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Relations between handshape and orientation in simultaneous compounds in Korean Sign Language*

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Hwangbo, Hyun Jin, Youngsuh Ji, and Jinwoo Jo. 2023. Relations between handshape and orientation in simultaneous compounds in Korean Sign Language. *Linguistic Research* 40(1): 119-150. The purpose of this paper is to examine the status of orientation relative to handshape in sign phonology. There have been two competing views on the status of orientation: one in which orientation is taken to be a subcategory of handshape, and the other in which orientation is taken to have an equal status with handshape. We assess the predictions made by the competing views involving the possibilities of total assimilation of handshape and orientation, partial assimilation of orientation, and partial assimilation of handshape, through the analyses of simultaneous compounds in Korean Sign Language (KSL). It is shown in the paper that simultaneous compounds in KSL can be analyzed to involve not only total assimilation and partial assimilation of orientation but also partial assimilation of handshape, which is possible only under the view that orientation is independent of handshape. Based on the discussion, we conclude that orientation and handshape are parallel categories that distinguish meaning in the phonology of sign language. **(Chosun University · Jeonbuk National University)**

Keywords contrastive, parameters, orientation, handshape, simultaneous compounds, sign phonology, Korean Sign Language

1. Introduction

Since Stokoe (1960) and then Battison (1978), it has been widely accepted in the literature that hand orientation constitutes a distinctive category in sign phonology. There

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has been some controversy, however, as to whether orientation has the equal status as another distinctive category, namely, handshape. Some researchers argue that the fact that orientation is distinctive does not necessarily mean that it has to be a parametric category in sign phonology, since "any distinctive feature is, by definition, contrastive" (Sandler and Lillo-Martin 2006). They claim that orientation, even though it is distinctive, must not be a major category parallel to handshape, but instead must constitute a subcategory of handshape. Other researchers, on the other hand, contend that orientation must have an equal status to handshape in sign phonology, because sign languages routinely resort to differences in orientation, as they routinely resort to differences in handshape, to distinguish meaning between signs.

In this paper, we argue that orientation has an equal status with handshape based on the assimilation process found in simultaneous compounds in Korean Sign Language (KSL). More specifically, it is first suggested that simultaneous compounds in KSL are formed through assimilation of (a) distinctive feature(s) followed by deletion of the source root. Then, it is shown that simultaneous compounding in KSL may not only involve "total assimilation" of handshape and orientation or "partial assimilation" of orientation, but it may also involve partial assimilation of handshape. The possibility of partial assimilation of handshape in simultaneous compounding, it is argued, indicates that orientation is represented as a category independent of the category of handshape in sign phonology, i.e., it is not a subcategory of handshape. We also claim that handshape and orientation are grouped together in sign phonology as the "hand configuration", which in turn has equal status with the other parametric categories suggested by Stokoe (1960), namely, location and movement. Such a view is adopted to capture the tendency that total assimilation of handshape and orientation occurs more frequently than partial assimilation of handshape or orientation.

The paper is organized as follows. In Section 2, we discuss the different views on how orientation should be represented in sign phonology. In that section, we argue that orientation in KSL is more appropriately represented in relative terms than in absolute terms, by showing that the arguments for relative orientation in languages like American Sign Language (ASL) or the Sign Language of the Netherlands (NGT) also hold in KSL. Based on the conclusion in Section 2, we adopt relative orientation (with some supplementary features) to represent the data presented in the following sections. In Section 3, we introduce the two different views on the relations between handshape and orientation in some detail, and illustrate what predictions do the respective views make

with respect to assimilation in simultaneous compounding. We will point out in that section that the possibility of partial assimilation of handshape in simultaneous compounding is predicted only by the view which takes orientation to be independent of handshape. Then in Section 4, we discuss cases of simultaneous compounds in KSL to examine the predictions of the two views. In the section, we show that simultaneous compounding in KSL may involve partial assimilation of handshape, which indicates that orientation must not be a subcategory of handshape. Finally, in Section 5, we provide a summary of the paper along with some concluding remarks.

