages from a typological standpoint, for example exploring the occurrence of numeral incorporation and instantiations of iconicity. Projects like this one, involving the collection of conversational data from 37 JSL signers, are still unusual and very few exist at the time of writing. Additionally, this number of informants allows for the study of sociolinguistic variation in JSL, which is also an under-researched area, including investigation into the factors affecting variation particularly in the Kanto and Kansai regions. Aside from theories from the fields of typology and sociolinguistics, the thesis makes use of theories associated with language documentation, because there are so few corpora or bodies of linguistic data for sign languages like JSL. This makes documentation an integral part of almost any project aiming to carry out sociolinguistic or cross-linguistic analyses of sign languages (Palfreyman, Sagara & Zeshan, forthcoming).

The first chapter of this thesis provides a brief overview of sign languages, including their phonological make-up, and then introduces the reader to JSL and the Japanese deaf community. The education of deaf children in Japan is discussed from a historical perspective and in light of the establishment of schools for deaf children across the country. Previous research on JSL and its sociolinguistic variation are considered, as well as the question of what constitutes JSL and the terminology used to describe the language of Japanese deaf people.

1.1. Sign languages

Sign languages are not merely forms of gesture or mime, but genuine, natural languages that are used by deaf communities worldwide (Valli & Lucas 1995; Sutton-Spence & Woll 1999; Brentari 2002; Johnston & Schembri 2007). More than 100 distinct sign languages have been identified around the world so far (Lewis 2009). For example, in East Asia the sign languages that have been identified include JSL (Kimura & Ichida 2005), Chinese Sign Language (CSL) (Fischer & Gong 2011), South Korean Sign Language (SKSL) (ibid) and Taiwan Sign Language (TSL) (Smith 2005). JSL, SKSL and TSL are noted as belonging to the same language family because of language contact (Fischer & Gong 2011:499). These languages, and others, are

explored further in chapters 6, 7, 8 and 9 of this thesis.

After many years of being unrecognised academically, sign language phonology research was pioneered by Trevoort in the Netherlands in 1953. He was followed by William Stokoe in 1960 and, later, by other academics from Gallaudet University in the USA. They studied the phonological structure of signs, in particular handshape, movement and location (Stokoe 1960). Battison (1974) expanded this inventory by adding a fourth phonological parameter: orientation. This is particularly relevant to numeral signs. Finally, following the work of Klima & Bellugi (1979), the inventory of phonological parameters was expanded further to include a fifth parameter: non-manual features. Many sign linguists take into account all five of the phonological parameters, however there are some who have proposed alternative models for the description of signs. These models tend to focus on one particular parameter. For example, Liddell & Johnson (1989) developed the 'movement-hold model' to account for the fact that not all signs move and that they have different permutations of movements and holds. Brentari & Eccarius's (2010) 'hand configuration model' is another example, this time with the central focus on the handshape parameter used in American Sign Language (ASL), Hong Kong Sign Language (HKSL) and German Sign Language (DGS) under a lexical model. Components of numeral signs and numeral-incorporated structures frequently have their own meaning and can be studied outside the scope of phonology. This thesis aims to advance this notion by providing a morphological rather than purely phonological analysis of numerals in Japanese Sign Language, and by including typologically-motivated comparisons with other sign languages.

1.2. The Japanese deaf community

JSL is used by approximately 57,000 people (Ichida 2001), although the Japanese government states that the country has 343,000 deaf people, including hard of hearing and deafened people (Ministry of Health, Labour and Welfare 2012). JSL has probably been used for hundreds of years, but prior to the founding of the Kyoto Deaf-Blind School in 1878, there is little evidence of what JSL was like, who used it and where it was used. The Japanese Federation of the Deaf (JFD) was established in 1947 with a focus on the improvement of the lives of deaf people and achieving equality, rather than on advocacy for language and cultural rights, which came later.

Prior to 1970, the tendency was for hearing people who worked as teachers at deaf schools, and could therefore sign, to act as informal interpreters between spoken Japanese and JSL (Yonekawa 2002). Then in the 1960s, 1970s and 1980s, sign language clubs were established, and more hearing people began attending them in order to learn JSL. The first sign language club, Mimizuku, was set up in 1963 in Kyoto. However, the signing that hearing

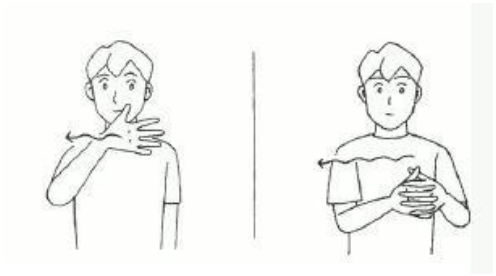
people tended to learn at these clubs was probably not JSL; it was more likely to have been signed Japanese due to the prevalent monolingual culture wherein Japanese was seen as the ideal (Kimura 2011). It was not until after 2000 that dedicated JSL interpreter training courses became available in Japan.

In the culture of Japan, both deaf and hearing people see Japanese as their national language, and it is a source of pride and identity. It is considered very important for deaf Japanese people to learn not just JSL but also written Japanese, though they are often less proficient in the latter. During the 1970s, several educators created teaching methods that mixed spoken Japanese with signs, i.e. 'artificial manual languages' (Mori 2011). Though these were rarely successful, the endeavours are notable because they gave rise, to some extent, to the linguistic study of JSL, as the educators began to analyse features of JSL academically (ibid).

The linguistic features that came to be accepted as inherent to JSL were partly influenced by the establishment of D-Pro, a deaf culture/community organisation modelled on American political minority organisations, in 1996. The American ideology of 'big D' deaf versus 'small d' deaf (Woodward 1972) affects the distinction between signed language grammar and spoken language grammar, or manually-coded spoken languages. It aimed to promote the importance of signed languages among deaf communities (Kimura and Ichida 1995) and, as a result, the sign language used in Japan now tends to be called either *Nihongo taiou shuwa* 'signed Japanese' or *Nihon Shuwa* 'Japanese Sign Language'.

Japan as a country is largely monolingual with regards to the wider hearing society, perhaps due to its island history (Heinrich 2012:140,170). The same is true for members of the Japanese Deaf community with regards to sign language acquisition, as contact with deaf people from abroad is rare. This means that deaf people in Japan do not tend to know International Sign, or other national sign languages. However, this attitude of monolingualism is slowly changing due to a number of different organisations that have an international orientation, including the Japanese ASL Signers Society, which focuses on teaching ASL and hosting a variety of international and national lectures as well as supporting students who want to study abroad; the Nippon Foundation, which provides funding support to deaf students who wish to study in the USA; and Duskin, which operates an exchange programme for deaf people in Japan and in other Asian-Pacific countries. The majority of these organisations are based in Tokyo but they support deaf and disabled people across Japan.

The increased mobility and higher exposure to foreign sign languages seem to have had an effect on JSL. It is possible that this higher exposure to foreign sign languages, in particular ASL, has influenced younger signers so that this age group uses signs that are not present in the discourse of older JSL signers. For example, the ASL sign for 'America' is beginning to be used in JSL, alongside the traditional JSL sign for 'America' (see Figure 1.1).



Traditional JSL sign for 'America'

ASL-derived JSL sign for 'America'

Figure 1.1 Traditional and ASL-derived JSL signs for 'America' (Yonekawa 2011:1671)

In terms of official recognition of JSL, Tottori prefecture, in 2013, became the first in Japan to advocate for sign language recognition in law by establishing new local regulations, which stipulate that the needs of sign language users must be met in the Tottori region, including educational needs and the provision of interpreters (Japanese Deaf News 2013). Funding was agreed (in October 2013) to ensure the needs of deaf people in this region are met by providing sign language interpreters, by expanding the teaching of JSL to hearing people and by ensuring that deaf children's sign language needs are met in schools. Ishikari city in Hokkaido was next to adopt this philosophy of sign language provision for its deaf people (Japanese Deaf News 2014). The JFD would like to see this development influence other prefectures and the national government. However, due to a lack of research, such prefectural legislations fail to show how JSL grammar actually differs from that of signing based on spoken Japanese, i.e. Signed Japanese (Mori 2011) (see section 1.4 for further details).

1.3. Deaf education in Japan

As with many other sign languages (Pfau, Steinbach & Woll 2012), the education of deaf children has played a huge role in shaping modern-day JSL. Therefore, it is important to convey some of the history of deaf education in Japan. The education of deaf children in Japan was established much later than in Europe. According to Ito (1998:214), a Japanese man named Yozo Yamao discovered the existence of deaf education in Britain when he travelled to Glasgow to study shipbuilding and saw workers using British fingerspelling (Suemori 2013). During his studies, he visited a school for deaf and blind pupils and decided to establish a similar institution in Japan. He wrote a letter to the Japanese government in 1871, but the process was difficult, as political administration in Japan at that time was fraught with conflict between different locales (ibid). Eventually his application to the government was successful, and as a result the first school for deaf pupils in Japan was founded in 1878 by Tashiro Furukawa (1845-

1907), a hearing man who was raised in a family of educationalists, as his father was a teacher. Furukawa became a teacher of deaf and blind children and founded the school in Kyoto[1]. Alongside a fellow teacher, Furukawa began teaching in the school with 31 deaf and 27 blind pupils (Ito 1998). Subsequently, schools for deaf children were established in Tokyo (in 1880) and Osaka (in 1900) (see Figure 1.2).

Figure 1.2 Map of significant prefectures in the history of deaf education in Japan

As further deaf schools opened across Japan, different sign language varieties were used, or emerged, and this is a key source of regional variation in modern JSL. One prominent area of contrast is how numerals are articulated by some older signers in Kyoto versus those in other parts of Japan (Shintani 2011). This can be explained by the fact that numeral signs in the Kyoto deaf school reflected and reinforced shapes from written Kanji, but this was not the case in other schools, such as the one in Osaka. For example the Kyoto sign for '8', shown in Figure 1.3, reflects the Kanji symbol for '8' (八). The Kyoto teachers thought it was appropriate for deaf children to learn Kanji first, because it is logographic, and then the Kana forms (Hiragana and Katakana), which are syllabic (Oya 2000; Shintani 2011). It is interesting to note that the current Chinese Sign Language number system is similar to the old Kyoto system: as one of three different writing systems used for Japanese, Kanji derives from the Chinese writing system (Min & Washio 2010).

[1] Interestingly, the JSL sign for 'who', in which the backs of the fingers brush against the cheek, may be a remnant of this school, where deaf children communicated with their blind peers through tactile signing (Maruyama 1984).

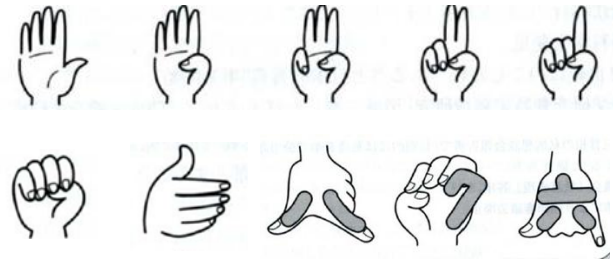


Figure 1.3 Right to left, signs for the numbers '1' to '5' (top row) and '6' to '10' (bottom row) in the Kyoto system (from Oya 2000)

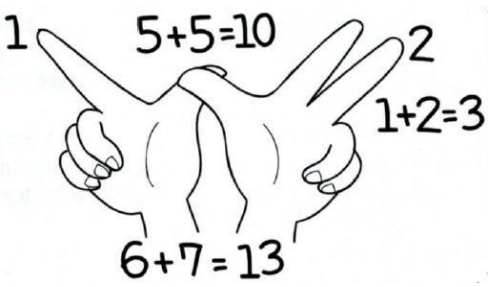


Figure 1.4 Sign for '13' in the Osaka system (from Oya 2000)

Oya (2000, cited in Yonekawa 2002:171) notes that there was disagreement between teachers at the Kyoto and Osaka schools concerning which number signs should become the common forms, and that, in time, Kyoto signs (see Figure 1.3) became less common across Japan. He suggests that this is because the Osaka signs (see Figure 1.4) were considered more logical, and therefore more beneficial for teaching mathematics. The numerals used in the Kyoto signs, as demonstrated in Figure 1.3 above, are the result of an iconic strategy influenced by the written form while the Osaka numerals were based on an additive system and clearly more suited to the teaching of mathematics. For example, the sign for '13' in the Osaka system, shown in Figure 1.4, is composed of four elements: '1', '5', '5' and '2'. Each thumb represents the number '5' and each finger represents '1' so thumb + thumb means '5' + '5', two fingers means '2' and one finger means '1'. Added together this makes '13'.

The school in Kyoto formally accepted the Osaka system in 1950 (Osugi 2009:54) because it facilitated a manual system for counting that helped deaf children to use the hands to represent digits for counting purposes in a way that the Kyoto system did not (Oya 2000 in Yonekawa 2002:171). The Kyoto number system has since virtually disappeared from use. There are examples, however, of older Kyoto signers moving to other areas of Japan and spreading the use of the Kyoto system. The Kyoto sign for '6' in particular is still seen in some areas of Japan. The Osaka system now forms the basic handshapes for the numbers 1-9 in JSL.

At an education conference in Milan in 1880, known as the 2nd International Congress on the Education of the Deaf, a resolution was passed that "formally endorsed pure oralism" (McBurney 2012:920). However, this recommendation did not spread to Japan immediately after the congress was held, as Tashiro Furukawa's school in Kyoto still used sign language, and had deaf teachers, from the 1880s through to 1933. In 1933, the oralist philosophy proposed by the congress was instituted in all Japanese deaf schools, partly due to influence from Europe and America. The outcome of the Milan Congress revolutionised the way deaf children were taught and emphasised an importance on oral, as opposed to signed, education. However, in

the 1960s, the 'total communication' method spread throughout the USA, which included the use of sign language in deaf education (Holcomb 1970). Furthermore, in 1968, Tanokami Takashi began using *dojiho*, a sign system borrowed from Britain (Nakamura 2006:26) (known among the BSL deaf community as Sign Supported English), to teach deaf children the grammar of spoken language. In 1993, the Japanese Ministry of Education declared in an official report that it was acceptable for schools to use sign language, but the differences between forms of signed communication were not appreciated at the time, and the declaration was taken to mean signed Japanese, not JSL in its native form. Following official recognition in 1993, access to a 'signed' education was largely limited to older students from junior high school and above (age 12 and above). Most young students in infant schools were not allowed access to signed education and continued to be restricted to oral education (Yonakawa 2002).

There has been a lack of agreement amongst scholars and educators in Japan with regards to a definition of 'sign language', with various terms being used such as 'traditional signing', 'manually signed Japanese' and 'intermediary signing' (see Yazawa 1996 in Nakamura 2006; Mori 2011), which are described further in the next section. Because of this, deaf people who wanted to promote the use of JSL in education opened an additional voluntary school at weekends, called *tastu no ko gakuen,* for children whose parents wished them to have a signed education.

In 1990, the deaf community began to campaign for a bilingual education method that uses JSL alongside written Japanese. In 2003, parents of deaf children campaigned for the government to set up a bilingual deaf school. Finally in 2008 the first, and currently only, bilingual school, the Meisei Gakuen School for the Deaf, was established in Tokyo. Japan now has around 106 deaf schools, which were established gradually over the years, but most deaf schools tend to use the total communication method, which included using many methods of communicating, such as fingerspelling, cued speech, gestures and the aural/oral method, instead of purely JSL (Hayashi & Tobin 2014).

1.4. Terminology and JSL vs. Signed Japanese

There has long been a debate over what to call the signed language used by deaf people in Japan. *Shuwa* is now the common term; the two characters that make up the Japanese word *shuwa* 手話 mean 'hand' and 'speech' respectively. Because Japan is a strongly monolingual country, and its citizens take much pride in the Japanese language, most deaf people do not think of their sign language (Japanese Sign Language, or *Nihon Shuwa*) as being distinct from standard Japanese. Another interesting example of language ideology can be found following the breakup of Yugoslavia; while there are separate Serbian and Bosnian languages they are

mutually intelligible and the distinction is political rather than linguistic (Petrovic 2006).

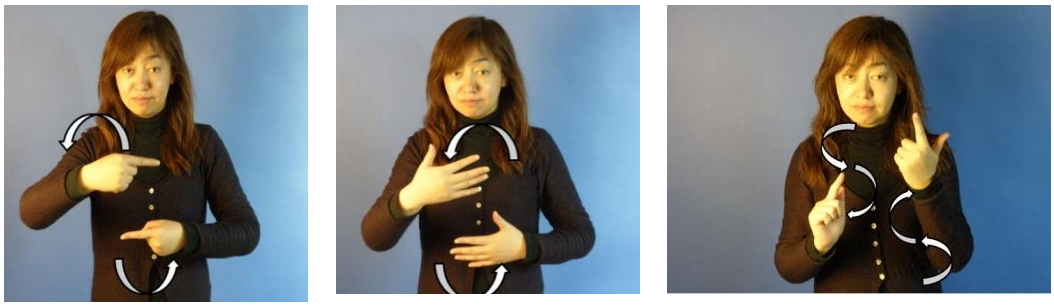
Table 1 Terminology over time for signs used in Japan

Time period	Name	Definition	Reference
Prior to the establishment of the first deaf school in 1878	*temane* 手まね 'gesture' or 'pantomime'	signing used before the beginning of formal education for deaf people	(Yonekawa 2002)
Approx. 1870s to 1930s	*shikata hou* 手勢法 roughly translates as 'hand method'	the sign-based teaching method at the first deaf schools in Japan	(Yonekawa 2002)
1980s- 1990s	*dōjihōteki-shuwa* 同時法的手話 'manually signed Japanese'	the grammar of spoken Japanese, with signs that can represent every word sequentially	(Nakamura 2006)
1980s- 1990s	*chukanteki-shuwa* 中間的手話'intermediary signing'	a mixture of spoken and signed language grammar	(Nakamura 2006)
1980s- 1990s	*dentōteki-shuwa* 伝統的手話'traditional signing'	the type of signing used by the older generation of deaf people in Japan	(Nakamura 2006)
Present day	*Nihongo taiou shuwa*, 日本語対応手話 'Japanese on the hands and fingers'	Signed Japanese, i.e. signs following the order of spoken Japanese	(Morgan 2006)
Present day	*Nihon Shuwa* 日本手話 'Japanese Sign Language (JSL)'	the native language of the Japanese Deaf community, with several mutually intelligible dialects and varieties	(Morgan 2006)

As Table 1 above indicates, in the past, the sign language used by deaf people was not known as Japanese Sign Language. Prior to the use of *shuwa*, the word *temane* (meaning 'gesture' or 'pantomime') was used to refer to sign language (Yonekawa 2002). When the first deaf schools were established in Japan, the sign-based teaching method they employed was known as *syuzei hou* 手勢法, which roughly translates into 'hand method' and has a very similar meaning to *shuwa. Syuzei hou* was designed by Furukawa (see section above), and was intended to facilitate the reading and writing of Japanese. Therefore, the method emphasised clear fingerspelling, for example, using 50 bespoke signs indicating the Hiragana and Katakana characters of the Japanese (syllabic) alphabet. When the trend toward oralism finally reached Japan, signers started making more use of mouth patterns derived from spoken Japanese.

Other terms that have been used over the years to describe the signing of Japanese

deaf people in education[2] include *dōjihōteki-shuwa* 'manually signed Japanese', *chukanteki-shuwa* 'intermediary signing', and *dentōteki-shuwa* 'traditional signing' (Nakamura 2006). *Dentōteki-shuwa* 'traditional signing' is "the common term for the type of signing used by the older generation deaf as well as some of the younger generation who are trying to recover their traditions", although the phrase is not particularly popular because it sounds as if the language is obsolete (Nakamura 2006:15). The term also lacks specificity, and includes a wide range of communicative methods, from gesture to signed Japanese (ibid). *Dōjihōteki-shuwa* 'manually signed Japanese' employs the grammar of spoken Japanese, with signs that can represent every word sequentially (including signs for Japanese particles like *ga* and *ni*). *Chukanteki-shuwa* 'intermediary signing' means a mixture of spoken and signed language grammar. This is now known generally as *Nihongo taiou shuwa*, or Signed Japanese (SJ), a mixture of different forms of the Japanese signed and spoken languages (Morgan 2006). Morgan (2006:94) describes SJ as a "contact language, or pidgin, partly artificial and partly natural, part JSL and part Japanese […] words are signed in Japanese order and generally speaking without certain of the elements of JSL grammar, such as grammatical use of the signing space and certain non-manual markings". Different signs are also used to refer to 'Japanese Sign Language' and 'Signed Japanese'. For the former, any one of three signs can be used, while the latter has one form, with a distinctive mouth pattern (see Figure 1.5 below).



Three variants of JSL

SIGNED-JAPANESE

Figure 1.5 Variations used to refer to Japanese Sign Language and Signed Japanese

[2] Outside the educational sphere, Japanese deaf people refer to sign language simply as *shuwa.*

Despite recognition of JSL by the Japanese government, the extent to which the grammar of JSL is distinct from that of Signed Japanese, and how to differentiate JSL and Signed Japanese, is still not fully documented because there has been so little research devoted to these questions. However, members of the Japanese deaf community, including researchers, tend to have a strong intuitive knowledge of what JSL is and what constitutes Signed Japanese. A recent book by Kimura (2011) addresses this issue and explains some of the specific differences between JSL and Signed Japanese. For example, in JSL the question 'have you heard?' (As in 'did you hear about what happened yesterday?') would be articulated as HEAR NO (with non-manual features providing the remaining grammatical information), as illustrated in example (1) below, while in Signed Japanese it would be HEAR NO IS ASK (reflecting the spoken Japanese word order of *kiite nai desu ka*?), as shown in example (2).


___q
(1) HEAR NO

'have you heard?'




(2) kiite nai desu ka

HEAR NO IS ASK

'have you heard?'

At present, this is still an on-going issue of debate, but as time goes on, more and more evidence is being published showing the differences between Signed Japanese and JSL.

1.5. Previous research on JSL

Following on from the section above, linguistic research into JSL and the notion that JSL is an actual language are relatively new phenomena. The Japanese Federation of the Deaf (JFD) produced the first book about JSL, called *Our Sign Language*, in October 1969. In 1973, the JFD published a small five-volume word book of some JSL signs. The JSL Research Centre was later set up as part of the JFD in 1987, focusing on the teaching of JSL. The first scholarly research into the linguistics of JSL was carried out by the Sign Language Society of Japan, also known as the Japanese Association of Sign Linguistics, which was founded in 1975 (Tanokami & Peng 1976:15; Mori 2011). Research into Japanese Sign Language was advanced further in the 1980s, when Kanda (1986) conducted research into fingerspelling. Kanda used some of Stokoe's methods to create a handshape inventory for JSL, which lists 54 handshapes that are used to form larger units of meaning in JSL (Kanda 1986:208), and also looked at hand orientation and movement in JSL. Other research that followed focuses on lexical changes in sign language (Kanda 1989) and other aspects of phonology in JSL (Hara 1991). The Japanese Association of Sign Linguistics, along with a more comprehensive JSL dictionary, published in 1997, developed the field even further. To date, no reference materials on JSL grammar have been produced, but Kimura and Ichida (1995) show that JSL has its own grammar, distinct from that of spoken Japanese, and Morgan (2005) provides a whole-language typology of JSL. The *New Japanese Sign Language Dictionary*, with an even fuller account of the lexicon than its predecessors, was published in 2011 (Yonekawa); however, this dictionary provides sign descriptions only (e.g. specifying the location and handshape of each sign), and does not include grammar or morphology. The first publication that deals with JSL grammar is *Structure of Japanese Sign Language* published in 2011 by Oka & Akahori. Though it is not a reference grammar, this book includes phonological parameters, classifiers, sign order and syntactic structure. This research is very useful in an applied context, as it demonstrates to teachers and interpreters the importance of verb modifications and inflections, and helps them to understand that using the citation form is not always appropriate. Other linguistic works on JSL include Peng (1974), Morgan (2006; 2008) and Osugi (2010).

In 2013, part of a JSL corpus became available due to the Colloquial Japanese Sign Language Corpus Project (Tsukuba University of Technology and Bono Lab 2013). Later, researchers at the Tsukuba University of Technology recorded 20 signers each for the two prefectures, Gunma and Nara, from a wider range of age groups, to further investigate variation. This has expanded into a larger corpus, and the entire data-set is due to be published in spring 2014 and, though it did not exist in full when the present research began, the parts that have been made available so far have proven a useful adjunct. This corpus contains single lexical items produced from pictorial stimuli, as well as interviews. Only the former has been

examined for this study, with the recognition that this corpus data was generated in a formal way (e.g. with cameras, lights and individual pictures intended to elicit single lexical signs) and may or may not reflect spontaneous or 'natural' language use.

1.6. Variation in JSL

Variation is a feature of all languages, whether spoken or signed languages (Vogl 2012; Schrembri & Johnston 2013). Japanese spoken language exemplifies this with its variation in dialect between east and west regions (Sugimoto 2010: 71). Variation, including regional, age and gender variation, has also been identified in many other sign languages, including British Sign Language (BSL) (Sutton-Spence, Woll & Allsop 1990 in Schrembri & Johnston 2013), American Sign Language (ASL) (Lucas, Bayley, Valli & Rose 2001) and New Zealand Sign Language (NZSL) (McKee, McKee & Major 2011). Regional variation in JSL also relates to sociolinguistic factors such as age and gender. Yonaiyama (2003) notes that members of the Japanese deaf community are aware that different signs are used across the two main regions of Japan: Kanto in the east (including Tokyo) and Kansai in the west (including Kyoto and Osaka) (see Figure 1.6 below).

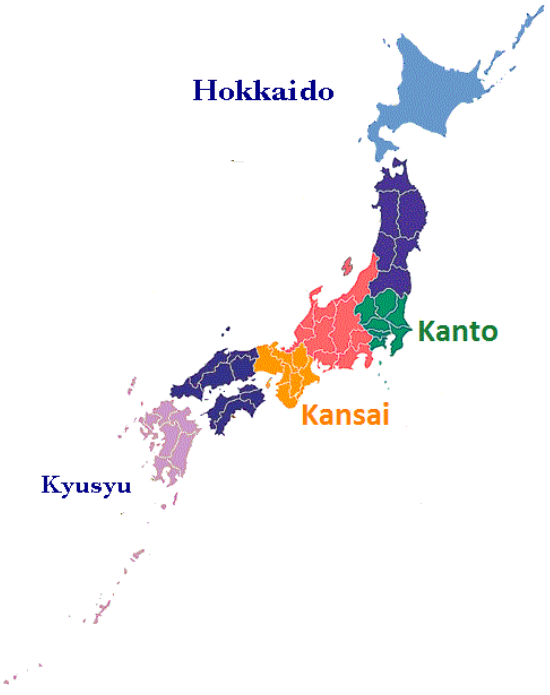


Figure 1.6 The two main regions of Japan: Kanto and Kansai

Interpreter training materials explain the differences between signs used in these two regions, e.g. signs for '10', '100' and '1,000', which are explored later in this thesis, in chapter 8 (NPO Skill Assessment Association 2002). One of the most commonly known examples of lexical variation is the sign NAME, for which a different variant is used in each region (Saito

2007). Yonaiyama (2003:80) attributes this level of variation to the sign language varieties that were used in the first schools in Japan for deaf children (see section 1.3). It seems, then, that the first deaf schools of Japan, in Kyoto, Tokyo and Osaka, are a possible source of existing variation in modern JSL number signs. In addition to regional variation between Kanto and Kansai, a high level of lexical variation, particularly of place names, has been documented in the six prefectures of Kyushu, as well as in Okinawa in southern Japan (Tsukuba University of Technology and Bono Lab 2013) and Hokkaido in northern Japan (Hokkaido Deaf Association 2005).

1.7. Research question and structure of the thesis

This study focuses on the numeral system of JSL, and where relevant, the JSL morphological structures are compared to those of other sign languages. The main research question is:

How can the JSL numeral system be characterised with respect to:

- aspects of the linguistic structure of JSL numerals at the phonological and morphological levels
- typological comparison with other sign languages
- sociolinguistic variation in JSL?

In order to examine the linguistic structure of numerals in JSL, the study examines the articulation of ordinal and cardinal numerals, fractions and some forms associated with quantification. Attention is paid to the level of iconicity that penetrates sign language number systems. Furthermore, the study makes reference to the semantic origins of numerals and to numeral incorporation. The typological comparison involves four groups of sign languages, though these are not all used in every comparative analysis: group 1 is comprised of South Korean Sign Language and Taiwan Sign Language; group 2 is Chinese Sign Language only; group 3 includes a number of urban sign languages; and group 4 is made up of several village sign languages (see section 2.2.1 on this term). Japanese Sign Language is not included in any of the groups, as it is the central language of the study, and comparisons are made between each of the groups and JSL. The languages are compared for where the numeral systems are phonologically and morphologically similar in order to make typological comparisons. In addition, sociolinguistic variation in JSL is considered in relation to the history and development of sign languages and the factors that predict the use of different variants, such as the age or regional background of the signer.

As a brief outline of the structure of the thesis from here on, Chapter 2 focuses on the semantic domain of numerals, beginning with a brief explanation of grammatical number and quantification in spoken languages. However, grammatical number is not a focus of this thesis,

and so the majority of chapter 2 discusses numerals, especially in sign languages, including numeral incorporation and enumeration. Chapter 3 explores the theoretical and conceptual approaches to sign language typology, documentation and sociolinguistics, including variation within and across sign languages. Ethics, issues in field linguistics, validity and reliability are also explored, and the chapter explains why and how the comparative analysis is used in this thesis. Chapter 4 gives a detailed description of the method used, including recruitment of participants, sampling, elicitation activities, collection of spontaneous data, introspection, annotation, ethical procedures, the use of existing sign language typology data sets, and hypotheses for the comparative analysis. Chapters 5 to 8 explain the findings, starting with the morphological structure of JSL and then semantics and iconicity, numeral incorporation and sociolinguistic variation respectively. The final chapter, Chapter 9, draws the thesis to a close, sums up the key findings of this study as a whole and makes recommendations for further research.

2. THE SEMANTIC DOMAIN OF NUMERALS

All known languages have a way of referring to at least some numerals, and the concept of 'number' appears to be universal (Hurford 2010:2). Greenberg's (1978) study of numeral systems found that many of the world's spoken languages make use of a system where a numeral provides attributive information to a noun (Greenberg 1978:249). There is much diversity in how numerals are expressed cross-linguistically (Corbett 2000), and it is particularly interesting to see how various cultural elements can affect the expression of numerals. Before moving on to review the existing research on numerals in JSL and in other sign languages, Section 2.1 provides an overview of research related to numerals in spoken languages, and introduces key concepts from this domain. Next, section 2.2 explores the instantiations of numerals in sign languages, focusing primarily on cardinal numerals, ordinal numerals, numeral incorporation and enumeration.

2.1. Numerals in spoken languages

The category of 'number' can be divided into two sub-categories: grammatical number and quantification (or lexical number). *Grammatical number* includes phenomena such as the formation of duals and plurals, agreement, verbal number, suppletion, repetition, and distributive classifiers (Haspelmath et al. 2005a and 2005b). *Quantification*, which is the greater focus of this thesis, means lexical expressions such as numeral forms, quantifiers, ordinal numerals, and phrases/structures showing size, shape or area. The expression of number has become grammaticalised (Corbett 2000) and many languages contain a number system that enables the expression of numbers into its nouns and verbs. In English most nouns can be expressed with a singular or plural reference, whereas this is not the case in some other languages, such as Japanese. An example of the singular and plural forms in English is seen in the difference in meaning in the following:

(3)

singular	**plural**
magazine	magazines
book	book*s*
table	table*s*

Japanese, however, does not make a distinction between singular and plural in its noun class. In other words, Japanese nouns do not exhibit number: the word *hon* can literally mean both 'book' (singular) and 'books' (plural), and information about number is provided by adding a numeral before or after the noun. While languages such as English and Russian make a binary distinction between 'singular' and 'plural', other languages have more than two categories of grammatical number. Corbett (2000:39), for example, notes that Upper Sorbian has three categories (singular, dual, plural), while Larike also has a trial (3) category, and Yimas has a paucal (small number) category.

Quantification, on the other hand, is concerned with the notion of quantity. Gil (2001:1275) cites several examples of quantity in English – *three, several, numerous, most, every, one hundred and twenty three, all but seventeen.* These can be divided into at least two further categories: numerals (*three, one hundred and twenty three*) and quantifiers (*several, numerous, every*), as depicted in Figure 2.1 below. It has been noted that in many sign languages, there is an overlap or relationship between numerals and grammatical number (McBurney 2002:353-4; De Vos 2012), because of the use of numeral forms that express a certain quantity via the number of fingers and also contribute to the expression of grammatical number, so the chart in Figure 2.1 may need revision when used to refer to sign languages.

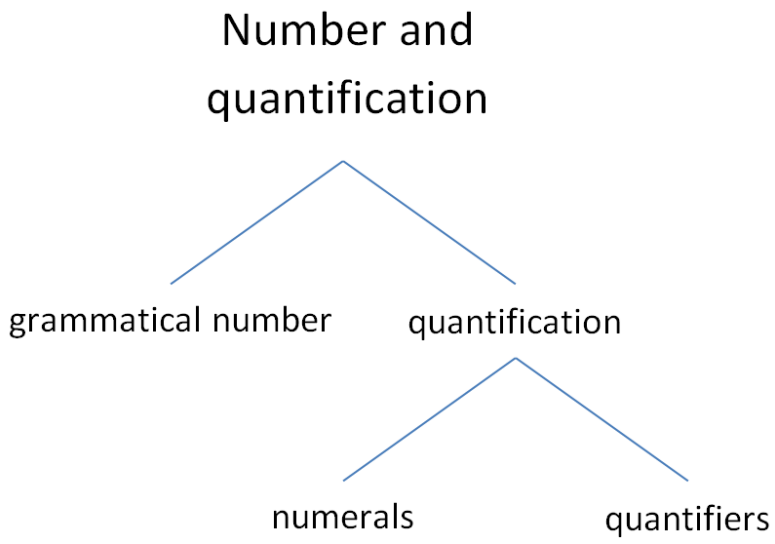


Figure 2.1 Theoretical categories of number and quantification.

For numerals, distinctions are often made between series such as cardinal, ordinal, distributive and restrictive. Stolz & Veselinova (2011) define cardinal numerals as "the set of numerals used

in attributive quantification of nouns". An example of a cardinal numeral is 'three' as in the expression 'three chairs'. Conversely, ordinal numerals show "the position a given member of a set occupies relative to the other members of the same set" (ibid). An example of an ordinal numeral is 'third' as in 'the third chair'. Further details of cardinal numerals are presented in 2.1.1 and ordinal numerals are discussed in 2.1.2.

2.1.1. Cardinal numerals

Gil (2013) states that most languages have a series of cardinal numerals represented by words, such as English *one*, *two*, *three* and so on. Spoken Japanese has two different sets of cardinal numeral words. The first of these two sets (see Table 2) is influenced by the Chinese language, and the other is from traditional Japanese. The Chinese-derived set is more common and is used to form all sorts of numbers using an additive strategy (e.g. *jyu+ni* = 10+2 = 12). Traditional Japanese number words only exist for 'one' to 'ten', and higher numbers do not occur in, and are not formed with, this set. As seen below, this paradigm involves pairs of similar words, e.g. *hi* and *hu* ('1' and '2'); *mi* and *mu* ('3' and '6'); and *yo* and *ya* ('4' and '8'). These pairs are mathematically related in that adding two of the first number in the pair results in the second number in the pair, e.g. *hi* and *hi* equals *hu*; *mi* and *mi* equals *mu* (Kubozono 2011:4). This is similar to what Hanke (2010:72) calls "neo-2 sums", i.e. numerals created by articulating an amount twice, as in '3+3' for '6'. This also occurs in some sign languages. For example, Zeshan, Escobedo Delgado, Dikyuva, Panda & de Vos (2013:373) document the existence of a sign in Mardin Sign Language from Turkey that uses repetition of a '4'-handshape in the sign for '8'.

Table 2 Japanese number pronunciations: Chinese influenced and traditional Japanese

	1	2	3	4	5	6	7	8	9	10
Chinese-based *(On Yomi)*	*ichi*	*ni*	*san*	*shi/yon*	*go*	*roku*	*shichi/nana*	*hachi*	*kyu*	*jyu*
Traditional Japanese *(Kun Yomi*)	*hi*	*hu*	*mi*	*yo*	*itu*	*mu*	*nana*	*ya*	*kokono-tu*	*to*

As shown in the table, the Chinese-derived set has two different forms for some numbers. For example, there are two words for 'four': *shi* and *yon*. The former is used when counting upwards, and the latter when counting down. Kubozono (2011) asked 30 participants in the Kansai region to count from 1 to 10, and found that only one used *yon*. This was also the tendency with *shichi* and *nana*, but much less pronounced (18 used *shichi* and 12 used *nana*).

When expressing months of the year, spoken Japanese uses a combination of both Chinese and Japanese variants. The Chinese counting system is used to show the month of the year that is being referred to. For dates '1-10', the Japanese traditional counting system can be used (see Table 3); dates larger than 10 are expressed using Chinese variants.

Table 3 Pronunciations of days and months with Chinese influenced and traditional Japanese

Day and Month	**Counting system**	**Spoken lexicon**
January 3rd	1 月 3 日	*ichi gatsu mik ka*
March 5th	3 月 5 日	*san gastu itsu ka*
May 10th	5 月 10 日	*go gastu to ka*

Languages use different bases on which to construct higher numbers. Comrie (2013) defines 'base' as "the value *n* such that numeral expressions are constructed according to the pattern … *xn + y*, i.e. some numeral *x* multiplied by the base plus some other numeral". Decimal systems, with a base of 10, are very common around the world, and even for spoken languages, it has been argued that there is a link between this base and the number of digits on the human hands: Hanke (2010:72), for example, notes that "verbal counting has very often, if not always, its origin in physical, or rather manual counting". However, other bases do occur. Vigesimal systems have a base of 20, and Comrie's study of 196 languages includes 20 that employ a vigesimal system. Languages with other bases are comparatively rare, and include Ekari (part of the Trans–New Guinea language family), which has a base of 60, albeit using a different definition of 'base' than Comrie's above, namely that of an additive base (see section 5.1.3 below and De Vos and Zeshan 2012:13):

(4) *èna ma gàati dàimita mutò*
one and ten and sixty (Drabbe 1952:30)

In English and some other spoken languages the numbers 1-10 are combined to produce higher numbers, e.g. 18 = 8+10 (*eighteen*). In Japanese the order in which these numbers are combined is the opposite, i.e. 18 = 10+8 (*jyu hachi*).

2.1.2. Ordinal numerals

In addition to cardinal numerals, most languages also have various other series of numerals, whose forms are derived from cardinal numerals, such as ordinal numerals, and whose denotations combine the concept of number with other concepts of a variety of different

kinds. For example, typological research into spoken languages has revealed that out of 321 countries, only 33 do not have ordinal numerals, so the majority of languages do have this category of numerals; however, the size of the ordinal numeral series varies across languages, with the most common type showing similarities between higher cardinal and ordinal numerals but suppletive forms for the lower numbers, particularly 'first' (Stolz & Veselinova 2011). In most European languages, suppletives are found for 'first', 'second' and 'third', but forms for 'fourth' and above are similar to the cardinal numerals from which they derive. In contrast, all Japanese ordinal numerals are derived from cardinal numerals (a morpheme is added to each cardinal numeral to form its ordinal equivalent). Amongst the 33 languages with no ordinal numerals is Ainu, which is used in north Japan.

