

Phonological Contact in Kana-based Signs in Japanese Sign Language : A Preliminary Study

著者 (英)	Hiroshi Baba, Kazumi Matsuoka
journal or publication title	Senri Ethnological Studies
volume	101
page range	29-42
year	2019-06-21
URL	http://doi.org/10.15021/00009417

3. Phonological Contact in *Kana*-based Signs in Japanese Sign Language: A Preliminary Study

BABA Hiroshi

Kwansei Gakuin University, Japan

MATSUOKA Kazumi

Keio University, Japan

Abstract

Finger-spelling handshapes have been continuously investigated in sign language phonology. Japanese Sign Language (JSL) has *kana* syllabary-based finger-spelling. Those handshapes are incorporated into some signs used by native signers. The current study is the first step of an attempt to describe the phonological characteristics of *kana*-based signs, focusing on the relationship between physical contact and location. *Kana*-based signs contain only the first *kana* symbol, and hence are similar to what is called ‘initialized signs’ in previous works on other sign languages. A list of 23 commonly used *kana*-based signs was created by a native signer of JSL who had been trained with sign language phonology. Five native signers were requested to sign the word list on their own and make judgments about whether physical contact was required with the sign or not. The current study revealed that there is an interaction between the location of the sign and the requirement of physical contact (Higher, Lower, Borderline, Neutral). *Kana*-based signs signed at the lower location tend to enhance their phonological salience with physical contact or internal movements added to the path.

3.1. Introduction: JSL Finger-spelling and *Kana*-Based Signs

In general, finger-spelled words are not considered as ‘signed words’ by native signers. However, it is not unusual that finger-spelled words undergo phonological and morphological transformations to form new signs (‘loan signs’). Moreover, finger-spelling handshapes have occasionally been incorporated into signs used by native signers (i.e. deaf signers born to deaf parents, who were exposed to a sign language since birth). Finger-spelling handshapes have been investigated in the seminal work of Battison (1978), which was developed further in later works such as Padden (1998) and Brentari and Padden (2001). Japanese Sign Language (JSL, *Nihon Shuwa*) is the language of the deaf community in Japan, and is estimated to have been in use since the 1800s (Kimura 2011). The JSL lexicon also contains a growing number of ‘loan signs’. JSL has *kana* syllabary-based finger-spelling (an equivalent

to manual alphabets), as shown in Figure 3-1 below (each *kana* basically corresponds to a mora, which can consist of one vowel, or a combination of a consonant and a vowel).¹⁾ The figure contains the range of handshapes available in JSL finger-spelling. Some of the finger-spelled *kana* may be augmented by a designated vertical or horizontal movement, and refer to a related but different letter (e.g. KA is changed to GA with a horizontal outward movement, HO is changed to PO with a vertical upward movement). The augmented movements, though, are replaced by lexical/phonological movements when the finger-spelled *kana* develops into *kana*-based signs.

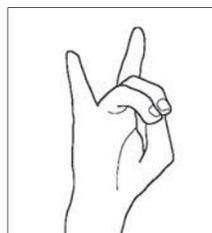


Figure 3-1 JSL Finger-spelling

These finger-spelled expressions have been incorporated into signs used by native signers. In the following example (Figure 3-2, KIMOCHI ‘feeling’), the finger-spelling ‘KI’ is signed on the upper chest of the signer. These *kana*-based signs contain only the first *kana* symbol, and hence are similar to what is called ‘initialized signs’ in previous works of other sign languages.²⁾



KIMOCHI ‘feelings’



Finger-spelling for KI

Figure 3-2 *Kana*-based sign

When new *kana*-based signs are to be added to the JSL lexicon, such as ‘Internet’, ‘AIDS’, etc., different signs are first tried in the community of native JSL signers, until signers agree on the more natural expression. The agreement seems to reflect some phonological properties of JSL signs shared by native signers. When a major political organization for deaf and hearing-impaired Japanese began to invent new signs by borrowing finger-spelled *kana* and including them in the training materials for interpreters, fierce criticism emerged from the community of the deaf who use JSL either as their mother tongue or their first language. According to native signers, many of those ‘new’ signs do not match their intuition of well-formedness. Their criticism was not unfounded: it has been pointed out that loan signs and initialized signs cannot be created randomly. Previous analyses of foreign vocabulary in ASL (Padden 1998; Brentari and Padden 2001) have revealed that newly developed signs with finger-spelled components follow phonological constraints observed in native signs. However, there are very few studies of phonological aspects of JSL *kana*-based signs. The current study is an attempt to identify what constitutes phonological requirements necessary for *kana*-based signs to be accepted as legitimate JSL words.