2. Two different ways of specifying hand orientation

Apart from the issue of whether orientation is a category independent of handshape, there has also been a controversy over how orientation should be represented in sign phonology. Traditionally, orientation has been described in terms of the direction of the palm (and fingers) relative to the signer's viewpoint (Battison 1978; Stokoe 1978; Sandler 1989; Brentari 1990). So, for instance, the orientation of the sign for 'practice' in KSL, shown in Figure 1a, may be described as 'the palm pointing toward the front from the signer's viewpoint', in other words, it may be viewed to have the orientation feature specified as [front].[1] The orientation of the sign for 'hearing person' in Figure 1b, on the other hand, may be described as 'the palm pointing toward the back from the signer's viewpoint', and its feature may be taken to be specified as [back (direction)]. Note that the signs in Figures 1a and 1b have exactly the same handshape (all fingers spread apart and bent), location (in front of the lips), and movement (circular movement). The only difference between the two signs is the direction of the palm of the hand, which makes the two signs constitute an apparent minimal pair. If orientation is described as the direction of the palm relative to the signer's viewpoint as such, the features that specify hand orientation may include (at least, but not limited to) [up], [down], [in], [out], [front], and [back] (Won et al. 2021). Following Crasborn and van der Kooij (1997), we will call such a way of specifying orientation *absolute orientation*. The system is 'absolute' in the sense that it employs a fixed frame of reference (namely, the signer's viewpoint) in the signing space and refers to a fixed part of the hand (namely, the palm) to

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1   The illustrations and pictures of the signs used in the paper are all borrowed from the Online Dictionary of Korean Sign Language (https://sldict.korean.go.kr), unless indicated otherwise.

characterize the direction of the hand, and accordingly, the orientation of a sign can be specified independently of the location at which the sign is articulated.

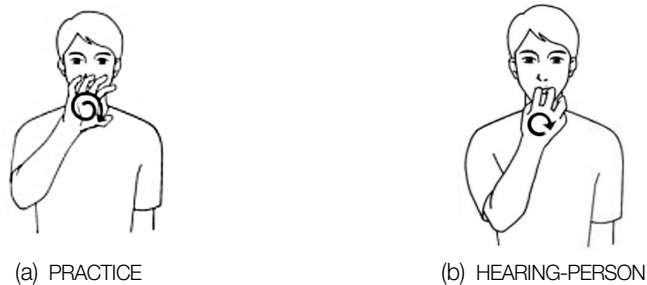(a) PRACTICE   (b) HEARING-PERSON
Figure 1. Contrast in orientation in KSL

Orientation does not necessarily have to be specified in absolute terms, however. That is, it does not have to be described in terms of the direction of the palm from the signer's viewpoint. Instead, orientation might well be described by characterizing the part of the hand associated with the location (the place of articulation) of the sign. Taking again the sign for 'practice' in KSL for example, its orientation may be described as 'the back of the signer's hand pointing at the location of the sign, i.e., the lips'. With the other parameters staying the same, such a description of orientation leads to the sign exactly the same as the description relativized to the signer's viewpoint does: both descriptions refer to the sign illustrated in Figure 1a. In this view, the orientation feature of the sign for 'practice' can be said to be specified as [back (of hand)]. In the same vein, the orientation of the sign for 'hearing person' in KSL can be described as 'the palm of the signer's hand pointing at the location of the sign, i.e., the lips', which may be taken to have the orientation feature specified as [palm]. Again, with the other parameters staying the same, such a description of orientation leads to the sign in Figure 1b as the description relativized to the signer's viewpoint does. Note here that the orientation features for signs may vary in this system depending on which part of the hand is associated with the location of the signs even though the signs are described in the same way in absolute terms; conversely, the orientation features for signs may stay the same even though the signs are described differently in absolute terms, if the same part of the hand is associated with the varying locations of the signs. We will call, again following Crasborn and van der Kooij (1997), the way of describing hand orientation by specifying

the part of the hand associated with the location, *relative orientation*. The features that specify orientation in this system include parts of the hand such as [palm], [back], [wrist], [front], [fingertip(s)], [ulnar], [radial], and so on (Crasborn and van der Kooij 1997; van der Kooij 2002).