2.1.3. Numeral classifiers

In many languages, numerals also occur alongside classifiers. Two types of numeral classifiers are mentioned in Gil (2011): mensural and sortal. Mensural numeral classifiers help people count items with low countability, such as water. Therefore, the English word *glass* is a mensural numeral classifier in the phrase *one glass of water*. Most languages have this type of classifier, so Gil focuses chiefly on sortal numeral classifiers, which are rarer and can be used with items of high countability. Of the 400 languages surveyed, the majority (including most of the European and African languages surveyed) do not use sortal numeral classifiers. Only 78 languages have obligatory sortal numeral classifiers (including Japanese), while in 62 languages, these forms are optional. Japanese uses several numeral classifiers such as *-satsu*, *-dai*, and *-bon*. Examples are as follows:

(5) *hon* *is-satsu*
book one-CL(bound objects like books)
'One book'

(6) *kuruma ni-dai*
car two-CL(machine-like objects)
'Two cars'

(7) *enpitsu* *san-bon*
pencil three-CL(long tubular objects)
'Three pencils'

In classifier languages (e.g. many East Asian languages), a quantifier and noun cannot appear

together without a classifier. The classifier may refer to size, shape, function or another characteristic (Emmorey 2000). For example, the Mandarin classifier *zhi* means 'elongated object' such as a flower or pencil. In Mandarin, *san* 'three' cannot occur with *hua* 'flower', unless the classifier *zhi* appears between them. So *san zhi hua* is the correct way to say 'three flowers'. It is important to note here that the term 'classifier' is used differently for spoken and signed languages (Emmorey 2000).

2.2. Numerals in sign languages

This section discusses past research on numerals in sign languages, including a cross-linguistic analysis of number systems in signed languages and an account of phonological research into JSL so far. It also introduces the concept of numeral incorporation and list buoys from a cross-linguistic perspective.

2.2.1. Previous research on numerals in sign languages

In section 2.1 it is noted that the use of numerals is universal across spoken languages. The same can be said of sign languages. Comparisons across sign languages are beginning to indicate where numeral systems are similar, where there are differences, and where and to what extent there is more complexity in some signed numeral systems than others. Sign language numerals have been extensively researched for various languages including BSL, NZSL, ASL, Catalan Sign Language (LSC), Argentine Sign Language (ArgSL) and Estonian Sign Language (ESL) (Skinner 2007; Fischer 1996; Fuentes et al. 2010; Miljan 2003). Examples of this research include Skinner's (2007) investigation into BSL systems which identified key variations. Fischer investigated the origins of ASL number systems and their links with older French sign languages, and Fuentes et al. researched the roots of both LSC and LSA numeral incorporation. This is explained in greater detail in section 2.2.2. Number was also explored in Lutalo-Kiingi's (2013) thesis on the morphosyntax of Ugandan Sign Language (UgSL), and he finds that the ability of a sign to take plural markers and/or quantifiers is not a clear indication of what sign class it belongs to; in contrast, the attachment or adjacency of such markers in spoken languages are often a clue as to word class. McKee & McKee (2011), Palfreyman (forthcoming), Skinner (2007) and Stamp (2013) have researched sociolinguistic variation in the domains of numerals and colour in NZSL, Indonesian Sign Language varieties and BSL respectively. Sociolinguistic variation is introduced and discussed at length with respect to JSL and other sign languages in Chapter 8.

For the linguistic comparisons in this thesis, it is relevant to distinguish between two types of sign languages: those used by urban deaf communities, sometimes with recognised

status as national sign languages (cf. Wheatley & Pabsch 2012), and those used in rural communities. The latter are characterised by de Vos & Zeshan (2012:2): “In contrast to the national sign languages used in urban deaf communities, these indigenous sign languages are typically shared between deaf and hearing community members, thus facilitating a high degree of integration between deaf and hearing individuals.” There are a number of different terms for these communities and their languages (ibid:3), but for the purpose of this thesis, the term ‘village sign language’ is used, and it is not the aim to go into details of the various sociolinguistic situations that can be found in these languages.

Base numbers in sign languages have also been explored by researchers; like many of the world’s spoken languages, most sign languages have been found to use a base of 10, with some such as BSL and DGS having a sub-base of 5 (Skinner 2007; Iversen, Nuerk, Jäger & Willmes 2006 respectively). Some village sign languages have typologically uncommon base numerals, for example Chican Sign Language and Mardin Sign Language both use additive bases of 20 and 50 (de Vos & Zeshan 2012:12-13). This may be due to the isolated nature of village sign language communities and a lack of language contact with other sign languages.

With regards to JSL, research into numerals has been limited so far, but there have been a few publications that have touched upon its numeral systems. Mori (1995) identifies three different sets that are used in JSL for expressing cardinal numerals. The first is the most common set: this is a neutral/unmarked form that has been called the ‘flaccid normal type’ (ibid). In the second set, the fingers are held horizontally instead of vertically. This set is used for showing dates or calendric numerals (see Figure 2.2 below), and is called the ‘tensely rotated type’ (ibid). The third set is used for number presentation or emphasis, and is called the ‘stamping type’ (ibid). Though the figure here cannot show it, this sign involves a forward push, as if emphasising the number.

flaccid normal set tensely rotated set stamping set

Figure 2.2 Three sets for expressing ‘2’ in JSL

Mori (2005) studies the structure of cardinal numerals from 1-99 in JSL, including variants for the numbers 1-4. He relies chiefly on introspection, and does not base his conclusion on a corpus. He describes the phonological structure of JSL's numbers, including hand-shapes, orientation, location and points of contact between the hands and/or face (e.g. in the signs for TWO-WEEK, THREE-MONTH). However Mori's study does not take into account the morphological composition of numerals and is concentrated on phonological descriptions only. Ichida (20005) also describes the numeral system of JSL, and also focuses on phonological structure, while Oka (2005) discusses numerical agreement, e.g. how some JSL verbs change to accommodate plural objects. Previous research on numerals in JSL and other sign languages is summarised in Table 4 below:

Table 4 Previous research on numerals in JSL and other sign languages

Research area on numerals	**JSL**	**Other sign languages**
Phonological descriptions of numerals	Ichida (2005) Mori (2005)	Liddell & Johnson (1989) Brentari (2002) Yang (in press)
Morphological elements of numerals		ESL – Miljan (2003) UgSL- Lutalo-Kiingi (2013) Yang (in press)
Sociolinguistic variation	Osugi (2013)	BSL – Stamp, Skinner (2007) NZSL - McKee, McKee & Major (2011) Indonesian sign language varieties – Palfreyman (forthcoming)
Numeral incorporation	Kjetik (2013)	Liddell (1997), Mathur & Rathmann (2010)
Agreement	Oka (2005)	
Psycholinguistics		LSC – Fuentes & Tolchinsky Landsmann (2004) DGS- Iversen, Nuerk, Jäger & Willmes (2006)

2.2.2. Numeral incorporation in sign languages

Numeral incorporation refers to the use of numerals within a sign, often interpreted as a numeral handshape appearing with another morpheme. For example in ASL the sign for 'three weeks' is produced with the dominant hand forming the sign for 'three', moving forwards away from the body on the non-dominant arm (see Figure 2.3 below).

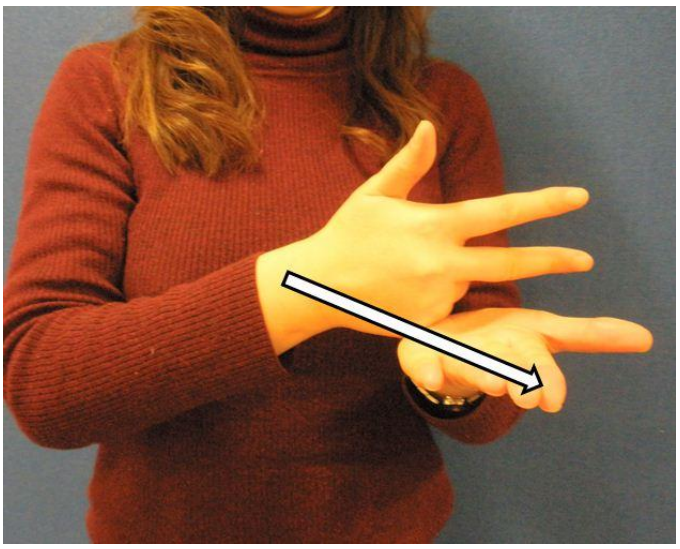


Figure 2.3 ASL sign for 'three weeks'

This process of numeral incorporation is "specific to sign language" (de Vos 2012:96) and found in many signed languages (Sagara & Zeshan 2013). With regards to numeral incorporation, there have been a number of studies that define numeral incorporation and how it is formed within sign languages. Liddell (1997:201) notes that there is ambiguity in terms of how numeral incorporation is constituted. Does the process combine:

- a simultaneous compound, i.e. two signs?
- a sign and a handshape?
- a handshape and a bound root?

The first of these options concerns the analysis of numeral incorporation as a simultaneous compound of two discrete signs. For example, the signs TWO-WEEK and THREE-WEEK in ASL all have the basic sign WEEK, and the same handshapes as the basic numbers TWO and THREE. Stokoe (1965) and Frishberg & Gough (1973, cited in Liddell 1997) were the first people to formally study numeral incorporation in sign languages, and move the analysis to the second option, stating that numeral incorporation is configured by a sign (e.g. WEEK) + handshape (e.g. SEVEN). Chinchor (cited in Liddell 1997) later proposed that some numeral incorporation forms do combine two signs, rather than a sign and a handshape, and so the debate regarding how to analyse numeral incorporation has continued. Following the same example, Chinchor's analysis would be: sign (e.g. WEEK) + sign (e.g. SEVEN). Each sign must be reduced, e.g. WEEK gives up its handshape and SEVEN gives up its location and movement. So the sign SEVEN-WEEK is the handshape of SEVEN and the location and movement of WEEK. However, Chinchor accepts that this analysis does not match the signs ONE-O'CLOCK or TWO-O'CLOCK (wrist turning), because there is no sign that means 'o'clock'. Chinchor goes on further to propose a two-way

classification of numeral-incorporated signs (p. 204): the first comprises forms with an independent base sign (2-MINUTE, 2-HOUR) and the second group consisting of forms with no related independent base sign (2-O'CLOCK, 2-MORE). The analysis of numeral incorporation according to this two-way classification is of interest to this research study, as it leads to an understanding of iconicity, which is discussed in detail in Chapter 6.

The analysis of handshape + root, i.e. the third configuration above, was introduced to sign linguistics by Liddell, Ramsey, Powell & Corina (1984). Liddell et al. (1984) proposed, for example, that TWO and HOUR are both bound roots because we are using the handshape from TWO and the location/movement from HOUR (the handshape, or the location/movement, cannot stand alone so they are not free roots - they are bound roots.) The morphological analysis of the root has also been debated in sign linguistics. For example, Liddell (1997) suggests that in the case of numeral incorporation including 'contact at the chin', this place of articulation may be analysed as a morpheme or merely the initial location for the larger incorporated form. Possible constraints on numeral incorporation are that it is unlikely to occur in two-handed symmetrical signs (e.g. TAG 'day' in German Sign Language, Mathur and Rathmann 2010:64-67), and where a particular handshape might cause confusion with other signs. Stokoe (1965, cited in Liddell 1997) notes that in ASL, 'five weeks' cannot be shown by an incorporated form because the '5' handshape is so frequently used). With regards to Japanese Sign Language, research has found that the options for numeral incorporation are dictated by the handshape of the number involved. Ktejik's (2013) recent study of numeral incorporation in JSL provides:

> […] an explanation of the numeral morphemes which are bound to root morphemes. Fourteen different paradigms are presented and, from these paradigms, two rules for numeral incorporation are proposed (Ktejik 2013: 186).

The findings from this research correlate with Ktejik's initial observations and they support the existence of fourteen different paradigms, however this research also finds that there is more variation in ordinal numerals and this is discussed further in section 5.2. The two rules for incorporation in JSL are stated by Ktejik (2013:207) as: "numerals with a single handshape can be incorporated" and "if the numeral contains any internal movement (e.g., bending of the fingers or shaking of the hand) that movement is not displayed in the surface form of the sign".

Cross-linguistic studies have also considered the extent to which the use of numeral incorporation is similar across sign languages. Fischer, Hung & Shih-Kai (2011) carried out research on the use of numeral incorporation in Taiwan Sign Language along with other members of the JSL family. In this research the main comparison remained between ASL and TSL and paid attention to numerals both in measurement terms and with regards to predicates of motion and location. The methodologies of this research involved data elicitation (via

discussion of presented materials) and the use of two consultants. In the data findings, Fischer et al. note that in general ASL numerals with internal movement cannot be incorporated. A further finding that strikes interest is TSL's use of numeral classifiers for non-human entities whose citation forms do not seem to lend themselves to numeral-based modification, e.g. 'bird'. For example, in TSL, 'three birds in a tree' can be articulated as pictured in Figure 2.4, i.e. using a numeral classifier for 'three' making contact with the sign for 'tree'. In some other sign languages, such a classifier would only be used to refer to humans.

Figure 2.4 'Three birds in a tree' in TSL (from Fischer, Hung & Shih-Kai 2011)

Fuentes & Massone (2010) conducted research into numeral systems in Catalan Sign Language (LSC) and Argentine Sign Language (ArgSL). The focus of this study was on numeral-incorporating roots, and the research considered whether the origin of the numerals affects the way in which roots are formed. For example, in LSC most numerals derive from manual counting, while numerals in LSA do not. The study used inventories of numeral-incorporating roots for both sign languages in order to compare the two varieties, and Fuentes & Massone conclude that the lexical numerals may be derived from counting in LSC but, for both languages, the numeral-incorporating roots do not derive from manual counting.

2.2.3. List buoys (enumeration)

List buoys can be defined as signs that are "normally produced by the weak hand and held in a stationary configuration as the strong hand continues producing signs" and that "help guide the discourse by serving as conceptual landmarks" (Liddell et al. 2007:187). Liddell (cited in Vermeerbergen, Leeson & Crasborn 2007:191) undertook a cross-linguistic comparison of buoys using American, Norwegian and Swedish Sign Language. This research suggested that the hand configuration used for enumeration is often the same hand configuration used for the

cardinal numeral. For example, the sign THREE in ASL is composed of the same hand configuration as the sign THREE=LIST, that is, the hand configuration for enumeration and for the cardinal numeral in ASL is identical. This appears also to be the case for NSL however SSL exhibits one exception in that it uses a different hand configuration for enumeration. In SSL, the index, middle and ring fingers are extended for the list buoy but the thumb, index and middle fingers are extended for the cardinal numeral.

Table 5 below compares five different sign languages in terms of the hand configurations used for enumeration, on the one hand, and cardinal numeral, on the other hand, for the sign for '3'. In ASL, NSL and JSL, the hand configuration used for enumeration and for the cardinal numeral is identical. However, the hand configuration for enumeration and cardinal numeral in SSL is different and it can be either identical or different in UgSL depending on the variant of enumeration used, since in UgSL enumeration can either start from the index finger or it can start from the little finger. In the former case, the hand configurations for enumeration and cardinal numeral are the same but in the latter case they are different. It is interesting to note that UgSL does not allow the thumb to be used for enumeration.

Table 5 Comparison of hand configurations in enumeration and cardinal numeral for '3'

	Enumeration	**Cardinal numeral**
ASL	Thumb, index, middle	Thumb, index, middle
NSL	Thumb, index, middle	Thumb, index, middle
SSL	Thumb, index, middle	Index, middle, ring
UgSL	Index, middle, ring Little, ring, middle	Index, middle, ring
JSL	Index, middle, ring	Index, middle, ring

Enumeration in JSL is discussed further in section 5.2 on ordinal numerals and in section 7.2.4 on numeral incorporation.

2.3. Summary

In this chapter, various types of constructions involving numerals have been reviewed. Across signed and spoken languages, we find a difference between cardinal and ordinal numerals, as well as other numeral series such as distributive or restrictive numerals. This thesis is concerned primarily with cardinal and ordinal numerals, which together with other types of numerals and various quantifiers constitute the semantic domain of quantification. This chapter has also shown that some structure and characteristics of numerals seem to be specific to sign languages, such as numeral incorporation and list buoys. An analysis of enumeration in JSL is discussed in chapter 5 and numeral incorporation is explored in further detail in chapter 7 of this thesis, both taking into account some of the theories discussed above. In the remaining

chapters, numerals in JSL will be highlighted from several different angles including shared iconicity and influence from written forms, which is considered in the next chapter.

3. THEORETICAL AND CONCEPTUAL APPROACHES

This chapter aims to give the reader an understanding of the theoretical and conceptual approaches that have informed the study, which is necessary before moving on to the more detail-oriented methodology chapter (Chapter 4). Approaches from typology and sociolinguistics are emphasised here, with their focus on documentation and fieldwork. A typological perspective is appropriate for examining similarities and differences between sign languages, and hypothesising about linguistic universals. This chapter also considers the validity and reliability of approaches associated with sociolinguistics and typology, and some ethical issues such as being an 'insider' or 'outsider' of the target community. Finally, it is noted that comparative (typological, cross-linguistic) and variation-based (sociolinguistic, intra-language) approaches cannot be wholly separated; there are often unclear boundaries between them.

3.1. Spoken language typology and sign language typology

This section explores the aims of linguistic typology, gives a brief background about typological research on numerals, discusses issues of sampling and representativeness in typology, and finally points out some challenges specific to sign language typology, including unclear genetic affiliations and a lack of available published data.

Language typology is 'concerned with mapping the diversity of languages, and discovering patterns that lie across languages' (Palfreyman, Sagara and Zeshan, forthcoming). Typologists compare languages by looking at the extent and nature of variation within different domains. Whaley (1997:7) defines typology as the "classification of languages or components of languages based on shared formal characteristics" and goes on to highlight three important parts of typology: cross-linguistic comparison, classification of languages or aspect of languages, and examination of formal features of language, all of which are important for sign language typology too. Whaley's study makes reference to 118 different languages, which is common for spoken language typological studies. However, this is not the case for typological studies on signed languages, though there have been some such studies on a much smaller scale by Zeshan (2006, 2008), Wilkinson (2009), and Velupilliai (2012). Of the innovative typology studies, most have considered the differences and similarities across sign languages; more recently, however, cross linguistic research has begun to include cross-modal research, i.e. a focus on differences and similarities across signed and spoken languages.

Sign language typology has three aims: (1) the documentation of individual sign

languages; (2) the cross-linguistic comparison of structures, systems and constructions; and (3) the theory of variation across sign languages. These three aims clearly involve different amounts of work, and different types of work. The first entails focusing on an individual sign language; the second entails comparing different sign languages; and the third entails creating a comprehensive typology of sign languages. This latter aim is not yet feasible given that so much research on different sign languages and in different domains has yet to be conducted. Therefore, this thesis comprises an important step towards achieving each of these aims, but while the first aim is fully achieved, the third aim is still distant. In this thesis, I document parameters in the domain of numerals in Japanese Sign Language (Chapter 5), and then examine these parameters cross-linguistically by comparing findings in JSL with other sign languages (Chapters 6 and 7). In this way, the objectives of the current research coincide with all three key aims of sign language typology that are described above.

An effective process for typological research is illustrated in the parameters established in Zeshan & Perniss's (2008) study of possessive constructions in sign languages, such as 'have-' and 'belong-' constructions. In this way, data analysis leads to bottom-up, inductive generalisations, which can then be compared with spoken language data. This cyclical process is illustrated in Figure 3.1 below.

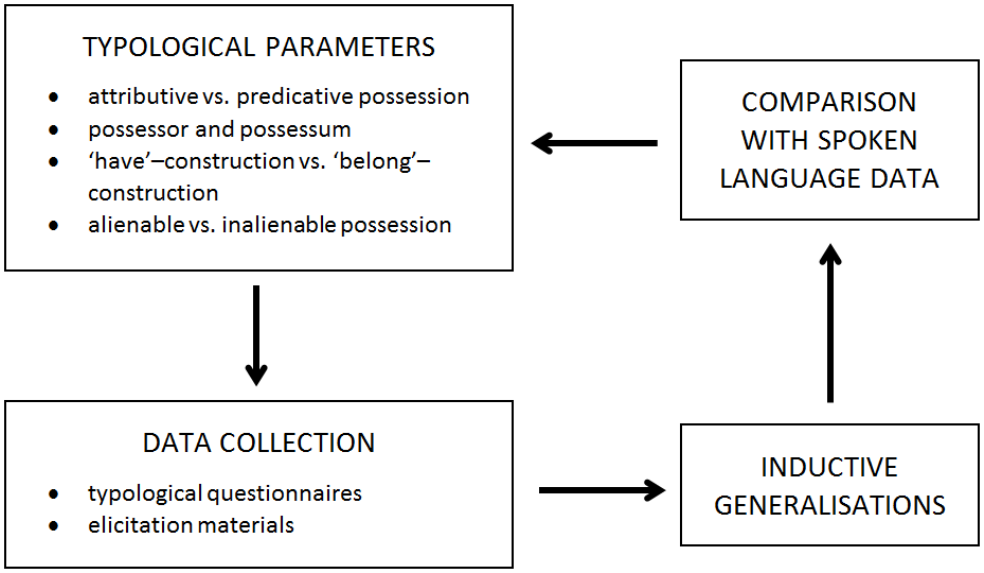


Figure 3.1 The cyclical nature of typological research on sign language (Zeshan & Perniss 2008:14)

Large-scale research on spoken language typology is a relatively recent undertaking, having begun in earnest only about 50 years ago (see Greenberg 1963), though smaller comparative studies existed as far back as 1772 (Velupillai 2012:1). The first typological studies were concerned with word order, so the typology of numerals in particular is an even more recent area of research. The *World Atlas of Language Structures* maps number-related linguistic

phenomena in both nominal and verbal categories. For example, it reports that suffixation is the most common way of indicating plurality across the globe, and that the vast majority of the world's languages use a base-10, i.e. decimal, number system from which larger numbers can be constructed. Gil (2001) identifies two approaches to a typology of quantification – internal typologies, focusing on the morpho-syntactic structure and semantic properties of quantifiers; and external typologies, focusing on how quantifiers relate to their semantic and syntactic context. The focus of this thesis is necessarily constrained by the data that are available for other sign languages (see Chapter 3). Although this thesis mostly focuses on the morphological structures of numerals as expressed in JSL and other sign languages, quantifiers and 'external' typologies are occasionally discussed.

In spoken language typology research, hypotheses and findings often rely on broad samples of languages, because if a sample is too small, any generalisations will be of little value empirically (Palfreyman, Sagara and Zeshan, forthcoming). In doing so, typologists depend upon reference grammars and other secondary sources, as they normally do not have personal experience of all the sampled languages in a given study (ibid). The challenge for sign language typologists is that there is currently no comprehensive reference grammar for any sign language, and a very limited number of secondary data sources compared to what exists for spoken languages, which means they must restrict the scale of their research or find ways to compensate for the fact that they cannot exploit large samples.

Knowledge of genetic affiliations between languages is another key ingredient in successful typological research because researchers try to work on the basis of data sets that are not skewed towards particular language families but include equal representation across genetic groups of languages. Establishing such affiliations can be an end in itself. To date, however, diachronic and genetic studies of sign languages have been very few, in part because of the dearth of historical data with sufficient time-depth (until recently, due to a lack of appropriate technology among other reasons, there were very few attempts to document sign languages visually in a systematic way). It is often necessary for typologists to create a genetically-balanced sample, but without robust research on language families, gathering such a sample is not possible. Indeed, even though several sign language 'families' are said to exist, including the British Sign Language family and the Japanese Sign Language family (see section 1.1), a precise linguistic definition of 'language family' has still not been established for sign languages (Palfreyman, Sagara & Zeshan, forthcoming). As Zeshan (2003:677) notes: "we know too little about how sign languages are historically related, that is, to which language families the known sign languages belong, to even address the issue of a genetically balanced sample". The issue of sampling, and in particular geographically and genetically balanced samples, is one of the challenges to sign language typology (Palfreyman, Sagara and Zeshan, forthcoming). To

make empirically substantiated generalisations, spoken language typologists often use samples including over 100 different languages (Whaley 2007), as suggested above, but the prospect of large-scale sampling for sign language typologists is problematic. One reason is that compared to spoken languages, sign languages are severely under documented, which means the amount of data needed for large scale typological research comparisons is simply not readily available.

In sign language typology, the first large-scale surveys were undertaken by Zeshan (2006), and Zeshan & Perniss (2008). Zeshan (2006) covers the interrogative and negative constructions of 37 sign languages across the world, using questionnaire data collection methods. Zeshan and Perniss (2008) look at the possessive and existential constructions of sign languages, conducting a typological survey across 28 sign languages. This study enhanced the previous data collection methods by using elicitation materials such as games that were particularly suitable for the articulation of possessive and existential signs. A similar approach towards elicitation materials is used in this study to that of the large-scale surveys undertaken by Zeshan (2006). Methodology is explored and outlined in detail in Chapter 4. The study involved deaf people conducting the games in pairs and was particularly effective, as it encouraged the natural, more spontaneous production of possessive and existential signs. Although these studies are relatively extensive, larger-scale projects of this kind focussing on sign languages are still rare. These studies present cross-linguistic comparisons of signed languages across the world, studying different semantic domains, but still with little focus on numeral systems. Interestingly, Zeshan (2006) and Zeshan & Perniss (2008) found a level of variability across the sign languages studied, just as variability exists across the specific grammatical categories used in spoken languages. Furthermore, research on possession and existence, such as Zeshan & Perniss, suggests that some signed languages may operate with systems more similar to certain spoken languages than to other signed languages, i.e. that just because sign languages all use the visual-gestural modality, it does not follow that their grammatical systems will be consistently similar to each other and wholly different to those of spoken languages.

3.2. Language documentation and field linguistics

3.2.1. Documentation

A cross-linguistic comparison of language would ideally take place, of course, when the selected languages have been documented and are readily available for comparative analysis. In the case of sign languages, however, documentation processes are relatively new and many sign languages still have no dictionary or other documentary evidence. As the previous section notes, a typological study of sign languages must therefore begin with a process of

documentation. The importance of language documentation in general has become increasingly recognised, warranting now its own discipline as 'documentary linguistics' (Hill, 2006). Documentation of languages is defined clearly by Himmelmann (2006) as "a lasting, multipurpose record of a language" but, as Himmelmann (2006:1) suggests, the recording of languages for preservation is not the only purpose of documentary linguistics:

> Language documentations strengthen the empirical foundations of those branches of linguistics and related disciplines which heavily draw on data of little-known speech communities (e.g. linguistic typology, cognitive anthropology, etc.) in that they significantly improve accountability (verifiability) and economizing research resources.

In the case of sign languages, this multipurpose aspect of documentation is most significant. As noted in sections 1.3 and 1.4, most sign languages, including JSL, have been afforded low status since the oralist philosophy attempted to deny the use of sign language for deaf people world-wide and many sign languages are still to be recognised as legitimate languages and to be documented. In order to examine the number systems of JSL, and compare them with those operating in other sign languages, it was first necessary to collect some primary data. As Himmelmann continues to note, any contribution to the documentation of a language must be narrowed to the focus of the specific research project and this study therefore concentrated on documenting the use of numerals, which is described in detail in section 4.3.

3.2.2. Field linguistics

In order to provide evidence of the numeral systems in operation in JSL and the other sign languages relevant to this study, it was therefore necessary to conduct field work. Consistent with processes of language documentation, it is important that fieldwork of this nature is carried out systematically, for example, according to a series of stages such as the five stages of documentation proposed by Austin (2006), which would be expected in the case of a comprehensive language documentation project:

1. recording – of media (audio, video, image) and text;
2. capture – moving analogue materials to the digital domain;
3. analysis – transcription, translation, annotation, and notation of metadata;
4. archiving – creating archival objects, and assigning access and usage rights;
5. mobilization – publication, and distribution of the materials in various forms.

(Austin, 2006: 89)

A smaller scale study may narrow elements of the process down to meet the needs of the particular task at hand. For this research, the documentation process relied upon elicitation games, which prompted informants to use a variety of numeral forms. The topic area of

numerals was selected because it has a limited enough scope for a project of this size, and yet was of interest typologically and morphologically. The first phase of the documentation involved forming a rapport with potential informants, and devising and implementing a relaxed, straightforward elicitation activity that would generate data that was as close to 'natural' as possible whilst targeting a specific domain. The second phase consisted of an interview, which was designed to elicit background information about the participants.

The intention of this research study was to collect primary data in the form of 'observable linguistic behavior' and 'metalinguistic knowledge' (Himmelmann, 2006:7-8). The observed use of numbers in the sign languages being examined serves to provide evidence of how numbers occur in actual language use as far as is possible given the limited scope of this research. The documenting of metalinguistic knowledge provided data related to what language users appear to understand about the numeral system. The theoretical purpose of collating both the observed use of numbers and metalinguistic data from selected participants is discussed further in section 3.2.3.

3.2.3. Research validity and reliability

An issue that affects all typological projects is the validity and reliability of the research. It is important that the research methodology enables a process of analysis that validates the data as a well-founded answer to the central research questions. With regards to reliability, it is essential that the study considers the effects of the research activities on the results. A crucial issue for the field worker, then, involves determining the type of event by which the data will be collected. As a typological study of language use involves comparing linguistic phenomena across languages, it is also significant that the data used is representative of various genres or types within the given languages. As Lüpke (2009:61) rightly notes, "researchers can use different types of events to complement each other for analytical purposes, as is the custom in the social sciences, where triangulation is a commonly practiced research method". As we shall see in the following chapter, this research employs the 'three-way distinction of communicative events' that Lüpke (ibid:60) illustrates clearly:

- Observed communicative events (OCEs) where the only influence of the researcher is (ideally) their presence;

- Elicitations (Es) being communicative events heavily influenced linguistically by and only created or the sake of the researcher, such as word lists, paradigms or acceptability judgments;

- Staged communicative events (SCEs) occupy a middle ground between OCEs and Es: they are prompted or 'staged' for linguistics purposes, but often use non-linguistic prompts, such as pictures, video clips that consultants are asked to sort or describe, or games that they are invited to play or describe

The relevance of the three event types for this research is that they provide a level of representativeness and enable a process of triangulation. In particular, for the fieldwork in Japan it was considered undesirable to use only constrained linguistic elicitation, such as asking for lists of signs, because it is know that in sign language linguistics, this can result in data unduly influenced by the context e.g. with respect to spoken/written language influence (McKee, McKee & Major 2011). Therefore a range of methodologies was used to reflect the three categories above: a personal interview (section 4.1.2, v) comes closest to the OCE category; although the interviewer was the researcher, the setting was informal and the aim of the interview was not related to the elicitation of numerals. Elicitations (E) were used in a limited way (see section 4.1.2, iv), only with respect to one listing activity. The majority of data were collected using SCEs (see section 4.1.2, i, ii, and iii) via a variety of game activities with non-linguistic prompts. Where more than one way of documenting the target linguistic structures has resulted in the same kinds of data, this has increased the validity and representativeness of the results. The data resulting from the three event types is presented and discussed in the next chapter.

3.3. Comparative approach to the data

As described in section 3.1, one of the questions that typologists face is how many languages to include when conducting cross-linguistic comparisons (Whaley 1997:36). For sign language typology, we have also seen that an additional problem is that most sign languages are severely under-documented, which greatly restricts the choice of languages that can be included (Palfreyman, Sagara and Zeshan, forthcoming). Additionally, nearly all of the well-documented sign languages are used in developed countries (ibid). In order to examine sufficient quantities of sign language data, it is usually necessary, therefore, to generate new data, and this is the approach used by Zeshan (2006) and Zeshan and Perniss (2008). The use of standard elicitation tools may also enhance the comparability of data generated from different sign languages.

Spoken language typologists have suggested different ways of ensuring that the languages included are representative of spoken languages generally: these include sampling in a way that takes into account language families (genetic balance) and geographical areas (areal balance). The interest in the degree of similarities in this study derives from the nature of

current typological research that has shown similarities across sign languages but in different domains. One of the aims of this study is to see whether similarities found within these language groupings for other domains extend to the numeral systems of these groups, especially for group 4 sign languages, which have never been compared with JSL before. For the typological comparison in Chapter 5, sign languages from four distinct groups are included. It is impossible to respond to these challenges fully, but the researcher has endeavoured to take them into account by grouping sign languages in a way that acknowledges areas and genetic factors, to some extent. In addition to JSL data collected by the researcher for this research study, existing data was used, which had been collected for other research projects, mostly from a project run by the Institute for Sign Languages and Deaf Studies (iSLanDS) at the University of Central Lancashire (UCLan), named the Sign Language Typology Project. In addition, individual native user intuitions (NUI) are used. Where native user intuitions are the only source of data used for a specific sign language, these were checked, where possible, by comparing them with the figures presented in the dictionary compiled for that sign language. The rationale for the sampling and hypotheses for each group are explained further in the sections below.

3.3.1. Grouping of sign languages for comparison with JSL

The following four groups constitute the data groups for this study:

Group 1 South Korean Sign Language (SKSL), Taiwan Sign Language (TSL)

The sign languages in Group 1 are known to be historically related to JSL (see Chapter 1), and are included in order to see how similar to JSL they are for the parameters in question. Because of the historical contact between these languages, at the beginning of this study it was hypothesised that number structures would be similar in JSL, TSL and SKSL. The findings for the comparison between JSL, SKSL and TSL are presented in chapters 6, 7 and 8.

As highlighted in Sasaki (2007: 8-11), there has been historical contact between TSL and JSL, which might explain why TSL influences have been observed in the larger numbers of JSL. Unfortunately, there is not much extant research on Korean Sign Language and its origins. Its inclusion in the JSL family of languages is supported by Fischer & Gong (2011).

Group 2 Chinese Sign Language (CSL)

There is no known concerted language contact between CSL and JSL, and therefore CSL is separated from Group 1. However, both CLS and JSL exist in a situation of language contact with written Kanji (though Japanese people have two other orthographic systems as well, and

rely on Kanji less than Chinese people). This is different from the situation in South Korea where Kanji characters are not in frequent use in daily life. In addition, there is no known historical relationship between China and Japan in terms of the education of deaf children and it is likely that there has been no exchange of teaching personnel between the two. During the course of this research, it has been of interest to untangle how the factors of historical relatedness on the one hand and a shared writing system (Kanji) on the other hand affect the form of numerals across the sign languages in Group 1 and Group 2.

For a wider comparison of JSL with sign languages that have neither a genetic affiliation nor specific language contact factors, two other groups of sign languages were included: urban sign languages and village sign languages (see Section 2.2.1 where these terms are introduced). Comparison with a wide range of unrelated sign languages has the potential to uncover tendencies that may be due to the visual modality itself rather than language-specific factors.

Group 3 Urban sign languages (see Table 10 in section 4.2)

This group includes over 25 urban sign languages, which have developed as indigenous national sign languages. There have been two levels of cross-linguistic comparison during the course of this research. Data from a larger number of urban sign languages were included in order to compare the prevalence of numeral incorporation across sign languages (see Section 7.2.7 and specifically Table 14 in that section). This is because relevant data were available for all of these sign languages. For other sub-domains of numerals included in this thesis, comparisons were drawn with a smaller number of urban sign language, depending on whether or not data were available from individual languages to make relevant points of cross-linguistic comparison. Urban sign languages from this smaller sub-group are Argentine Sign Language, British Sign Language, Greek Sign Language, Indo-Pakistani Sign Language, Indonesian Sign Language, Czech Sign Language, Turkish Sign Language, and Ugandan Sign Language.

Group 4 Alipur Sign Language (APSL), Chican Sign Language (ChicanSL), Mardin Sign Language (MarSL).

Group 4 comprises sign languages that have been referred to as ‘village sign languages’ or ‘rural sign languages’. They are mostly used in rural communities and tend to show typologically rare features, some of which call into question previous assumptions about sign languages (Zeshan & de Vos 2012; Zeshan et al. 2013). They are included here because they are known to exhibit typologically unusual features that challenge some of the assumptions that have been made about sign languages (see for example Zeshan et al. 2013). Due to the isolated situations in which village sign languages typically arise (cf. de Vos and Zeshan 2012), and

previous evidence as to the unusual nature of some of their numeral structures (Zeshan et al. 2013), comparison with these sign languages was of particular interest to this thesis. Sources of data for the four data sets are summarised in Table 6.

Table 6 Data sources per group[3]

Group	Selected sign language	Data sources
Group 1	SKSL and TSL	iSLanDS semantic typology project; dictionary; personal communication
Group 2	CSL	iSLanDS semantic typology project; personal communication
Group 3	Urban sign languages (see section 4.2)	iSLanDS semantic typology project ; personal communication
Group 4	APSL, ChicanSL, MarSL	iSLanDS semantic typology project; personal communication

3.3.2. Data analysis

The process of data analysis for this study was conducted in a way that would enable the JSL numeral system to be characterised according to the focus of the research questions (see section 1.7). Initially, a two-stage process was applied:

The first stage enabled the phonological and morphological aspects of JSL numerals to be highlighted and second stage enabled the typological comparisons with other sign languages to be explored. Further data analysis was conducted to examine the level of sociolinguistic variation in JSL and across the data-sets and is presented in Chapter 8. During the first stage, the JSL data was analysed according to the following areas of research interest, established with the intention of identifying how numerals are expressed:

- Numeral series: this relates to the types of numerals available in a language, and includes cardinal numerals as well as ordinal numerals (see Chapter 5).
- Numeral incorporation: this refers to the use of numerals as part of complex signs expressing a numeral together with a countable unit such as time or monetary units, as well as the use of the same process to construct complex cardinal numerals (see Chapter 5 and Chapter 7). Details of the process of collecting and analysing JSL data is explained in section 4.1.

The second stage, which paid particular attention to a typological analysis, involved analysing target structures across the language groups. Due to time restrictions, typological comparisons

[3] The table lists sources of data compiled specifically for this project. Where references to published works have been used for sign languages, the references are cited in the thesis and are not included in this table.

were carried out on the use of cardinal numerals and numeral incorporation only. It is crucial for typologists to work with real examples from a database, rather than working only with reported findings, and always to bear in mind that re-interpretation and re-evaluation may be necessary in light of the cross-linguistic patterns that start to emerge. For details on the analysis process regarding typological comparisons, see section 4.2.

3.4. Variation within and across sign languages

Sign language variation concerns the comparison of elements both 'within' a language and 'across' languages. Sociolinguistic variation is usually concerned with variation within a language, while typology is usually concerned with variation across languages with the aim of categorising languages based on shared properties (Kortman 2004). As summarised by Tagliamonte (2006), we know linguistics is the study of individual languages with the aim to understand why languages are the way they are, by exploring grammar and other component parts or mechanisms that make up a language. Whilst theories of language are being developed often to determine the structure of language as a fixed set of rules or principles, it is evident that languages change constantly. Structures cannot be fixed; they must be fluid, changing over time. It is for this reason that variation is selected as an element of this study, to discover whether or not the sign languages examined contain different variants for expressing numerals. This change, according to Johnston & Schembri (2010) is the result of both internal factors (linguistic process of lexicalisation and grammaticalisation) and external factors (social variables).