In particular, we focus on the relationship between physical contact and location. Contact has played an important role in the development of theories of sign language phonology. For example, physical contact is influential in phonological changes in the formation of compounds (Liddell 1984). Sandler (1993: 249) argued that movement should be included in underlying phonological representation, referring to the fact that movement must be non-redundantly specified for contact. In her prosodic model, Brentari (1998) assumes that [contact] is considered as one of the inherent features which interact with the [path] feature. The current study is the first step of an attempt to describe the phonological characteristics of *kana*-based signs, focusing on the relationship between physical contact and location. Our research questions are as follows:

- (i) Are there any systematic differences between acceptable and unacceptable *kana*-based signs in terms of physical contact?
- (ii) If so, what are their phonological properties?

To address the questions above, five native signers were recruited as informants. Their background information is summarized in below. As shown in Table 3-1, the participants were from the eastern and western parts of Japan. Their ages ranged from 30–50s.

Table 3-1 List of participants

BIRTHPLACE	AGE	GENDER
Gumma	30s	Female
Gumma	40s	Female
Osaka	30s	Female
Osaka	40s	Male
Kagawa	50s	Male

A list of 23 commonly used *kana*-based signs was created by a native signer of JSL (one

of the authors, male, in his 40s, from Wakayama) who had been trained with sign language phonology.³⁾ The participants were requested to sign the word list on their own and make judgments about whether physical contact (e.g. hand to body, hand to hand) was required with the sign or not. When four or more signers reported that the physical contact is necessary, the contact was considered to be ‘required’. If one or two signer(s) accepted the lack of physical contact, while others claimed that contact is necessary, the contact was ‘strongly preferred’. When no signer reported that contact was necessary, contact was ‘not required’ for the sign. When all signers reported that no physical contact is possible, the contact was labeled as ‘none’. In the following sections, we report the observations in our preliminary study and consider their theoretical implications.

3.2. Observations

3.2.1 One-Handed Signs

There is an interaction between the location of the sign and the requirement of physical contact. In this section, four different categories (Higher, Lower, Borderline, Neutral) are described with examples.

A: Higher

Expressions signed higher than the chin (such as cheek or temple) do not require contact. An example is shown in Figure 3-3:



CHISHIKI ‘knowledge’

Finger-spelling for CHI

Figure 3-3 Kana-based sign without contact, higher location

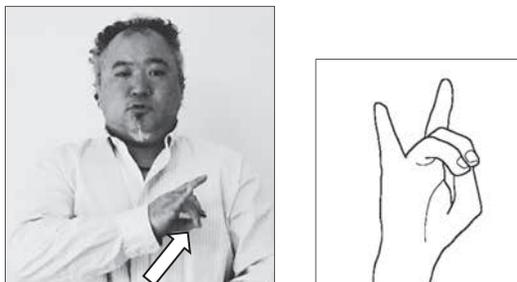
The following signs belong to the ‘Higher’ category. As indicated in Table 3-2, physical contact is not required for these signs.

Table 3-2 List of kana-based sign without contact, higher location

SIGNED WORD	HAND-SHAPE	LOCATION	MOVEMENT	LOCATION OF CONTACT	PHYSICAL CONTACT
CHISHIKI ‘knowledge’	CHI	Forehead	Non-dominant to dominant side	Forehead	Not required
ANKEETO ‘questionnaire’	A	Temple, dominant side	Outward	Temple	Not required
IKEN ‘opinion’	I	Temple, dominant side	Outward	Temple	Not required

B: Lower

Expressions signed below the chin require physical contact, either to the non-dominant hand or to a part of the body, such as an arm/chest. An example is shown in Figure 3-4:



KIMOCHI 'feelings'

Finger-spelling for KI

Figure 3-4 *Kana*-based sign with physical contact, lower location

The following signs belong to the 'Lower' category. As indicated in Table 3-3, physical contact was judged as 'necessary' by more than half of the informants.