Some of the motivations for describing hand orientation in relative terms come from morphosyntactic agreement phenomena and phonetic variability (Crasborn and van der Kooij 1997; van der Kooij 2002; see also Greftegreff 1992 and Choi 2021). To begin with, van der Kooij (2002) points out that the phonological forms of agreement verbs in sign language can be adequately described with relative orientation but not with absolute orientation. This is because the orientation of an agreement verb at the surface level varies greatly according to how it is inflected to agree with the subject as well as with the object. For instance, the verb for 'visit' in NGT is articulated with various palm directions depending on where the object is located in the signing space. The palm of the hand can, in principle, be pointing in any direction according to the locus of the object. Under the system of absolute orientation, according to van der Kooij, different phonological descriptions would be needed for the lexical entry of a verb like 'visit' due to its varying inflected forms as such. Under the system of relative orientation, however, differing inflected forms of the verb can be easily taken to have a single underlying form by relativizing the reference point to the locus of the object; that is, it can be said that the 'palm' of the signer's hand is always associated with the location in the signing space to which the object is assigned.

In a similar vein, Crasborn and van der Kooij (1997) and van der Kooij (2002) note that relative orientation can be motivated by the occurrence of phonetic variation in orientation. The sign for 'idea' in NGT, for example, is articulated with the index finger extended, moving from ipsilateral temple outwards. Although in its citation form the direction of the palm is diagonally downwards contralateral, the sign can also be produced with many different palm directions, from almost straight down to almost fully contralateral. What stays constant across the variations of the sign, according to the authors, is the relation between the part of the hand and the location: the tip of the index finger is always associated with the location of the sign, namely, the ipsilateral temple. The system of relative orientation can easily capture the constant characteristic of the sign produced in various phonetic forms, while it would be so much harder for the system of absolute orientation to do so.

The arguments for relative orientation introduced above can be extended to KSL as

well. First, the forms of agreement verbs may also vary in KSL according to the loci of the subject and the object. For example, the signs for 'help' and 'look at' in KSL, whose citation forms are shown in Figures 2a and 2b, respectively, are realized in various forms according to the arguments that the verbs take.


(a) HELP   (b) LOOK-AT

Figure 2. Agreement verbs in KSL

Specifically, in the case of the sign for 'help', if the verb takes the signer as the subject and the addressee as the object to mean 'I help you', the palm of the hand should point in the direction of the addressee; similarly, if the sign for 'look at' takes the signer as the subject and the addressee as the object to mean 'I look at you', the tips of the extended index and middle fingers should point toward the location of the addressee. On the other hand, if the arguments of the verbs are reversed, that is, if the verbs take the addressee as the subject and the signer as the object to mean 'You help me' and 'You look at me', then the palm of the hand for the sign for 'help' and the tips of the two fingers for the sign for 'look at' should instead point in the direction of the signer, not the addressee. Analogously, if some referent that is not present in the discourse context is assigned a locus in the signing space, and the signer wants to say 'I help him/her/it' or 'I look at him/her/it', then the palm of the hand or the tips of the two fingers should point in the direction of the locus associated with the non-present referent, which may vary depending on where the non-present referent is localized. Clearly, the exact location in which the addressee or the non-present referent is associated with can vary greatly: it can, in principle, be in any direction from the viewpoint of the signer. This means that just as in the case of the sign for 'visit' in NGT, it would be extremely hard in the system of absolute orientation to characterize the orientation for the phonological form of an agreement verb in KSL. Under relative orientation, this can be easily done. As for

the orientations of the verbs for 'help' and 'look at', it can be said that the orientations of these verbs are relativized to the locus of the object, and the orientation of the verb for 'help' is specified as [palm] while that of the verb for 'look at' is specified as [fingertip(s)].