Sociolinguistics explores the concept that language exists in a context, dependent on speaker, place, purpose and other social influences. Variationist sociolinguistics is therefore:

> the branch of linguistics which studies the foremost characteristics of language in balance with each other – linguistic structure and social structure; grammatical meaning and social meaning – those properties of language which require reference to both external (social) and internal (systemic) factors in their explanation (Tagliamonte 2006:5).

Both the internal linguistics and sociolinguistic approaches have restrictions if focused purely on one or the other. However, as researchers will always be likely to be influenced by their own preferences, research questions, data and findings may naturally tend to focus on one domain over the other.

With regards to the signs used to express numerals *across different sign languages*, a study of lexical similarities between Mexican and American Sign Language was conducted by Faurot, Dellinger, Eatough & Parkhurst (1999) and this type of lexical comparative research provides phonological descriptions of numeration similarities. These similarities in unrelated

sign languages are often due to iconicity, and this also applies to sign languages, as with the use of “zero”-handshapes/eyes and iconicity borrowed from writing which is discussed in chapter 6. The writing system of the national spoken language may have an effect on the numeral system of a signed language. For example, JSL is influenced by the Kanji writing system but BSL is not, since English does not use the Kanji writing system. Most signers across the world have two hands each containing five digits with which to create numerical systems, which may also explain similarities in sign languages that have had no contact. For example, counting one to five using the digits of one hand seems to be universal, and so this could explain why so many signed languages use the fingers to represent the numbers 1 to 5.

Woll (1984) and Guerra Currie, Meier & Walters (2002) suggest that there is a relatively high degree of judged similarity between signed language lexicons. Guerra Currie et al. analysed lexical data from four different sign languages: Mexican Sign Language (LSM), Spanish Sign Language (LSE), French Sign Language (LSF), and Japanese Sign Language or Nihon Shuwa (NS). After comparing the lexicons of these four languages, Guerra Currie et al. suggest that signed languages exhibit higher degrees of lexical similarity to each other than spoken languages do, and this is likely to be the result of the relatively high degree of iconicity present in sign languages. In another cross-linguistic study, Sasaki (2007) compared JSL and TSL (Taiwan Sign Language). For this study three sets of lexical items were used. These items were word lists devised by Woodward (1976, 1978 and 1991 cited in Sasaki 2007), McKee & Kennedy (2000 cited in Sasaki 2007) and a list by Smith & Ting (1970 cited in Lee, Tsay & Myers 2001). In the comparisons, Sasaki classified the signs of JSL and TSL into three categories: phonologically identical signs, phonologically distinct signs and phonologically similarly-articulated signs, using also the parameters of handshape, movement, locations, etc. to further distinguish between the signs. As a result of the three comparisons Sasaki suggested “that roughly 40 percent of lexical items are phonologically identical, that roughly 20 percent of them are phonologically similarly-articulated, and that roughly 40 percent of them are phonologically distinct” (2007:67). Interestingly, this study concluded “that the rate of shared vocabulary between JSL and TSL is lower than that among historically related sign languages, such as BSL, Auslan and NZSL, and is higher than that among historically unrelated sign languages such as JSL and Mexican Sign Language” (ibid: 68).

Sasaki’s research could indicate that signed languages share more in common in terms of lexical and phonological similarity than spoken languages. However, this indication is based primarily on urban signed languages and it does not take into account all of the world’s signed languages, for example village signed languages. As a result, further research and understanding of the world’s signed languages is required before any generalisations can be made in regards to the cross-linguistic similarities of signed languages, either lexically or

phonologically.

It is of interest to also note here that Fischer (1996) found that the numeral system of ASL derives from that of Old French Sign Language. She argues that ASL numbers are a combination of Old French signs and common American gestures, i.e. they are evidence of creolisation. Quinto-Pozos (2002) in his study of sign language contact and interference between ASL and LSM, explains that language contact between signed languages can produce several outcomes, including lexical influence, foreigner talk, interference and the creation of pidgins or mixed systems. Language contact between LSM and ASL also has a historical dimension. According to Quinto-Pozos, both languages have evolved from French Sign Language (LSF). Since ASL and LSM are sister languages, it can be problematic to identify the difference between signs originating from LSF and signs borrowed directly from ASL into LSM (and vice-versa).

3.5. Summary

This chapter has considered four theoretical and conceptual approaches: sign language typology, language documentation and field linguistics, comparative approaches to sign language research and variation as a notion that can be considered within a sign language and across sign languages. There are of course overlaps between these theoretical domains. For example, with regards to linguistic variation, this chapter has considered two sub-types of linguistic variation: 'across languages' and 'within languages'. The former relates to linguistic typology, that is, the comparison of signed languages based on shared linguistic properties. The latter relates to linguistic and sociolinguistic variation, which is usually language-specific. Moreover, this chapter has also considered the typical view of sign languages, that they show both a comparatively high degree of intra-linguistic variation, i.e. within one and the same language, and a degree of overlap across sign languages due to shared iconicity and influence from writing systems. The following chapter, Chapter 4, outlines the methods used to collect the data for this study and it details how the theories explored in this chapter are applied.

4. METHOD

This chapter covers how the study was conducted, including participant recruitment, research activities, detailed information regarding data collection and data coding, and ethical considerations. Introspection is also considered in light of the researcher's position in the Japanese Deaf community. The methodology for this research is typological and comparative in nature, with a central focus on JSL numerals. More emphasis has been given to the number structures of JSL due to the researcher's greater interest in JSL as her first sign language, and her 'insider' status within the Japanese Deaf community (discussed further section 4.4.1). This facilitated two fieldwork trips during which several signers were filmed.

4.1. JSL data

This section explains how data was collected for JSL, including the selection of participants (4.1.1). This research has made use of multiple data sources, including the researcher's own elicited data using several activities (see section 4.1.2); data from introspection (see section 4.1.3); data from a larger sign language typology study (see section 4.2); and personal communications with other academics (where necessary). These data sources are summarised in Table 7.

Table 7 Sources of data collection for JSL

research question	own data	introspection	Sign Language Typology data	personal communications with academics	cross-reference
structural aspects of JSL numerals	✓	✓			Chapter 5
typological comparison with other sign languages	✓		✓	✓	Chapters 6 and 7
sociolinguistic variation in JSL	✓	✓			Chapter 8

4.1.1. Participants

According to Sankoff (1973; 1974 - cited in Tagliamonte 2006), three different decisions need to be considered about data collection: a) choosing what data to collect; b) stratifying the sample; and c) deciding how much data to collect from how many speakers, all of which form the central discussion in the following sections. These questions are important ones to be

considered, along with boundaries in terms of region or social constraints.

For the purpose of this thesis, choosing a sample of JSL participants was an important consideration, and several approaches were considered. Variation analysis sampling strategies include random sampling (where all members of the population have an equal chance of being selected) and stratified random sampling (altering the random sample according to the aspect under investigation, e.g. age) (Tagliamonte 2006). Other strategies are the ethnographic approach, where the researcher engages in events within the target community in order to perform observations (used by Labov 1972 to study phonetic variation in spoken language on Martha's Vineyard); and the social networks or 'friend of a friend' approach, where the researcher is introduced into an existing network of people by a representative of that group and can then observe spontaneous communication between its members (ibid). For data collection in this research the main approach has been similar to this social network, or 'friend of a friend' approach, by way of contact via a deaf school and a teacher of the deaf who was able to introduce the researcher into the local deaf community/deaf club. The research could not use large scale random sampling because of the minority language being studied, a language native only to Japanese deaf people: a community which makes up a very small proportion of the larger population.

With regards to the geographical boundaries selected, Yonaiyama (2003) notes that the deaf community in Japan is familiar with lexical variation between two regions: Kanto (in the east, including Tokyo) and Kansai (in the west, including Kyoto and Osaka). Yonaiyama (2003:80) attributes this to the sign language varieties that were used in the first schools in Japan for deaf children, which were established in Kyoto (1878), Tokyo (1880) and Osaka (1900). Deaf signers in Japan regularly comment on these differences, for instance, on the fact that the signs for 'name' and 'school' are different in each dialect. As the Kanto and Kansai dialects are well-known in Japan for exhibiting major lexical differences, and there was preliminary evidence from the researcher's own experience with JSL varieties to suggest that these differences included numeral signs too, Kanto and Kansai were chosen for the sampling in this research as constituting two major dialectal variants within Japan. Moreover, JSL signers from these two regions could easily be accessed as, due to the history of deaf education in these areas, and the deaf schools currently there, the researcher was able to achieve relatively straightforward access to the local deaf community. These schools provided a way to contact deaf teachers, and the space to accommodate some research activities. Thus capturing variation in these regions (north and south) allowed for effective comparative data for this thesis.

In order to elicit data appropriate to demonstrate the JSL numeral systems, the research required skilled users of the language. While remaining aware of the different

educational backgrounds and influences of the language changes currently on-going in JSL, various age groups were sampled to try to capture these differences. As demonstrated by Poplack and Tagliamonte's African Nova Scotian English project (in Tagliamonte 2006) elderly informants are less likely to participate in on-going linguistic changes initiated by the younger generation (2006:25), so the inclusion of older signers may help reveal diachronic changes currently in progress. The same can be applied to the different generations using JSL. How much data is to be collected is an important decision too. Feagin (cited in Tagliamonte 2006) suggests that 'a small amount of data is better than an unfinished grandiose project', and the size of data has to be balanced with the available time, funds and resources for data handling, factors which impacted this research, with the researcher being based in the UK and the participants in Japan.

As mentioned above, it was possible to contact participants through networks of deaf JSL teachers, who have strong links to local deaf community members in both the Kansai and Kanto regions. Of the six prefectures in the Kansai region, participants were selected from the Osaka, Kyoto, Shiga and Nara prefectures. Of the seven prefectures in the Kanto region, participants were selected from the Tokyo, Kanagawa, Saitama and Ibaraki prefectures. In Kansai, there are six well-established locations where deaf people are known to regularly congregate: a university, two deaf schools and three community centres. In Kanto, the researcher received permission to attend a JSL teachers' workshop, where she asked those present if they would like to take part in the study. Those who said yes were invited to be filmed in another room set up for the purpose. The researcher also sought participants at people's private homes, universities and deaf schools in Kanto. The benefit of doing this is twofold. Firstly, it is much more convenient for the participant if the researcher comes to them. Secondly, it allows the research to take place in an environment that the participant is familiar with and in which he feels comfortable.

Across both fieldwork trips, data was collected from 41 participants, five of whom contributed both times, resulting in 46 data clips. However, data from four of the participants was excluded from the sample and thus data from only 37 participants was analysed. This is because some of the participants had spent time living in several parts of Japan, and therefore their signing was not suitable for inclusion in research on regional variation of numerals, as it would be difficult to establish, with confidence, a link between variant and region. Additionally, the sign language of some of the participants is strongly influenced by the grammar of spoken Japanese. Given that the aim of this study is to research numerals in Japanese Sign Language, clips from these participants have not been included in the sample. However, the raw data has been retained, which means that it is available for other lines of research in future. Of the 37 participants whose data remain in the sample, 22 participants' data were collected on the first

field trip (December 2011 to January 2012), and data were obtained from a further 15 participants on the second field trip (November 2012 to January 2013). This is illustrated in Table 8 below, which gives the number of participant data sets (37 as mentioned above). The researcher asked five people (three from Kanto and two from Kansai) to contribute to the second fieldwork as well due to the skill level of their JSL. The samples are relatively balanced for region, age and gender, as shown in Table 8 below. The selection of 37 participants allows this research to achieve reasonable parity with other studies of number structures in sign languages, such as Fischer, Hung & Liu (2011) and Fuentes & Tolchinsky Landsmann (2004).

Table 8 Participants in the two fieldwork trips

age	**19-45**		**46+**		**Total**
	M	**F**	**M**	**F**	
Kanto	6	3	6	3	18
Kansai	4	5	6	4	19
Total	10	8	12	7	37 people

The researcher focused on the two geographical areas for the reasons highlighted in section 1.6 and this is the first time the numeral systems of these two regions in comparison have been studied. For the variation part of the study, participants are divided into two age groups so that age variation can be studied, for example any differences in how they use technology-related signs. The age categories have been chosen to account for the fact that when older signers meet younger signers in Japan, there are often some differences in the signs that they use. Specifically, in the 1990s several new ideas emerged in the Japanese deaf community concerning language and identity (Nakamura 2006). As a result, there are now two ways of signing, and one – advocated by the organisation D-Pro (see chapter 1, section 1.2) – is quite different from the other, which is associated with the Japanese Federation of the Deaf (ibid: 179). Given the fact that signers of various age groups do not have many opportunities to interact (outside of deaf families), and hence there is often little inter-generational mixing, it is expected that the sign language of those who are 46 or older would remain largely unaffected by these developments, while it is more likely that those who are 45 or younger will have been exposed to these new ideas. The classification of participants therefore enables any differences in the semantic domain of number to be identified. This stage of the research, then, resulted in the data collection activities shown in Table 9.

Table 9 Data collection activities

Activity	Participants	Signed data	Transcribed data
Matching	37	3hrs:30mins	54mins
Mathematics	22	2hrs	0
Bargaining	37	4hrs	63mins
Calendar	20	2hrs	30mins
PowerPoint slides	37	3hrs 10 minutes	70mins
Interview	37	4hrs	74mins
TOTAL	37 people	18 hours and 40 minutes	291 minutes

4.1.2. Elicitation activities and spontaneous data

The first major source of data for this study was elicitation activities, which were guided by the researcher and carried out by participants. These games are described below in (i)-(iii). In addition, participants were asked to translate written numbers into JSL from PowerPoint slides (iv). They also underwent a short interview (v) to generate data of a slightly different nature. It is recognised here that while none of these methods involves gathering truly unplanned, spontaneous data (due to the remit of collecting utterances containing numerals), the first and third games as well as the interviews do allow participants to be quite spontaneous in their language production. The bargaining game is especially suitable for facilitating spontaneity at the same time as encouraging a range of numeral-based signs.

(i) Matching game

Participants in the both the first and second fieldwork played the matching game, as this was the easiest of the three elicitation activities; this game did not involve much conversation, only uttering numbers individually. The game lasted approximately 10 minutes. One participant had 32 cards with random numbers on both sides, while the other also had 32 cards, but with numbers only on one side. The second participant then had to ask the first what the numbers on the other side of his or her cards were (e.g. 'what is the number on the other side of your "8" card?') (See Figure 4.1 below - where two participants are playing the game. The four squares on the right show the fronts and backs of two of player A's cards, while the four squares on the left show the fronts and backs of two of player B's cards. Player B would need to ask player A, 'What number is on the back of your '8' card?'). The aim of this game was to collect numeral signs while avoiding the listing of numbers by rote, which can produce stilted forms; eliciting numerals in non-sequential orders seems to permit more natural and accurate data (e.g. McKee, McKee and Major 2011:78). Participants who had already played this game in the first fieldwork were not asked to repeat it during the second fieldwork.

Figure 4.1 Example from the matching game

In the actual data, most of the utterances produced for this game consisted of numerals in isolation, and it was rare for players to articulate more than one or two signs at a time. A typical conversation might include, 'B: TWO? A: TEN. B: EIGHT? A: FIVE.'

(ii) Bargaining game

The second game was the bargaining game, in which participants bargained over the cost of an object that was being sold. This game was quite useful in eliciting natural communication, and was used during both the first and second fieldwork trips. The first person selling the item would try to give a value and the buyer to negotiate the fee downward. The aim of this was to elicit numerals related to currency, observe general discourse around this topic and target larger numbers than those used in the other games. Different objects were used to ensure variety, for example smaller objects like apples and t-shirts, and larger objects such as cars and houses which allowed for different sums of money to be observed. In some instances the actual object could be placed in front of participants so the bargaining could be played out literally; in other instances picture cards were used, e.g. for the larger objects.

(8) Participant 1 APPLE MONEY HOW-MUCH _____q *(game3.ba 00:10-00:25)*
How much is this apple?

Participant 2 1000 YEN
1000 Yen

Participant 1 EXPENSIVE CHEAP CAN ___q
That's expensive! Can you make it a bit cheaper?

Participant 2 800 YEN, THINK WHAT ____q
How about 800 yen?

Figure 4.2 Examples of materials used for bargaining game

(iii) Calendar game

The calendar game, which aimed to elicit signs for time units, including numeral incorporated forms, comprised three tasks. First, participants were put into pairs, and each person in the pair was given a piece of paper showing a filled-in timetable for one week. The timetable was different for each participant (see appendix 5). The aim of the task was for the participants to plan a date and time to see a film together, given their respective 'schedules'. Next, the paper timetables were put aside and participants were asked to discuss their real-life day-to-day schedules, for example to find out when they might meet for tea. This discussion generated more spontaneous data than the paper-based activity. However, both of these activities focused on smaller time units such as weeks, days and hours, so for the final task in this game, a calendar showing all the months of 2013 was projected onto a screen for participants to view while they asked each other questions about their plans for the year, e.g. whether they were going to attend various deaf community events. This was more successful with the younger than older signers, because the latter tended to have fewer plans for the year. The calendar game was used only in the second fieldwork, as a replacement for the maths game which had been problematic during the first fieldwork as explained in section 4.1.3. (The calendar game was adapted from an elicitation activity used by the DGS Corpus Project Team, and presented at the Hamburg University Corpus Sign Linguistics Summer School in 2012.)

(9a) (*Schedule game-ba 00:02- 00:14*)

Participant 1 NIGHT SEVEN FROM EIGHT SIGN LANGUAGE CLUB HAVE YOU COME CAN YOU?

'Can you come to the sign language club from 7 to 8pm?

Participant 2 PAH PAH PAH INDEX ALWAYS EVERY-WEEK GO EXERCISE SAME TIME SEVEN ONE#HOUR

'No, I can't. Every week I exercise at that time, for one hour.'

(9b) ___q

Participant 1 NEXT WEEK FREE

'Are you free next week?'

_____ rh-q

Participant 2 NEXT WEEK MORNING NINE TO WORK MONDAY FROM FRIDAY NINE FROM FIVE ALL

'Next week I am working from nine to five, all week.'

(iv) PowerPoint slides

After the above games, participants in both the first and second fieldwork were asked to watch PowerPoint slides (e.g. shown in Figure 4.3) that showed cardinal numerals (including multiples, fractions and mixed numbers above 10, i.e. numbers with two or more digits not divisible by 10, such as '37') ordinal numerals, nouns associated with numbers (e.g. people). These examples were taken from the iSLanDS Sign Language Typology project questionnaire (see section 4.2 and Appendix 6). Participants were asked to sign the numbers and/or words they saw on the screen. The underlying purpose of this activity was to elicit numbers that might not have come up in the above games. However, the researcher recognises that this is not an ideal way to collect this kind of data, as the slides could be seen as 'leading' participants toward certain pre-determined types of constructions, and the use of words from spoken language may influence the type or order of utterances produced. Therefore, the data from this activity was not analysed for the present project, and it was merely used to answer any queries that arose when analysing the other data, especially for the comparative part of the study.

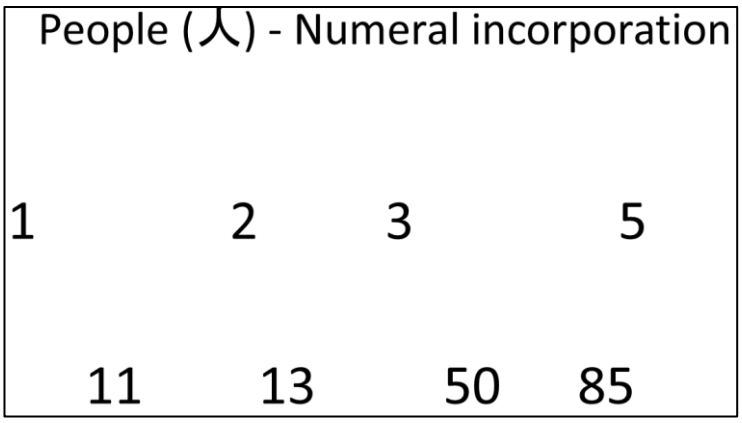


Figure 4.3 Example of PowerPoint slide

(v) Interviews

Finally, a short interview of 5-10 minutes was held with each participant to obtain metadata

and numeral data of a different character than previously sought, and through general conversation that included information about the participant's background, education and daily life. This was done for both the first and second fieldwork trips. It was important that the interviews were held on a one to one basis so that the interviewee felt comfortable in giving personal information. The metadata is deemed important, as the background of each participant may help to explain why certain variant forms are used, hence it elicited information regarding:

- Place of birth
- Residential location (i.e. Kanto or Kansai)
- Where sign language was acquired (i.e. in the home or school)
- Age

It also provided further information about the actual people – whether they knew each other, for example, and the details of where and when the filming took place. The metadata are particularly important for the chapter on sociolinguistics, Chapter 8. A secondary aim for these interviews was to see what numeral forms tend to occur in a slightly more ordinary conversation, as opposed to the utterances produced during the elicitation games.

4.1.3. Unused data

In addition, one other game was used to elicit data on numerals. For the mathematics game, participants performed various addition, subtraction, and multiplication calculations, prompted by a pack of cards showing different functions (e.g. '+30', '-4', 'x5'). Pairs of participants were given a pile of face-down cards. Starting from the number 10, they were asked to take turns flipping over the top card in their pile and performing the function shown and signing the resulting number. Participants were told to start the game again when they reached 100. This game aimed to elicit signs meaning 'minus', 'plus', etc. However, this game was problematic because of the cultural context. Japanese people tend to do such calculations in their head and give the answer only, rather than sign the whole process. Therefore, after the first fieldwork, the game was not used again, and the data have not been analysed for this research.

4.1.4. Transcription and analysis

This section describes only the coding of JSL, not the other sign languages in this study, because the researcher personally coded only the JSL data. Data on the other sign languages were gathered via intermediaries, i.e. informants who are experts in their respective sign languages. These individuals provided data that they had already transcribed into English.

Therefore the precise coding processes they used are unknown to the researcher.

Once the JSL participants were chosen and the research activities had taken place, a vast amount of data was available for analysis. Due to the considerable length of time necessary for the annotation of sign language data, it was not possible to code all of the clips. Using introspection, the researcher identified data segments that related to the themes from the questionnaire and that revealed possible variation, particularly unexpected or unusual forms. Forms for '10', '100' and '1,000' seemed to be where the most (possibly sociolinguistic) variation was present, so these were identified as a main focus. Some signers appeared to be using structures from signed Japanese, rather than JSL (see section 1.4), so these were eliminated from the corpus. In this way, an appropriate data corpus was selected for transcription.

The data was annotated using ELAN, a specific annotation software package devised by the Max Planck Institute for Psycholinguistics in Nijmegen for the annotation and coding of sign language data. ELAN is a professional tool that enables an unlimited number of complex annotations on video and audio resources to be made. The annotations provide a format for describing (via glossing and/or translations) any observed features that are deemed relevant for analysis. The annotations are placed along tiers and can be time-aligned to the video clips (see Figure 4.4). As mentioned above, only the JSL data was transcribed (not the data from other languages) (further description of the coding for the sociolinguistic aspect of this study is given in chapter 4).

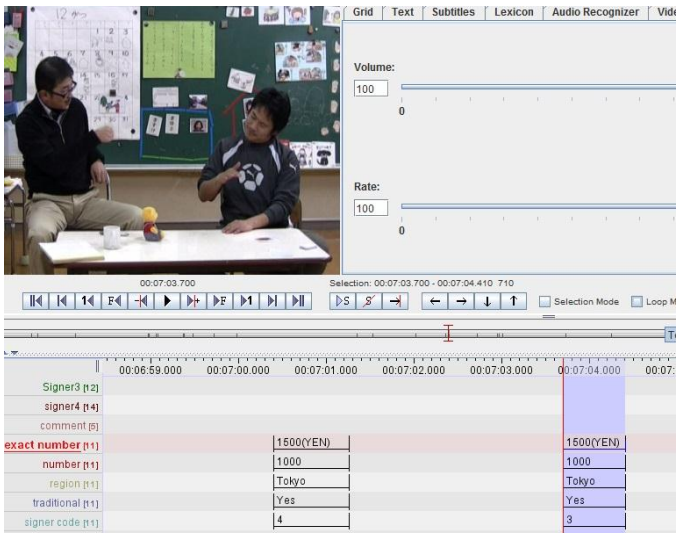


Figure 4.4 Example of ELAN data transcription interface

For all filmed (JSL) data resulting from the matching game and the bargaining game (see i and iii in section 4.1.2 above), the forms pertaining to '10', '100' and '1,000' were coded because there are different variants for them in Kanto and Kansai. The Kansai forms for '10', '100' and

‘1,000’ are related to each other, while those used in Kanto are more suppletive (see Chapter 5). Numeral-based signs were also coded to indicate whether and how they were associated with money (i.e. as ‘context not money’; ‘context & money but no sign YEN’; 'YEN with number (numeral incorporation)’; and ‘number and YEN signed separately’). The aim of this coding was to enable investigation of the semantics and grammar surrounding the use of numeral-based signs. For example, was one particular variant of ‘10’ more frequently used than other variants in the money context? Could the lexical sign for ‘yen’ be dropped in certain cases? The repeated bending of the fingers in the sign for ‘20’, coded as ‘+ (repetition)’ and ‘+++tr (tremolo)’. Any special comments were added along a separate tier.

The researcher carried out a quantitative analysis of the forms, and selected example sentences illustrating each variant for the sake of a qualitative analysis. Film clips from the maths game (see ii in section 4.1.3 above) were not coded, as they did not include forms for ‘thousand’. It is relevant to note that this paragraph only alludes to the data collected expressly for this project, and not to the large-scale sign language typology project data at iSLanDS (see Chapter 9 for further details). In order to analyse the data from games i and ii, the recorded clips were uploaded on to ELAN software.

4.2. Sign Language Typology Project data

Before considering the other languages used for comparison within this study, it is useful to briefly discuss the concept of language families, which was considered in section 3.1. The study of spoken language families is well-established, but researchers have only recently begun to explore the notion of language families as pertaining to sign languages. For example, it has been asserted that British Sign Language, New Zealand Sign Language and Auslan (Australian Sign Language) belong to the same family (Johnston 2003). CSL and HKSL are also in the same language family (Fischer & Gong 2011). There has not been any known contact between users of each language or any previous documentation on many of the village sign languages. Of the many urban sign languages in group 3, and the various village sign languages in group 4, several are known to be unrelated, which tends to strengthen the applicability of generalisations.

As mentioned in section 3.3, the comparison groups of data were selected from existing data-sets collected for other research projects. Data on other sign languages were taken from a large-scale typology project. The University of Central Lancashire’s International Institute for Sign Languages and Deaf Studies (iSLanDS) commenced a sign language typology project on three semantic domains (number, colour and kinship) in October 2010. Consultants and participants were recruited through mailing lists, websites, newsletters and international deaf networks (e.g. through the World Federation of the Deaf). Eventually, the project

encompassed 31 different sign languages, including some village sign languages (see Figure 4.6 below). Questionnaires (see Figure 4.5) and elicitation games (the 'maths' and 'bargaining' games described in sections 4.1.3 and 4.1.2 respectively) were used to collect data.

How does your sign language express numbers with multiples of ten, e.g. 30, or 79? In the case of simple multiples of ten, i.e. 20, 30, 50, etc., there are three main reported strategies which may be used. First of all, the individual digits may be produced in a columnar format to form a sequential compound, e.g. "3-0" becomes "30". Secondly, single digit signs may be combined with movement patterns, e.g. British Sign Language "5"-handshape with an away-movement becomes "50". Thirdly, sign languages may also add up lower numbers to create higher numbers, e.g. in Kata Kolok where one may sign "10-10-10" for "30".

Your sign language may use one or several of the described strategies.
Please indicate which strategy is found in your signed language.

- ☐ Sequential compound "3-0" becomes "30".
- ☐ Movement pattern with a single digit, e.g. "5"-handshape with away-movement means "50".
- ☐ Adding up lower numbers to create higher numbers, e.g. "10-10-10" to mean "30"
- ☐ Another strategy for simple multiples of ten. *Please provide a description.*

Figure 4.5 An item from the questionnaire for the semantic domains project at iSLanDS

The questionnaire items included cardinal numerals (zero and 1-10); iconicity in cardinal numerals; cardinal numerals above 10; simple multiples of 10; mixed numbers above 10 (i.e. numbers of two or more digits, not divisible by 10 such as '64'); base numbers; fractions; ordinal numerals; numeral incorporation; nominal plurals; and quantifiers. A cardinal numeral database is being constructed for this project, and is yet to be completed; however, the finished parts of this database have been helpful for the current study.

Figure 4.6 Map of countries participating in the typology project

Table 10 List of sign languages included in the Sign Language Typology project – Semantic Domains

Alipur Language	Icelandic Sign Language	Sign Language of the Netherlands
Argentine Sign Language	Indo-Pakistani Sign Language	New Zealand Sign Language
British Sign Language	Indonesian Sign Language	Norwegian Sign Language
Chican Sign Language	Inuit Sign Language	Polish Sign Language
Chinese Sign Language	Israeli Sign Language	Saudi Sign Language
Czech Sign Language	Japanese Sign Language	South African Sign Language
Estonian Sign Language	Jordanian Sign Language	Spanish Sign Language
Finnish Sign Language	South Korean Sign Language	Sri Lankan Sign Language
German Sign Language	Mardin Sign Language	Taiwan Sign Language
Greek Sign Language	Mexican Sign Language	Turkish Sign Language
Hungarian Sign Language		Ugandan Sign Language

These data do not follow a uniform standard of data collection, but this is not inappropriate as the data are used only as a contrastive balance against the main JSL data, and their collection is a matter of feasibility. Relatively few sign languages have been documented and studied thus far, and there is not yet a wealth of typological data to draw from. To further explain how the four groups highlighted in section 3.3.1 were initially established, details of each group are outlined below:

Group 1: Korean Sign Language (SKSL), Taiwan Sign Language (TSL)

Data for Korean Sign Language sampling was compiled in the form of three small collections of SKSL numbers under the typology project data-set. The first data-set in this group came from a video recording of SKSL numbers used by a native SKSL signer from a deaf family, and the second came from recording numbers produced by a deaf SKSL user who attended a school for deaf children. Both of these signers are from Seoul. The third data-set came from a native SKSL signer in Busan. As mentioned above, the iSLanDS Sign Language Typology questionnaire was utilised for this (also see Appendix 1), and so the order of forms produced in these videos mirrors the order of items in the questionnaire.

In the case of TSL, which was not originally part of the iSLanDS typology project, it was necessary to rely on an on-line dictionary which provides descriptions of numerals, and this was supported by discussions with a colleague who is a native user of TSL. These discussions generally corroborated the descriptions in the dictionary, but also provided more in-depth information about variants. In addition, this colleague was able to complete some data collection in the form of recordings of numerals used in TSL and this supplemented the on-line

data set. This informant is deaf and is a teacher of TSL and is from the older generation (61+) of TSL users. He teaches TSL in several areas in northern Taiwan, including Taipei, Taotuan, and Hsinchu. He also teaches in southern Taiwan, including Chiayi and Tainan, travelling between those areas every week.

Group 2: Chinese Sign Language (CSL)

Data for analysing the articulation of numerals in Chinese Sign Language also came from the existing data-set complied for the iSLanDS typology project. CSL is included in the sample in order to see whether Kanji has had any comparable influence on the expression of numbers in CSL and JSL. Fischer and Gong (2011) record the existence of 2 separate families of sign languages in East Asia: the JSL family and the CSL family. As sign languages used in close geographical proximity to Japan, the sign languages in Groups 1 and 2 may also be considered to have an actual or potential areal affiliation. Discussions with informants suggest that CSL and JSL have definite similarities based on the use of Kanji in both countries.

Group 3: Urban sign languages (see Table 10 above)

The iSLanDS typology project also provided data for all of the languages in Group 3. This group includes various urban sign languages from around the world, some of which are known to have had contact (such as BSL and NZSL – see Schembri et al. 2010) but also many sign languages that are not known to have any historical relationship. Such a group was desirable to include in this study because the languages are geographically spread out, the researcher already has some knowledge of them, and the data on them is ample and of a high quality.

Group 4: Alipur Sign Language (APSL), Chican Sign Language (ChicanSL), Mardin Sign Language (MarSL).

The data for Group 4 are taken from the set complied for the typology project at the iSLanDS Institute, and also from a recent volume on endangered sign languages edited by Zeshan and de Vos (2012). There is not thought to be any contact between these languages and JSL.

The reason that the sign languages in this group have been selected is because they exist in quite different sociolinguistic settings than languages in the other groups; they are known to have unusual features not often seen in other sign languages (ibid); they are readily available due to the researcher's connections with users of the sign languages; and they are severely under-documented.

4.3. Introspection and data supplementation

As section 4.1 noted, the researcher has been able to use introspection with regards to the findings presented in chapters 5 and 8. As a fluent user of JSL, she was able to exploit her own introspective judgements due to being involved in the Japanese deaf community for more than 20 years. However, due to not being born deaf, the researcher felt that agreement from native JSL users would help to verify the data and supplement the introspective judgements made. The additional introspective judgments were made by four teachers at the Meisei Gakuen School for the Deaf in Tokyo, and are all deaf and highly skilled native JSL users. The teachers viewed the findings and verified them as typical of the numerals found in JSL.

For chapters 6 and 7, it was necessary to seek additional data sources. As many languages were considered during the course of this research, one of the main ways to supplement the data for analysis was through the use of an on-line sign language dictionary for Taiwan Sign Language and a recent publication that includes a detailed discussion of numeral incorporation in Kata Kolok Sign Language (de Vos, 2012). As more information was required regarding some sign languages than the recorded data could provide, additional information regarding numerals in some sign languages was sought via personal communication with colleagues. Personal communication was sought for Ban Khor Sign Language (BKSL) from Angela Nonaka, for Argentine Sign Language from Juan Druetta, for South Korean Sign Language from Kang-Suk Byun, and for Taiwan Sign Language from Yijun Chen.

4.4. Research ethics

This section explains how the research methods implemented in this study are informed by considerations relating to ethical issues in sign language linguistics research. Consideration of ethical issues during linguistic fieldwork is paramount. For example, minority languages often belong to minority groups with distinct social dynamics. Researchers must therefore carefully consider a range of ethical issues, including the effect on local customs, before conducting any research in the field. It is true that minority languages are at greater risk of becoming endangered without research, which is why language documentation is important, but research should also be of some benefit to the local community. Dikyuva et al. (2012:334) surmised that the benefits of documenting minority languages could include the “development of user-friendly language resources, educational opportunities and changes in attitudes”. Dwyer (2006: 38-40) sets out five ethical principles for linguistic research, which are expressed as doing no harm, reciprocity and equity, doing some good, obtaining informed consent before starting research, and archiving and disseminating data and results. Harris, Holmes and Mertens (2009: 105) also outline similar principles: respect: treat people as autonomous

agents; beneficence: secure the participants' well-being by doing them no harm; and justice: focus on the distribution of goods and services in the research setting.

Considering the above ethical principles, aspects that are especially important for sign language work in Japan are to respect, archive sensitively and disseminate data and results. Sharing information is very important, particularly at present, with deaf organisations and the Japanese government working together to make access improvements for sign language communities, as noted in section 1.2. Further research and data will increase our knowledge about JSL grammar and reinforce its differences from that of signing based on spoken Japanese (see section 1.4).

4.4.1. Credibility within the deaf community

Harris, Holmes and Mertens (2009) explain the importance of the deaf researcher. Deaf researchers from within a community initiate leadership and lay the tracks on which future generations of deaf researchers can build. This stimulates organic growth within a community and develops a shared appreciation of language, culture and social status. It is therefore relevant that the author of the present research is a deaf user of JSL and thus an active participant in the JSL community. In studies such as this, a deaf researcher may be viewed as an 'insider', as opposed to an 'outsider', of the target community. However, the researcher's status as an 'insider' or an 'outsider' has a number of effects. For example, a researcher who is an 'insider' may find it challenging to maintain an academic perspective and to differentiate between his research role and his community member role (Dikyuva et al. 2012; Harris, Holmes and Mertens 2009). On the other hand, a deaf researcher who is researching the sign language of a deaf community may be considered an 'insider', while a hearing researcher may be considered an 'outsider'. The deaf researcher's 'insider' status provides him with better access to the target community by virtue of a shared language, culture and life experience. A hearing 'outsider' researcher could employ a deaf research assistant from the community to liaise between the researcher and community. The researcher's 'insider' or 'outsider' status is also important for minimising the effects of Labov's 'observer's paradox', as Dwyer (2006: 40) notes:

> In anthropology and linguistics fieldwork, a researcher's presence changes the phenomena under observation, often making conversation less spontaneous. Most field workers simply attempt to minimize the intrusiveness of their presence (the so-called observer's paradox (Labov 1971: 171) by, for example, using a small recording device, or by having native-speaker insiders conduct the field research. These methods have provided adequate data and have been seen as ethically sound by the majority of field linguists and community researchers.

Therefore, for participant recruitment, the researcher made use of the expertise of deaf teachers and assistants. The researcher asked the coordinator of a sign language teacher training seminar in Kanto to identify signers with the most native JSL ability in that region, and this individual also helped to balance the selected signers in terms of age and gender. For Kansai, a person working in the Osaka Deaf Association was asked for information, and they suggested selecting participants at the association's pending 20th anniversary celebration, which was expected to attract a wide age range of signers from the Kansai region. The other sources for recruitment, which also involve the assistance of Japanese deaf signers, are mentioned above. Ethically, this approach amounts to reliance on 'insiders', rather than on people on the periphery or outside the boundaries of the community. Having the involvement of such 'insiders' increases the comfort level of the participants, the naturalness and spontaneity of their utterances, and the reliability of the data. There is also the benefit observed by Harris et al (2009) that having a deaf researcher also benefits the sign language community because they often share the researcher's concerns about the language and culture.

4.4.2. Consent and confidentiality

It is often not easy to obtain informed consent, especially since sign language data collected using video cameras are difficult to make anonymous (Crasborn 2010). Finding opportunities to involve deaf people in research is important, as this empowers deaf people to contribute to researching their native languages and complies with the ethical principle of beneficence. Paying informants also raises further issues: Kusters (2012: 34), a deaf anthropologist, notes the views expressed towards white hearing visitors by several deaf members of a village community in Ghana: "they just talk and talk…they give money to us, say bye-bye and are gone". Dikyuva et al. (2012) offer some excellent insights into the ways that they negotiated some of the ethical issues that have been touched upon here, as deaf researchers.