Table 3-3 List of *kana*-based sign with physical contact, lower location

SIGNED WORD	HAND-SHAPE	LOCATION	MOVEMENT	LOCATION OF CONTACT	PHYSICAL CONTACT
KIMOCHI 'feeling'	KI	Chest	Inward, toward the signer, repeated	Chest	Strongly preferred
SUTORESU (one-handed) '(mental) stress'	SU	Torso, front	Upward	Torso	Strongly preferred
ENERUGII 'energy'	E	Arm	Upward and downward, forming an arc	Arm	Strongly preferred

C: Borderline

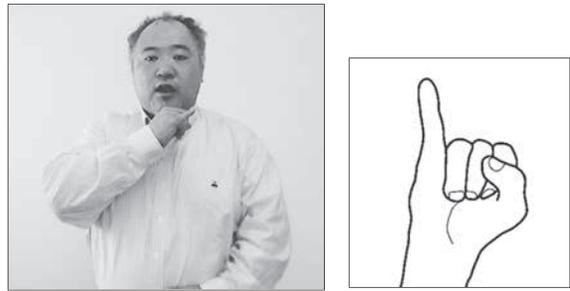
The area around the chin/mouth is the 'borderline' location. Namely, some *kana*-based signs require contact, while others do not. Two examples are shown in Figures 3-5 and 3-6, below:



KITAI 'expectation'

Finger-spelling for KI

Figure 3-5 *Kana*-based sign with contact, borderline location



INFURUENZA ‘influenza’ Finger-spelling for I
Figure 3-6 *Kana*-based sign without contact, borderline location

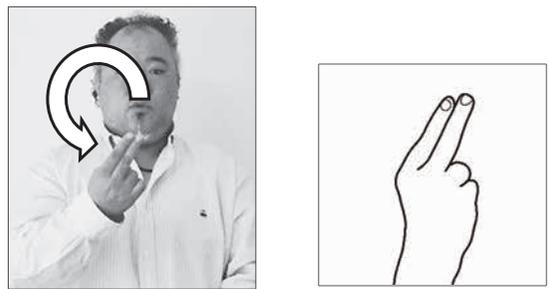
The following signed words in Table 3-4 belong to the category.

Table 3-4 List of *kana*-based sign with physical contact, borderline location

SIGNED WORD	HAND-SHAPE	LOCATION	MOVEMENT	LOCATION OF CONTACT	PHYSICAL CONTACT
KITAI 'expectation'	KI	Chin	Inward, toward the signer	Chin	Required
WAIN 'wine'	WA	Chin/mouth	Inward, toward the signer, repeated	Chin/mouth	Required
INFURUENZA 'influenza'	I	Chin	Inward, toward the signer, repeated	Chin	Not required
KISU (one-handed) 'to kiss'	KI	Mouth	Inward, toward the signer	Mouth	Required
MURASAKI 'purple'	MU	Mouth	Non-dominant to dominant side	Mouth	Not required

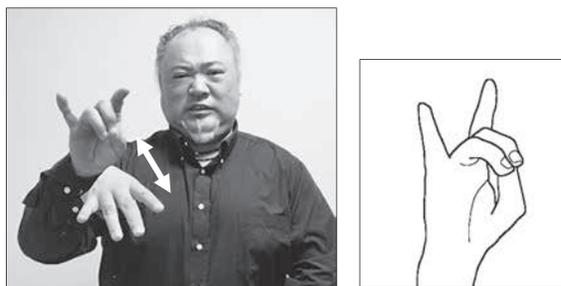
D: Neutral

Kana-based signs in this group cannot be signed with contact. Rather, their path contains repeated internal movement such as rotation or reciprocation. The location of those *kana*-based signs is what is typically referred to as ‘neutral’, which is also used for usual finger-spelling. An example of signs with rotation and reciprocation is shown in Figure 3-7, below:



TOMATO⁴⁾ ‘tomato’ Finger-spelling for TO
Figure 3-7 *Kana*-based sign with no contact, with rotation, neutral

The *kana*-based sign GIRIGIRI, shown in Figure 3-8 below, is also signed at a neutral position with repeated movement:



GIRIGIRI⁵⁾ ‘just barely’