The argument from the perspective of phonetic variability also holds in KSL. Take for instance the signs for 'think' and 'observe' in KSL, whose citation forms are shown in Figures 3a and 3b, respectively. Here, the direction of the palm is diagonally downward-contralateral for both signs for 'think' and 'observe'.
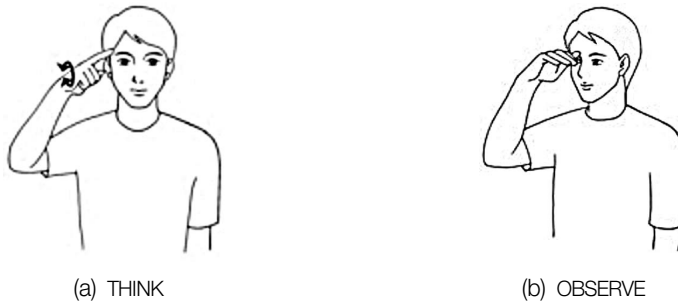
(a) THINK   (b) OBSERVE
Figure 3. Verbs showing orientation variation in KSL

In natural utterances, however, the signs may exhibit considerable variations in the direction of the palm. As for the sign for 'think', it can be produced with the index finger bent, resulting in the direction of the palm being towards the contralateral side. It can also be articulated with the elbow raised high such that the direction of the palm become almost straight down. Yet, these variations would still mean 'think'. The same is the case for the sign for 'observe'. The sign can be produced in natural utterances in such a way that the direction of the palm varies from pointing downwards to pointing towards the contralateral side, with the meaning of the variants staying the same. Despite the varying directions of the palm, the orientation of the signs for 'think' and 'observe' can be easily specified in relative terms, respectively as [fingertip] and [radial].

The discussion so far suggests that the orientation of a sign in general can be more adequately described in relative terms than in absolute terms. In this regard, we will adopt the system of relative orientation to represent orientation of a sign in this paper. There is, however, a potential difficulty in describing orientation solely by relativizing it to the

place of articulation of a sign. It is that the part of the hand that is associated with the place of articulation of a sign is not easily identifiable when the sign is articulated in the neutral space in front of the signer. To circumvent the potential difficulty, we will include to the typical features of relative orientation (such as [palm], [back], [fingertip(s)], etc.) the following features: [neutral], [prone], [supine] (cf. Brentari 1998), [up], and [down]. The feature [neutral] will be used to refer to the orientation of a sign whose location is the neutral space and the palm of the hand is facing inwards toward the mid-sagittal plane of the body, that is, it will be used to refer to the orientation of the hand found in the "fundamental signing position" (Brentari 1998). As for the features [prone] and [supine], they will be used to refer to the orientations of signs whose location is the neutral space and the palm of the hand is, respectively, facing downwards and facing upwards. In addition to the three features, we will adopt the two features [up] and [down] which may be used to indicate the direction of the hand determined according to the posture of the wrist. The feature [up] indicates that the wrist is hyper-extended (or the hand is raised), and the feature [down] indicates that the wrist is flexed (or the hand is lowered). So, for example, if a sign has the orientation features [up] and [back], the sign will have the orientation that can be described as 'the back of the hand facing the coronal plane', and if a sign has the orientation features [down] and [palm], then the sign will have the orientation that can be described as 'the palm of the hand facing the coronal plane', and so on. Inclusion of these five features will be useful in describing the signs discussed in this paper. Note, however, that the paper is never intended to explore the inventory of orientation features; the purpose of the paper is to determine the status of handshape and orientation relative to each other. The five features (and other more typical features, for that matter) are used in the paper only for descriptive purposes.