The researcher met with participants in pairs. Each participant was given an information sheet to read, which was available in both written Japanese and JSL, (see Appendix 2). The information sheet included details about the researcher, the research title and aims and, along with this, questions related to ethical considerations of the research were answered. This included informing the participants why they had been chosen and what they would be asked to do if they consented to participating. Explanations were also given for questions relating to the use and storage of data, how confidentiality and anonymity would be maintained and with regards to the right to refuse to consent to future publications and to withdraw from the research. Following this, each participant was given a UCLan consent form, (see Appendix 3) to sign if they wanted to proceed, and finally participants were asked to fill in

a background questionnaire (Appendix 4), which enquired about their age, birthplace, length of residence in current area, age at onset of deafness, number of deaf family members, which school they attended, when they started learning sign language, how often they used sign language to communicate, and their level of Japanese reading and writing skill. For each step of this process, for those participants who seemed unsure or hesitant about reading the documents provided in Japanese (some of whom stated that they were uncomfortable with accessing written information), the researcher signed the contents in JSL, explaining what it meant and ensuring that it was understood. As some of the data analysed came from the typology project running at the iSLanDS Institute, consent from the participants involved in that had already been sought and an ethics process had already been followed, ensuring that all participants whose data was analysed were aware of the research project rationale, their right to withdraw at any time, and the process for storing and using the data.

4.4.3. Reciprocation ('giving back' to the community)

Sharing the research findings and reciprocating or bringing benefits to the target community are vital components of sign language research ethics (Zeshan 2007). The findings from the present study will be disseminated using the deaf community networks that the researcher has become involved in. An article is being produced in written Japanese, for greater accessibility by the participants and beneficiary community, and the researcher will also explain her research and its applicability to informants and intermediaries using JSL. Moreover, an offshoot of this research has been the piloting of an online searchable database of numeral signs across sign languages, which will become available in an open access form. As this resource is non-technical and does not presume any knowledge of linguistics, it will be of interest to sign language using communities both in Japan and elsewhere.

This research is likely to be of use within deaf education, specifically in the teaching of maths. As the researcher's 'insider' network includes several teachers in both Kanto and Kansai, she plans to discuss with each of them how they might exploit the findings of this study in the classroom. The research may be interesting in tertiary level education as well, particularly at Tsukuba University of Technology, which has a new deaf studies course and caters only for deaf students. The fact that this project has been carried out by a deaf scholar might inspire these students to undertake their own linguistic studies of JSL or other sign languages.

On a larger scale and in the longer term, this research could contribute to the on-going improvement of rights for deaf sign language users within Japan; for example the Japanese Federation of the Deaf (JFD) might use this research as part of a body of evidence that JSL is a natural indigenous language of Japan, with levels of linguistic complexity and variation

comparable to any spoken language. This would perhaps strengthen the case for greater JSL recognition and associated access provision.

5. OVERVIEW OF LINGUISTIC STRUCTURE OF JSL NUMERALS

This chapter gives an overview of the structure of the numeral system and its component parts in JSL according to the findings of this research project, beginning with the cardinal and ordinal numeral series in sections 5.1 and 5.2, as well as the expression of fractions in sections 5.3. JSL numerals display intralinguistic variation with respect to several factors including region and age, which is the topic of section 5.4., while section 5.5 considers various numeral forms with respect to their degree of lexicalisation. The purpose of this chapter is to provide a general overview of the numeral forms found in JSL. The domain of numerals is complex in many languages as it may include a substantial number of sub-systems, which may in turn be subject to morphological processes such as compound formation or other types of morphology. In this thesis, the subsequent chapters (chapters 6 to 8) explore some of the phenomena associated with numerals and aim to compare the numeral system in JSL with those of other sign languages. In preparation for these more detailed explorations, chapter 5 provides the basis for understanding the discussions in chapter 6 to 8, so that JSL numerals can be placed in a wider context. Thus chapter 5 is more descriptive than other chapters in this thesis, as the aim here is to provide the reader with a concise overview of the relevant structures.

5.1. Cardinal numerals

The structure of JSL numerals relies on a base-ten (decimal) system, which is characteristic of the majority of the world's languages. In the *World Atlas of Language Structures*, Comrie (2013) categorises 125 out of 196 spoken languages as having a decimal numeral system. In JSL, the numerals 1 to 9 are produced on one hand only and act as important building blocks within the JSL numeral system, particularly in forming larger numerals by way of handshapes used in numeral incorporation. The main cardinal numeral forms of JSL found in the data are here examined in terms of morphology, semantics and phonological variation for the first time, as previous works on JSL, such as dictionaries, have tended to take a lexical perspective and give only one form for each numeral, and previous work has not analysed the internal morphology of numeral signs.

5.1.1. ZERO

The JSL sign for 'zero' has two phonological variants that differ in handshape, as shown in Figure 5.1 below. The two variations differ in frequency and in user composition; such variations will be discussed further in a later chapter. There is also a 'traced' variant and all three variants are articulated with a round mouth pattern.

Figure 5.1 Three phonological variants for ‘zero’.

5.1.2. ONE to NINE

The numeral signs ONE to FOUR in JSL appear the same as the gestures that hearing people tend to use (Ichida 2005) (see Figure 5.2 below). Usually, these signs are performed with the palm facing away from the signer, though not always (see Ktejik 2013:191). There are some instances in the data of these numerals being articulated with the palm facing toward the signer.

ONE TWO THREE FOUR

Figure 5.2 ONE to FOUR in JSL

As mentioned in section 2.2.1, Mori (2005) found that there are three ‘types’ of the numeral signs ONE to FOUR in JSL (see chapter 2, Figure 2.2). Signs of type 1, the unmarked ‘normal’ type, are performed with a neutral, relaxed hand, whereas those of type 3 are marked and produced with a tense or ‘stamping’ hand, where the hand moves firmly forward at the moment of articulation. Type 2 signs refer to dates and are articulated with the digits held horizontally. Because it appears permissible to produce signs for the numerals ONE to FOUR with the palm facing toward or away from the signer, or even to the side, this differentiates JSL

numerals from those of some other sign languages, in which numbers must have a particular orientation; for example, in Ugandan Sign Language (Lutalo-Kiingi 2013), number signs have an inward palm orientation to distinguish them from certain letter signs, such as V and W, which always have an outward orientation. Also, in Catalan Sign Language (LSC), the numbers one to five are signed with the palm inward but for seven, eight, nine and zero, the palm faces outward, though this rule is not always followed in practice (Fuentes & Tolchinsky Landsmann 2004). When giving citation forms, JSL signers always seem to articulate numerals ONE to FOUR with the palm outwards, but in everyday contexts the orientation of the palm varies.

The numbers from ONE to NINE are particularly important, since they also form the basis of larger numbers, and provide the handshapes for numeral incorporation paradigms (the signs for 'ten' and other numbers are shown in section 5.1.3). In JSL, the sign FIVE is different from hearing people's gestures (see Figure 5.3), using a closed fist with thumb extended instead of a spread '5' handshape and is nearly always articulated with the palm facing away from the signer (Ichida 2005). The numbers from SIX to NINE are built from the number FIVE, as they contain the handshape of FIVE and then additional fingers are extended to reflect the relevant numeral. There numerals have a palm-inward orientation, with the digits orientated horizontally. It is possible that the signs FIVE to NINE derive from the use of an abacus (ancient calculator), which had vertical columns of five beads, and multiples of five indicated at the top of each column (Maruyama 1984). However, although this has been mentioned in one book (ibid) and by several participants, there is no empirical evidence and this supposed origin has been passed down the generations through folk etymology.

FIVE SIX SEVEN EIGHT-1 NINE

Figure 5.3 FIVE to NINE in JSL

5.1.3. TEN

There are two variants of the numeral 'ten' in JSL, which differ in handshape (see Figure 5.4 below). TEN-1 can be modified for numeral incorporation but this is not possible for TEN-2, due to the physical restrictions that the handshape imposes. This is a fully lexicalised sign. The two variants of TEN are discussed in more detail in sections 5.1.3, in relation to variation, and 8.2, in relation to sociolinguistic factors.

TEN-1 TEN-2

Figure 5.4 Two variants of TEN in JSL

5.1.4. Cardinal numerals above ten

In JSL, multiples of ten, 100 and 1,000 have numeral incorporation structure. Typically, each paradigm has a location and a movement with values from 1 to 9 incorporated as handshapes. Hence the handshapes TWO THREE FOUR and so on up to NINE are numerally incorporated to articulate TWENTY, THIRTY, FORTY respectively. For multiples of ten (20-90), this is done by bending the fingers (but see comments on phonological variants below). There is also often an added movement, whereby the hand is shaken slightly from side to side with the digits in a bent position. In some cases, the selected digits may be bent several times resulting in a trilled form – this is particularly noticeable among older signers.[4] For 60 to 90, the thumb may bend along with the selected fingers, or may be held straight (i.e. the bending of the thumb for these numeral signs appear to carry no phonological significance). For numerals 100 to 900, the hand begins with an orientation with the fingertips pointing sideways, and is flicked in an upward motion; for multiples of one thousand, the same orientation is used as for multiples of one hundred, but a sweeping motion is used, moving downwards and into a slight circular motion (see Figure 5.5 for examples of these forms with the '2'-handshape).

TWENTY TWO HUNDRED TWO THOUSAND

Figure 5.5 Movement variation in cardinal numerals

[4] The use of this form particularly with older signers has been observed in the data, but not quantified or analysed in detail.

Mixed numerals above 10 are formed by the using an additive system, whereby individual digits are signed sequentially to form a larger number. For example: 10 + 3 = 13, 20 + 4 = 24 and 100 + 60 + 4 = 164 (glossed TEN^ONE for '11', TEN^TWO for '12, etc.). The individual numeral component signs are articulated in the same location with no particular transitional movement feature. The numerals 15, 25, 35 and 45 present a special case: the compositional form of these numerals is also based on the multiple of ten and FIVE, and they can be articulated in the same way as other compositional numerals. However, these numerals are usually phonologically reduced to a trilled form, with rapid movement of the index finger (see Figure 5.6). Additionally, the numerals 11–14 may be shortened and articulated with a twist of the wrist, changing the orientation of the second number from palm-outward to palm-inward (see Figure 5.7 below for an example). This results in signs that can be considered instances of numeral incorporation, on the basis of its formational features, but bearing in mind that the contracted form is merely one of several variants, and other variants are not formationally similar to numeral incorporation.

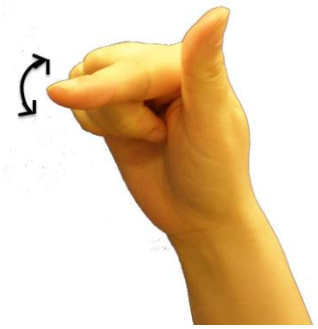


Figure 5.6 FIFTEEN (trilled form)

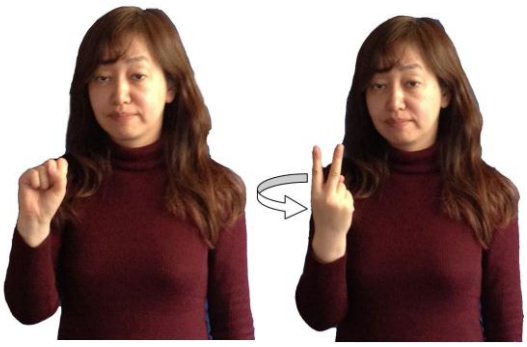


Figure 5.7 Shortened form of TWELVE

In addition, multiples of 1,000 and multiples of 10,000 are also subject to shortening. The full form of 1,000 traces the complete form of the Kanji character as shown in Figure 5.5 for 2,000,

but in the shortened form, only one stroke is visible and the movement is repeated. The reduced form is shown in Chapter 8 (Figure 8.13), and this form can be used for all multiples of 1,000. By contrast, a reduced form of the sign 10,000 is only available for the sign produced with the '1'-handshape and cannot be used for other multiples.

The various phonological processes that can affect variants of individual numeral signs in JSL are summarised in Table 11 below. This includes shortening of the signs by reducing either the spatial trajectory (path) of the movement or by reducing internal movement, repetition of path movement, and numerals that can be articulated in a rapid, trilled form.[5] Considering these phonological variants is important because processes of phonological shortening are important for understanding the relationships between variants of numeral signs, both within one and the same sign language and between different sign languages. Variants of numerals in one and the same sign language that are characterised by phonological shortening are discussed in section 5.5 in terms of lexicalisation. In chapter 8, this is relevant to the comparison between signs from the sign languages of the JSL family (Japanese, Korean and Taiwan Sign Language). Processes of phonological reduction are not discussed in detail here in their own right, as this would be beyond the scope of this thesis, but the comparison between signs with and without phonological reduction plays a role in some of the other sections of this thesis.

Table 11 Phonological variant forms in cardinal numerals above 10

Numerals affected	Shortening of movement	Additional movement	Repeated movement	Trilled movement
20-90		yes		yes
11-14	yes			
15, 25, 35, 45	yes			yes
1,000-9,000	yes		yes	
10,000	yes			

5.2. Ordinal numerals

For this thesis, only cardinal and ordinal numerals have been explored, as cross-linguistic data was not available for other numeral series. For some sign languages, evidence for further numeral series has been documented, such as collective, restrictive, and distributive numerals in Ugandan Sign Language (Lutalo-Kiingi 2013), but for JSL, the main focus here is on cardinal and ordinal numerals only. Ordinals are numerals that articulate position or rank, such as 'first',

[5] Path movement is the movement trajectory where the hand moves as a whole performance through space, whereas an internal movement involves a stationary hand with moving parts, such as bending of the fingers or a change in hand orientation (cf. Brentari 2002).

'second' and 'third'. Ordinal numerals are present in many sign languages,[6] and in JSL, there are a substantial variety of forms and uses of ordinal numerals, depending on the situation being described. Sagara (in press) demonstrates the existence of six distinct ordinal numeral paradigms (see Figure 5.8 below), which are also modified for numeral incorporation. It is notable that a similar range of ordinal numerals is not documented for any other signed language and may be specific to JSL. The individual paradigms are as follows:

– For the ***me* paradigm**, the index finger is placed high up on the cheek, as if pointing to the eye (*me* means 'eye' in Japanese). Ktejik (2013:198) describes this as denoting 'one's place in a line', although this concept may also be extended to show other items, such as occurrences, or the order of published works. Where the numeral is incorporated, the relevant numeral handshape is articulated on the cheek and this is available for 1 to 4; in other cases, the numeral is articulated and then the *me* sign is produced afterwards.

– The ***i* paradigm** is described by Ktejik (2013:199) as one's place in a competition; it is articulated in the neutral signing space on the non-dominant hand, which assumes the shape of a fist. 1, 2 and 3 are the most common numerals to be incorporated in the *i* paradigm. This is referred to as the *i* paradigm because this word (pronounced 'ee' in Japanese) is used to denote first place.

– The ***ban* paradigm** refers to the same phenomenon, and is articulated on the opposing shoulder to the dominant hand. This is also associated with competitions such as marathons where participants finish in first, second and third place, and may derive from the tape that crosses the finishing line of a race (Yonekawa 2011:96). As with *i*, 1, 2 and 3 are the most common numerals to be incorporated in the *ban* paradigm. The name of this paradigm comes from the use of *ban* as a classifier in spoken Japanese, as in *ichi-ban* ('the first one'), *ni-ban* ('the second one'), and so on.

– The ***kyu* paradigm** is used to refer to the level of proficiency that someone has in a certain skill or language. The most common numerals to be incorporated are 1-4, where 1 refers to a high level of ability or skill, and 4 to a lower level. Interestingly, the same paradigm can be used to refer to a person's level of hearing, where '1' is 'very deaf' and '4' is akin to 'hard of hearing'. The paradigm is articulated to one side of the neutral signing space, with the fingertips facing forward; the hand is then moved slightly in a backward direction.

[6] Among the data collected for the semantic typology project, some respondents did not comment on ordinal numerals, so there was not enough data to make any firm generalisations, but ordinal numerals did feature in a number of responses from sign languages around the world.

– The ***dai* paradigm** is articulated with a change in the orientation of the hand. It refers to an item on paper or on a list, such as an agendum, a rule, or one in a series of conferences. This is referred to as the *dai* paradigm after the Japanese word *dai,* which means 'order of things or events'.

– The ***kodomo* paradigm**, which was briefly discussed in section 2.2.3, has no equivalent in spoken Japanese, but the word *kodomo* ('children') is used because this paradigm refers to children, or siblings. This paradigm is described in more detail in section 7.2.4 on numeral incorporation.

Figure 5.8 Ordinal numeral paradigms

5.3. Fractions

To articulate fractions in JSL, a columnar format is generally used, where the numerator and denominator are articulated on top of one another in the signing space. This system is used in many other sign languages, but unusually, in JSL the denominator is signed first and the numerator second – so moving upwards, whereas other sign languages tend to move

downwards in the form of a one-handed sign. The reason for this may be due to influences from written Japanese, in which the denominator is penned first in order to express the concept of the amount of the denominator first before showing the remaining portion of that amount via the numerator. Two-handed signs are also used to express fractions. For example, 'one-third' is signed with the denominator THREE and then a line and the numerator ONE above it. This is also probably due to influence from written Japanese, which states the denominator first. With regards to HALF, a two-handed sign may be used, as shown in Figure 5.8. Additionally, HALF can be produced by the dominant hand striking in between a V handshape on the non-dominant hand (see Figure 5.9 below).

HALF (blade on palm) HALF (V shape) ONE-THIRD

Figure 5.9 Fractions in JSL

5.4. Regional and age-related variation

This sub-section provides a brief introduction to lexical variation in JSL that has been observed in the JSL data collected during fieldwork as described in Chapter 4. The subject of dialectal variation within JSL was touched upon in Chapter 1, which presented a general introduction into the current research on variation in JSL. As discussed in Chapter 4, only the Kanto and Kansai dialects are examined in this study. A more detailed discussion of sociolinguistic variation is presented in Chapter 8, but the short summary below is provided at this point to complete the survey of JSL numerals in this chapter.

The Kanto and Kansai dialects demonstrate differences in the systems used to express the numbers 10, 100, 1,000 and 10,000. In the Kansai dialect, each finger makes contact with the thumb to represent a 0, starting from the index finger and working down to the little finger. This is illustrated in Figure 5.10 below. Lexical signs such as these tend to be used to refer only to the base number, and are very rarely used to express compounded numerals, such as 200 or 300. For example, the index and middle fingers touching the thumb tends to be used only for expressing '100'. The combination of the sign '2' plus this sign for '100' to mean '200' is rare; instead, the Kanto signs are used for multiples of 100. On the other hand, the Kansai system is

more common when expressing larger numbers in excess of 1,000. For example, the number 1,500 may be formed with this variant of 1,000 and then followed with the numeral-incorporated sign for '500' (cf. Sagara, in press).

The signs for 10, 100 and 1,000 in the Kanto paradigm involve an index handshape, bent for 10, moved upward for 100, and tracing a cross for 1,000 (in reference to the Kanji symbol for 1,000). All of these three signs can be subject to numeral incorporation, but the signs for 10,000 and 'hundred million' are not and instead use a multiplicative strategy (TWO 10,000 for '20,000'). Interestingly, in Kanto the sign for 10,000 is the same as in the Kansai series (see Figure 5.10). Discrete lexical signs exist in JSL for 'ten thousand' and 'hundred million', and this is in parallel with spoken Japanese which has discrete words for these numerals (*man* for '10,000' and *oku* for 'hundred million') but no words for other large numbers such as 'million' or 'billion' in English.

Figure 5.10 A comparison of signs in the Kanto area (top row) with signs in the Kansai area (bottom row)

Some cardinal numerals are subject to age variation. 'Eleven', for example, has at least three different variants (see Figure 5.11), which seem to pattern according to age, with the form in the third variant used only by older signers. In the data corpus, the two-handed form ELEVEN-3 is only used by two of the participants, both of whom are elderly signers.

ELEVEN-1 ELEVEN-2 ELEVEN-3

Figure 5.11 Three lexical variants for ELEVEN

The numeral EIGHT also seems to pattern according to age. The standard form for this sign is as shown in Figure 5.3 above. Figure 5.12 below shows a particular variant of EIGHT that involves bending of the ring finger as opposed to the little finger. This variant has been met with some controversy because the extension of the little finger means '9' and so it causes some confusion (see transcript of an interview with a younger participant below the age of 45 in example (13) below). However, despite the controversy surrounding this variant as a legitimate form, it continues to be used by some younger signers.

(13) Story about variants for 'eight'

Participant: My family members are all deaf but we all went to different high schools, except my father, who didn't go to high school.

Researcher: So did you use different signs?

Participant: Yes, yes…I remember once my father being very cross because my sister started using a different sign for '8'. We always used EIGHT-1 but my sister went off to high school in Ichikawa, where they have their own sign, EIGHT-2. My father was confused as to whether she was signing SEVEN or NINE. My sister started using EIGHT-2 when she came home and my father went mad because the communication kept breaking down. He would moan at me to tell my sister to use EIGHT-1 because it was very confusing

m.a(interview) .m2v 04:45-05:40

Figure 5.12 Variation EIGHT-2

In the participant interviews, one Kansai signer aged 60+ reported using two-handed iconic signs for numbers 6-10, but later changing to one-handed signs due to influence from the Kanto signers. Similarly, according to Flaherty & Senghas (2011), the two-handed iconic signs for 6 and 10 that emerged after the establishment of a deaf school in Nicaragua in the 1970s changed to one-handed signs by the 1990s. While the above comments on age-related variation are incidental and appear only anecdotally in the data, variation between the different forms for 'ten', '100' and '1,000' has been investigated quantitatively in Chapter 8, where both regional and age-related variation is discussed in detail with respect to these signs.

5.5. Lexicalisation

In addition to the additive and multiplicative systems that have been discussed already, a further process associated with the formation of numerals, lexicalisation, is exemplified in the numbers 12-14 in the Hokkaido dialect (Hokkaido Deaf Association 2005). The number 12 is shown in Figure 5.13 below. While formational elements of the original component parts TEN-1 (bent index finger) and TWO (index finger and middle finger) are still visible in this sign, it can now be considered a single non-componential lexeme. It seems that the sign has undergone a lexicalisation process whereby its constituent parts have fused together into a form that can now be considered monomorphemic. The transition from multi-sign expressions to monomorphemic lexemes has been studied for other domains. According to Zeshan (2003:132), "lexicalisation involves the creation of conventional lexemes out of constructions" and it "is extremely common and productive" in the domain of classifier constructions that are the focus of this publication. Zeshan (2003) provides the following definition of lexicalisation:

> Initially, a form that describes a certain object or situation for which there is no conventional lexical sign is freely coined. When an originally descriptive form is regularly used for a certain object or situation, it may become a conventional lexical sign (Zeshan 2003:134-135).

The difference between a so-called construction and a lexicalised form may be described on both a phonological and semantic level. On a phonological level, lexicalised forms are fixed and formal variation is no longer present. On a semantic level, the lexicalised forms lose their semantic compositionality so that the sign is no longer analysable into constituent parts (Zeshan 2003).

Figure 5.13 TWELVE-2

Signs such as the form in Figure 5.12 seem to have undergone a parallel process, although the domain of numerals is quite different from the domain of classifiers in sign languages. Because lexicalisation is a continuous process, it is expected that there will be varying degrees of lexicalisation (see Figure 5.14 below): signs may be 'semi-lexicalised', 'non-lexicalised' or 'fully lexicalised' (Zeshan 2003). In their discussion of variation and change in sign languages, Johnston & Schembri (2010) refer to lexicalisation as a process that accounts for elements of variation seen across sign languages. In relation to the numeral signs of JSL, a lexicalisation process exists where initially separated lexical signs become compounded, and eventually this compound may become a fully lexicalised numeral sign, such as TWELVE-2 above in JSL.

Similar pairs of compositional and lexicalised forms are also found in other sign languages. For example, in American Sign Language (ASL) the sign for '25' has both a compositional and a reduced, trilled form (Valli 2005:495; see Figure 5.14). In Ugandan Sign Language, there are several variants of '100', and in the most reduced form the index finger bends as the hand moves across the signing space, instead of a separate articulation of ONE ZERO ZERO. Over time, these three signs have combined into a single sign whose formation parallels numeral incorporation, and Lutalo-Kiingi (2013:151) speaks of on on-going process "from digital numeral to compound to numeral incorporation".

Figure 5.14 Compositional and lexicalised numerals

The lexicalisation apparent in such forms is, as section 3.4 briefly notes, due to internal linguistic processes that result in changes over a period of time. This can be observed not only within one and the same linguistic variety but also across different dialects and different languages. In section 8.4.3, this lexicalisation continuum is explored in more detail with respect to sign language varieties in Japan, Taiwan, and South Korea.

5.6. Summary

Chapter 5 has described several of the forms used to construct JSL numerals. Examples of productive morphology include the numeral incorporation exploited in most of the paradigms for ordinal numerals, as well as in multiples of 10, 100 and 1,000. Conversely, numbers from 11 to 19 are expressed as compounds that are combined using the additive system. An exception to this rule is the Hokkaido variants, which use monomorphemic lexemes for some of the numerals between 11-19. In addition to this, forms often have different variants, e.g. the shortened form of multiples of 'thousand' and the trilled form of the sign for '15'. JSL's ordinal numeral paradigms seem to be quite extensive when compared to the way such numbers are expressed in other documented sign languages. Most sign languages appear to have only one or two means of signifying ordinal numerals.

The variation and change observable in JSL suggests that signs are becoming phonologically reduced and more arbitrary. For example, the two-handed variant for '11' is only used by older signers, while younger signers use one-handed variants. In addition, some numeral signs are subject to a process of lexicalisation over time, and can be situated along a lexicalisation continuum, where initially separated signs become compounded and eventually fully lexicalised. A number of issues were raised in this chapter in preparation for more detailed discussions of sociolinguistic variation. In particular, ways in which variants are identified, and issues of geographical and age variation as well as historical change in terms of lexicalisation are all important concepts for appreciating the discussions in Chapter 8.

6. THE SEMANTIC MOTIVATIONS OF NUMERAL SIGNS

This thesis aims not only to document numerals in JSL but also to view them in the light of cross-linguistic variation using typological comparisons with a wide range of sign languages. This comparison is carried out with respect to several sub-domains, and this chapter is concerned with the issue of semantic motivation of numeral signs in JSL and across other sign languages. Numeral signs often display a level of non-arbitrary form-meaning pairing in various ways, which is discussed in this chapter. For instance, the use of the extended fingers to indicate numerals 1 to 5, which is known as 'number for number iconicity' (Taub 2001:85), is a typical example of this representation, and this resembles transparent gestures that hearing people also employ. Semantic motivations are noted in this chapter as including the iconicity apparent in the form of numeral signs (see section 6.1), which includes the relation between numerals and the body parts that provide locations for the numeral signs, the increased use of the signing space to semantically indicate larger numbers, and the derivation of numerals from other types of sign, namely sign names (section 6.7) and signs denoting monetary units (section 6.8).

6.1. Iconicity and motivation

De Saussure believed that "human communication is based on convention" (cited in Rosenstock 2008:134). In other words, de Saussure maintained that language is composed of an arbitrary link between a linguistic form, the signifier, and its meaning, the signified (cf. Perniss, Thompson & Vigliocco 2010). However, it has since emerged that there are many examples of non-arbitrary form-meaning pairings in languages, both signed and spoken, and this is often discussed in terms of iconicity. The concept of iconicity relates to a likeness between the word and the referent it represents whereby "its qualities resemble those of that object and excite analogous sensations in the mind for which it is a likeness" (Houser and Kloesel 1998 cited in Rosenstock 2008:134). Taub (2001:23) discusses the concept of 'likeness' in greater depth and argues for a theory of "structure-preserving mapping between mental models of linguistic form and meaning". In other words, likeness is "not an objective relationship between image and referent; rather, a relationship between our mental models of image and referent" and therefore constructed on a conceptual level (Taub 2001:20). For example, legs and the handshape with the index finger and middle finger extended share a likeness because they both have similar constituent parts. That is, each leg consists of a long thing part and then a joint before ending with a foot. Each finger also consists of a long thin part and then a knuckle before ending with a nail. Legs and fingers do not 'look' the same but

they are perceived as being similar, or iconic, because our minds construct the prototypical mental image of each item and then searches for correspondences: the greater the correspondence, the greater the iconicity.

However, iconicity is not a straightforward concept and can be divided into different types, as shown in Figure 6.1 below (from Nanny & Fischer 1999:xxii, who focus mainly on spoken languages). The two main categories of iconicity might be described as 'imagic' and 'diagrammatic'. The first type is perhaps the more easily understood, as it involves a form-based relationship between signifier and signified (which might be aural, tactile or visual), such as the English signifier *meow* for the signified 'sound a cat makes'. This type is also the one usually associated with sign languages, as when a sign is said to be 'iconic', this commonly means the visual form relates more or less closely to the meaning (e.g. two hands held in the shape of a book means 'book'). Sometimes a distinction has been made between signs being "transparent", i.e. easily understood on the basis of their iconicity even by non-signers, and signs being "translucent", i.e. having recognisable iconicity only post-hoc, after the meaning of the sign has been given (cf. Klima & Bellugi 1979).

The other, arguably more complex, category is diagrammatic iconicity, which is based on patterns in various ways. This encompasses both structural and semantic ways in which features of language (e.g. syntactic or lexical) can reflect their meaning. This normally is somewhat indirect and involves metaphoric or analogic extension. An example is isomorphism (a type of structural diagrammatic iconicity), which means that there is a one-to-one relationship between forms and meanings, and that two different forms cannot have exactly the same meaning (and vice versa).

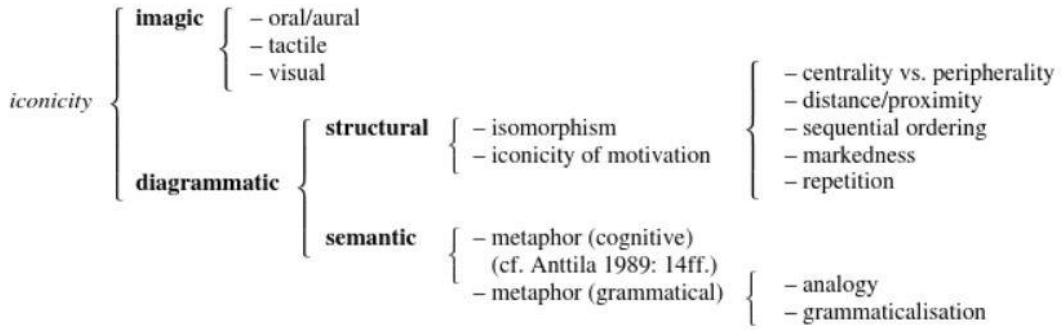


Figure 6.1: Types of iconicity (Nanny & Fischer 1999:xxii)

In the sense of Taub (2001), iconicity relies on our experiences and interpretations of the world. Therefore, it is natural that, although spoken languages do exploit iconicity (e.g. in the use of onomatopoeia), this phenomenon is much more noticeable in sign languages, which

make use of the ability to create a visual link between form and meaning by virtue of the signing space and by the visual nature of sign languages. For example, the signs for 'tree' are iconic in ASL, DSL and CSL, but they differ in terms of the particular aspect of the tree that signers tend to emphasise, as shown in Figure 6.2. According to Taub (2001), these three signs use two ways of articulating items iconically. The former is when the handshape represents the entity (called 'substitutive depiction') and the latter is when the path, or tracing outline, of the sign represents the outline of the entity (called 'virtual depiction').

CSL Danish Sign Language ASL

Figure 6.2 Signs for 'tree' from China, Denmark and America (these pictures are taken from Klima & Bellugi 1979: 21; they appear as Figure 1.8 in Baker-Shenk 1991:39)

Thus for sign languages, the category of visual imagic iconicity in the diagram above must be further sub-divided, as there are many ways in which a sign can visually resemble its referent. One such classification is provided in Rosenstock (2008), who proposes the following eight ways in which individual signs may resemble their referent:[7]

- Physical Entities Represent Themselves (indexical in the Peircean sense)
- Shape of Articulators Represents Shape of Referent
- Movement of Articulators Represents Movement of Referent
- Representation of Body Parts
- Shape of Articulators' Path Represents Shape of Referent
- Locations in Signing Space Represent Locations in Mental Spaces
- Size of Articulation Represents Size of Referent
- Number of Articulators Represents Number of Referents
- Temporal Ordering of Signing Represents Temporal Ordering of Events
- Signing Represents Signing

Rosenstock (2008:134)

Three of Rosenstock's ten types of sign language iconicity are relevant for the expression of numerals in the further discussions in this chapter: that in which the shape of the articulator

[7] A total of 10 categories are proposed by Rosenstock (2008), but only eight relate to the form of individual signs.

represents the shape of the referent; that in which the shape of the articulator's path represents the shape of the referent; and that where the number of articulators represents the number of referents. However, in the case of numerals the referents themselves are abstract entities, and an in-depth analysis would therefore require further sub-categorisation in terms of the ways in which an indirect relationship between a numeral concept and a numeral sign is instantiated. For instance, a possible relationship is metonymy, where the form of a sign represents a part or a certain aspect associated with the reference rather than the referent as a whole. For instance, the CSL sign TREE in Figure 6.2 represents the trunk of the tree only rather than the whole tree, and thus there is a metonymic relationship between the CSL sign TREE and the referent.

Even from the above brief sketch of the topic it is evident that iconicity can be a minefield of categorisations and sub-categorisations. In the context of this thesis, the matter is further complicated by the fact that numbers themselves are abstract entities. With the possible exception of the above-mentioned "number for number" iconicity, it seems that non-arbitrary relationships between a number sign and the referent number have to be indirect in one way or another. However, the aim here is not to go into the details of cognitive mechanisms of functional categorisations of iconicity. Rather, this chapter aims at characterising the ways in which numeral signs across sign languages are non-arbitrary, and detailed classifications of iconicity are beyond the scope of this thesis. Therefore, this chapter will discuss numeral signs in terms of their motivation, conceived broadly, rather than using any technical definition of iconicity. Thus motivated numeral signs are those whose origin can be related, directly or indirectly, to any extra-linguistic factor or reason outside the paradigm of numeral signs themselves, and the aim of discussing motivation is to throw light on the semantic origin of numeral signs. This will then elucidate how the motivation of JSL numerals compares to motivation of numerals in other sign languages. Where individual elements of forms are said to be "iconic", this does not imply any technical definition of iconicity.

6.2. Motivation in ZERO

The data analysed for this project indicate that motivation exists in the numeral systems of many sign languages. Numeral signs are often derived from an iconic representation of the shape of written numbers, which may include a visual representation of the shape itself or a 'tracing' of the shape in the signing space. For example, the sign ZERO may be produced by tracing the circular shape 0 (in addition to the two phonological variants of zero presented in section 5.1.1) and this is sometimes seen in JSL when articulated to large gatherings of people, e.g. when expressing the number 2000 (to refer to the year) by writing the digits "in the air". The individual digits are traced in the signing space, following the shape of the written

numerals, so that all participants are easily able to view the numbers.[8] Alternatively, the year 2000 is expressed by using a sequence of ZERO signs as in Figure 5.1, where it is the handshape and not the tracing movement that reflects the form of the written number.

Some signs for 'zero' are also seen to exploit a level of motivation in relation to the eyes and/or the mouth. The 'o' mouth shape that is articulated with the JSL sign ZERO could be regarded as iconic (i.e. another instantiation of a round shape), or simply as the ending of the mouthing 'zero', a word borrowed from English with an arbitrary form-meaning association. There is nothing inherent in the form of the mouth shape that would allow us to choose which option is preferable, and thus it is up to the sign language user and his/her conceptual mapping (as in Taub 2001) whether to regard the mouth shape as iconic or not. Such examples underscore the claim discussed above that iconicity is not objectively given but a matter of interpretation.

In several parts of Indonesia, sign language makes use of the eyes to represent the two middle zeroes found in the sign for the numeral 1,000, with the hands forming the initial 1 and final zero (see Figure 6.3). Although this is not a common semantic origin for numerals in a large number of documented sign languages, it is seen in the western variant of CSL (Fischer & Gong 2011) as well as in Indonesia (Palfreyman, in press). The JSL data, specifically from one of the interviews, reveal that the same iconic motivation was previously used for a variant of the numeral 100 (perhaps up until about 30 years ago) in JSL, at the Numazu deaf school in Sizuoka prefecture but this variant is no longer in use in JSL. This iconic use of the mouth and eyes in JSL is evident in the interview data, as seen in example (18) below:

(18)

Researcher: Where did you go to school?

Participant: For junior high school, up to the age of 15, I went to Hamamatsu deaf school and then for high school I went to Numazu deaf school. I was quite surprised because the number signs were very different in the two schools, for example, the round shape of the mouth and eyes, with the index finger extended alongside, are used for 10 (mouth) and 100 (eyes) and the first two fingers are held horizontally on the chin for ZERO, again reflecting the rounded shape of the mouth and also reflecting the two horizontal lines found in the written Japanese ZERO symbol. These signs are only used in Numazu deaf school and not in any of the other schools.

m.a(interview) .m2v 4.10—4.52

It is of interest to note that these iconic signs are no longer used at the Numazu deaf school (see Figure 6.4). The sign for '0' in the Numazo deaf school system is based on the double

[8] This is based on the author's personal observation in the JSL community.

underlining of the number ‘0’, which is typically used in Japan to indicate the grade of an exam paper.

Figure 6.3 A variant for ‘1,000’ in Indonesian Sign Language (from Palfreyman 2014)

Figure 6.4 Obsolete variants for ‘10’, ‘100’ and ‘0’ from Numazu deaf school

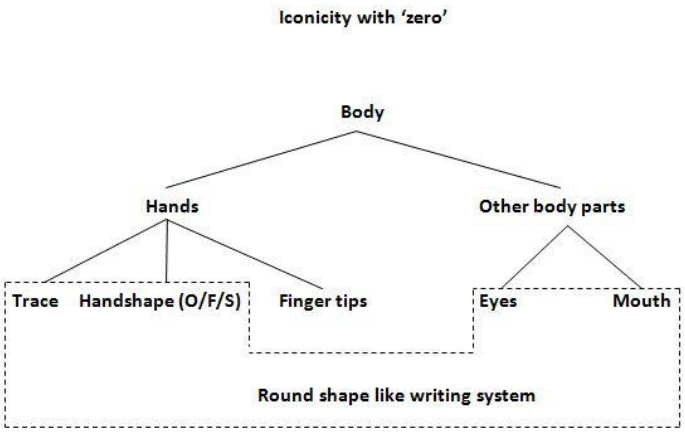


Figure 6.5 Schema of the ways ‘zero’ is represented iconically in sign languages

Figure 6.5 shows how certain representations of ‘zero’ are iconic, namely those representations that are formed using the mouth, eyes, fingertips, or handshapes such as those presented in section 5.1.1. As the figure illustrates, these iconic means of expressing ‘zero’ can be categorised into two main groups: those using the hands, and those using other body parts.

The former includes the O-, F- and S-handshapes as well as the fingertips and the use of tracing. The latter encompasses eyes and mouth patterns. All of these exploit some sort of round shape, reflective of the written Arabic form of zero, except perhaps the fingertips, which refers to a variant from Indo-Pakistani Sign Language (IPSL), where three extended fingers are pointed and 'stamped' forward to indicate the number of zeroes, e.g. in the sign for '1,000' (see Figure 6.6). In some dialects of IPSL, there is a more extended system indicating five and seven zeroes on the fingertips to signify '100,000' and '10 million'. This kind of visual motivation for '0' is not used in JSL but all other methods in Figure 6.5 are.