Finger-spelling for KI

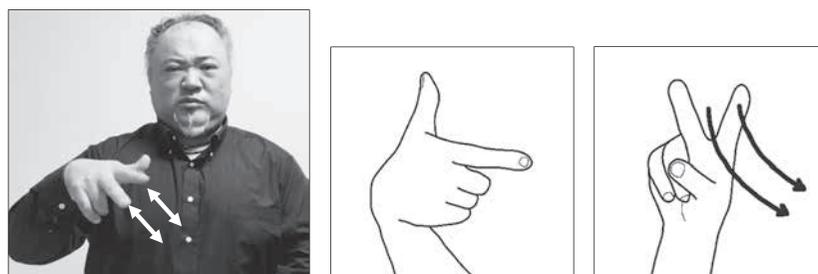
Figure 3-8 *Kana*-based sign with no contact, repeated movement, neutral

The following signs in Table 3-5 belong to the ‘Neutral’ category. The height of the sign can be in front of the face or the dominant side of the upper chest. Since there is no physical contact of the hand to any other part of the body, there is no entry in the location of contact.

Table 3-5 List of *kana*-based sign with physical contact, lower location

SIGNED WORD	HAND-SHAPE	LOCATION	MOVEMENT	LOCATION OF CONTACT	PHYSICAL CONTACT
TOMATO ‘tomato’	TO	(Neutral) ⁶⁾	Rotation	n.a.	None
AJIA ‘Asia’	A	(Neutral)	Rotation	n.a.	None
SAAKURU (one-handed) ‘hobby/study group’	SA	(Neutral)	Rotation, horizontal	n.a.	None
GIRIGIRI ‘just barely’	KI	(Neutral)	Quick, short movement iterated	n.a.	None

Repeated, reciprocal quick movements seen in GIRIGIRI (Figure 3-8), above, are also observed in some loan signs from finger-spelled words. For example, MURI ‘cannot/no way’ is formed with two finger-spelled *kana* (MU and RI). In this loan sign, the two



MURI ‘cannot/no way’

Finger-spelling for MU

Finger-spelling for RI

Figure 3-9 Loan word from a finger-spelled word

handshapes are merged in one, and middle and pointing fingers engage in reciprocating motion. Loan words, including MURI, are typically signed in the neutral space.

In the following section, two-handed *kana*-based signs are discussed. They follow similar phonological patterns observed in one-handed signs, in addition to general phonological constraints on two-handed signs.

3.2.2 Two-Handed Signs

Two-handed *kana*-based signs on the list are classified into two categories, following Battison (1978). Battison observed that two-handed signs obey either of the following phonological constraints:

‘The Symmetry Condition states that (a) if both hands of a sign move independently during its articulation, then (b) both hands must be specified for the same location, the same handshape, the same movement (whether performed simultaneously or in alternation), and the specifications for orientation must be either symmetrical or identical.’ (Battison 1978: 22)

‘In effect, the Dominant Condition rules that if a two-handed sign is so complex as to involve two different handshapes, then the overall complexity of the sign must be reduced by (a) prohibiting movement of one hand (usually the non-dominant) and (b) severely restricting the possible handshapes which may appear on this passive hand.’ (Battison 1978: 24)

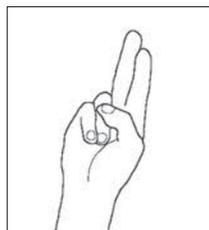
We label the two-handed *kana*-based signs that follow the Symmetry Condition as ‘symmetrical’ (group E), while the ones that follow the Dominant Condition as ‘dominant’ (group F). Observations with these categories are summarized below.

E: Two-handed, symmetrical

Handshapes of both hands are identical in the *kana*-based signs in this category. Figure 3-10, below, is an example of a symmetrical two-handed sign. Both hands are shaped in the finger-spelling ‘U’ and undergo the same movement (bouncing forward movement).