3. Consequences of the differing hypotheses on hand orientation

Stokoe (1960), who first discovered that signs are formed through a finite number of meaningless units, proposed that sign language has three major contrastive categories, or "parameters", i.e., handshape, movement, and location, treating orientation merely as features of handshape. Later, Battison (1978), focusing on its contrastive property, proposed that orientation should be considered as a fourth parameter in sign phonology parallel to handshape as well as the other parametric categories. Since Battison, it has

been generally considered that sign phonology refers to the four contrastive categories to distinguish meaning. In this paper, we will assume that the four contrastive categories are organized such that handshape and orientation are grouped together into a category called 'hand configuration'. The reason for grouping handshape and orientation together as such will be motivated in Section 4. So, under the view that handshape and orientation belong to hand configuration, Stokoe's (1960) and Battison's (1978) claims about the status of orientation can be restated as whether orientation is a subcategory of handshape or not within the category of hand configuration. We will refer to the view that orientation is a subcategory of handshape as the Dependent-Orientation Hypothesis (DOH) and the view that orientation is independent of handshape as the Independent-Orientation Hypothesis (IOH) in this paper. The two competing hypotheses are presented in Figures 4a and 4b, respectively (where R indicates 'root', HC 'hand configuration', L 'location', M 'movement', HS 'handshape', and O 'orientation'). What matters for the current purpose is that in Figure 4a, the orientation node is dominated by the handshape node, reflecting the view that orientation is a subcategory of handshape, and in Figure 4b, the orientation node is dominated directly by the hand configuration node, representing the status of orientation independent of handshape.

(a) Dependent-Orientation Hypothesis (DOH)   (b) Independent-Orientation Hypothesis (IOH)

Figure 4. Two competing hypotheses on hand orientation
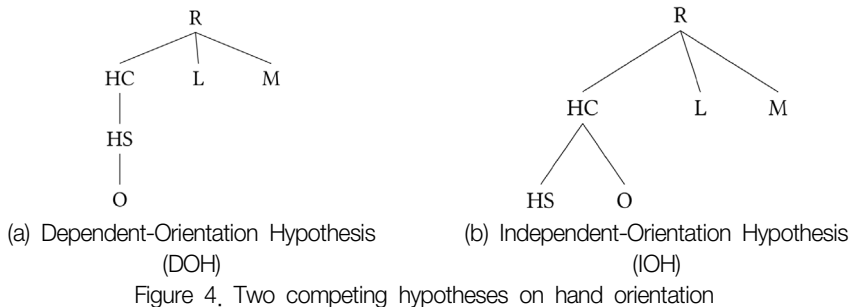
   The IOH has been generally accepted in the literature since Battison (1978), but it is hardly the case that it has never been questioned. Some researchers have suspected that orientation might not have the equal status with handshape. The skepticism about the IOH has come from the fact, among others, that assimilation of handshape to the exclusion of orientation is hardly attested in sequential compounds (Sandler 1989; van der Hulst 1996; van der Kooij 2002; Sandler and Lillo-Martin 2006). For instance, Sandler and

Lillo-Martin (2006) note that the compound sign for 'oversleep' (SLEEP^SUNRISE) in ASL is realized in two different ways depending on whether it exhibits "total assimilation", whereby the handshape as well as the orientation of one of its components spread to the other component, or it exhibits "partial assimilation" of orientation, whereby the orientation but not the handshape of one of its components spreads to the other component.[2] Importantly, according to Sandler and Lillo-Martin, the compound sign does not have a variant which exhibits partial assimilation of handshape, whereby the handshape of one of its components spreads to the other component, to the exclusion of the orientation.

This is actually expected if orientation is only a component of handshape, that is, if the DOH, not the IOH, is correct as Sandler and Lillo-Martin (2006) argue. Consider the representations of the sequential compound involving assimilation shown in Figure 5, where the orientation node is dominated by the handshape node. In the representations, the numbers such as '1' and '2' are used to distinguish contrastive categories originated from different roots. The symbol '=' indicates delinking of a node, and the node(s) that are delinked and consequently eliminated in the representation are indicated in a gray font. And the arrow represents spreading of the feature(s) from a node to another node. In the representations in Figure 5 and those that follow, we will omit the location and movement nodes for the sake of simplicity. Now, in the case of total assimilation shown in Figure 5a, HC2 spreads to R1, and so do HS2 and O2. The node HC1 that is originally linked to R1 is delinked as a result of HC2 spreading (otherwise, R1 will end up having two sets of, most likely conflicting, hand configuration specifications), and again, since HS1 and O1 are subcategories of HC1, so do HS1 and O1. Consequently, it is expected under the DOH that both the handshape and the orientation of R1 can assimilate to those of R2. Hence, the possibility of total assimilation in sequential compounding. The DOH also predicts the possibility of partial assimilation of orientation as illustrated in Figure 5b: here, O2 spreads to HS1, and consequently, O1 delinks. In this case, the orientation of R1 assimilates to that of R2 while having its handshape stay the same.