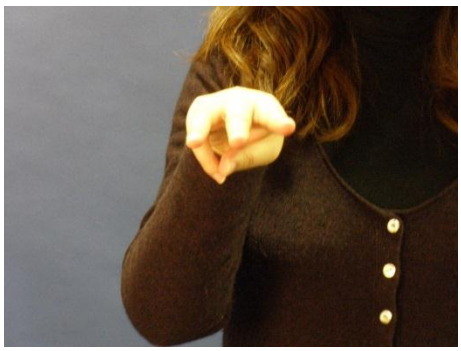


Figure 6.6 A variant for '1,000' from Indo-Pakistani Sign Language

In summary, this section has examined visually motivated signs for '0', which may be expressed iconically in both Indonesian Sign Language and JSL. It is evident that while certain variants of Indonesian Sign Language retain visually motivated signs for '0', these forms are extinct in JSL. It is also possible that iconic forms such as these are gradually becoming rarer in signed language.

6.3. Influence from writing in other numerals

The influence from writing in JSL provides further evidence of the semantic origins of numeral signs. Numerals 1-4 may be articulated with the 1, 2, 3 or 4 relevant fingers extended upwards or extended sideways (using "number for number" iconicity). The second variant is particularly used when expressing dates and the numbers 1, 2 and 3 in this sideways-oriented variant reflect the shapes of the relevant Kanji symbols. The first variant for '1,000' also demonstrates semantic origin based on the Kanji writing system, as it makes use of a tracing motion mirroring the shape of the Kanji symbol for '1,000', though in conversation this is often reduced to a briefer side-to-side movement because the form is somewhat cumbersome to trace in full. The second variant of '1,000' makes use of three closed fingers to represent the three zeroes and it is glossed here as THOUSAND-2 (see section 5.4). Influence from writing can also be seen in UgSL and TID in Figure 6.7 below.

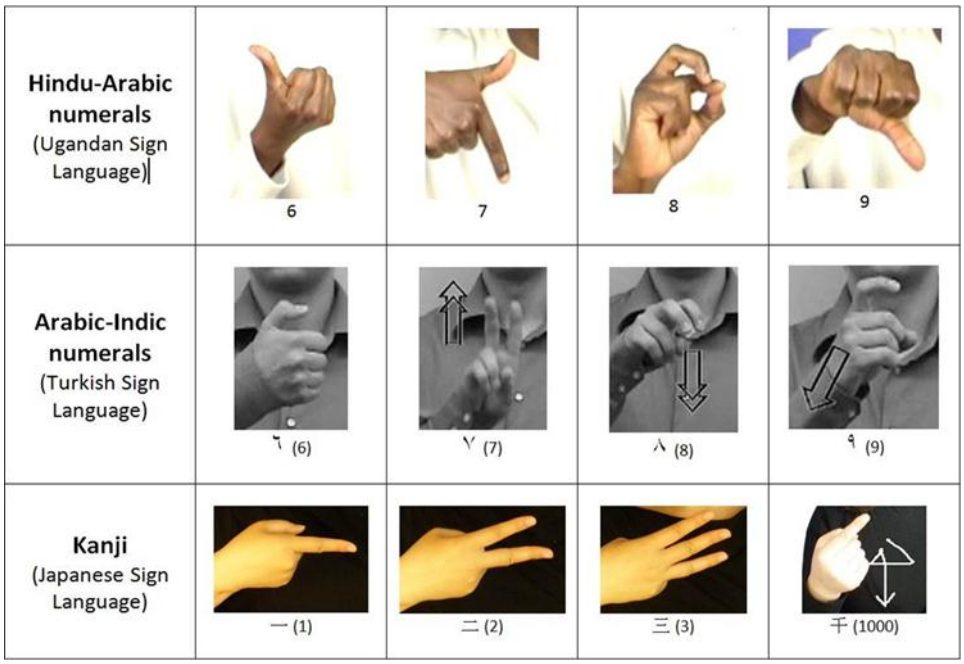
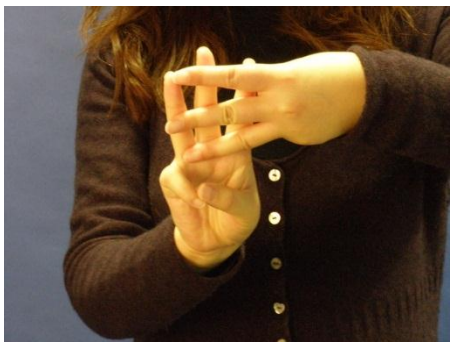
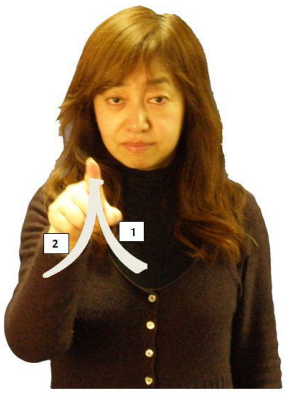


Figure 6.7 Numeral signs deriving from written forms in UgSL, TID and JSL

With regards to the typological comparison carried out on the data for this study, it is found that while JSL has two distinct variants for the numerals 1-4 (one vertical and one horizontal), in CSL, the orientation of the signs for 1-4 is somewhat flexible and it is often unclear whether there are two variants or one.

Fischer and Gong (2011) give several examples of how written characters such as Kanji have influenced JSL, either as depicted character signs (i.e. static signs forming the same shape as the relevant Kanji symbol such as 田 'rice field', shown in Figure 6.8), or traced character signs (i.e. signs that involve drawing in the air the relevant Kanji symbol, like 人 'person', shown in Figure 6.8). The writing system in Japan appears to have had an influence on the expression of numbers. For example the sign for ELEMENTARY-SCHOOL is based on the first character of the Kanji for 'elementary school' (小学校), and when this sign is followed by a cardinal numeral (to indicate school grade), the form of this number is orientated in a similar manner to the Kanji number; thus, instead of pointing upwards, the fingertips point sideways. The same is true of the compound signs indicating junior school and high school grades (see Figure 6.9). This also illustrates the phenomenon that some numerals exploit double iconicity: influence from Kanji and 'number for number' iconicity.





Kanji-based sign for ‘rice field’ 田 Kanji-based sign for ‘person’ 人

Figure 6.8 Signs motivated by Kanji symbols

小一 中二

Elementary grade one Junior grade two

Figure 6.9 Influences from written forms

Signs for ‘thousand’ also tend to be iconic in JSL (see pictures in section 5.4 on variation); the Kanto variant for ‘thousand’ reflects the Kanji shape, and its Kansai counterpart makes reference to the number of zeroes in the thousands (being part of a paradigm in which each bent finger represents a zero). However, the Kanto variant for ‘hundred’ seems to be arbitrary (see section 5.4). A similar system is used in CSL, which expresses school grades for junior school using the lips instead of the hand. Both the JSL and CSL systems are visually motivated based on the Kanji writing system, which explains why JSL and CSL have similar forms despite signers from each country having had very little contact (see Figure 6.10 below).

Figure 6.10 CSL ‘junior high school’

6.4. Body parts

The data reveal that numerals in some sign languages may have a semantic relation to a part of the body (other than hands and fingers, which are used in most sign languages). In the previous section, this has already been noted with use of the eyes and mouth in the expression of ‘zero’, and other body parts can be recruited for the expression of other numerals too. For example, the numeral 20 in Chican Sign Language is produced by placing the hands on the thighs, which refers iconically to ‘10 fingers and 10 toes’, as shown in Figure 6.11 below (Zeshan et al. 2013). This constitutes a vigesimal number system where ‘20’ is the base number. Additional numerals may then be added to produce further multiples of 10 (de Vos & Zeshan 2012: 13). A similar system is noted in Cambodian Sign Language (see Figures 6.12 and 6.13 below), where the two phalanx (sections in between the joints) of the thumb and the three phalanx of the fingers are used to represent numerals ‘100’ and ‘1,000’ respectively (i.e. the thumb, which has two phalanx, is extended to represent the two zeroes in ‘100’, and the index finger, with three phalanx, is extended for ‘1,000’). These phenomena involve metonymy, which Fischer and Gong (2010) have noted for CSL numbers as well (e.g. to indicate ‘10,000’, CSL uses a tracing movement that appears to be a 7, which is a metonymic reference to the final written stroke of the Kanji symbol for ‘10,000’). This seems somewhat different to the iconicity that appears in JSL numerals, which tend to be based on whole Kanji signs rather than parts of them.

Figure 6.11 20+10 Chican Sign Language to express '30' (de Vos & Zeshan 2012: 13)

Figure 6.12 Cambodian SL '100' using phalanx of the thumb

Figure 6.13 Cambodian SL '1,000' using phalanx of the index finger.

6.5. Spatial modification

Alipur Sign Language has an iconic and metonymic way of articulating large numbers: the higher the number, the further apart the hands are (see Figure 6.14). In other words, "increasing the spatial dimensions of the sign is equivalent to adding additional zeroes in written numbers" (de Vos & Zeshan 2012:13).

Figure 6.14 Alipur SL '100', '1,000', '100,000' (de Vos & Zeshan 2012: 14)

6.6. ‘Half’

Many signed languages, such as BSL and JSL, have a lexical sign for ‘half’, though this sign rarely refers to a specific number. Interestingly, however, several village sign languages, including Chican SL, Mardin SL and Alipur SL, use the lexical sign HALF to refer to the number 50 as being half of 100 (Zeshan et al. 2013). (This sign also means ‘half’ in both languages, and the specific meaning is normally derived from the context.) While JSL has a lexical sign for ‘half’, this sign is never used to refer to 50. Zeshan et al. comment on the interesting fact that in all three of the village sign languages studied, the lexical sign meaning ‘half’ has a very similar form, which is also used to mean ‘50’ (see Figure 6.15 below), even though these sign languages are unrelated and signers from each of these communities have never been in contact with other sign language users. According to Zeshan et al. (2013) this is no coincidence: the similarity can be put down to “shared iconicity”. The sign shows the thumb or index finger cut across the index finger of the non-dominant hand, which visually expresses the concept of ‘half’.

Figure 6.15 Chican SL ‘half’

Section 6.1 has explored influences on numeral signs. In JSL, iconicity often relates to Kanji forms, and does not include the use of certain other features like spatial modification. Unlike some village sign languages, JSL does not exploit signs for ‘50’ to mean ‘half’. Previously, iconicity involving body parts was a characteristic of JSL, but now this type of usage is obsolescent.

6.7. Sign names

One unusual means of indicating numerals, involving the use of sign names, comes from

Argentine Sign Language (ArgSL). Juan Druetta (personal communication 2013) conducted some unpublished research on the form of number signs in ArgSL, and found that numbers up to 19 are lexical signs in that they cannot be decomposed into constituent parts or units (see Figure 6.16). Druetta believes that the reason for this is because number signs in ArgSL come from sign names of pupils in numbered dormitory beds in deaf schools. Druetta also believes that it is likely that the signs come from sign names for men, as opposed to women, because of the lower social status of women at that time. This phenomenon is corroborated by a Japanese informant in the typology project, who advised that ArgSL involved this unusual source of number signs; the researcher then drew on the contacts she already had in the Argentinean deaf community to seek further details.

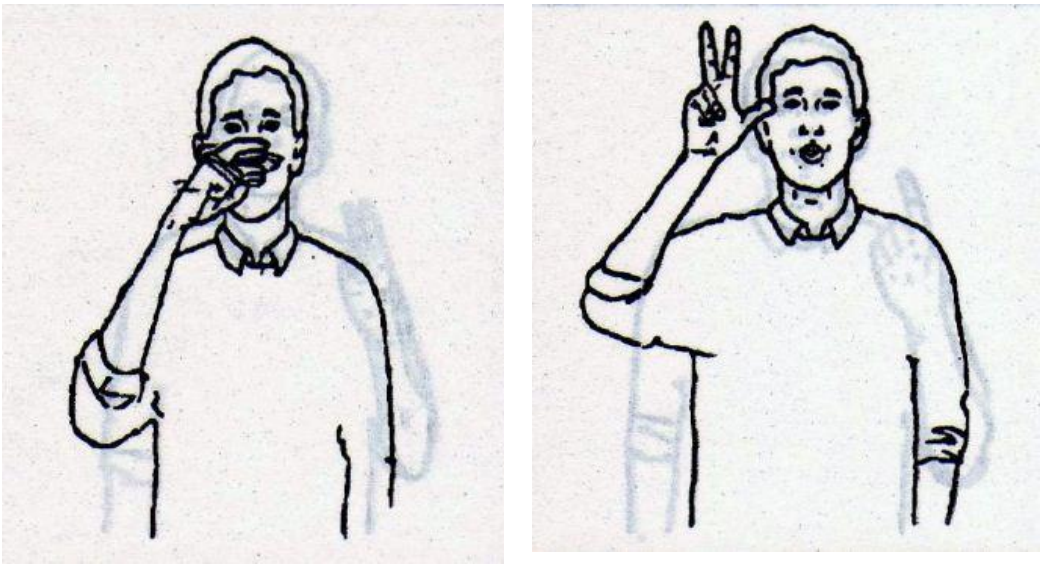


Figure 6.16 ArgSL '7' '8' from the dictionary of ArgSL (Crespo et al. 1993)

Research by Day and Sutton-Spence (2010)[9] on sign names sheds light on perhaps the opposite phenomenon to the above in BSL. That is, rather than the sign name influencing the forms of the number signs, already-established number signs become sign names. This phenomenon follows the now outdated practice of assigning numbers to deaf children in deaf schools before the 1960s (Day & Sutton-Spence 2010).

[9] Just as numeral signs may be motivated by sign names, some sign names involve reference to numerals. However, this is outside the scope of the thesis.

6.8. Money

Iconic number signs in JSL and village sign languages have a similarity in that both make use of images shown on currency. The ChicanSL sign for '100' refers iconically to the deer that was formerly depicted on 100-notes in Mexico, and an older JSL sign for '10,000' referred to the beard of Prince Shotoku, whose picture appeared on the 10,000-yen note. This was referred to in one of the participant interviews - *ok(interview).m24* – with an elderly informant above the age of 80, who explained use of this sign during his time at school.

6.9. Summary

This chapter has revealed the types of semantic motivation that are relevant to numerals in JSL, and a number of interesting generalisations can be drawn from the data discussed in this chapter. First of all, JSL makes use of a relatively small number of types of semantic motivation. The cross-linguistic data have revealed that across sign languages, there are many distinct ways in which numerals can be iconic, and several of these are not present in JSL at all. Present-day JSL uses two of these strategies: Taub's 'number for number' type of iconicity (Taub 2001:85), i.e. that in which the number of articulators represents the number of referents as noted by Rosenstock above; and iconicity associated with the written language of the community, primarily in the form of Kanji. Again, in terms of the categories proposed by Rosenstock above, influence from writing may be realised through producing a handshape resembling a written form, 'tracing' a written form in the air, or using another body part to represent a number (e.g. the eyes represent zeroes in one Indonesian Sign Language sign for '100'). All of these options have been discussed in section 6.2 with respect to the numeral 'zero', which employs a particularly wide range of iconic strategies.

Interestingly, this research has revealed that JSL has lost or is in the process of losing several types of semantic motivation in numerals. Semantic motivation in older varieties of JSL and newer varieties of JSL (as defined in Chapter 4) is contrasted in Table 12.[10] This shows several tendencies. Firstly, the 'number for number' iconicity used to cover a wider range of numerals in older JSL varieties, including two-handed signs with extended fingers for numerals between six and 10. In present-day JSL, this type of motivation is restricted to the numerals 1 to 4 only. Secondly, two types of semantic motivation that characterise older varieties of JSL are no longer used and have disappeared from the newer varieties. This concerns the use of the mouth and eyes to express 'zero', as well as the visual iconicity derive from a currency note (for 10,000) and the corresponding numeral sign. The conclusion is therefore that in this

[10] Some of the "older varieties" of signs described in this chapter seem to be associated with very elderly signers who are above 80 years of age, but distinctions between signers who are 'over 45' as defined in Chapter 4 and those who are even older are not pursued here.

domain, JSL is moving away from visually motivated iconicity, and the role of writing, in particular Kanji, in the motivation of signs has been increasing. It is tempting to relate this to the known increasing literacy in the JSL deaf community, but systematic exploration of this point would be beyond the scope of this thesis.

Table 12 Semantic motivation in older and younger varieties of JSL

Type of semantic motivation in numerals	**Older varieties of JSL**	**Newer varieties of JSL**
Number for number	Yes (1-10)	Yes (1-4 only)
Writing	Yes	Yes
Body parts	Yes (mouth and eyes in 'zero')	No
'half'	No	No
Spatial modification	No	No
Sign names	No	No
Money	Yes (10,000)	No

7. NUMERAL INCORPORATION

This chapter focuses on numeral incorporation, both in the form of combinations with sign for countable units and numerals, and within the numeral system itself to form complex numerals. The various approaches to a linguistic analysis of numeral incorporation have been discussed in Section 2.2.2. The analyses presented below take the position of Liddell et al. (1984) and Ktejik (2013), that numeral incorporation can be interpreted as a combination of two bound roots. This perspective is favoured here because many numeral-incorporated signs involve elements which cannot be perceived as free morphemes, i.e. they are lacking an essential phonological component such as a handshape, and do not occur no their own.

The chapter first outlines the main findings from the data in relation to numeral incorporation in JSL, with a particular focus on the morphological aspects in order to explore the first element of the central research question (see section 1.7). The typological comparison of numeral incorporation in Section 7.2 enables the second element of the central research question to be considered.

A comparison of the sign languages studied under this project reveals that overall, numeral incorporation in constructions with particular semantic fields relating to everyday life, such as time, money and school grade, seems to be a common feature of sign language grammar. As section 2.2.2 noted, this is a feature of sign languages only and is not apparent in spoken languages. Not all nominal signs that refer to countable entities can incorporate a numeral sign. Instead, countable entities outside the domains usually associated with numeral incorporation use separate lexical numeral appearing after or before the nominal sign. For example, a noun phrase such as ‘three books’ must be signed using two separate signs THREE BOOK, and not using a ‘3’-handshape with the movement from the sign BOOK. Thus signs such as *{THREE}{BOOK} are unacceptable in all of the observed sign languages.

The data reveals that numeral incorporation is used in the domains of time, money and age in many sign languages, such as ASL, BSL, JSL and NZSL. Signs for these concepts all occur reasonably frequently in language and are often articulated with numerals, as they involve highly countable entities (e.g. years, dollars). This may explain why they tend to be incorporated more than other nominal signs (see also comments below on frequency effects, e.g. with the JSL expression ’20 years’).

7.1. Numeral incorporation in JSL

This section presents data findings related to numeral incorporation in JSL, which uses numeral incorporation to express multiples of tens, hundreds, and thousands. The use of numeral incorporation to signify higher numbers in this way has been rarely addressed in the literature, which has tended to focus on numerals occurring with units from other domains, such as money and time. Typically, each paradigm has a location and a movement with values from 1 to 9 incorporated as handshapes. As Ktejik (2013) states, the options for numeral incorporation are determined by the handshape involved. Simple multiples of ten are discussed initially before moving to an illustration of larger numbers and numeral incorporation in other units.

7.1.1. Numeral incorporation in JSL cardinal numerals

JSL exploits numeral incorporation in the formation of complex numerals i.e. tens, hundreds and thousands, as discussed in Chapter 5. The numeral signs 20 to 90 and their phonological variants have been discussed in Section 5.1.4 and summarised in Table 11 in that section. The figures below are from the data corpus and show articulation with the fingers bent and an added side-to-side movement (Figure 7.1.a). Alternatively, the selected digits are bent once, as in Figure 7.1.b, though this is less common. In some cases the selected digits may be bent several times – this is particularly noticeable among older signers. For '60' to '90', the thumb may bend along with the selected fingers, or may be held straight (see Figure 7.1.b from elicitation game 1), i.e. the bending of the thumb for these number signs appears to carry no additional meaning. This bending /unbending of the thumb being a phonetic variant which causes no difference in meaning reflects a rather common phenomenon that has been noted for other sign languages, e.g. Indo-Pakistani Sign Language as found by Zeshan (2000). A variant of the sign for '80', shown in Figure 7.1.c (where the ring finger instead of the pinkie finger is bent) appears in the data, albeit rarely.

Figure 7.1.a: '40'
ma(game2).eaf 01.07

Figure7.1.b: '70'
i-ino(game1-1) 02.35

Figure 7.1.c: '80' with little finger bent (based on EIGHT-1) and '80' with ring finger bent (based on EIGHT-2) ma(list) 00.56

Figure 7.1 Number incorporation in cardinal numerals for '40', '70' and '80'

In JSL, the signs for 100-900 use number incorporation by internal movement. This is done by extending the fingers as if for 1-9 and then flicking in an upward motion to refer to the 'hundred'. In Kansai, however, there is an alternative way to sign '100', i.e. by bringing the thumb, middle and index fingers together (see Figure 7.2b). This sign can only be used for '100', not for '200', '300' and so forth, though it was probably part of a more productive numeral series, though without numeral incorporation, at some point in the past (see Chapter 8 for more on these signs).

7.2a '300' (Kanto)

7.2b '100' (Kansai)

Figure 7.2 Kanto and Kansai variants for 'hundreds'

For multiples of one thousand, the same orientation is used as for multiples of 100 and a sweeping motion is used, like that of the Kanji character 'thousand' (千). This has become simplified and now traces a shape more similar to 𠂉 or, when articulated quickly, simply a brief side-to-side movement. This paradigm has been discussed in Section 5.1.4 (see Figure 5.5).

Each of the above category (tens, hundreds, and thousands) also has one Kansai variant (i.e. a sign for '10', '100' and '1,000') that cannot be incorporated. The iconicity related to the multiples of thousand, which refers to the Kanji character, has been discussed in Chapter 6; however, multiples of 'tens' and 'hundreds' seem arbitrary, and there is no evidence of any semantic motivation with these signs.

7.1.2. Numeral incorporation in ordinal numerals

As discussed in section 5.2, five paradigms are used to create ordinal numerals in JSL. Each paradigm refers to a particular type of ordinality such as the order in a competition or the order in time. In spoken Japanese, ordinal numerals are derived from cardinal numerals, with various morphemes, such as *ban, me* and *kyu*, added to the cardinal numeral sign (either before or after) to form an ordinal numeral (Stoltz and Veselinova 2011). It is interesting to note that four of the paradigms used in JSL are also used in spoken Japanese, which were discussed in section 2.1.2. This suggests that they may be the result of language contact. Figure 7.3 compares JSL to spoken Japanese.[11] JSL and spoken Japanese share the paradigms of ordinal numerals, that is, the *me*, *i*, *ban*, *kyu* and *dai* paradigms are used in both languages. In spoken Japanese, some of these words occur before the number and some of these words occur after the number. In JSL, these words are incorporated simultaneously with the number. For example, NI-BANME in JSL is produced with the lexical sign for '2' touching the eye. The eye contains the 'banme' morpheme.

Paradigm JSL	*me*	*I*	*ban*	*Kyu*	*dai*	*Kodomo*
						
Japanese	Ni-banme 'second (in the queue)'	Ni-i 'second (in the race)'	Ni-ban 'second (in general)'	Ni-kyu 'second (best)'	Dai-ni 'second time'	N/A

Figure 7.3 Ordinal number paradigms in JSL

Spoken Japanese does not have the 'kodomo' paradigm, which is specific to JSL. This paradigm does not have numeral incorporation but is able to differentiate between 'second-of-three', 'second-of-two', etc., depending on the hand configuration used in the 'kodomo' paradigm (Figure 7.3 shows the sign for SECOND-OF-THREE). In these ordinal series, the handshapes of the non-dominant hand are the same as for the cardinal numerals by themselves, with the exception of number 'five', which has a different hand configuration for the cardinal numeral and for the 'kodomo' paradigm: the sign FIVE is a closed hand with an extended thumb but the

[11] It has not been at this stage explored whether the JSL and the Japanese forms are used in exactly the same contexts in all cases.

sign FIVE-KODOMO is an open hand with all fingers extended (Figure 7.4). Of these five incorporation paradigms that can be called ordinal, to the author's knowledge only two (the *me* paradigm and the *i/ban* paradigm) have so far been described (Ktejik 2013).

FIVE LIST-BUOY-1-2-3-4 HEARING LIST-BUOY-5 DEAF

'Five people, four hearing and one deaf'

Figure 7.4 List buoy in JSL

TK(interview).eaf 00.39-00.41

As Ktejik (2013:198) reports, the maximum number that may be incorporated is not always clear in JSL. Numerals such as 1, 2 and 3 are regularly incorporated; situations that require the use of higher ordinal numerals, such as 7, 8 and 9, are so rare that the acceptability of such incorporation is ambiguous. For numbers larger than 10, many sign languages do not use numeral incorporation because the numbers ten and above tend to contain internal movement. However, there are some exceptions to this generalisation in JSL and some other Asian sign languages (see Section 7.1.3).

7.1.3. Numeral incorporation for time units in JSL

For the numeral incorporation of ordinal numerals, described in section 5.2 above, it is noted that acceptable or compatible values usually, if not always, have an upper limit of 9. For other paradigms, such as time and age, however, signers are more likely to talk about larger numbers and so these numbers can sometimes be incorporated (see below example from JSL). However, only numeral handshapes that do not feature internal movement can be incorporated in JSL

(see Mathur & Rathmann 2010:65; Ktejik 2013:207). This means that it is not grammatical to incorporate numbers such as ELEVEN-1 and TWELVE-1. Interestingly, where variants for these numbers do *not* include internal movement, it is permissible to use these with numeral incorporation instead. For example, ELEVEN-2 (see Figure 5.10 in Chapter 5) and TWELVE-2 (Figure 7.5) have a single handshape and no internal movement, and may be incorporated, although the use of TWELVE-2 is largely restricted to Hokkaido (Hokkaido Deaf Association 2005). Mathur & Rathmann (ibid) found that, in the case of numerals where the variant includes internal movement, numeral incorporation may be partial (see Section 7.2.3 for details).

Figure 7.5 TWELVE-2 (in Hokkaido)

JSL uses numeral incorporation to express numbers of hours and numbers of minutes, but not seconds. To indicate numbers of minutes, the dominant hand shows a number from 1-10 or a multiple of ten up to 50, twisting at the wrist (Figure 7.6.a). For numbers of hours, the dominant hand moves in a circular pattern as if on a wristwatch, while articulating a number from 1-12, or multiples of ten up to 90 (Figure 7.6.b).

Numeral incorporation is also used to indicate a number of days, weeks, months and years. The {DAY} paradigm is located on the chest, and the movement root entails the numeral handshape moving from the non-dominant side to the dominant side (Figure 7.6.d). When the number of days being referred to is 1-5, 10, 20, and sometimes 6, the handshape makes contact with the chest once on each side. For a period of days between 6 and 9, the hand moves in a similar direction but is held out from the chest and does not make contact; this may be because the sign meaning '7 days' has the same movement root as the {WEEK} paradigm, which is also articulated further out from the chest. The number of weeks (Figure 7.6.e) is also incorporated, and takes values from 1-3 only (perhaps because, for higher numbers, it is possible to use a larger unit, such as 'one month' as opposed to 'four weeks'; see also Ktejik 2013:208). The sign for 'month' (Figure 7.6.c) is located at the cheek and can incorporate numerals from 1-11. There is some variation in this form, as some signers twist the hand when moving it away from the cheek. Numeral incorporation of years is allowed for numbers from 1-

10, and multiples of 10 up to 90. The sign involves the non-dominant hand in a fist, with the dominant hand forming number handshapes and moving in a circle, then touching the fist (see Figure 7.6.f). According to folk etymology, the fist handshape represents a tree trunk with the annual growth rings facing upward (Maruyama 1984).

{FIVE}{MINUTES} 'five minutes' KO(game3) 01:28-01:29

Figure 7.6.a

{ONE}{HOUR} 'one hour' Hi-interview2 04:19-04:20

Figure 7.6.b

{FIVE}{MONTHS} 'five months' H-list 08:00-08:01

Figure 7.6.c

{TWO}{DAYS} 'two days' Number-list A 00:02-00:03

Figure 7.6.d

{THREE}{WEEKS} 'three weeks' Hi- list 03:54-03:55

Figure 7.6.e

{ONE}{YEAR} 'one year' AM(game3) 04:29-04:30

Figure 7.6.f

Figure 7.6a-f Numeral incorporation of time

7.1.4. Numeral incorporation for money in JSL

Numbers 1-9 can be incorporated with the monetary unit 'yen'. This is done by twisting the hand outwards in a sweeping motion. There is also a sign meaning '100 yen', which uses a

'flick' of the index finger against the thumb, but this does not commonly incorporate other numeral handshapes. Apart from the small numbers and {100}{YEN}, there is no option to express money terms via numeral incorporation and a separate lexical sign is required. Where this is previously established in the discourse, the monetary sign is commonly dropped and it is evident in the discourse that the numerals articulated relate to money.

(19)

Participant a: ONE {100}{YEN}, APPLE FIVE 500

'One apple is 100 yen, and five apples is 500 yen.'

_____q _____q

Participant b: DISCOUNT CANNOT ONE 100 ONE 50 NOT

'Can't I get a discount, one for 50 yen instead of 100?'

a-m(game3).eaf 08:00 – 20:50

7.1.5. Numeral incorporation for people in JSL

It is possible to use numeral incorporation to refer to a certain number of people (see Figure 7.7). In these cases, the numbers from 1-10, and also for multiples of 10 up to 90, are articulated with a movement that traces the shape of the Kanji sign for person (人), although as with several other examples of numeral incorporation described above, the movement may be reduced.

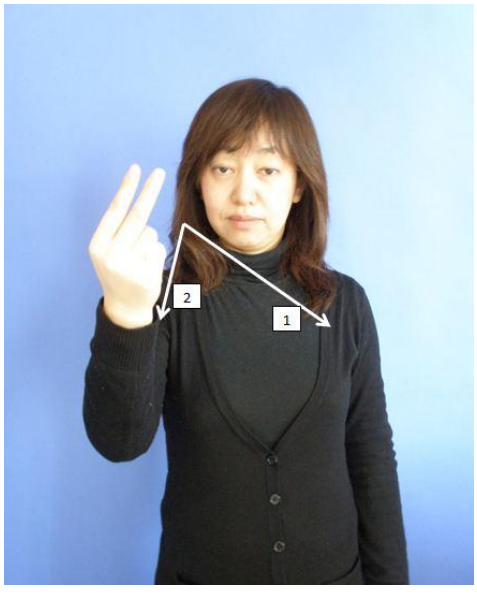


Figure 7.7 **JSL sign {TWO}{PEOPLE}**

7.1.6. Numeral incorporation for age in JSL

Although rarely used, ages from 1 to 4 years are sometimes incorporated with a movement from the chin. Interestingly, 20 can also be incorporated in the same fashion, as this is considered the year of entry into 'adulthood'. This suggests that the process of numeral incorporation is related to frequency: since '20 years old' has significant meaning in Japanese culture it is likely to be used more often than other ages. In other words, the unit and numeral occur together with high frequency. As a result, the form has possibly become lexicalised. Other numbers, such as 30 and 40, are not incorporated in this way. The majority of JSL users express age sequentially as a compound of the sign AGE and the requisite number of years. Figure 7.8 shows the lexicalised sign {TWENTY}{YEARS OLD} (Figure 7.8.a) alongside {TWENTY}{YEAR} '20 years' (Figure 7.8.b), which is part of a larger paradigm of numeral incorporation. The latter sign cannot be used to refer to age and only refers to a time period.

Figure 7.8.a{TWENTY}{YEARS OLD} 7.8.b. {TWENTY}{YEAR}

TK(interview).eaf 06.21 – 06.23

In summary, the JSL data show evidence of numeral incorporation and commonly used in many other sign languages, but there are also some cross-linguistically unusual structures. This includes the possibility of partial numeral incorporation, an individual lexicalised form with incorporation of '20' in the 'age' paradigm that is evidence of a frequency effect in this particular cultural context; numeral incorporation with Kanji-based forms (PERSON), and the existence of stationary numeral handshapes for ELEVEN and TWELVE. Moreover, some incorporation paradigms in JSL also extend to include an interrogative handshape (e.g. 'what-age?'), using the same formational process as with numeral handshapes. This is discussed in Morgan (2006), but not pursued further here. The next section explores cross-linguistic data on numeral incorporation to place the observations on JSL into a wider context.

7.2. Cross-linguistic comparison of numeral incorporation

This section focuses on comparing numeral incorporation in JSL with that of various other sign languages (see section 3.3). Some languages were chosen because of the availability of existing data related to them, collected for the Sign Language Typology Project, leading to a natural convenience sample. This data also enriches the typological scope of the analysis presented here as the languages come from a range of different families.[12]

In this section, sign languages from Groups 1-3 are the focus of these comparisons, with particular emphasis on Groups 1 and 2. Group 1 and 2 sign languages show some interesting similarities with each other, and some of the information presented here informs the discussion of numerals in the Japanese Sign Language family in Chapter 8. Numeral incorporation appears to be rare for Group 4 sign languages. This is not to say that numeral incorporation does not exist in village sign languages at all. For example, numeral incorporation of cardinals is not used when counting in Ban Khor Sign Language (BKSL) but incorporation of small amounts of money (e.g. 20 *baht*, 30 *baht*, 40 *baht*) is found (Angela Nonaka, p.c., January 2014). In contrast, many urban sign languages have extensive examples of numeral incorporation, including incorporation for time, calendar units (days/weeks/months/years), money and school grades. De Vos (2012) observes three signs in Kata Kolok that exhibit this phenomenon: ONE-DAY-AGO, THOUSAND-RUPIAH and SCHOOL-GRADE (2012: 96). Numeral incorporation, though very rare, is noted for money in Adamorobe Sign Language (AdaSL), where a study found a number handshape that combines with a movement in a particular direction and location. The signs are located at the pocket area of the waist and move forwards and upwards, the incorporated numeral indicating an amount of payment made to a person (Nyst 2007:107).

7.2.1. Cardinal numerals

The use of numeral incorporation in cardinal numerals in Group 1 and Group 2 sign languages shows parallels that can be assumed to be the result of historical contact and/or contact with the same writing system in the same wider cultural area. Table 13 shows how the JSL (Kanto) variants for multiples of 10, 100 and 1,000 (cf. Chapter 5) compared to other Asian sign language varieties in the region. The table shows that numeral incorporation with these multiples is common across these sign language varieties, with the exception of Kanto JSL variants and southern Taiwan. Moreover, the underlined varieties in each column employ the

[12] The analysis here is presented by topic, rather than repetitively explaining each group.

same sign forms, with a few modifications to be detailed below. The southern variant of TSL and the Kansai variant of JSL do not use the numeral-incorporated paradigm for 'hundreds' and 'thousands'. Further discussion of these variants is presented in Chapter 8, including pictures of the relevant signs.

Table 13 Numeral incorporation with complex numerals in JSL, SKSL, TSL and CSL

	multiples of 10	multiples of 100	multiples of 1000	multiples of 10,000
JSL (Kanto)	Yes	Yes	Yes	No
JSL (Kansai)	No	No	No	No
TSL (north)	Yes	Yes	Yes	No
TSL (south)	Yes	No	No	No
SKSL	Yes	Yes	Yes	No
CSL	Yes	Yes	Yes	Yes

Where individual sign variants are underlined in each column, this means that the same sign forms are used across these sign languages. However, individual underlined variants of the same signs differ from the JSL (Kanto) variants in the following formational ways:

- For multiples of 10 with numeral incorporation, JSL orientates the hand to its side with palm facing the signer, while TSL orientates the hand vertically and with the palm facing away from the signer. Figure 7.9 illustrates this difference for '80' in TSL.
- CSL uses bending to express multiples of ten, but it uses different handshapes to JSL.
- For multiples of '1,000' based on the Kanji character, the orientation of the hand in CSL appears to be more flexible than in JSL: in CSL, the hand and movement involved in this sign for 'thousand' is allowed greater flexibility and signers are permitted to change the orientation of the hand, while in JSL, hand orientation must be with palm facing inwards.
- The SKSL sign for multiples of '1,000' is a reduced form, not tracing the entire Kanji character (see picture of THOUSAND-1 in Chapter 8).

Figure 7.9 TSL '80'

There are three different ways to articulate numerally incorporated multiples of 100 in CSL, all of which are different from JSL: firstly, the relevant extended fingers move sideways to the right and this is a nationally used variant; secondly, in the South of China, the relevant number of extended fingers move forwards; and thirdly, in the western regions, the relevant number of extended fingers is held to the side of the face, making use of the eyes to represent '00'. There is also an option to produce multiples of 100 in CSL by using compound signs (which is used all across the country) or by using numeral incorporation, though the 'hundred' morpheme is different to that used in JSL.

Like JSL signers, TSL and SKSL signers do not use numeral incorporation with signs for 'ten thousand'. The sign for 'ten thousand' in JSL does not refer to Kanji, but to four zeroes, and TSL and SKSL have similarly motivated signs. However, CSL signs for this number reflect the shape of the Kanji symbol meaning 'ten thousand' and can be numeral-incorporated. For numbers over 'ten thousand', JSL does not use numeral incorporation. The largest lexical number sign in JSL means 'one hundred billion' and reflects the Kanji symbol for this concept. CSL shows even more influences from Kanji in its signs for large numbers and also has Kanji-related lexical sign meaning 'one hundred billion', without numeral incorporation. However, its form is different to its JSL counterpart.

Analysis of the typology project data from Group 3 sign languages indicates that many of the sign languages from group 3 employ numeral incorporation for multiples of 100 as well as multiples of 1,000.[13] On the other hand, not many of Group 3 sign languages employ number incorporation for multiples of 10. For example, BSL uses a system of compounding whereby '20' is composed of the signs for '2' and '0'. Those sign languages using numeral incorporation for multiples of 10 include sign languages in the Czech Republic, Finland, Germany, Greece, Iceland, Jordan, Kosovo, Norway, Poland, Saudi Arabia and Turkey. Interestingly, several sign

[13] The pilot Sign Language Typology database includes 11 sign languages each, but there are more instances in the data that are not incorporated into the database because of data permission issues.

languages use bending of the fingers for multiples of 10 as in JSL (including German Sign Language and Greek Sign Language). As Zeshan (2010:223) notes, it is common in sign languages to see "identical or very similar forms can arise independently in sign languages that are in no way genetically or geographically related". Therefore, the arguments around language relatedness in Chapter 8 rely on several parallel forms in JSL, SKSL and TSL rather than on a single numeral form, which could be the result of accidental similarity.

An alternative common strategy for expressing multiples of 100 and 1,000 without numeral incorporation in the sign languages used for the typology project is to use multiplicative compounding strategies. In these languages, the relevant numeral sign is followed immediately by a lexical sign for 'hundred' or 'thousand'. For instance, Cambodian Sign Language does not use numeral incorporation for these numerals but uses a multiplicative strategy (Figures 6.12 and 6.13 in Chapter 6). In Indo-Pakistani Sign Language, the numeral is followed by three extended fingers representing the three zeroes in the sign for 'thousand' (Figure 6.6 in Chapter 6).