UTAU ‘sing’



Finger-spelling for U

Figure 3-10 Two-handed *kana*-based sign (symmetrical)

The following two-handed *kana*-based signs in Table 3-6 belong to the symmetrical group. Those signs seem to show the same pattern as one-handed signs, described in the previous section. For example, UTAU ‘sing’ does not necessarily require physical contact, since it is signed at the borderline position (see group C in the preceding section). The other two signs (CHIIMU ‘team’, KISU ‘to kiss’) are typically positioned lower than the chin, and hence require physical contact.⁷⁾

Table 3-6 List of two-handed *kana*-based signs, symmetrical

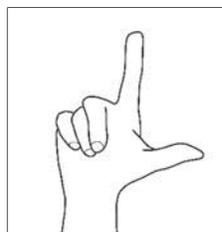
SIGNED WORD	HAND-SHAPE	LOCATION	MOVEMENT	LOCATION OF CONTACT	PHYSICAL CONTACT
UTAU ‘sing’	U	Mouth	Outward bouncing movement	Mouth	Not required
CHIIMU ‘team’	CHI	Neutral	Inward, each hand forms a horizontal arc, symmetrical	Non-dominant hand	Required
KISS (two-handed) ‘to kiss’	KI	Neutral	Both hands moving from the side to the center	Non-dominant hand	Strongly preferred

F: Two-handed, dominant

When the two hands are shaped differently, they follow the Dominant Hand condition and tend to require physical contact. The following figure is the sign for REPOOTO (document for reporting). The dominant hand is shaped in finger-spelling ‘RE’ and the non-dominant hand is open flat, which is considered as one of the unmarked handshapes in JSL (Torigoe 1997: 220). Only the dominant hand moves outward, after touching the palm of the non-dominant hand.



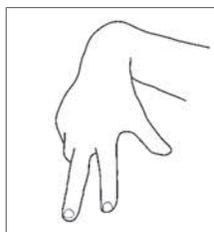
REPOOTO ‘document for reporting’



Finger-spelling for RE



SUTORESUSU (two-handed) ‘stress’



Finger-spelling for SU

Figure 3-11 Two-handed *kana*-based signs (dominant)

The following are the *kana*-based two-handed signs that belong to the dominant-hand group. As shown in the list, physical contact to the non-dominant hand is either required or strongly preferred in this group.

Table 3-7 List of two-handed *kana*-based signs, dominant

SIGNED WORD	HAND-SHAPE	LOCATION	MOVEMENT	LOCATION OF CONTACT	PHYSICAL CONTACT
REPOOTO 'document for reporting'	RE	Neutral, palm up, fingers pointing front	From the wrist of the non-dominant hand, outward	Non-dominant hand	Strongly preferred
SAAKURU (two-handed) 'hobby / study group'	SA	Neutral, palm toward the dominant side, fingers pointing up	From the lower torso, upward semi-circular movement, contact at the palm of the non-dominant hand	Non-dominant hand	Required
KI-O-TSUKAU KI 'to consider other's feeling'	KI	Neutral, palm up, fingers pointing front	From the wrist of the non-dominant hand, outward	Non-dominant hand	Required
SHIRYOO 'reference'	SHI	Neutral, palm up, fingers pointing front	From the wrist side of the non-dominant hand, outward	Non-dominant hand	Strongly preferred
SUTORESUSU (two-handed) '(mental) stress'	SU	Upper chest, Palm down, fingers pointing to the dominant side	Straight upward from the lower torso, contact at the palm of the non-dominant hand	Non-dominant hand	Required

To sum up, symmetrical two-handed signs behave in the same way as one-handed signs: when the word is signed in a lower position, below the chin, physical contact is strongly preferred or required. On the other hand, most of the dominant two-handed signs tend to require physical contact. It is not clear if the requirement (or preference) is related to the fact that they are signed in lower/neutral position (which is below the chin), or the fact that dominant hand needs to make contact with the non-dominant hand. Battison (1978: 50) noted that the passive (non-dominant) hand may be added to 'emphasize' a one-handed sign. He pointed out that the passive hand is typically the open-palm, and a sharp, clear physical contact is made between two hands. Even though the dominant two-handed signs in Table 3-7 are not emphatic, they all include the open-palm passive hand, which might encourage physical contact using the dominant hand. This hypothesis needs to be tested using other two-handed dominant *kana*-based signs with the non-dominant hand of different handshapes.