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2   The terms "total assimilation" and "partial assimilation" are borrowed from Sandler and Lillo-Martin (2006) only for expository convenience without any theoretical intention. Throughout the paper, we will use these terms, without quotation marks, simply as labels for 'assimilation of both handshape and orientation' or 'assimilation of either handshape or orientation'.
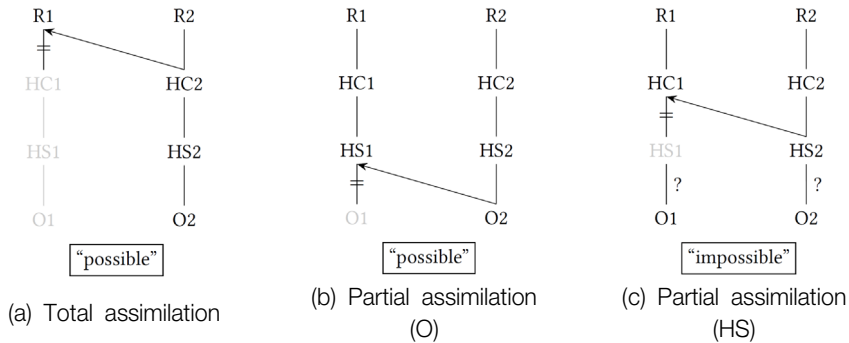
Figure 5. Predicted assimilation patterns in sequential compounding under the DOH

Unlike these two cases, partial assimilation of handshape is predicted not to be possible under the DOH, and this is illustrated in Figure 5c. In order for partial assimilation of handshape to occur, HS2 must spread to HC1, and accordingly HS1 must be delinked from HC1. When delinking of HS1 takes place, however, O1 must also be delinked from HC1 since O1 is dominated by HS1. This means that orientation of R1 cannot stay the same in this model when assimilation of handshape takes place. Moreover, when spreading of HS2 occurs, spreading of O2 must also occur as O2 is dominated by HS2. In order to prevent O2 from being part of R1, it must be delinked from HS2, but then, it will also be delinked from R2, which will result in R2 having no orientation feature at all. This amounts to saying that assimilation of handshape cannot take place under the DOH without the source root giving up its orientation property entirely.

On the other hand, if orientation has the equal status with handshape as claimed by the IOH, not only total assimilation and partial assimilation of orientation, but also partial assimilation of handshape, should be possible in sequential compounding. Consider the representations in Figure 6. It is obvious from Figures 6a-6c that the IOH predicts that all three types of assimilation are possible in the sequential compound: since orientation and handshape are separate categories independent of each other, either orientation or handshape, or both, may undergo assimilation.
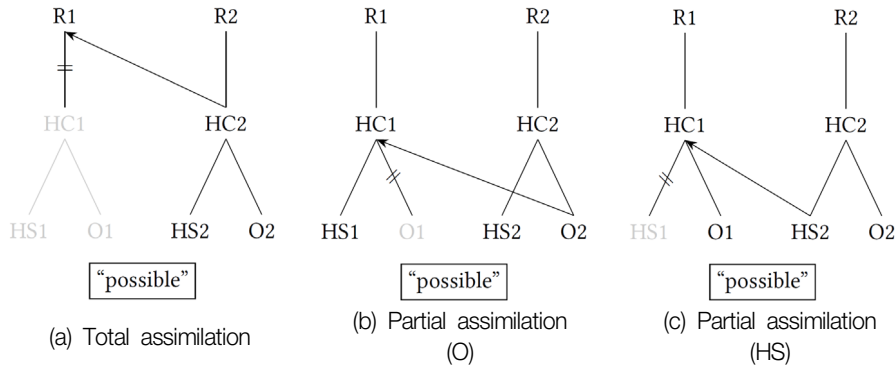
Figure 6. Predicted assimilation patterns in sequential compounding under the IOH

So, it might appear that a case like the compound sign for 'oversleep' in ASL noted by Sandler and Lillo-Martin (2006), which has the variants with total assimilation and partial assimilation of orientation but lacks the variant with partial assimilation of handshape (even though it is perfectly easy to produce), supports the view that orientation is a subcategory of handshape.