Group 4 sign languages do not tend to use numeral incorporation but employ unique methods for expressing number, such as the additive method and spatial modification. ChicanSL employs an additive method in which multiples of ten are created by adding tens. For example, the number '30' is expressed by signing '10' three times. APSL uses spatial modification to distinguish three augmentative forms of the sign 'hundred'. Each form roughly correlates with 'thousand', 'hundred thousand' and 'ten million' has been compared to Urdu, where 'hundred thousand' and 'ten million' are separate lexemes (Zeshan et al. 2013).

7.2.2. Ordinal numerals

Most signed languages in the typology data have two ways of expressing ordinal numerals. The first often includes a twisting of the wrist when forming the cardinal numeral sign, which may be placed in varying locations in the signing space. This form is seen across a number of unrelated sign languages. The second common form corresponds to the JSL KODOMO paradigm and involves the use of a list buoy, or enumeration (see section 2.2.3); however this does not constitute numeral incorporation and so it will not be discussed in any further detail.

The data reveal that the sign languages from the first three groups all use modifications to cardinal numerals in order to articulate ordinals. The parallel with spoken languages is interesting here, as we find the same preference to derive ordinal from cardinal numerals. Stolz & Veselinova (2011) report that in 205 out of 321 spoken languages, ordinal numerals are derived from cardinal numerals, often with 'first' and 'second' being exceptional. In the sign languages considered here, however, there is no case of 'first' and 'second' using different lexemes; instead the derivation of ordinals is regular for all cases in the sign languages

considered in this study.

As no data were collected related to Group 4 ordinals, the system for creating ordinals in those sign languages is not known. However, as explained in section 5.2, JSL has a wider range of paradigms for ordinal numerals than most other known sign languages. In contrast, SKSL seems to have fewer options, including the *ban* paradigm and a modification of SKSL cardinal numeral signs (further research is needed, as there may be more ways of expressing ordinals in SKSL). TSL also has a more limited range of ordinal numeral series compared to JSL, with four options for expressing ordinals. Three of these are the same as the *dai*, *ban* and *kodomo* paradigms that exist in JSL. The fourth option is not used in JSL because it is related to the concept of first/second name which is not expressed in Japan; however, this option is the same as one of the CSL paradigms. Ordinal numerals in TSL are thus quite interesting as they show evidence of the historical influence from both JSL and CSL, due to each country's occupation of Taiwan. (This is discussed in Section 3.3.1 as well as in Chapter 8.)

7.2.3. Numeral incorporated units: time

It is common across sign languages for units of time to be numeral-incorporated. These include units such as hours, weeks, months, days and years. However, different sign languages allow different units to be incorporated. Section 7.1.5 examined numeral incorporation in JSL and revealed that JSL uses numeral incorporation for o'clock, hours, weeks, months, days and years. SKSL is able to incorporate numbers with units for hours (e.g. {ONE}{HOUR}, {TWO}{HOUR}), clock time (e.g. {ONE}{O'CLOCK}, {TWO}{O'CLOCK}), days, months and years but it does not incorporate numbers with the unit for 'week'. 'Week' must be articulated in a separate lexical form (this also applies to signs for money, as explained in the next section). TSL uses numeral incorporation for hour, week, month and year but it does not allow incorporation for 'o'clock'. This is shown using the digital method, for example TWO ZERO ZERO. This digital method is no longer seen in JSL and it is not found in the data on SKSL. However, personal communication with a native signer of SKSL has revealed that the digital method is still acceptable in SKSL. Table 14 below indicates what time-related units can be incorporated in groups 1 and 2.

Table 14 Numeral incorporation with time units in JSL, SKSL, TSL and CSL

Time unit	JSL	SKSL	TSL	CSL
O'clock	+	+	-	+
Hours	+	+	+	+
Days	+	+	+	+
Weeks	+	-	+	+
Months	+	+	+	+
Years	+	+	+	+

As mentioned above, JSL does not allow numeral incorporation with handshapes containing internal movement. This suggests that there is a phonological constraint at work to limit the amount of phonological complexity allowed within a sign with numeral incorporation. However, this phonological constraint does not apply to CSL or TSL, which allow handshapes with internal movement to be incorporated. Mathur & Rathmann (2010:65) illustrate grammatical forms and ungrammatical forms of numeral incorporation in JSL (see Figure 7.10 below). The sign TEN-TWO ('twelve') cannot be incorporated with HOUR. Instead, each sign must be articulated separately. This suggests that the phonological constraints at work in JSL consequently limit the extent of numeral incorporation in JSL. This is not the case for CSL and TSL, which do not have this phonological constraint. Figure 7.11 shows the TSL sign {TEN}{HOUR}^TWO 'twelve hours'.

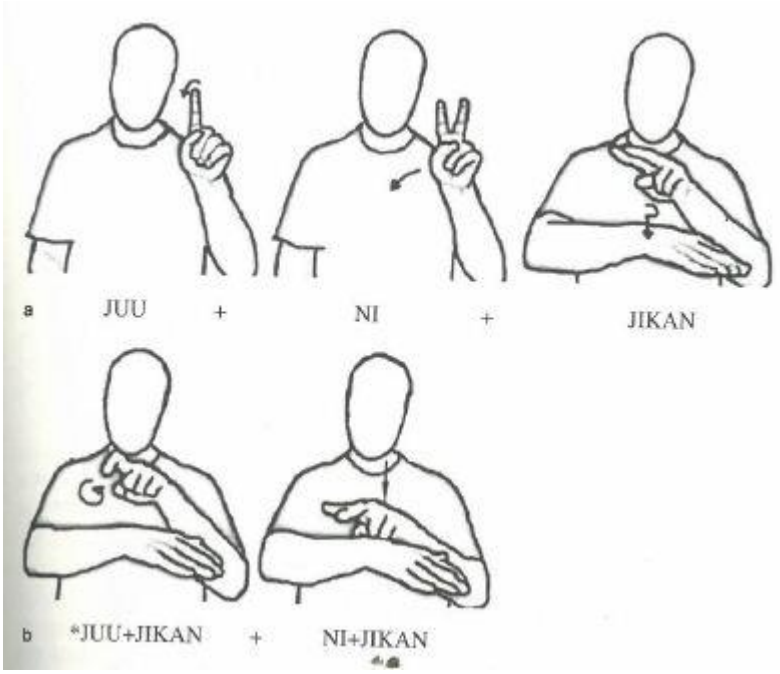


Figure 7.10 Example of partial numeral incorporation in JSL. Example in (a) shows the correct form in JSL for 'twelve hours' as opposed to the incorrect form in (b). (Mathur & Rathmann 2010:65).

Figure 7.11 TSL {TEN}{HOUR}^TWO 'twelve hours'

The same form that is ungrammatical in JSL (see Figure 7.10) is acceptable in CSL, which allows handshapes with internal movement to be incorporated. Figure 7.12 below shows the CSL incorporated form for 'thirteen hours'. This kind of structure is also used to incorporate numbers of days, e.g. 'twelve days', 'thirteen days', in CSL. Though CSL and TSL employ different systems of numeral incorporation, both sign languages allow for numeral incorporation of handshapes with internal movement, while JSL must use partial numeral incorporation instead, i.e. with the final 'two'-handshape element only (Mathur & Rathmann 2010:65). Numeral incorporation of handshapes with internal movement is certainly uncommon across sign languages and is explicitly ruled out as ungrammatical in JSL and some other sign languages, such as ASL (Fischer, Hung & Liu 2011).

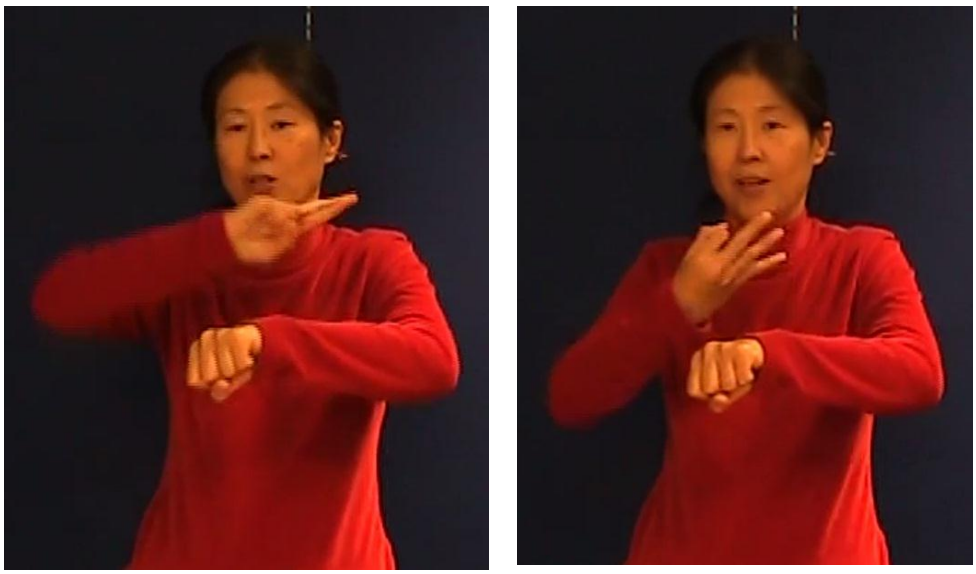


Figure 7.12 CSL {TEN}{HOUR}^THREE 'thirteen hours'

CSL shows variation in its numeral-incorporated signs referring to numbers of months. The Shanghai sign (see Figure 7.13) is similar to the numeral-incorporated form X-MONTH in ASL, while the Beijing sign (see Figure 7.14) is unique to China.

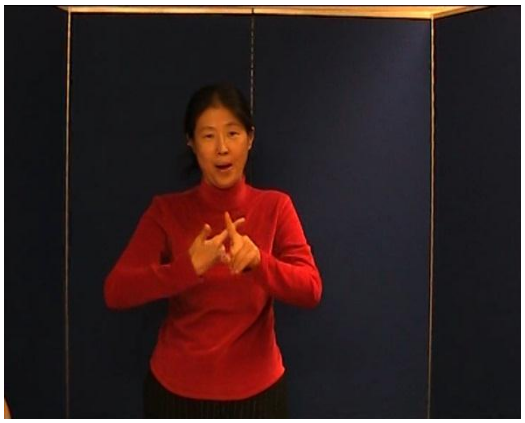


Figure 7.13 Shanghai variant {EIGHT}{MONTH} 'eight months'

Figure 7.14 Beijing variant {EIGHT} {MONTH} 'eight months'

Numeral incorporated signs for numbers of weeks in JSL make iconic reference to a calendar: the hand moves from left to right to mimic the rows of a calendar. The CSL sign for numbers of weeks is also iconic in this way, but it is not numeral-incorporated.

To users of other sign languages, the JSL sign for WEEK as used in 'last week', or 'next week' may appear to be numeral-incorporated as it has movement and seems to have a numeral handshape. However, it is actually the case that WEEK in JSL has the same handshape as the numeral SEVEN, due to the number of days in a week.[14] This can be moved forward and backward to indicate 'next week' and 'last week' respectively. In CSL, conveying these meanings involves pointing downward for 'next week' and upward for 'last week' as this language uses a different spatial organisation in these signs than most Western sign languages. Although this has not been explicitly investigated, this may be similar to the visual notion of a 'calendar plane' as mentioned in Engberg-Pedersen (1993) for Danish Sign Language, i.e. there is a vertical dimension involved, which in the case of CSL seems to suggest that weeks are conceptually arranged as progressing in a top-down direction.

In Group 1 and Group 2 signed languages, there are no examples of signs that have numeral incorporation with a time unit as well as an incorporated movement along the time line to show past or present. In comparison, there is one structure in BSL, a Group 3 signed language, that allows the signer to indicate number, year and either future or past in a single

[14] Interestingly, some sign languages conceive of the week as consisting of eight days. Thus the village sign language Chican Sign Language in Mexico derives WEEK from the sign for EIGHT (Zeshan et al. 2013).

sign. The number is encoded on selected fingers of the dominant hand. The dominant hand then orbits the extended index finger of the non-dominant hand in either a forwards (away from the body) or backwards (towards the body) circular movement. The former signifies 'years in the future' while the latter signifies 'years in the past'. Figure 7.15 below illustrates the numeral incorporation of 'years' – the sign begins at the extended index finger of the non-dominant hand and moves forwards to indicate the future. Turkish Sign Language uses the same process, but with a different lexical sign. These forms are morphologically more complex, consisting of morphemes for the numeral, the time unit, and the movement along the time line.

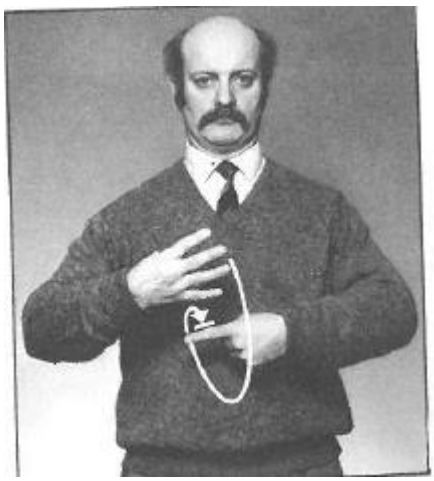


Figure 7.15 FOUR-YEARS-IN-FUTURE 'in four years' time'

(Miles 1988:100)

7.2.4. Numeral incorporated units (Kanji-based): people

There appear to be two ways to express a numeral simultaneously with signs referring to persons. The first is common among many signed languages and involves the use of so-called 'whole-entity classifiers' (Emmorey 2003), whereby each extended finger represents one person, and the number of fingers corresponds to the number of people referred to (another instance of the 'number for number' iconicity discussed in Chapter 6). The second method appears only to be used by JSL and CSL and involves the numeral sign tracing out the outline of the Kanji symbol for 'person'. This is illustrated in Table 15 below.

It is interesting to compare signs for numbers of people in Group 1 and Group 2 signed languages because these signs appear to be quite similar across the languages, despite the fact that they are not all in the same genetic family. Several of these signs make iconic reference to the Kanji symbol for 'people'. Unlike JSL and CSL, TSL and SKSL do not use numeral incorporation when referring to numbers of people. The SKSL sign for 'people' is commonly

signed after a cardinal numeral sign, as shown below in Figure 7.16. This sign for ‘people’ also occurs in JSL, but in JSL it is not normally used with numerals (although it may be used with adjectival modifiers such as a sign meaning ‘hearing’). Whenever the number of people is relevant, JSL signers seem to prefer either of the two Kanji-based signs for ‘people’, one of which can be numeral-incorporated (see Table 15), while the other cannot. The latter appears to be the same as the TSL sign for ‘people’. In this sign, the numeral is articulated before the sign for ‘people’; although the numeral sign is held in the air as the Kanji-based ‘people’ element is signed, it cannot really be considered a numeral-incorporated sign.

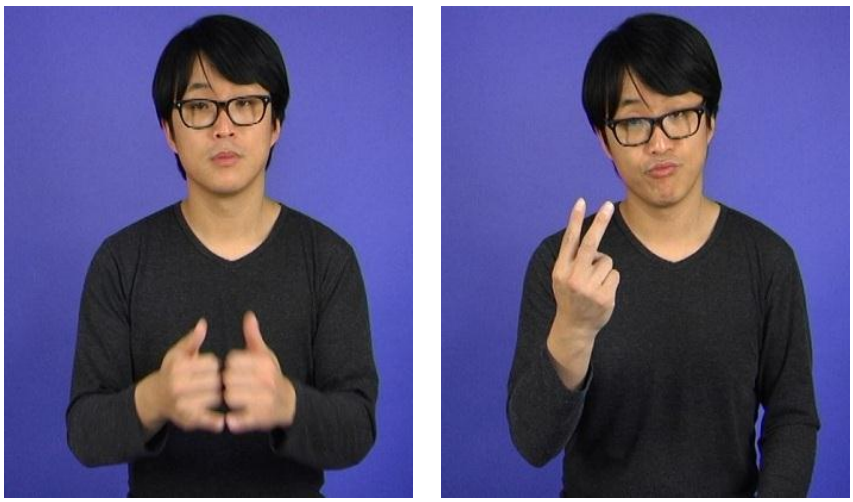


Figure 7.16 SKSL PEOPLE^TWO

Interestingly, although both JSL and CSL languages employ a Kanji-related numeral incorporating system for ‘people’, the way in which this is manifested phonologically is different in each language. In JSL, the signer traces the shape of the Kanji symbol for ‘person’ (人) with the relevant handshape for the number. For example, the handshape for ‘20’ coupled with the ‘person’ tracing movement renders the meaning ‘20 people’. In CSL, however, the Kanji-based sign is two-handed and stationary, as opposed to one hand plus movement in JSL. For example, in CSL three fingers on the dominant hand touching the non-dominant index finger on the non-dominant hand renders the meaning ‘three people’ (see Figure 7.17); one of the two strokes of the Kanji character has been replaced by a numeral handshape.

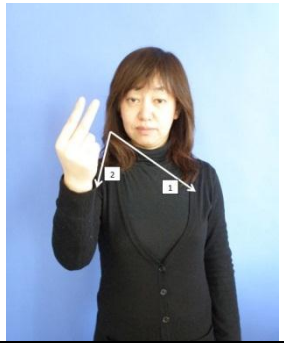
Figure 7.17 ‘three people’ in CSL

Additionally, CSL appears to permit numeral incorporation for a much wider range of numerals compared to JSL. For example, CSL can incorporate numerals 12 to 19 with PERSON but this is not possible in JSL, which articulates numerals 12 to 19 and PERSON separately.

JSL and CSL each have two different signs for ‘person’ that are based on the Kanji character. In both languages, one form permits incorporation and one does not. TSL has one sign for ‘person’ which is based on Kanji, but does not permit numeral incorporation. On the other hand, in TSL the form for ‘people’ is not numeral-incorporated although it is based on the Kanji character. In SKSL, the form for ‘people’ is neither numeral-incorporated nor motivated by Kanji; rather, it is motivated by the paradigm in which the thumb means ‘man’ and the little finger means ‘woman’ (Sagara, in press). Other examples of sign languages allowing numeral incorporation to signify numbers of people have not been found anywhere else in the data from the Sign Language Typology project, so this option seems to be restricted to a sub-group of those East Asian sign languages that use Kanji-based signs.

Table 15 below shows Group 1 and Group 2 signed languages and whether or not these signed languages allow numeral incorporation for ‘people’, as well as whether the sign is influenced by the Kanji writing system.

Table 15 Numeral incorporation and influence from Kanji in signs for 'people' in JSL, CSL, TSL and SKSL

	Numeral incorporation	**Kanji 人 influence**
JSL	Yes 	Yes
CSL	Yes 	Yes
TSL	No	Yes
SKSL	No	No

7.2.5. Numeral incorporated units: school level

As seen in Chapter 6, JSL has signs for school levels but these do not exploit numeral incorporation. The same is true of CSL. In both languages, these signs are associated iconically with Kanji. In SKSL, numeral incorporation is used to indicate school levels for elementary school, junior school, high school and university. For 'elementary school', the numeral sign is articulated on the dominant hand and brushes against the fist of the non-dominant hand (see Figure 7.18). For 'junior high school', the number sign starts at the forehead and moves away from the body (see Figure 7.19). For 'high school', the number sign is also articulated from the forehead (see Figure 7.20). The school year is indicated by the number of extended fingers, which point downwards. For 'university', the path evokes the outline of the graduation cap (see Figure 7.21). For example, the handshape with two extended fingers indicates the second year of the respective educational institution. The SKSL system of numeral incorporation for school levels is quite different to the way JSL and CSL represent school levels, which does not involve incorporation.

Figure 7.18 'second year of elementary school'

Figure 7.19 'second year of junior high school'

Figure 7.20 'second year of high school'

Figure 7.21 'second year of university'

CSL also has numeral incorporated forms related to schools, but in reference to school names, not levels. The cities of Beijing and Shanghai each have four deaf schools, known as SCHOOL-1, SCHOOL-2, SCHOOL-3 and SCHOOL-4 in both places. The signs for these are different in each location, but both paradigms involve two morphemes, a location morpheme (e.g. the shoulder) signifying 'school' and the other a handshape morpheme signifying the number (e.g. 'two'). In Beijing, the signs are articulated from the cheek (see Figure 7.22), while in Shanghai they are located at the shoulder (see Figure 7.23). The number of fingers represents the number of the school; for example, in Beijing, one finger moving downwards along the cheek refers to 'School 1' and so on. JSL, on the other hand, does not have a number system that incorporates either school grade or school name.

Figure 7.22 Beijing variant for SCHOOL-2

Figure 7.23 Shanghai variant for SCHOOL-2

Across the sign languages for which data were available, it is clear that numeral incorporation for referring to the school system is less common than numeral incorporation with time units. For instance, numeral incorporation is not used for school years in sign languages from the UK, Estonia, Iceland, and several other non-European sign languages (see Table 16 below).

7.3. Summary

The Typology Project investigated numeral incorporation in a variety of the world's signed languages (Sagara & Zeshan 2013). The findings revealed that most signed languages contain some form of numeral incorporation. An exception to this generalisation is Indonesian Sign Language, which is the only sign language in this sample that does not contain any system of numeral incorporation at all. Table 16 below presents data from the Sign Language Typology Project showing the cross-linguistic variation for numeral incorporation in the domains of time, money and school grade.

Table 16 Numeral incorporation for time, money and school grade (taken from the Sign Language Typology Project)

Sign language	Time	Money	Grade
British	+	+	-
Chinese	+	+	+
Czech	+	+	+
Estonian	+	-	-
Finnish	+	+	+
Greek	+	+	+
Hungarian	+	+	+
Icelandic	+	-	-
Indian	+	+	+
Indonesian	-	-	-
Israeli	+	+	-
Japanese	+	+	-
Kata Kolok	+	+	+
Kosovo	+	-	+
Mexican	+	+	+
New Zealand	+	+	-
Polish	+	+	+
Spanish	+	-	+
Sri Lankan	+	+	+
Turkish	+	-	+
Ugandan	+	+	-

From these data, a generalisation emerges that can be summarised in the following implicational hierarchy (cf. Sagara & Zeshan 2013):

time < money/school grade

That is, if a signed language allows numeral incorporation for money or school grade then it is likely to allow numeral incorporation for time. Conversely, there are no instances of sign

languages that allow numeral incorporation for monetary units and/or school grades, but not for time units.

In comparison with other sign languages, JSL is rich in the use of numeral incorporation. Numeral incorporation is used in JSL for units including money and time, as well as with numerals above 9. There are six paradigms for ordinal numerals in JSL, some of which were described by Ktejik (2013), and five of which participate in numeral incorporation. Comparison of complex numerals using numeral incorporation has shown how sign languages can share forms both due to historical contact (further explored in Chapter 8), and by coincidence. Thus there are some similarities between numeral forms in disparate sign languages that seem to have arisen coincidentally and independently of any contact, e.g. between JSL and Greek Sign Language.

Another interesting finding relates to possibilities of expression numeral incorporation with numerals above 9. We have seen that where a JSL number sign has internal movement, it cannot be numeral incorporated. However, this rule does not hold in CSL or TSL. This constraint may explain why there are co-existing variants for some numbers in JSL, because variants without internal movement can be used in numeral-incorporated forms while those with internal movement cannot (Sagara, in press). Likewise, the phenomenon of partial numeral incorporation occurs in JSL, but not in many other documented sign languages. Thus JSL uses two ways to incorporate numerals above 9 into signs – partial numeral incorporation and specific numeral handshapes in ELEVEN-2 and TWELVE-2 that do not have internal movement. The third possibility, allowing for numeral incorporation to occur when there is internal movement in the numeral, is used in CSL and TSL. All these possibilities are particular to East Asian sign languages, and nothing similar has been found in any of the other sign languages in the typology data.

8. SOCIOLINGUISTIC VARIATION (IN NUMERALS) IN JSL, WITH REFERENCE TO TSL AND SKSL

Previous chapters have touched upon the issue of variation in JSL. Section 1.3 explained how deaf schools in different regions of Japan have played a part in creating the linguistic variation apparent today, and some examples of variants for numerals are described in section 5.1. Chapter 8 presents the findings of a small sociolinguistic study that aims to obtain a more detailed understanding of how these variants are used by signers, and the social factors that affect the choice of variant. The scope of this study is limited to a small number of variables, namely the expression in JSL of the numerals 10, 100 and 1000, and the numerals 12–19. Furthermore, this chapter will consider variation in two regions only, the Kanto and the Kansai. Having explored these factors, the chapter concludes with discussion of apparent variation in the languages of Group 1 (TSL and SKSL), and the consequences of historic contact between JSL and these languages.

Section 8.1 presents findings from sociolinguistic studies of other sign languages, including BSL and NZSL (8.1.1), and then focuses on the small amount of research that has been conducted on variation in JSL. Section 8.2 describes the method that is used to collect and analyse data. The findings of this analysis are presented, and this analysis discussed, in section 8.3. In section 8.4, the sociolinguistic situation for numerals in JSL is compared with what is known about sociolinguistic variation for this domain in TSL and SKSL. The chapter concludes with section 8.5, a summary of the main findings of the study, and why they are significant. There are many possibilities for future research in this area, and a few of these are mentioned in this section.

8.1. Background

8.1.1. Sociolinguistic variation in sign languages

Variation in a given domain of a sign language can be motivated by a large number of external social factors. Johnston and Schembri note that these may be:

> further specified between social or inter-speaker constraints, and stylistic or intra-speaker constraints. Social factors include, for example, a signer's age, region of origin, gender, ethnicity, and socio-economic status. Stylistic variation involves alternation between, for example, casual and formal styles of speech used by an individual speaker, often reflecting differing degrees of attention to speech due to changes in topic, setting and audience (Johnston & Schembri 2010: 19).

Other research on sociolinguistic variation in sign language includes Lucas et al. (2001) and Johnston & Schembri (2007). Research on variation in numeral systems has been conducted for only a small number of sign languages to date. Skinner (2007) investigates variation for

numerals 1-99 in BSL, which comprise four main variants. Other studies have examined variation in the numeral system of NZSL, including McKee & McKee (2011) and McKee, McKee & Major (2011). Research into the expression of numerals from 1-20 in New Zealand Sign Language analysed data from 109 participants, and found that numeral variation is affected by the factors such as the age and region of the signer (McKee, McKee & Major, 2008).

The recent creation of corpora for sign languages such as NGT, BSL and DGS has enabled the study of lexical variation in several semantic areas, including numerals. A team working on the BSL corpus have detected correlations between the use of numeral variants 1-20, and factors such as region, age, and residential school (Stamp et al. 2013). In BSL, sign language users tend to use variants linked to their own city or variants associated with that city, especially because they originated or are frequently used in deaf schools in or near that city (Stamp 2013). For example, of tokens for numeral signs supplied by 249 participants, 76% were variants from their own city. This is also the case for colour signs (84%) and country signs (64%), so the semantic field of colour seems to be changing lexically more than that of number, but less than country signs (Stamp 2013:31).

8.1.2. Sociolinguistic variation in JSL

Lexical variation in JSL has also been studied by Osugi (2010), who used a word list of 31 different lexemes covering different semantic areas (weekdays, animals, countries, kinship terms, cardinal directions, colours, and school-related terminology). This list was used to elicit data from two deaf participants from each of the 46 prefectures in Japan (Figure 8.1).

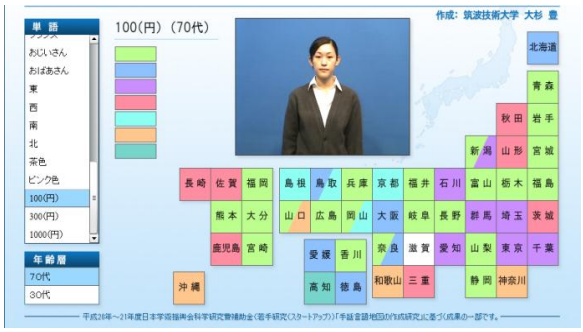


Figure 8.1 Data from the online Japanese Sign Language Map by Osugi, 2010

Osugi categorised participants according to two different age groups: 30-39 and 70-79 years, and the variants elicited are presented for each group. Three of the list items are numerals, glossed as 100-YEN, 300-YEN and 1,000-YEN. However, participants were not asked to produce any further monetary numerals or signs for numerals in other, non-monetary contexts. In Osugi's data, between three and seven variants are presented for each of the three number terms (see Table 17 below), but the range and extent of variation is not clear, since data have

only been collected from one representative of each age group per prefecture. In other words, the actual use of language in real life situations is not taken into account. For example, it is very possible that another participant would provide a different variant; this has been found to be true for other sign languages, including varieties in Indonesia (Palfreyman forthcoming).

The variants presented by Osugi are categorised here according to whether they are phonological or lexical variants. This distinction has been observed in Lucas et al. (2001), and is discussed further by (Cormier et al. 2012). Phonological variants are usually two similar forms that differ in only one phonological parameter, e.g. handshape or movement (Palfreyman, in press). Where variants differ from one another in more than one phonological parameter, they are said to be lexical variants (ibid). For example, Figure 8.2 shows three variants; variants 1a and 1b are phonological variants, since the left hand of 1b (representing a wallet) is dropped. Variant 2 is a lexical variant, since it differs from 1a and 1b in handshape, movement and orientation. It should be noted that, in some cases, it is not always easy to distinguish between the two types of variant, because the difference is essentially a question of degree (Palfreyman, in press).

Variant 1a | Variant 1b (a phonological variant) | Variant 2 (a lexical variant)

Figure 8.2 Examples of variants for 100-YEN

Table 17 presents the total number of variants elicited for the expression of 100-YEN, 300-YEN and 1,000-YEN, across all prefectures in Japan. These totals are shown as the number of lexical variants and, in brackets, the number of phonological variants. For example, 4(*7*) denotes seven discrete phonological variants; which may be considered as constituting four lexical variants. On examination, there seems to be more heterogeneity among older signers, and more homogeneity amongst younger signers. While there is still some variation across the three items 100-YEN, 300-YEN and 1000-YEN for younger signers, there is considerable overlap in the lexical signs used by young and older JSL users; the picture here suggests that the pool of variants becomes smaller as the age group of signers becomes younger.

Table 17 Number of lexical variants (with number of *phonological* variants in brackets) for money signs according to age group of signers.

variable	30-39 age group	70-79 age group
100 yen	4(*3*)	4(*7*)
300 yen	4(*2*)	6(*4*)
1,000 yen	3(*3*)	6(*5*)

8.2. Method

The investigation focuses on the variable expression of the numerals 10, 100 and 1000, and the variants are described in Section 5.4. It is believed that one set of variants emerged in the Kanto region, while another set of variants emerged in the Kansai region, and hence the variants are referred to as 'Kanto variants' and 'Kansai variants' respectively. For glossing purposes, Kanto variants are referred to using (-1) after the gloss, and the Kansai variants are indicated using (-2). For example, TEN-1 is the Kanto variant, and TEN-2 is the Kansai variant. Figure 8.3 shows examples of these variants. An important distinction is made hereafter between HUNDRED-1 and HUNDRED-2, which are variants; and (HUNDRED), which is a variable). In other words, (HUNDRED) is a neutral variable which is realised in the data as either Kanto variant HUNDRED-1 or Kansai variant HUNDRED-2. This notation is in accordance with that used for denoting variables in spoken languages (Berruto 2010:229).

Kanto			
	TEN-1	HUNDRED-1	THOUSAND-1
Kansai			
	TEN-2	HUNDRED-2	THOUSAND-2

Figure 8.3 Variants for (TEN), (HUNDRED) and (THOUSAND) in Kanto and Kansai

This variable has been chosen for several reasons. Firstly, the variation is not simply lexical, but there is an element of systematicity. The Kanto variants feature numeral incorporation, while the Kansai variants have an iconic way of showing the number of zeroes in the numeral (see sections 5.4 and 6.3). Secondly, although the variants have been referred to as the 'Kanto' variant and the 'Kansai' variant, I have previously observed THOUSAND-2 used in prefectures of the Kanto region, and THOUSAND-1 used in prefectures of the Kansai region. This suggests that the use of these variants is not categorical; that is, signers do not only use the variant that emerged in their own region, and hence there is a real chance that the choice of sign may be influenced by other social factors. Thirdly, the variable is expressed many times naturally in the data, which means that it is not difficult to generate tokens for further analysis.

A decision was taken to collect data from signers in the Kanto and Kansai regions (see Figure 8.4). There are two main reasons for this: firstly, a set of variants for expressing the numerals in question has emerged in each of these regions, and secondly, these are established regions in spoken language research. Indeed, there has been much enquiry into spoken languages in these two distinct areas due in part to their respective histories, politics and economy (Sanada 2013). Additionally, this was convenient since these two areas were also selected for comparisons earlier in this research project (see sections 1.4 and 5.5). There is no doubt that variation can be found for JSL in in other parts of Japan too, for this variable and others, but these are not included in this study due to the limitations of time and space.

Figure 8.4 Map of Japan

It is hypothesised that the signs for '1,000' are used interchangeably by people from the two regions, but that there is a more definite division between the two regions for the expression of the numerals 10 and 100. This hypothesis is based on my own observations as a JSL user

based in the Kanto region, who has occasionally travelled to the Kansai region. Based on the brief analysis of Osugi's data (section 8.1.2) I also hypothesise that age will be a factor, because it seems that younger signers are using fewer variants, and a process of standardisation is taking place. This has also been observed for other sign languages, such as British Sign Language. Stamp (2013) has found evidence to suggest that a process of dialect levelling is taking place in BSL due to factors such as the closure of residential schools, the use of BSL in national media, and the increased mobility of younger deaf people.

Through the data collected for the sign language typology project, similarities emerged between numeral signs in JSL and group 1 sign languages (SKSL and TSL), and in Chapter 1 it was noted that there has been historic contact between JSL and these sign languages. I therefore contacted the two informants in South Korea and Taiwan to ask if they knew of other variants in their sign languages for these numerals. Both informants supplied more data on this. While in-depth analysis of these data was not possible, the collection and preliminary analysis of these data allows for some comparisons to be made into how sociolinguistic variation in a source sign language that has contact with other sign languages can lead to linguistic and sociolinguistic variation in those target languages.

The three research sub-questions for the investigation in Chapter 8 are as follows:

1. What is the distribution of the variants for the variables (TEN), (HUNDRED) and (THOUSAND) in the Kansai and Kanto regions?
2. Which factors are significant in predicting the selection of these variants?
3. How does this variable pattern across JSL, TSL and SKSL (which are known to be related)?

Data were collected during the course of two fieldwork sessions with a total of 37 people from the Kanto and Kansai regions (Chapter 4). The same sample was used for the sociolinguistic analysis, and the sample stratification is repeated here for convenience as Table 18. Importantly, the interviews were used to check that participants were either born in the same region as they were being filmed, or have lived there for at least the past 15 years. This was also included as questions three and four on the participant questionnaire (Appendix 4) in order to be certain.

Table 18 Participants in the first and second fieldwork: December 2011 to January 2012 and November 2012 to January 2013 respectively

age	**19-45**		**46+**		**Total**
	M	F	M	F	
Kanto	6	3	6	3	18
Kansai	4	5	6	4	19
Total	10	8	12	7	37 people

To begin with, only data from (i) the matching game and (iii) the bargaining game were included in the analysis. Descriptions of these games are provided in section 4.1.2. The researcher annotated all expressions of the variable appearing in 291 minutes of data. Importantly, there are linguistic constraints upon the way in which these variable forms are used. While Kanto variants (as in example 20 below) can present numbers that feature multiples of 1000, 100 and 10 through the incorporation of a numeral handshape (section 5.4), the Kansai variants cannot do this (see example 21 below). In other words, the Kansai variants do not take multipliers in JSL, although there is some anecdotal evidence to suggest that they may have done in the past, since older signers very occasionally produce signs in this way (as in the resource from NPO Skill Assessment Association 2002, mentioned in section 1.6). Due to uncertainty concerning the grammaticality of combining Kansai variants with multipliers, such sums have been omitted from analysis here – not just for Kansai variants, but also for Kanto variants. This is part of the process of 'circumscribing the variable context' (Tagliamonte 2006:13), whereby decisions are taken as to which tokens to include and exclude, in order to ensure a fair comparison.

(20) {THREE}{THOUSAND-1} {FOUR}{HUNDRED-1} {TWO}{TEN-1}
Three thousand four hundred and twenty.

(21) ? THREE THOUSAND-2 FOUR HUNDRED-2 TWO TEN-2
Three thousand four hundred and twenty.

For the signs meaning 'thousand', occurrences where the sign appeared with further digits (see example 22) were included because both variants behave similarly in this respect. The researcher attempted to compensate for this by examining the variants for 100 and 10 further through interviews.

(22) THOUSAND-2 {FOUR}{HUNDRED-1} {TWO}{TEN-1}
One thousand four hundred and twenty.

Altogether, 280 tokens of the variable were expressed in these clips. Importantly, both of these elicitation materials generated data in a relaxed setting. However, this did not produce sufficient data for all of the cells (see Table 19 in section 8.3), which meant that there was not enough data on which to base any reasonable generalisations. Further data were therefore added from the interviews and the PowerPoint slides discussed in chapter 4, which yielded a higher number of 413 tokens in total. One of the disadvantages of including this extra data is that the activity is more contrived, which may affect the naturalness of the responses that were given. In order to try and lessen this effect, the numerals on the PowerPoint slides were presented out of order, to prevent signers from producing signs 'by rote' (see Appendix 6).

In order to analyse my data, I chose a similar method to Stamp (2013), who coded signs in BSL as 'traditional' or 'non-traditional' variants. In this sense, 'traditional' is used to refer to variants of a given region that have been used there for many years and are the most typically used signs. Stamp et al (2013) reported that, for BSL, participants' use of traditional signs (and non-traditional signs) was influenced by a number of social factors, the most significant being age, followed by school location and then language background. As explained earlier in section 8.2, the Kanto and Kansai variants are also typically associated with each respective area, and so Stamp's labels of 'traditional' and 'non-traditional' were used to provide a straightforward and logical way of describing the status of a variant relative to the region of its production.

The data were coded using ELAN software (see section 4.3). Six tiers were used for coding (Figure 8.5 below). The first tier ('exact number') indicates the entire numeral sign that is expressed in the clip. The second ('number') indicates which variable is being expressed. These are coded as *TEN*, *HUNDRED* and *1000* to avoid making any inadvertent slips with the number of zeroes. The third tier ('region'), provides information regarding the region the participant is from (Kanto or Kansai), and tier four indicates whether or not this is the 'traditional' variant for that region ('yes' or 'no'). The fifth tier ('signer code') indicates the anonymous number code for the participant, which enabled the sign to be traced to the signer's demographic background, and tier six is for noting any additional observations.