3.3. Discussion

As shown in the previous sections, *kana*-based signs follow phonologically consistent patterns. One-handed signs tend to require physical contact, according to their location: the lower the location of the sign is, the more likely it is to require a form of physical contact. Two-handed *kana*-based signs were accepted as long as they follow phonological constraints

such as Battison's conditions. Our observations can be related to Siple's (1978: 101) claim that the area around the face or upper chest are the regions of higher acuity, where signs are more visible. For that reason, Battison (1978: 29) reported that marked handshapes are used more often in the head and neck locations.⁸⁾ It is conceivable that *kana*-based signs tend to have more marked handshapes and hence need to be supported by physical contact, particularly when they are signed in the regions of lower acuity. In other words, *kana*-based signs with lower locations tend to enhance their phonological salience by either of two different methods: with physical contact or internal movements added to the path. Adding extra movement, which was observed in the rotating/reciprocal *kana*-based signs (group D) is certainly a method to enhance sonority. For example, Sandler (1993) discussed that the trill internal movement increases the effect of the sonority cycle of signs. In his analysis of ASL signs, Hara (1998: 8; 10) also points out that physical contact and internal movement enhance the sonority of the syllable nucleus.⁹⁾ Since signs in group D incorporate a highly visible (noticeable) internal movement, the use of contact is not necessary for those signs.

How about *kana*-based signs with a simple, straight path? Let's consider SUTORESUSU '(mental) stress', which has two forms with different types of contact (Figure 3-12). The one-handed version requires continuous contact (brushing) with the body (torso). On the other hand, the two-handed version does not involve the brushing movement. Instead, the movement finishes with contact to the non-dominant hand. These two signs can be used interchangeably.



SUTORESUSU, one-handed



SUTORESUSU, two-handed

Figure 3-12 Variations of the *kana*-based sign SUTORESUSU '(mental) stress'

According to Brentari's (1998) analysis, those two forms each correspond to the [path] feature with the feature [tracing] in input (which results in continuous contact throughout the movement), and the [path] feature with the feature [direction] in input (with which the contact occurs when the dominant hand meets the plane, i.e. the palm of the non-dominant hand). It is insightful that contact is always required, one way or the other; native informants uniformly rejected this sign when it is not signed without any contact. That indicates that the path feature in this sign was selected with either [tracing] or [direction], which must be realized as physical contact.

3.4. Conclusion

Observations made in the current study clearly indicate that *kana*-based signs used by native signers should follow phonological constraints, which are not the case for native JSL signs. Specifically, location plays an important role in determining whether *kana*-based signs require physical contact or not. Whether they are one-handed or two-handed, *kana*-based signs tend to require physical contact when they are signed in a position lower than the chin/mouth area (e.g. arm, chest, or torso). *Kana*-based signs in neutral locations appear with distinctive internal movements such as rotation or reciprocation. Our preliminary analysis suggests that to consider the phonological properties of JSL *kana*-based signs, we need to develop a model in which the interaction between the path feature and point of articulation can be explained.

As a preliminary study, however, the range of the data has its own limitations. In addition to acceptable *kana*-based words analyzed in this study, *kana*-based signs that are judged unacceptable by native signers need to be considered in order to identify the source of their ‘unnatural’ nature. Moreover, it would be insightful to investigate the process of unacceptable signs which transform over time to more acceptable forms. For some signs included in this study, judgments of informants showed variety, possibly due to the usage-related effects, such as frequency. To address this issue, experimental studies with artificially created signs are in order. Finally, we did not detect any systematic pattern of requirement of physical contact for *kana*-based signs in the chin/chest (borderline) area. Further studies are necessary to decide if physical contact is induced by some other factors than the location of those signs. Studies of *kana*-based words in JSL, based on a mora-based, non-alphabetic writing system, would continue to add an important piece of evidence about the universal aspect of loan word formation in sign languages.

Acknowledgements

We would like to show our gratitude to native JSL instructors at Kwansai Gakuin University and the members of Kansai JSL Study Group for participating in our study. Diane LILLO-MARTIN, two anonymous reviewers of SSLL, and participants of the 5th Meeting of Signed and Spoken Language Linguistics provided us with insightful comments. John HELWIG provided editorial assistance. This research was funded by JSPS KAKENHI Grant Number JP26284061 (PI: MATSUOKA Kazumi). All errors are our own.