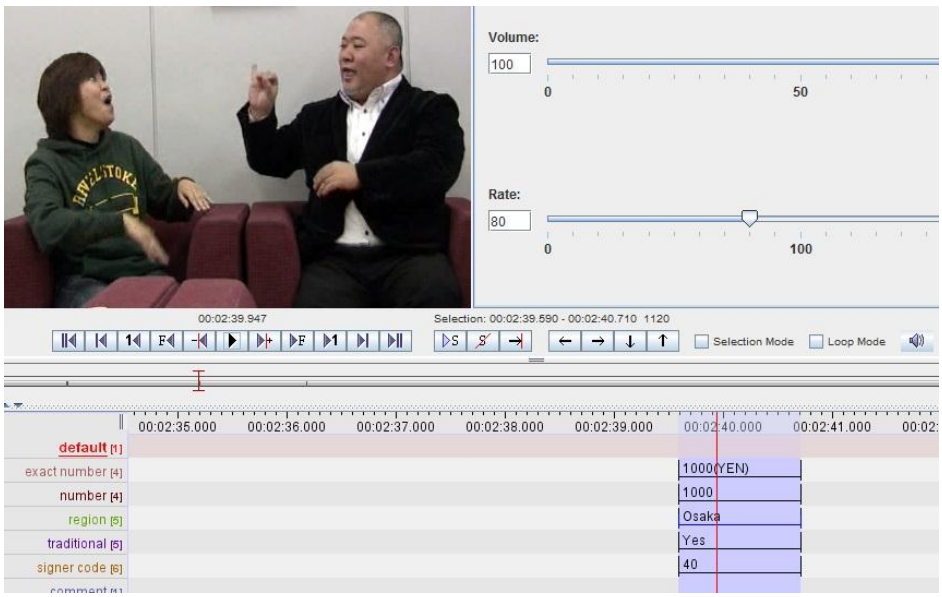


Figure 8.5 A screen shot of JSL data in ELAN

8.3. Findings and discussion

8.3.1. Distribution of the variable

Table 19 below shows the distribution of the variables (TEN), (HUNDRED) and (THOUSAND) according to the region in which they were produced. Participants from the Kansai region have a strong tendency to use the traditional sign THOUSAND-2, and did so for 92% of tokens. Intriguingly, 60.4% of participants from the Kanto region also typically use the Kansai variant THOUSAND-2, although the use of this variant is still not as frequent as it is in the Kansai region. For the other two variables, a different picture emerges. All Kanto signers produced the traditional Kanto variants HUNDRED-1 and TEN-1, while Kansai signers use either HUNDRED-2/TEN-2 or HUNDRED-1/HUNDRED-1.

Table 19 Regional distribution of variants for (TEN), (HUNDRED) and (THOUSAND) (n = 280).

		(THOUSAND)		**(HUNDRED)**		**(TEN)**		**Total**
		n	**%**	**n**	**%**	**n**	**%**	
Kansai	traditional	69	92.0	12	42.9	8	57.1	**89**
	non- traditional	6	8.0	16	57.1	6	42.9	**28**
	total	**75**	**100**	**28**	**100**	**14**	**100**	**117**
Kanto	traditional	44	39.6	25	100	27	100	**96**
	non-traditional	67	60.4	0	0.0	0	0.0	**67**
	total	**111**	**100**	**25**	**100**	**27**	**100**	**163**
GRAND TOTAL		**186**		**53**		**41**		**280**

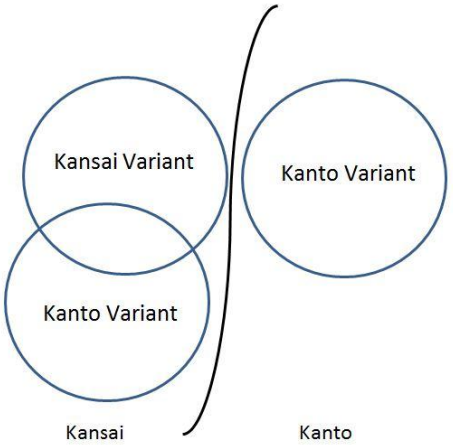
Overall, it seems that Kansai signers are more likely to prefer their traditional variant than the Kanto signers (see Table 19). In fact, Kanto signers did not use HUNDRED-2 or TEN-2 at all. This

may be a 'categorical context' (Tagliamonte 2006:86-7), because no Kanto signers use these Kansai variants in the data (see the shaded area in Table 19). However, the number of tokens for (HUNDRED) (25 tokens) and (TEN) (27 tokens) is comparatively small, especially compared with (THOUSAND) (111 tokens) and so further tokens were analysed in order to enable more certainty about the categoricity of this variant choice. As described in section 8.2, the supplementation of tokens resulted in a further 135 tokens, and the distribution is shown in Table 20. The continued absence of HUNDRED-2 and TEN-2 in the data suggest strongly that this is a categorical context for Kanto signers.

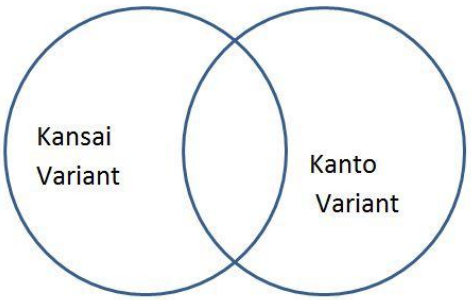
Table 20 Tokens for traditional and non-traditional signs for variables (TEN), (HUNDRED) and (THOUSAND) in Kanto and Kansai (n = 415).

		(THOUSAND)		(HUNDRED)		(TEN)		Total
		n	%	n	%	n	%	
Kansai	traditional	75	92.6	45	60.8	54	55.7	**174**
	non- traditional	6	7.4	29	39.2	43	44.3	**75**
	total	**81**	**100**	**74**	**100**	**97**	**100**	**249**
Kanto	traditional	44	39.6	25	100	27	100	**96**
	non-traditional	67	60.4	0	0.0	0	0.0	**67**
	total	**111**	**100**	**25**	**100**	**27**	**100**	**163**
GRAND TOTAL		**192**		**99**		**124**		**415**

Kansai signers can therefore be considered more 'bidialectal' than Kanto signers in their expression of these variables, because they seem to mix variants more frequently, as shown in Figure 8.6a. However, in both regions, there is a mixed distribution of variants for (THOUSAND) (Figure 8.6b).



Distribution of traditional Kanto and Kansai variants for (TEN) and (HUNDRED) in Kansai (left) and Kanto (right)



Distribution of Kanto and Kansai variants for (THOUSAND) in both regions

Figure 8.6a (left) and 8.6b (right)

8.3.2. Quantitative analysis using Rbrul

As described in 8.1.1, other sociolinguistic studies of sign languages have investigated the role of several social factors, including the region, age and sex of the signer. While region certainly seems to play an important role here in determining the choice of variant for (TEN), (HUNDRED) and (THOUSAND), the role of age and sex has not yet been investigated. In order to investigate further the effects of the region, age and sex of the signer on the choice of variant, mixed effect logistic regression analysis (using Rbrul software, Johnson 2009) has been used. One of the advantages of using a variable rule programme is that it can detect whether linguistic and social factors are statistically significant in predicting variant choice; in other words, if correlations can be found, how certain can one be that this is more than simply coincidence? The Rbrul programme does this by formally assessing the relationship between independent and dependent variables (Tagliamonte 2012:121). As Stamp (2013) notes, another advantage is that this programme is familiar to scholars from other disciplines, such as psychology and psycholinguistics, facilitating understanding across disciplines.

Rbrul can only deal with binary variables (Tagliamonte 2012:121), and so the independent variables of 'traditional' and 'non-traditional' were used. The application value was 'traditional', which means that 1 = traditional and 0 = non-traditional. There is no need to use Rbrul for categorical contexts, as identified in Tables 16 and 17, since the correlation between region and variable is absolute. For this reason, Rbrul has been used to examine (a) the expression of (THOUSAND) by Kansai and Kanto signers (shown with blue shading in Table 20); (b) the expression of (THOUSAND), (HUNDRED) and (TEN) by Kansai signers (shown with red shading in Table 20).

In terms of deciding which factors to investigate, there are many possible linguistic and social factors, of which some are listed in Table 21. Unfortunately, due to time constraints, it was not possible to code for all of these, and so only age, sex and region have been included in the Rbrul analysis. Here it suffices simply to point out that the current study is far from exhaustive, and that there are many interesting possibilities here for further research, which has the potential to reveal more about the factors that may affect choice of variant.

Table 21 Examples of linguistic and social factors that could be investigated.

Linguistic factors	Social factors
rote vs random (whether numbers are being produced in 'counting' fashion, or randomly)	family background (whether the signer's family of origin was deaf or non-deaf)
phonological (the handshapes and other phonological features of signs appearing adjacent to the sign in question)	age of acquisition of sign language (how old the signer was when they learned the sign language)
money vs other (whether the sign is being produced in the context of money or a different context)	educational background (whether the signer attended a deaf school or a mainstream school)
	persistence (whether the signer repeats attempts at using the sign) and accommodation (whether the signer adopts the sign used by his/her interlocutor)

(a) The expression of (THOUSAND) by Kansai and Kanto signers

The Rbrul analysis (Table 22) shows that, as expected, region is statistically significant in the choice of variant ($p = 0.00002$). The important detail to note is the factor weight, which shows 'the probability of the dependent variable to occur in that context' (Tagliamonte 2012:127). This indicates that Kansai signers are more likely to produce a traditional variant (THOUSAND-2) than a non-traditional variant (THOUSAND-1). However, age and sex are not significant ($p > 0.05$), which suggests that the expression of the (THOUSAND) variable is stable – that is, use of THOUSAND-1 and THOUSAND-2 does not seem to be changing with new generations of sign language users.

Table 22 Mixed effect logistic regression analysis for the social factors conditioning choice of variant for (THOUSAND) by Kansai and Kanto signers.

Input: 0.856

Total N: 190

REGION (p = 0.00002)

factor	logodds	tokens	yes/yes+no	centred factor weight
Kansai	2.2	79	0.924	0.9
Kanto	-2.2	111	0.396	0.1

AGE

not significant

SEX

not significant

(b) The expression of (THOUSAND), (HUNDRED) and (TEN) by Kansai signers.

The second Rbrul run includes only tokens produced by Kansai signers. Furthermore, the **type of variable** – (THOUSAND), (HUNDRED) or (TEN) – can now be included as a variable, to see whether one variable is more likely than the other to be produced as a traditional variant. The type of variable was coded on tier 2 of the ELAN file (see Figure 8.5). The outcome of this run is shown in Table 23.

Table 23 Mixed effect logistic regression analysis for the social factors conditioning choice of variant for (THOUSAND), (HUNDRED) and (TEN) by Kansai signers.

Input: 0.757

Total N: 254

TYPE OF VARIABLE ($p = 3.67 \times 10^{-14}$)

factor	logodds	tokens	yes/yes+no	centred factor weight
1000	2.563	79	0.924	0.928
(HUNDRED)	-0.725	72	0.625	0.326
(TEN)	-1.838	103	0.583	0.137

AGE (p = 0.0431)

+1 logodds = 0.048

SEX

not significant

Rbrul shows that two factors are significant in predicting the choice of variant by Kansai signers. Firstly age, which is a continuous variable, has a favouring effect on the use of a traditional variant (the logodds is a positive value of 0.048). This means that older signers are more likely to produce a traditional variant. (Were the logodds to have a negative value, then age would have a disfavouring effect on use of traditional variants.) However, where p = 0.0431 for age, $p = 3.67 \times 10^{-14}$ for type of variable. This means that the type of variable is highly significant. In other words, signers are highly likely to produce a traditional variant for (THOUSAND) (factor weight = 0.928) but much less likely to produce a traditional variant for (TEN) (FW = 0.137). Therefore age is a significant factor, but by far the most significant determinant is the number being signed (see Figure 8.7). Once again, sex is statistically insignificant ($p > 0.05$) which means that the sex of the signer does not predict their choice of variant.

8.3.3. Further investigation of age for Kansai signers

Having identified that age is a significant factor in predicting the choice of variant, further

cross-tabulation is presented to show how the variant (traditional/non-traditional) differs according to different age groups. The ages of participants are categorised here according to two groups – 18-45 years, and 46 or older – for the following reasons. Firstly, these age groups represent the younger and older halves of the Japanese deaf community. Secondly, the younger half was educated after 1995, when there was greater awareness of sign language as a language (see section 1.2), which may have affected their language attitudes and openness to adopting and sharing new signs. The results are shown as a graph (Figure 8.7).

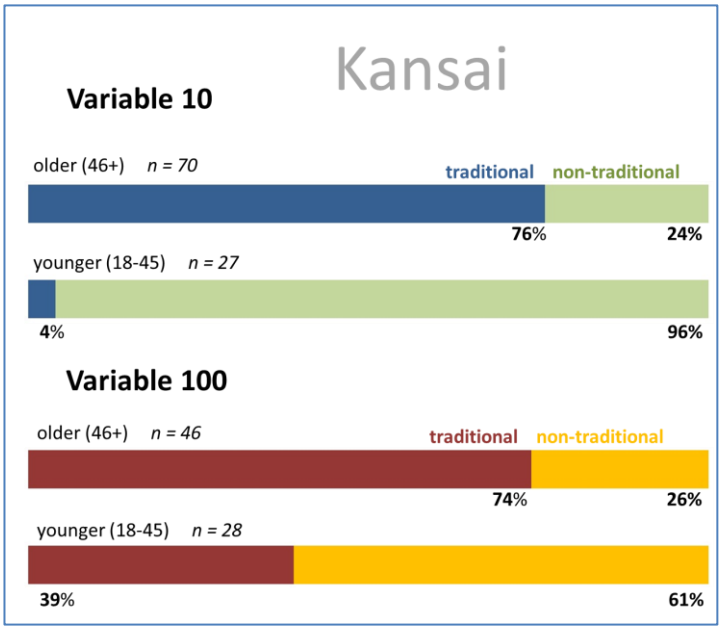


Figure 8.7 Variants for '10' and '100', with age group comparison (Kansai signers only)

While 76% of tokens produced by older signers are TEN-2, the figure reduces to 4% for younger signers. Similarly, although the difference is less marked, 74% of tokens produced by older signers are HUNDRED-2, while only 39% of the tokens of younger signers are traditional. This reinforces the finding that Kansai signers are more likely to use traditional variants for (HUNDRED) compared with (TEN), especially younger Kansai signers. The contrast in usage between the older and younger signers is more striking in the case of the '10' variants, but there is a definite tendency for older signers to use the traditional variant in both cases.

Interestingly, one Kansai participant aged over 75 years old strongly favoured the Kansai variants, and never used those from Kanto. This individual even produced the numeral-incorporated Kansai signs meaning '200' and '300', which are very rarely seen now (see the discussion about this in section 8.2). Two Kansai signers aged around 35 – one male and one female – both used a mixture of Kanto and Kansai variants in their utterances. The interviews revealed that both of these participants had travelled to Tokyo, where they may have acquired the Kanto variants.

8.4. Comparison of variation in JSL and group 1 (TSL and SKSL)

Section 8.4 describes findings relating to variants for (TEN), (HUNDRED) and (THOUSAND) in the languages of group 1 (JSL, TSL and SKSL). Next, the concept of lexicalisation is explored and illustrated by a number of forms in these languages. Though this section focuses primarily on JSL, TSL and SKSL, there is also some mention of Chinese Sign Language where this is relevant to the analysis.

In Chapters 1 and 3, it was noted that TSL and JSL have had historical contact. Sasaki (2007:8-9) reports that TSL is derived from three different sources: a manual form of communication dating from before the Japanese colonial occupation; JSL, which was brought into Taiwan during the 50-year occupation from 1895 until 1945, through the training of teachers in various educational settings; and Chinese Sign Language from 1949 onward (Sasaki 2007:11). Regarding TSL variation, Sasaki states that teachers from the Tokyo School for the Blind and Mute in the Kanto region were sent to Taipei, whereas teachers from the Osaka School for the Deaf in the Kansai region were sent to the school in Tainan, which might explain the dialectal differences that still exist today and why TSL influences can be found in some signs for large numbers in JSL.

SKSL and JSL have also had historical contact due to colonial occupation, which started in 1910 and ended in 1945 (Caprio 2009). However, beyond this it is not clear by what means JSL influenced SKSL, so the historical picture is less complete for this relationship than for that of JSL-TSL.

8.4.1. Variants for the variable (TEN)

JSL, SKSL and TSL each have at least two variants for (TEN) (TEN-1 and TEN-2) and (HUNDRED) (HUNDRED-1 and HUNDRED-2). The origin of the variants in TSL are the two schools in Tokyo and Osaka, which influenced signers in the north (Taipei) and south (Tainan) of Taiwan respectively. Known use of variants for the variable (TEN) is distributed as shown in the map below (see Figure 8.8).

It has not yet been determined where the two SKSL variants for each number come from or how they are derived. Indeed, in South Korea it is reported that these variants are used differently, depending on the context or adjacent signs (see Table 24 below), e.g. whether minutes or hours are being referred to, or whether counting is being used. Having only collected data from two Korean informants, it is not yet known whether region is a factor in the

Figure 8.8 Locations where TEN-1 and TEN-2 are known to occur for JSL, TSL and SKSL.

distribution of the variants for (TEN). However, when counting numbers in order up to 10 (i.e. 1, 2, 3…10), it seems that signers tend to use the Kansai variant. When referring to time, the Kansai variant appears first to demonstrate the hour (e.g. 10 o'clock) and the Kanto variant appears next to show the number of minutes (see Figure 8.8). In other contexts, SKSL signers may use either the Kansai or the Kanto variant (see Table 24), though as mentioned, more research is needed as the data for SKSL, albeit of a high quality, was insufficient in terms of tokens.

Figure 8.9 SKSL structure meaning 'ten minutes past ten' (TEN-2 TEN-1)

Table 24 shows that the different signs tend to be used with particular domains. More research is needed to establish whether SKSL has internal syntactic or linguistic factors that govern the use of one variant over the other.

Table 24 Grammatical usage of the two variants for ‘10’ in different contexts in SKSL

	TEN-1	TEN-2
100,000	+	
Hour	+	+
Minutes	+	
O’clock		+
Year	+	+
Month		+
Test	+	
Money	+	
Age	+	+
1/10	+	+

8.4.2. Variants for the variable (HUNDRED)

Interestingly, the Kansai variant for (HUNDRED) is still used in the south of Taiwan, including for multiples such as ‘200’ and ‘300’ (see Figure 8.10), but in JSL, this variant tends to be used only for ‘100’ (see section 8.2), although a few older signers may continue to use this variant in the same way it is used in Taiwan. Higher multiples in JSL are usually signed using the Kanto variant, which allows for incorporation of numerals (see section 5.4). When signing higher multiples of 100 using the Kansai variant, TSL signers rely on juxtaposition.

Figure 8.10 TSL structure meaning ‘200’

In SKSL, the Kansai variant HUNDRED-2 is rarely used, according to one of the research participants. Rather, it is only used in contexts where the number is specific or ‘perfect’, as in ‘exactly 100’. It may also be used more commonly by older signers. SKSL signers mostly use HUNDRED-1.

The map in Figure 8.11 shows the two signs for the known distribution of the variable (HUNDRED), for SKSL, JSL and TSL. As with the two signs for the variable (THOUSAND) (see below), there is a division for these forms in TSL, wherein HUNDRED-1 is used in Taipei and HUNDRED-2 in Tainan. As shown in section 8.3, for JSL users, both variants can be observed in

Kansai, but HUNDRED-1 only appears in the Kanto region. Likewise, SKSL makes use of HUNDRED-1 exclusively.

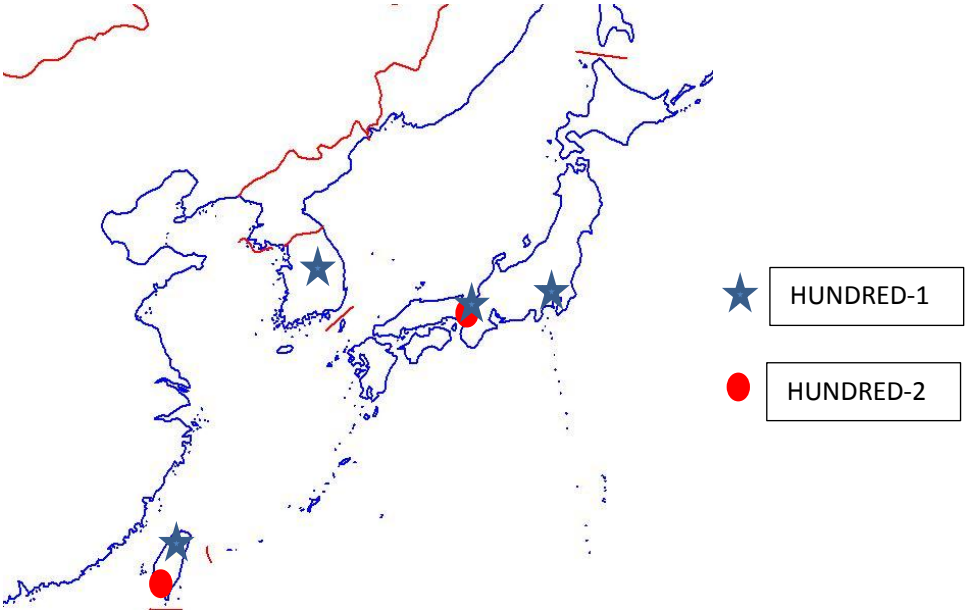


Figure 8.11 Locations where HUNDRED-1 and HUNDRED-2 are known to occur for JSL, TSL and SKSL.

8.4.3. Variants for the variable (THOUSAND)

As explained in section 5.5, THOUSAND-1 in JSL is motivated by Kanji, and THOUSAND-2 by how many zeroes are in the (Arabic) written form "1,000". As shown in 8.3, the JSL data suggest that there is no longer a clear delineation in the use of these variants in Kanto and Kansai; both forms can be seen in both regions, as depicted in the map (see Figure 8.12). Conversely, the data analysed here suggest that this dichotomy may still survive in Taiwan, where THOUSAND-2 typically occurs in Tainan, and THOUSAND-1 typically occurs in Taipei, although much more research is needed in order to establish this. In addition, THOUSAND-2 tends to be used only for expressing 'one thousand exactly' and cannot be used to express higher multiples. This is in contrast to how this variant is used in Taiwan, where signers use this variant to express all multiples of thousand.

The orientation of THOUSAND-1 in CSL and JSL is slightly different, but both have clearly derived from Kanji characters (see section 7.2.1). The SKSL form for the variable (THOUSAND) is essentially a very reduced version of THOUSAND-1, which may be difficult for some people to identify as being motivated by Kanji. Interestingly, this form sometimes appears among JSL

signers as well. For the variable (THOUSAND), SKSL signers tend to use THOUSAND-1.

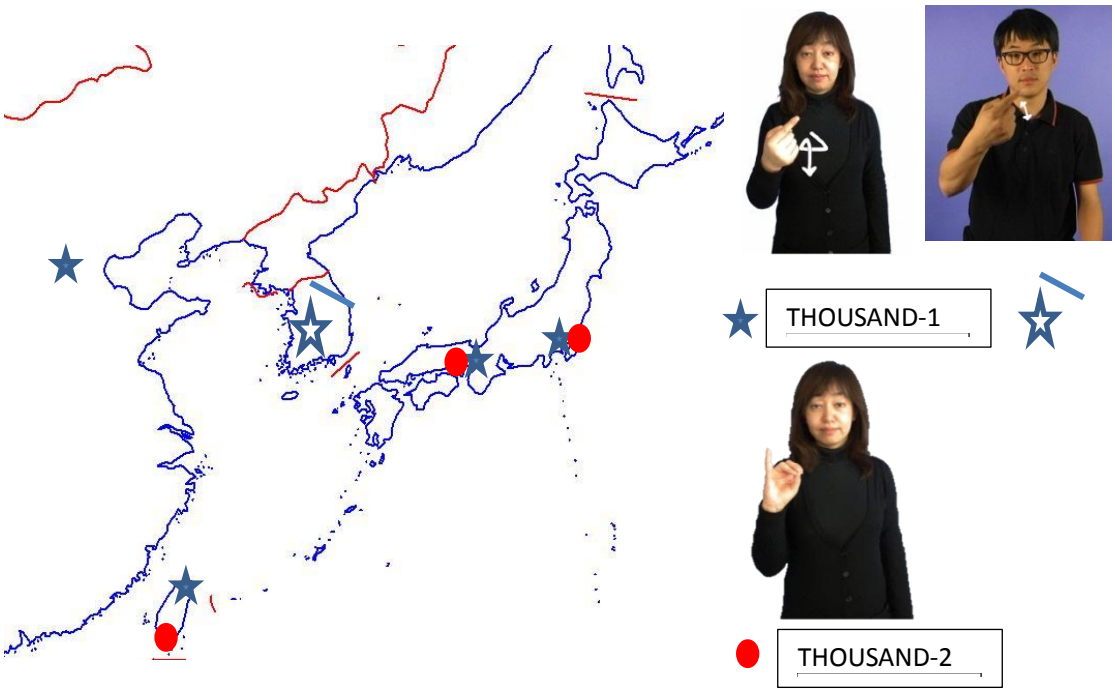


Figure 8.12 Locations where THOUSAND-2, THOUSAND-1 and its reduced form are known to be used in Japan, Taiwan and Korea

The map in Figure 8.13 illustrates the distribution of two forms for '1,000': the predominant JSL sign, which has a clear Kanji motivation (glossed THOUSAND-1), and the predominant SKSL sign, which may have been motivated by Kanji in the past but is now so reduced that it is difficult to identify its iconicity (glossed THOU-1). The former is found in three places (Japan, China and Taiwan), while the latter is seen in Korea and Japan. However, both of these forms can be numeral incorporated.

	1000 千	**Gloss**
Full form (clear Kanji influence) Japan China Taiwan		 THOUSAND-1
Reduced form (Kanji influence difficult to ascertain) Korea Japan		 THOU-1

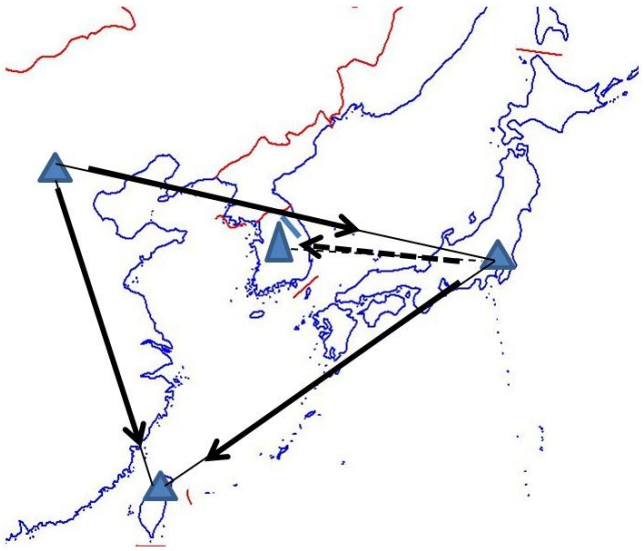


Figure 8.13 Locations of Kanji-based forms for '1,000'

An interesting phenomenon is that JSL uses distinctly compounded forms while SKSL uses similar but shortened or reduced versions of these. For example, the sign for '10,000' seems to be composed of two morphemes in JSL, while its equivalent in SKSL occurs as one lexeme, though its handshape and movement appear to be derived from JSL.

8.5. Summary

One of the key findings from section 8.3 is that Kansai signers are much more likely to produce a traditional variant for (THOUSAND) than for (HUNDRED) or (TEN). Why might this be? One possibility is that THOUSAND-2 has an indexical social value, and that signers use THOUSAND-2 to express their status as Kansai signers. The use of variants to express a signer's regional identity has been noted for several sign languages, including ASL (Lucas et al. 2001), VGT (Antoons & Boonen 2004) and Auslan (Johnston & Schembri 2007). A second important finding is that Kansai signers are more likely to use HUNDRED-1 and TEN-1 than their older peers, and that, while Kanto signers have adopted THOUSAND-2, they have not adopted HUNDRED-2 or TEN-2. This points to a process of standardisation, or dialectal levelling. Stamp et al. (accepted) describe how dialect levelling may be taking place in BSL, with younger signers using an ever smaller pool of distinct regional variants. There are implications, then, for the future of some traditional variants, which may well cease to be used as other variants become more widespread.

Sociolinguistic variation, in this study, can also be considered in relation to the Japanese government's attempt to enforce a standardised variant of JSL, which was deemed necessary before the language could be officially recognised as a language in line with requests from the

JFD (Sadahiro 1969). This has had a major impact on the amount of variation used by JSL users across the country. Japan is not the only country to have faced attempts to standardised sign language. Yang (2008) writes about educational professional and official committees that came together in the 1950s to standardise sign language in China. However, Yang also notes that some local deaf communities in Shanghai, Nanjing, Beijing and Tianjin maintained their own dialects and other varieties have also spread across regions due to teachers of the deaf moving from different teaching establishments.

More recently, standardisation has been a pressing issue in the Netherlands, with the government stating that the sign language used there *must* be standardised and a section of the deaf community is not happy with this. Regardless of this opposition, government demands for a standard lexicon persist in order to officially give legal recognition to the language (Schermer 2003). Despite the experiences and research of standardisation in numerous countries, including those mentioned above, there is strong evidence that linguistic variation has persisted due to the natural development of language, education and other factors which can be found when looking at research that has already been completed on numeral systems in other countries.

Finally, and from a typological and historical perspective, there are similarities in patterning across JSL, SKSL and TSL, and especially between JSL and TSL, where sociolinguistic variation in a 'source' sign language seems to have resulted in a replicated pattern of sociolinguistic variation in a 'target' sign language. Meanwhile, the entry of some variants into SKSL, through sign language contact, has resulted in an interesting situation whereby the use of these variants is in some cases determined by new linguistic constraints. It is especially noteworthy that JSL appears to exploit mainly compound-based numeral signs, while SKSL uses cognate but more lexicalised forms. Though several interesting sociolinguistic findings are explored here for JSL, the limited number of TSL and SKSL informants means that comparisons of sociolinguistic factors cannot be made for these two languages, and further research is warranted in these and other domains in order to create a more detailed picture of sociolinguistic variation, and the consequences of language contact and processes of lexicalisation.

9. CONCLUSION

9.1. Overview of innovative aspects

The previous eight chapters have explored the rationales, background details, stages, procedures and findings of this study on the numeral system of JSL, and the aim of this chapter is to highlight the most salient and innovative aspects of the project as well as areas that could not be investigated in full here and thus require further research. Due to its amalgamation of typological and language-internal perspectives, the project can be seen as boasting several innovative aspects, including methodology (9.1.1 below), ethics (9.1.2) and linguistic findings (9.1.3).

9.1.1. Methodological aspects

The methodology exploited in this study, which involved comparing primary data from the target language with primary data from a number of other sign languages from a typological standpoint, has not been realised in precisely the same way in sign language linguistics before. Other sign language linguistics studies, notably Hendriks's (2008) work on Jordanian Sign Language and Lutalo-Kiingi's (2013) thesis on Ugandan Sign Language, made use of a cross-linguistic perspective, but with secondary rather than primary data from other sign languages for comparative purposes. The researcher has been able to harness the methodology appearing here, which is innovative in the field of sign language linguistics, because of her unique opportunity to collect primary data both from users of JSL as a member of the Japanese Deaf community, and from dozens of signers of different languages from around the world as a research officer for the Sign Language Typology project.

The combination of methodologies used in this thesis therefore helps to advance the field of sign Language Typology. Palfreyman, Sagara & Zeshan (forthcoming) note that "[t]he aims of sign language typology are threefold: to document individual sign languages; to compare structures, systems and constructions across different sign languages; and to determine the extent to which patterns of variation are modality-specific." Usually, the documentation of linguistic domains from individual sign languages (the first aim), though it may be approached with a typological perspective in mind, is a separate undertaking from the cross-linguistic comparison of primary data (the second aim). In terms of feasibility, this is of course much more achievable, and it is only the unique context with access to primary data from both JSL fieldwork and a project in sign of typology that has enabled the present work to combine both of these perspectives in the investigation of the domain of numerals.

9.1.2. Research ethics

It is accepted with reasonable uniformity within the sign language linguistics discipline that any research should involve reciprocal benefits for the deaf participants and their communities (e.g. Harris, Holmes & Mertens 2009, Zeshan 2007), even if this is merely ensuring appropriate dissemination. Such 'giving back' usually takes place at the end of the research process, often as the final stage concomitant with publication, that is, academics may disseminate publications to an academic audience, while also making available the results of their research in an accessible way to deaf communities, for examples through translating selected passages into sign languages.

The present study departs from this paradigm by implementing reciprocation at several points *during* the project, and this has included several aspects. As indicated in Chapter 3 and Chapter 4, during data collection there has been an intensive process of face-to-face consultation on various sign languages with deaf consultants. The researcher's fluency in multiple sign languages enabled her to engage with deaf consultants and receive valuable unpublished data from personal communication; this process meant that most informants were probably able to gain substantially more meta-linguistic knowledge than they had previously; that they learned about linguistic elicitation and other methods; and that they benefited professionally, intellectually and socially from establishing new contacts including academics and other deaf community peers (cf. Dikyuva et al. 2012).

More significantly, the study involved the creation of a database of JSL numeral signs by the researcher and several deaf Japanese colleagues, which constituted a capacity-building training activity as well as resulting in a convenient sustainable resource for the JSL community and sign language linguists.[15] Finally, a special one-day dissemination workshop was organised in Japan at Minpaku, the National Museum of Ethnology in Osaka in September 2013, as part of a larger conference. The typological database on numerals was demonstrated to participants, and the methodology and findings from the present research were explained in a signed presentation that was accessible to dozens of deaf participants at the workshop, including a majority from Japan and a smaller number of deaf signers from outside Japan.

9.1.3. Linguistic findings

Though the researcher did not intend at the outset of this study to focus on sign languages diachronically, one of the most interesting features of the project is that it resulted in new

[15] This database currently exists in pilot form and is not yet publicly accessible, but it is anticipated that it will be an Open Access resource soon.

insight into two aspects of historical change: that within JSL itself and that taking place across the JSL language family, which may intimate what happens over time for other sign language families as well.

Firstly, examining age variation in JSL facilitated a discovery of diachronic processes at work within this language, especially increasing standardisation, a decreasing variety of iconic motivations, and a stability over time of signs motivated by writing, i.e. Kanji symbols. In chapter 6, findings regarding the decreasing use or loss of several types of semantic motivation in JSL numerals over time (namely, those associated with iconic reference currency notes and with the iconic use of the mouth and eyes to represent '0') were presented. Increasing standardisation was also evident in Chapter 5, which includes reference to several variants of numerals that are no longer in active use by the present-day JSL community, e.g. the variant ELEVEN-3. At the same time as visual motivations in signs have decreased, the reliance on Kanji-based signs has remained stable over time in JSL (Chapter 6).

The typological perspective afforded a cross-linguistic overview of iconic motivation which informed the language-internal findings on JSL, as the researcher could apply what was found in other sign languages with JSL to examine types and processes of change. As mentioned in section 9.1.1 above, both the typological and language-internal findings of the research stemmed from primary data, which supports the originality of the results and the value of the study as a whole, and stands as evidence that sign language linguists using comparative perspectives can generate worthwhile results from primary data collection, even where samples are small relative to those of spoken language studies (see Palfreyman, Sagara and Zeshan, forthcoming).

Secondly, the investigation of other languages in the JSL family, i.e. TSL and SKSL, uncovered some noteworthy characteristics with respect to (genetically) related numeral signs across the JSL family. As was shown in Chapter 8, TSL has seen the spread in Tainan of some numeral signs as the only existing variant, while the same signs only exist as variants restricted to specific regions in JSL (namely, HUNDRED-2 and THOUSAND-2). SKSL shows evidence of phonological reduction of signs from JSL, visible in THOUSAND-1. This suggests a spreading of signs between languages and hints at what sorts of historical processes might be observable among or across languages in a single family, which perhaps begins to shed light on diachronic aspects of comparative sign language studies. These findings are not as robust or carefully examined as those relating to JSL exclusively, due to the limited scope available for this thesis. Therefore, the next section, 9.2, briefly discusses this and other remaining questions from the project as well as relevant recommended paths for further research.

9.2. Perspectives on future research

This study placed a lens on both cross-linguistic and language-internal aspects of JSL numeral structures, especially the phonological, lexical and sociolinguistic variation that occurs within JSL. The sub-sections below consider the topics stemming from this examination that require further study in order to be addressed in sufficient depth, in relation to JSL itself (9.2.1), numeral systems (9.2.2), and diachronic change in sign languages (9.2.3).

9.2.1. Further research on JSL

One area that this project drew attention to was the rich tapestry of variation in the JSL numeral system, which is visible at several linguistic levels - phonological variation as discussed in Chapter 5, of distinct lexical variants as discussed in Chapter 5-8, and the sociolinguistic aspects of variation discussed in Chapter 8. However, this thesis has been limited to investigating numerals in isolation. For further research, the use of numerals at noun phrase and clause level, i.e. how JSL incorporates numeral signs into noun phrases and clauses, would need to be studied in more detail. This thesis has focused on analysing JSL's cardinal numerals, ordinal numerals, iconicity and sociolinguistic variation but has emphasised the lexical and sub-lexical levels only; as yet, no studies on the syntactic behaviour of JSL numerals are available. However, the data collected for this study are ample enough to facilitate noun phrase-level and clause-level analyses, e.g. the frequency of alternative orders numerals and nominals (THREE BOOK vs. BOOK TREE). Although time restrictions precluded such an endeavour in this instance, these data provide a straightforward means of launching further research into the expression of numeral concepts within clauses and noun phrases.

9.2.2. Researching numeral systems

As well as the study of JSL numerals syntactically, future research might delve into the nature of the various numeral sub-systems in JSL that this project has revealed, including digital, additive, multiplicative, and numeral incorporation sub-systems or morphological processes (see Table 25). The notion that numeral forms within a language can be compared in terms of distinct, identifiable sub-systems is relatively new for sign language linguistics, and arises here from an analysis that is meta-systemic because it looks at which sub systems are active in the language.

Table 25 Sub-systems in JSL

Morphological process/strategy	JSL sign examples
Additive	11-19
Lexical	10(TEN-2) 100(HUNDRED-2)
Numeral incorporated	10-90, 100(HUNDRED-1)-900, 1000(THOUSAND-1)-9000
Multiplicative	10,000- 90,000
Digital	YEAR (e.g. 2000)

For future research, it would be interesting to compare the findings of Table 25 with other sign languages, as there seem to be substantial differences in numeral systems in terms of the complexity of sub-systems. For instance, Zeshan et al. (2013) point out that, for numerals under 1,000, Indo-Pakistani Sign Language users only a single option, the digital strategy, and that some rural sign languages employ strategies not found previously in urban sign languages (e.g. spatial modification of signs as in APSL, see Figure 6.14 in Chapter 6).

9.2.3. Historical sign linguistics

Following on from section 9.1.3 above, this thesis has unexpectedly brought greater clarity to the issue of historical change in individual sign languages and in sign language families. For example, differences among the three languages in the JSL family can be conceptualised in terms of a lexicalisation continuum (see Chapter 5). In Section 5.5, this was observed within individual languages, but strikingly, this can also be observed across languages of the same language family, this case the JSL language family. Figure 9.1 shows an example of signs that can similarly be placed along a lexicalisation continuum as raised in Chapter 5, but where the signs have been collected from three different sign languages.

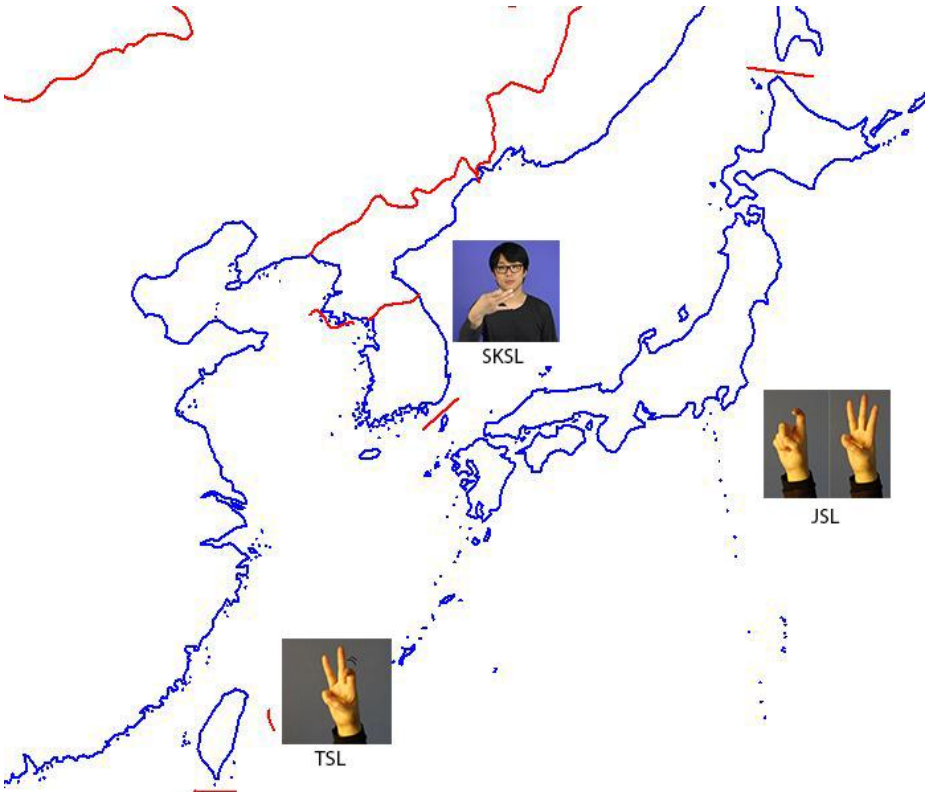


Figure 9.1 Variants for ‘13’ in Japan, Taiwan and Korea

In other words, while certain numeral signs in JSL comprise separate forms, their counterparts are more fused in TSL and fully lexicalised in SKSL, though the handshapes are similar across the three languages. To sign ‘13’ in JSL, two signs are required (a bent index finger meaning ‘10’, and an extended middle finger meaning ‘3’); in TSL, ‘13’ is signed in a similar way, but with both handshapes (i.e. the bending finger with internal movement meaning ‘10’ and the straight finger meaning ‘3’) performed simultaneously on the same hand; the SKSL sign for ‘13’ involves only one morpheme, a stationary handshape with the index finger bent and the middle finger extended.

Such data may be illustrative of language change, i.e. the form used in some countries may be at a later stage of lexicalisation, or the differences could relate to interference, whereby phonetic realisations of the same phoneme are transferred across languages (Quinzo-Pozos 2008). These kinds of questions have for the most part not yet been addressed for sign languages, in part because of the lack of available historical data. Fortunately, as this study illustrates, concentrating on age variation can allow a researcher to gather abundant information on the nature of older versus newer structures, and thus begin to understand the processes of diachronic change in and across signed languages. Further exploration of such issues could lead to improved historical models for sign language linguistics, a field in which the effects of time-depth have yet to be pursued fully, especially from a comparative or typological perspective.

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Appendix 1

Nominal number in sign languages (questionnaire)

iSLanDS Institute, UCLan - Keiko Sagara, Connie de Vos, & Ulrike Zeshan

This questionnaire focuses on the number systems of signed languages. The questionnaire is meant to guide you in describing nominal number in the signed language you are analysing. It includes cardinal and ordinal numbers as well as numeral incorporation in the lexicon and the use of generic quantifiers. In several sections of the questionnaire we will also address aspects in which the signed language and the spoken languages or gesture systems of the wider hearing community may show some overlap, or notable discrepancies. Please check the boxes in response to each question to indicate which option is correct for your signed language.

Cardinal numbers

0.a. Zero

Most signed languages documented so far have a zero number. **Does your the sign language have a sign meaning 'zero'?**

☐ Yes, there is a sign meaning 'zero'. *Provide a description, picture or video of the sign.*

☐ No, there is no sign meaning 'zero'.

0.b. Numbers 1-10

In signed languages the signs for 1-5 are normally one-handed, and the digits 6-9 (or 6-10) can be one-handed or two-handed. Note that certain numbers may display variation. See for instance the numbers 1-5 in Adamorobe Sign Language (Nyst, 2007, p.103) where there are two variants of the number THREE.

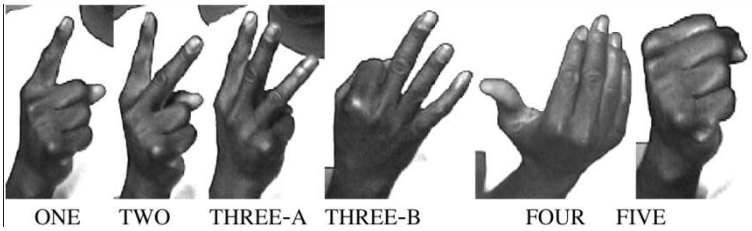

Figure 1 The number 3 has two variant forms in Adamorobe Sign Language (Nyst, 2007, p.103)

Please indicate how the numbers 1- 5 are produced, and include potential variants that may occur, similar to Figure 1 above.

☐ The signs for 1-5 are all one-handed.

☐ Some signs for 1-5 are two-handed. Please specify which numbers are produced with two-hands.

Provided description or pictures/videos of all signs for numbers 1-5.

Please indicate how numbers 6-10 are produced, and include potential variants that may occur.

☐ The signs for 6-10 are all one-handed.

☐ The signs for 6-10 are all two-handed.

☐ There is a mix of one-handed and two-handed signs. Please specify which numbers are produced with one hand and which with two hands, and provide descriptions of all signs and variants.

Please provide descriptions or pictures/videos of all signs for numbers 6-10.

0.c. Iconicity in cardinal numbers

We are also interested whether the cardinal numbers from 1-10 have an iconic base. The cardinal numbers of signed language can be highly iconic in that the number sign may simply correspond to the number of extended fingers. Number signs can also be linked to the written language of the community. For example, numbers 6-9 in TID, the sign language of the Turkish Deaf community (see Figure 2), are derived from written Arabic numerals because they go back to Ottoman times, where Turkish was written with the Arabic script (this is no longer the case in modern Turkish). Numbers may also be derived from the conventionalised gestures used by hearing people in the same area/culture, and we also include this case here, although the gestures themselves may or may not be iconic.

Figure 2: TID numbers 6-9 are motivated by the Arabic written numbers used in Ottoman times in Turkey

One may also find a mix of iconic strategies within a number system. For example, 1-5 may be iconically represented by the extended fingers of the hand, but 6-10 may be linked to the written forms. **Are the cardinal number signs in your sign language iconically motivated, and if so, how?**

☐ The cardinal numbers are represented by the extended fingers of the hand.
Please indicate for which of the numbers this is the case.

☐ The cardinal numbers are the same as the gestures used by hearing people.
Please indicate for which of the numbers this is the case.

☐ The cardinal numbers are motivated by the writing system.
Please indicate for which of the numbers this is the case. If the iconicity is based on a non-Latin writing system (e.g. Arabic, Chinese), include a description/representation of how these numbers are written.

☐ The cardinal numbers are motivated, but in a different way. *Please indicate for which of the numbers this is the case, and explain the iconic basis.*

☐ The cardinal numbers are non-iconic. *Please indicate for which of the numbers this is the case.*

0.d. Cardinal numbers above 10

Not all sign languages have high numbers (e.g. above 100 or 1,000), or they may talk about high numbers only in some contexts, e.g. in relation to money. See Example 1. The provided translation is a rich interpretation of the utterance within a signed conversation between two young men. The men are discussing their financial futures, and the topic comes up that they may want to buy some cattle. One of the men says COW SEVEN, pauses shortly and then signs FINISH BROKEN FIVE. Note that the first cardinal number SEVEN means '7 million' within this context, while the second cardinal number FIVE refers to the number of cattle that has been 'broken' to be used for ploughing, i.e. 'five'.

Example 1 Kata Kolok
COW SEVEN -- FINISH BROKEN FIVE
'A bull is priced seven million, but I only have five broken cattle.'

Talking about higher numbers may also be imprecise or ambiguous, depending on the context for resolution. Kata Kolok and Alipur Sign Language show some of these aspects. In Kata Kolok for instance, numbers larger than a million are indicated by a large circle traced in signing space, with the circle being made larger to indicate even higher numbers. Alipur Sign Language has a similar process, with two open hands describing alternating circles that are bigger for the higher digit numbers (100,000, 10 million etc). Example 2 from Alipur Sign Language also relies on the context to resolve the meaning of the two single digit numbers (THREE meaning '30', but TWO meaning '200')

Example 2 Alipur Sign Language

THREE LESS TWO	-	TWO LESS FIVE
'28' (i.e., thirty less two)		'195' (i.e., two hundred less five)

Finally, it is conceivable that larger digits may be indicated by the addition of non-manual features to the cardinal numbers, or maybe by subtle formational changes to the movement of a sign (e.g. fast, large, or tense movement).

Please indicate how your signed language deals with higher digits.

☐ There is a lexical sign for 100. *Provide a description or picture/video of the sign and an example of its use.*

☐ There is a lexical sign for 1,000. *Provide a description or picture/video of the sign and an example of its use.*

☐ There are lexical signs for even higher digits (10,000, 100,000, 1,000.000, etc.). *Provide a description or picture/video of the sign(s) and examples of their use.*

☐ There are no lexical signs which refer to any of these quantities specifically. → *If you tick any of these options, please provide some example sentences which show how signers may talk about large quantities.*

- ☐ The interpretation of cardinal numbers as high numbers is contextually motivated.
- ☐ The interpretation of cardinal numbers as high numbers relies on non-manual or other subtle formational clues.
- ☐ There is an imprecise, gradient sign which indicates high quantities (as in the signs with gradually larger circle movements from Kata Kolok and Alipur Sign Language).
- ☐ Large quantities are referred to in some other way, namely.....

Strategies for constructing cardinal numbers

0.a. Simple multiples of ten

How does your sign language express numbers with multiples of ten, e.g. 30, or 79? In the case of simple multiples of ten, i.e. 20, 30, 50, etc., there are three main reported strategies which may be used. First of all, the individual digits may be produced in a columnar format to form a sequential compound, e.g. "3-0" becomes "30". Secondly, single digit signs may be combined with movement patterns, e.g. British Sign Language "5"-handshape with an away-movement becomes "50". Thirdly, sign languages may also add up lower numbers to create higher numbers, e.g. in Kata Kolok where one may sign "10-10-10" for "30".

Your sign language may use one or several of the described strategies. **Please indicate which strategy is found in your signed language.**

☐ Sequential compound "3-0" becomes "30".

☐ Movement pattern with a single digit, e.g. "5"-handshape with away-movement means "50".

☐ Adding up lower numbers to create higher numbers, e.g. "10-10-10" to mean "30"

☐ Another strategy for simple multiples of ten. *Please provide a description.*

For each available option, please provide examples and explain for which numbers they may be used. Please also provide contextualised examples for each of the ticked options whenever possible.
Note that some sign languages may have special, non-complex signs for a specific multiple of ten; for instance, Yucatec Mayan Sign Language has a special sign for '50'. Please discuss such signs under Q.2.c.

Q.2.b. Complex numbers above ten

In more complex numbers above ten, the following strategies are documented:
a) Individual digits in a columnar format, resulting in a sequential compound, e.g. in Indian Sign Language, signing "1-5" for the number "15".
b) Single digit signs combined with movement patterns, e.g. German Sign Language "5"-handshape with a to-and-fro movement for "15". In effect, the language may have a paradigm where the same digit refers to 5, 15, or 50 depending on movement patterns; this is the case in British Sign Language (see Figure 3). This strategy has been found for numbers between 11 and 19, but not other complex numbers above ten.

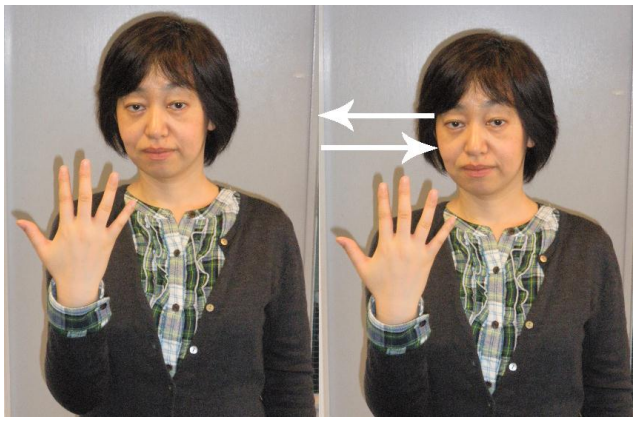

Figure 3: example BSL 5, 15

c) Adding up lower numbers to create higher numbers, e.g. in Kata Kolok where one signs "5-5-5" for "15".

d) There is one reported case of a "subtractive" system in Alipur Sign Language, e.g. "28" can be expressed as "30-2" in a columnar format (cf. Example 2 above). The system resembles the use of Roman digits like XIV.

Please indicate which strategy is found in your signed language. Note that your sign language may use one or several of the described strategies, so it is possible to tick more than one option.

- ☐ Sequential compound; "1-5" to express "15".
- ☐ Movement pattern with a single digit, e.g. "5"-handshape with to-and-fro movement to express "15"

- ☐ Adding up lower numbers to create higher numbers, e.g. “5-5-5” to express “15”.
- ☐ Simultaneous compound “7#10” to express “17”.
- ☐ The sign language makes use of a subtractive system, e.g. “30-2” to express “28”. This option is extremely rare, yet found in the case of Alipur Sign Language. Please contact us at uzeshan@uclan.ac.uk if the language you are analysing uses such a system.
- ☐ Other kind of strategy for complex numbers above ten. *Please provide a description.*

Please provide examples of each of the indicated strategies and explain for which numbers they may be used. Please also provide contextualised examples for each of the ticked phenomena whenever possible.

0.c Base numbers in number systems

The phenomena you have identified above will have revealed system-internal patterns on how numbers are combined to result in higher numbers. The question which is addressed here is which number forms the semantic base of a particular number system. The base number is the number on which higher numbers are built, and which itself is not made up of smaller numbers. Cross-linguistically in both signed and spoken languages, 10-base number systems are most common, but there are other options such as 5-base or 20-base systems. The distinction between 5-based and 10-based systems in numbers below ten is obscured in sign languages due to the iconicity of the fingers of the hand; therefore, we focus on the evidence of a semantic base in numbers above 10 here.

Most sign languages are 10-based, that is, when talking about eleven or twelve they will produce signs like TEN^ONE, TEN^TWO. An examples of a 5-based expression is the use of FIVE^FIVE^FIVE to express “15” in Kata Kolok. Such 5-based expressions may however have limited productivity. For instance, the Kata Kolok sign for “15” may not be used to form “17”, so signing *FIVE^FIVE^FIVE^TWO is not possible. A 20-base number system is rare in sign languages, but is evidenced in Mardin Sign Language, where, for example, TWENTY^THREE means “60. This is similar to spoken French, where the word for “80” (*quatre-vingts*), literally means “four twenties” (i.e., 4 times 20). Yucatec Mayan Sign Language also uses “50” as the base of some numbers, so “60” is expressed as FIFTY^TEN (50+10).

Importantly, different base numbers may co-occur within the number system of one and the same language. For instance, French has both 10-based *dix-sept* (“ten-seven”, i.e. 17) and 20-based *quatre-vingts* (80), on even a combination of both in *quatre-vingts dix-sept* (“4 times 20 plus ten-seven”, i.e. 97). **Please indicate which strategies are found in your signed language.** Remember it is possible to tick more than one option.

☐ The number system has characteristics of a 5-based system.

☐ The number system has characteristics of a 10-based system.

☐ The number system shows features of a 20-based system.

☐ Number system uses other base numbers, e.g. '50' in YMSL.

For each available option, please indicate which numbers above 10 may get this kind of strategy, and provide examples with pictures/videos.

0.d. Fractions

How does the sign language you are analysing deal with fractions of numbers? There are four attested ways in which sign languages may code this. First of all, there are strategies related to written language, for instance the use of a lexical sign meaning "percentage", or a system which involves a comma or dot, e.g. 3 DOT 5 to mean 3 ½. Secondly, a sign language may use a sign for "half", typically represented by a "cutting off" movement through a finger or hand. This is illustrated by Figure 7. This type of system may be productive and also used to indicate smaller fractions such as thirds, and be used on other cardinal numbers. For instance, in Indian Sign Language, a "cutting off" movement through the ring finger means TWO-AND-A-HALF. Finally, there are also languages which use a columnar difference to indicate fractions, using spatial arrangement of numbers. For example, in American Sign Language the number ONE produced above the number THREE indicates '1/3'.

Importantly, these systems are often only partially productive. The Indian Sign Language system of fractions, for instance, only goes up to THREE-AND-A-HALF, since the system is one-handed and there are no more fingers available.

Figure 7: Kata Kolok: ONE-AND-A-HALF

Please indicate which of the strategies are used in your signed language.

☐ There is a sign meaning "percentage".

☐ The sign language uses a digital representation, e.g. 3 DOT 5 for 3 ½

☐ There is a sign for “half”.

☐ Fractions are indicate by a columnar difference, e.g. in ASL: ONE produced above THREE for ‘one-third’.

☐ Another strategy. *Please describe in detail.*

For each available option, describe the sign or provide a picture/video, and provide examples of its use. Also comment whether the system is fully productive, or limited to certain numbers only.

Ordinal numbers

Q.3.a. The paradigm of ordinal numbers

Ordinal numbers are signs which refer to first, second, third, etc. Most sign languages have at least some such expressions, but we often find partial systems that are not fully productive. **Which dedicated signs are found in your sign language to express ordinal number?**

☐ There is only a sign for “first”, but no other ordinal numbers.

☐ There are signs for “first” and “second”, but no other ordinal numbers.

☐ There is a small set of ordinal numbers, with between 3 and 10 ordinal expressions. *Please list all available ordinal numbers, with examples.*

☐ Ordinal numbers are fully productive; any ordinal number can be expressed.

☐ There are no ordinal numbers. → Proceed to 0.

0.a. The form of ordinal numbers

There are two common ways in which a sign language may form ordinal numbers. Firstly, the cardinal number may be produced with an added movement, e.g. “1” handshape with a twist of the wrist, for the ordinal number “first”. Secondly, the signer may point to fingers of the non-dominant hand. This is very common for talking about siblings, starting with touching the thumb (or sometimes the index finger) and counting down to touching the little finger Figure 8). Another possible option (though not attested in our data yet) would be a sequential combination of cardinal number with another sign to indicate ordinal numbers. For instance, this may conceivably be derived from writing, e.g. signing “20” followed by finger spelled “TH” for “20^{th}”, but a sign for “ordinal” unrelated to writing and following a cardinal number is also logically possible. Such options may be more common with higher numbers, especially under the influence from the written language.

Figure 8: Ordinal numbers in Kata Kolok: THIRD

Please indicate which strategy is used in your signed language. If several options exist, please comment on how they are used (e.g. only for higher numbers, only for talking about siblings, etc.)

- ☐ Ordinal numbers are formed by producing the cardinal number with added movement.
- ☐ Ordinal numbers are formed by pointing at the fingers of the non-dominant hand.
- ☐ The cardinal sign is followed by another sign expressing ordinal number, e.g. “20” + “TH”
- ☐ Ordinal numbers are formed in another way. *Please provide details.*

For each available option, please provide a description or picture/video of the sign(s), and example sentences exemplifying their use.

Numeral Incorporation

This part of the questionnaire addresses numeral incorporation: the incorporation of cardinal numbers into lexical paradigms. The phenomenon occurs when signers express the numerical value simultaneously with a lexical element, resulting in a compound, such as TWO#YEAR, THREE#YEAR etc. Across sign languages, numeral incorporation is attested with various semantic domains, including time units, monetary units, and educational levels. Time units include YEAR, MONTH, WEEK, HOUR, MINUTE, and SECOND. Numeral incorporation in signs for the seasons, or for decades, centuries, and millennia are also conceivable, but not really documented. Signs for monetary units include: POUND, DOLLAR, CENT, or whatever currency is used in the particular country. Signs for educational levels are used with classes/grades with reference to a particular school system of a country. This usually stays within the single-digit area, sometimes also including zero (“class-zero” in Turkey is kindergarten or the university prep year). Finally, numeral incorporation may occur with classifiers, e.g. one upright index finger for a single person, but three upright fingers for three people. Figure 9 shows some examples of numeral incorporation in Kata Kolok in sign for school grades.

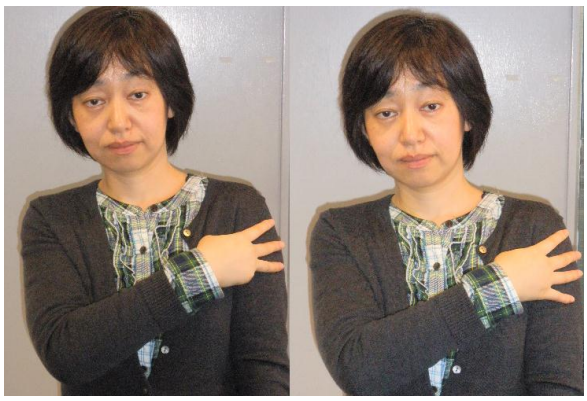

Figure 9: example from Kata Kolok: left: 'third grade, right: 'fourth grade'

Signed languages may or may not make use of numeral incorporation when talking about these domains, and they may also vary in the digits with which the signs can be produced. That is, there usually are some restrictions to the system for example because of articulatory reasons (e.g. FIVE#YEAR, but SIX YEAR because the sign for the cardinal number six is produced with two hands). **Please proceed to the checklist below and provide examples.** Note that in some cases they may be two variants, one with and one without numeral incorporation; these should also be included in your answers

- ☐ There are no recorded cases of numeral incorporation in the sign language. → Proceed to Q.5.
- ☐ Numeral incorporation is used for **time units**.
- ☐ Numeral incorporation is used for **monetary items**.
- ☐ Numeral incorporation is used for **educational levels**.
- ☐ Numeral incorporation is used for **classifiers**.
- ☐ Numeral incorporation occurs in another lexical domain. *Please provide full details*.

For each available option, specify the lexical signs with which numeral incorporation occurs, provide examples, and for each lexical sign indicate the cardinal numbers which can be incorporated into the sign.

Quantification

0.a. Nominal plurals

Languages may mark number on nouns (e.g. the English plural –s, as in cup**s**). How are nominal plurals expressed in the signed language you are analysing? Apart from the special case of numeral incorporation, we distinguish here between two main options: marking plural on the noun sign itself, or plural marking external to the noun. We do not consider cases where the nominal sign is merely combined with a cardinal number (e.g. BALL THREE for 'three balls'), as this is a typologically uninteresting default option.

When plural is marked on nominal signs, a common strategy in sign languages is repetition/reduplication of the noun. This may involve repetition at several locations in signing space with various movement patterns (articulated separately or with a tracing movement), or, more rarely, static repetition. Figures 10 and 11 show some examples of attested patterns: static, distributive, circular, and in a straight line. This strategy usually does not apply to all nouns, and may sometimes apply to very few items only. For instance, the pair CHILD – CHILDREN is often one of very few cases of noun reduplication.

Figure 10: Example of reduplication for plurality: SISTERS in Indian Sign Language (static)

Figure 11: Straight line reduplication from Jordanian Sign Language SIBLINGS

Plural marking external to the nominal sign commonly occurs with classifiers. Again, the classifier forms can be distributed in the signing space in various spatial patterns (e.g. arranged in a line, or with a circular tracing movement), and some forms can be subject to numeral incorporation. Static reduplication with classifiers is not attested in our data. Finally, there may be suppletive plural forms in some cases, where the sign with plural reference is completely different from the singular sign, such as PERSON and PEOPLE in American Sign Language. Suppletive plurals are always rare and limited to specific lexical items only.

Please indicate the options available for marking nominal plurals in your sign language. Note that it is common to find several options in one and the same sign language.

☐ There are no possibilities for marking nominal plurals, except combining a nominal signs with a cardinal number, e.g. THREE BALL. → Proceed to Q.5.b.

☐ Repetition/reduplication of the lexical sign indicates plurality.

- ☐ Individually articulated repetitions of the lexical sign at different locations in signing space, e.g. BALL#loc1 BALL#loc2 BALL#loc3
- ☐ Repetition of the lexical sign involves a tracing movement, localized in signing space, e.g. SIBLING#loc1-loc3 (Jordan).
- ☐ The repetition is static, i.e. the lexical sign is repeated at the same location, e.g. SIBLING++ (India)

Please provide examples of each construction, and comment on any restrictions. Repetition of lexical signs does not usually apply to all nouns.

☐ Plurality is marked through entity classifier constructions.

- ☐ Individually articulated repetitions of the classifier at different locations in signing space.
- ☐ Repetition of the classifier involves a tracing movement, localized in signing space.
- ☐ Entity classifier used with numeral incorporation

Please provide examples of each construction, and comment on any restrictions, which may apply to tracing or numeral incorporation.

☐ There are suppletive plural forms (e.g. PERSON – PEOPLE). *Please provide a complete list with pictures/videos of the signs.*

☐ Plurality is marked in some other way. *Please provide specifics on this construction.*

0.b Inventory of quantifiers

General quantifiers are often used in signed languages to make generic statements, for example 'All/many/some/no students passed the exam.' Please indicate from the list below whether the following lexical quantifiers occur in your signed language. Note that there may be more than one sign in each of these categories. For instance, sign languages in Finland and South Korea have several signs for "none". There may be subtle semantic distinctions between the items within a category, for instance, a difference between "none" to indicate specifically that a quantity has been exhausted (in the sense of "there is none left"), and general negative "none" that can be used in any context. Signs for "all" might distinguish between individual reference ("each one") and collective reference ("every; all together").

☐ ALL, EVERY

☐ MANY, MUCH

☐ SOME, A-FEW

☐ NO, NONE, NOTHING

For each available option, please provide a description or picture/video of the sign(s), and a few example sentences illustrating their meaning and use.

Q.5.c. Modifications with quantifiers

Quantifiers may be subject to various formational modifications, such as spatial inflections or other morphological processes. For instance, the sign NONE in South Korean Sign Language can be localised in space to agree with the location of its referent, e.g. signing BOOKSHELF followed by the sign NONE articulated along a straight line at the same location. In Indian Sign Language, ALL can similarly be localised. Another possible formal modification, for which there is less evidence from existing data, has to do with pluralising the quantifiers themselves. For instance, quantifier signs could be reduplicated (at the same or at a different location), or two hands articulating the same quantifier could be positioned at two spatial locations (possibly to indicate a contrast or comparison); this implies that one-handed signs could become two-handed.

Please indicate the kinds of formal modifications that occur with quantifiers in your sign language. For each option, please provide a list of the quantifiers that can be affected by the formal modification.

☐ There are no formal modifications with quantifiers. → Go to Q.6.

☐ Quantifiers with spatial inflection / localisation.

☐ Reduplicated quantifiers to indicate plurality.

☐ Two-handed forms where the two hands are positioned at different spatial locations.

☐ Any other formal modification. *Please provide details.*

For all available options, please provide example sentences to illustrate how these forms are used.

Q.6. Feedback

You have now identified all of the numeral constructions which we are investigating in our study. If you would like to make any comments about this questionnaire, answers to the questions, your data, etc., please add your comments below, or contact Ulrike Zeshan at uzeshan@uclan.ac.uk to provide your feedback.

THANK YOU FOR USING THIS QUESTIONNAIRE!

Appendix 2

Participant information sheet

Keiko Sagara – MPhil Research: Participant Information Sheet

You are being invited to take part in a research study as part of a student project. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Who will conduct the research?
The research will be conducted by Keiko Sagara. Keiko is a student at the International Institute for Sign Languages and Deaf Studies (iSLanDS), UK.

Title of the Research
The research is a cross-linguistic comparison of number systems in sign language, with particular attention to Japanese Sign Language.

What is the aim of the research?
I want to know more about the structure of number systems in Japanese Sign Language, and how these compare with other sign languages, such as British Sign Language and Chinese Sign Language.

Why have I been chosen?
You have been chosen because you are a Japanese Sign Language user. I aim to include around 20 sign language users.

What would I be asked to do if I took part?
If you decide to take part, you will be asked to fill in a background questionnaire on subjects such as your age, background, schooling etc. You will then be asked to play three games with another sign language user who has been selected by the researcher. Finally, there will be a 1:1 interview with Keiko, the researcher. ***Altogether, the session will take about 2 hours.***

What happens to the data collected?
The video cassettes will be taken to the UK, and stored securely in a locked cabinet. The data on the cassettes will be captured and stored in the iSLanDS Database. Only the researcher and her supervisors will have access to this data. In 5 years' time, the data will either be deleted or, if you give consent, it will continue to be stored after this.

How is confidentiality maintained?
The data will only be used in conjunction with this project. There are different levels of confidentiality:

COMPLETE ANONYMITY – your data will be used for analysis, but only sentences and line drawings will be published.

CONSENT FOR PUBLICATION – your data will be sued for analysis; you can give consent for any of the following:

(a) photos from the data to be used in publications
(b) video clips to be used in conferences
(c) video clips to be used in publications, ***and/or***
(d) photos and videos to be used on the internet.

It is entirely up to you as to whether you grant any of these permissions.

What happens if I do not want to take part or if I change my mind?
It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time without giving a reason and without detriment to yourself.

Will I be paid for participating in the research?
Travel costs will be paid (though there is a limited amount of funding for this), and participants will also be given a small gift as a token of gratitude.

Where will the research be conducted?
Research will be conducted in Tokyo and Shiga.

Will the outcomes of the research be published?
The research findings will be published, and I will give a presentation on the findings, to which the research participants will be invited. I would like to include the names of participants in the publication, so that I can thank you for your involvement. However, this will only happen if you give permission for me to include your name – otherwise you will remain anonymous.

Contact for further information
If you have any questions, now or in future, please contact me using the following details:
Keiko Sagara
iSLanDS Institute, HA122 Harrington Building, University of Central Lancashire, Preston, PR1 2HE, United Kingdom.
Email KSagara@uclan.ac.uk, or MSN – for webchat – k_sagara130@hotmail.co.jp

Thank you for reading this!

(Japanese version):

研究にご協力して下さる皆様へ

研究にご協力頂くに際しては、以下の内容をご理解頂きますようよろしくお願いします。また、ご不明な点がありましたら、ご遠慮なく質問していただきますよう、重ねてお願いいたします。

１． 研究者：相良啓子（サガラケイコ）

２． 研究テーマ：手話の数詞表現における類型論の研究
―　日本手話に焦点をあてて　―

３． 研究の目的：日本手話の数詞に関する文法構造を研究すること。またイギリス手話や中国手話などの他国の数詞に関する手話の構造との比較研究を行う

４． 研究への協力内容：最初に、年齢や教育・生活環境についての簡単なアンケートにご記入頂きます。その後、数詞に関する３種類のゲームを他のろう者とのやり取りしながら行って頂きます。最後にインタビューを行います。全体として約２時間を見込んでいます。

５． データの扱い方：撮影したビデオカセットはイギリスのセントラルランカッシャー大学内の手話研究所に厳重に保管します。記録データは、研究者本人とその指導教官以外には閲覧しません。研究期間５年以内にデータはすべて削除しますが、５年後もデータを保持しておいて良いという本人の了解がある場合は、削除せずに保存します。

６． もし途中で研究に協力することができなくなった場合は、いつでも研究への協力を取り消すことが可能です

７． お支払いについて
ご協力いただく場合は、一定の交通費または小さな贈り物をお渡しします。

８． 研究成果の報告・発表・出版などについて
研究成果については、報告会や学会などでの発表や論文出版などを行います。

９． 連絡先：

質問やお問合わせ等がありましたら、以下へご連絡をお願いいたします。

iSLanDS Institute, HA122 Harrington Building, University of Central Lancashire
Preston PR1 2HE UK Email: ksagara@uclan.ac.uk
MSN- webchat ： k_sagara130@hotmail.co.jp

Appendix 3

Consent form for research participants

International Institute for Sign Languages and Deaf Studies
University of Central Lancashire
Preston PR1 2HE, UK

Consent form for research participants

Please tick the boxes where applicable and sign at the bottom.

☐ 1. I have seen and understood the information for research participants.

☐ 2. I have had a chance to ask questions about this research, and I am happy with the answers.

☐ 3. I understand that my help is voluntary, and that I can change my mind and stop participating any time, without giving a reason.

4. Use of data

☐ 4.1 I agree to having my sign language data stored and analysed at the University of Central Lancashire for the purpose of research by the International Institute for Sign Languages and Deaf Studies.

In addition:

☐ 4.2 I do not consent to the publication of video data or photos because I want to remain completely anonymous. (that is, only transcribed texts and line drawings can be published)

Or: I agree to the publication of the following:

☐ a) Photos in publications (print, CD/DVD, online) and/or

☐ b) Video segments for lectures / conferences (presentations) and/or

☐ c) Video segments in publications (CD/DVD, online) and/or

☐ d) Photos and Videos in the internet (open online access).

5. Data retention

☐ 5.1 I do not want my data to be stored after the research project. Please delete all my data after the standard retention time of 5 years.

☐ 5.2 I may want you to keep my data after the research project. Please contact me at the end of the research project to make arrangements. If I cannot be contacted, my data will be deleted after 5 years.

6. Review dates: (Any changes are to be recorded on a new consent form)

_____ _____ _____ _____

Name Place Date Signature

(Japanese version):

同意書

国際間における数詞・色・家族の表現に関する手話比較研究

この度、セントラルランカッシャー大学の手話研究所（iSLanDS）にて、日本手話と他国の手話の数詞に関する比較研究を行うことになりました。つきましては、日頃日本手話で生活をされていらっしゃる皆様に日本手話データの提供をお願い申し上げます。ご協力いただいたデータは、本研究以外に使用することはありません。また、協力してくださった皆様には研究結果をご報告します。何卒、ご理解とご協力の程、よろしくお願い申し上げます。

以下、適応する箇所にチェックを入れてください。

☐１．私は、この研究についての意図を理解しました。
☐２．私は、この研究について回答することに賛同しました。
☐３．私は、この研究について協力できなくなった場合は、いつでも辞退することができることを理解しました。

☐４－１．私自身の手話データが、イギリスのセントラルランカッシャー大学の手話研究所内で、分析されるということに賛同いたします。

４－２．以下の出版などに関する事項に賛同します。
A)☐ 論文、DVD-CD オンラインなどへの写真に使用する
B)☐ 講演などでのビデオに使用する
C)☐ 本と同時に付属する DVD・CD 等へのビデオの使用
D)☐ インターネットへの写真とビデオのアクセス
または
☐ 私は、写真やビデオを公開することは許可しません。（この場合は、文字情報のみで論文を執筆することになります）

☐ ５－１．私は、研究が終わった後に自分のデータがそのまま残されることを好みません。研究終了後、5 年後にはすべてのデータを削除してください。
☐ ５－２．私は、自分手話データが保持されることを希望します。このプロジェクトが終わった時点でデータをどうするかについて連絡をお願いします。もし、5 年後に、連絡が取れなくなった場合は、データが削除されることに同意します。

名前 日付

Appendix 4

Participant questionnaire

Please circle the options that apply:

1. Are you: female / male
2. How old are you? 18-25 26-45 46-60 61 or over
3. Which prefecture do you live in now? _____
4. How long have you lived there? ____ years
5. When did you become deaf? I was born deaf / I became deaf when I was ____ years
6. Is anyone else in your family deaf? yes / no (go to question 7)
   If yes, please write down who: _____
7. Do you wear hearing aid(s)? yes / no

8a. have you ever attended a deaf school? yes / no (go to question 9)

8b. If yes, at what age? (please circle all that apply)
   kindergarten / elementary / junior / high school / vocational college

8c. Which deaf school(s) did you attend? _____
   (if you have been to more than one school, please name all of them)

9. When did you start to use sign language?

   - for as long as I can remember (since I was very young)
   - I started to learn when I was about _____ years old
   - I am not sure / I cannot remember

10. How would you describe your skills for reading and writing Japanese?

   - I have no problem reading and writing Japanese
   - I find it difficult to read and write Japanese

11. How often do you meet with deaf people and use sign language to communicate?

   - once or twice a month
   - once a week
   - several times a week
   - every day

Thank you for your time!

(Japanese version):

アンケート

１．性別　（　男　・　女　）

２．年齢（　18 才～25 才　　26 才～45 才　　46 才～60 才　　61 歳以上　）

３．現住地　（　　都道府県）

４．現在お住まいの地域（関東・関西）には、何年お住まいですか。（　　）

５．聴力を失ったのはいつですか。　（　生まれた時から・　　才の時）

６．家族に聞こえない人はいますか？　いらっしゃる場合はどなたですか？
（　　）

７．A)　ろう学校経験はありますか。（　はい　・　いいえ）
B)　在学していた学部に○を付けてください。

（ 幼稚部 ・ 小学部 ・ 中学部 ・ 高等部 ・ 専攻科 ）

C) 在籍したろう学校名をお願いします（複数校の場合も連記してください)。
（ ）

8． 日本手話を習得したのはいつ頃ですか。
（ とても幼い時から ・ _____ 才から ・ 覚えていない ）

9． 読み書きの日本語についてお伺いします。
（読み書きには問題がない・ 簡単な日本語は理解できる・ 殆ど読み書きできない ）

１０． 現在の生活の中で、どのくらいの頻度でろう者と会い、手話を使いますか。

（ 月に１回～２回程度 ・ 一週間に一回程度 ・ 週に数回 ・ 毎日 ）

Appendix 5

Examples from ‘calendar game’ elicitation activity

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	
8 - 9								8 - 9
9 -10	work	clean room	Work	Work	Work	Hair cut	wash clothes	9 -10
10-11								10-11
11-12		11.20 Dentist Appt						11-12
12-13					12.45 Doctor Appt			12-13
13-14		13.15 meeting with the quest from Germany				Lunch with friend	shopping	13-14
14-15					Gym(2 hours)			14-15
16-17								16-17
17-18			17.15 Skype with friend			Cinema (show starts 16.35)		17-18
18-19								18-19
19-20	Deaf club	Gym(45 mins)	Gym(45 mins)	badminton with 4 friends				19-20
20-21								20-21
21-22								21-22
22-23								22-23

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	
8 - 9								8 - 9
9-10	work	Work	Work	Work	Work	9.30 Hair cut Appt	wash clothes	9-10
10-11								10-11
11-12							visit family	11-12
12-13								12-13
13-14						Food Shopping		13-14
14-15								14-15
16-17								16-17
17-18								17-18
19-20	GYM(2 hours)	19.15 skype with sister Appt	Skype with friend		GYM			19-20
20-21								20-21
21-22								21-22
22-23								22-23

Appendix 6

PowerPoint slide examples