Notes

- 1) There are also signed expressions corresponding to a limited selection of Chinese characters (kanji). The JSL lexicon also contains *kanji*-based signs (e.g. KAWA ‘river’, HITORI ‘one person’). Moreover, there are signs that can be analyzed as a combination of *kana* and *kanji* expressions such as SHI-RITSU (GAKKO) ‘city/municipal (school)’ or CHU-SHI ‘cancellation (of an event)’. Since the purpose of the current study is to analyze *kana*-based signs, which incorporate handshapes used in finger-spelling, *kanji*-based signs were not considered.

- 2) The JSL lexicon also contains loan signs from finger-spelled words such as MURI ‘cannot/no way’, which will be briefly introduced in Section 3.2. Since those loan words do not involve physical contact and are typically signed in a neutral location, we consider these words need to be analyzed separately from the *kana*-based signs included in the current study.
- 3) Two words were removed from the original list, for different reasons. KEKKO ‘blood flow’ was excluded because the handshape for this sign is CHI, which means ‘blood’ in Japanese. The handshape does not match the first *kana* of the word (KE) and hence is considered to be different from a *kana*-based sign. Note that the phonological property of the sign corresponds to the phonological pattern observed in this study. The *kana*-based sign GENSHIRYOKU ‘atomic energy’ was also dropped from the original list, as most signers claimed that they do not use it and hence could not make any judgments about its acceptability.
- 4) One might wonder if the rotation path is motivated when the first and the last *kana* of the word are identical. This does not seem to be the case, however: there are *kana*-based signs with a similar rotation movement, in which the first and last *kana* are different, e.g. DOCOMO ‘Docomo (the name of the cell phone service provider)’.
- 5) Finger-spelling, such as KI, can be converted to a voiced equivalent, e.g. GI, by adding a horizontal outward movement, though the movement is typically omitted in *kana*-based signs. Consequently, either KI or GI is expressed with the same handshape.
- 6) The location ‘neutral’ refers to the general area in front of the signer’s upper chest.
- 7) It is possible that the semantic property of the word KISS ‘to kiss’ is a gesture-motivated source of physical contact (i.e. the action of kissing obviously involves physical contact). Other two-handed *kana*-based signs, signed in the lower position, need to be collected and analyzed to resolve this issue.
- 8) As an anonymous reviewer pointed out to us, it is not clear how the area covering ‘head’ and ‘neck’ can be described in any modern theory of sign phonology. We will leave this issue for future research.
- 9) We thank an anonymous reviewer who referred us to this work.

References

- Battison, R.
 1978 *Lexical Borrowing in American Sign Language*. (Reprinted in 2003) Burtonsville: Linstok Press.
- Brentari, D.
 1998 *A Prosodic Model of Sign Language Phonology*. Cambridge: MIT Press.
- Brentari, D. and C. Padden
 2001 Native and Foreign Vocabulary in American Sign Language: A Lexicon with Multiple Origins. In D. Brentari (ed.) *Foreign Vocabulary in Sign Languages*, pp. 87–120. New York: Psychology Press.
- Hara, D.
 1998 Amerika Shuwa ni Okeru Sesshoku o Fukumu Shinindoteki Sonority ni Tsuite (Contact and Visibility-Based Sonority in ASL). *Japanese Journal of Sign Linguistics* 14(2): 1–20. (in Japanese)

- Kimura, H.
2011 *Nihon Shuwa to Nihongo Taiō Shuwa: Aida ni Aru Fukai Tani* (Japanese Sign Language and Signed Japanese: A Deep Gap between Them). Tokyo: Seikatsu Shoin. (in Japanese)
- Liddell, S. K.
1984 THINK and BELIEVE: Sequentiality in American Sign Language. *Language* 60(2): 372–399.
- Padden, C.
1998 The ASL Lexicon. *Sign Language & Linguistics* 1(1): 39–60.
- Sandler, W.
1993 A Sonority Cycle in American Sign Language. *Phonology* 10(2): 243–279.
- Siple, P.
1978 Visual Constraints for Sign Language Communication. *Sign Language Studies* 19: 95–110.
- Torigoe, T.
1997 Shuwa no Kakutoku (The Acquisition of a Sign Language). In H. Kobayashi and M. Sasaki (eds.) *Kodomotachi no Gengo Kakutoku* (Language Acquisition of Children), pp. 211–235. Tokyo: Taishukan. (in Japanese)