However, sequential compounding is not the only way of forming a compound in sign language. As is well known, one of the essential characteristics of sign language is simultaneity; that is, in sign language, more than one linguistic unit can be produced simultaneously, thanks to the visual-gestural modality that the language uses. This means that it is possible to form a compound in sign language where the components of the compound are produced simultaneously, rather than sequentially. KSL, for instance, has not only a sequential compound like the sign for 'church' (CROSS^HOUSE) shown in Figure 7a but also a "simultaneous compound" like the sign for 'volcano' (MOUNTAIN/ERUPT) shown in Figure 7b.[3] To the best of our knowledge, it has not been examined if the predictions of the DOH and the IOH hold for simultaneous compounds. If the DOH is correct, as seems to be supported by the case of a sequential compound for 'oversleep' in ASL, partial assimilation of handshape must not be found in simultaneous compounds either, as the hierarchical relations between the distinctive categories should hold across the board regardless of whether compound signs are formed sequentially or simultaneously. On the other hand, if the IOH is correct, it is predicted that not only total assimilation of handshape and orientation as well as partial assimilation

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3 We will use the symbol '/' to indicate that the components of a compound are produced simultaneously.

of orientation, but also partial assimilation of handshape must be available. In the next section, we report cases of simultaneous compounds in KSL that exhibit partial assimilation of handshape, which shows, contrary to what Sandler and Lillo-Martin (2006) among others claim, that the IOH might be correct after all.
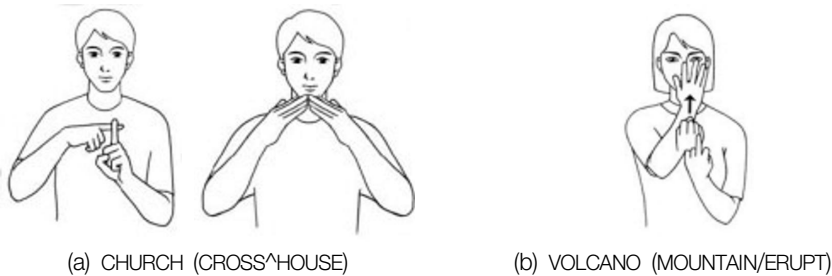

(a) CHURCH (CROSS^HOUSE)   (b) VOLCANO (MOUNTAIN/ERUPT)
Figure 7. Sequential and simultaneous compounds in KSL

Before moving on to discussion of the relevant data in KSL, the assumption must be stated clearly first that we make for the analysis of simultaneous compounding. We assume that simultaneous compounding is the process in sign language which in essence involves deletion of the root(s), except for one root, that participate in the word formation process, causing the newly formed word to have a single root in its phonological representation. In this view, spreading of features (i.e., assimilation of some kind) is an inevitable process in simultaneous compounding, because without it no information from the deleted root(s) will be realized in the resulting compound sign. In other words, we take simultaneous compounding as a word formation process which involves the phonological processes of spreading from a source root to a target root and deletion of the source root; such phonological processes result in a single (target) root containing the phonological specifications of all the components of the compound, having them all be produced at the same time. Spreading of features in simultaneous compounding may take place from any type of node (HC, HS, O, L, or M), but as before, we will discuss only HC, HS and O in this paper for simplicity. Note in passing that the assumption that the simultaneous compound has only a single root in its representation is consistent with the view that the simultaneous compound consists only of a single syllable (however a syllable may be defined), for a single root may contain at most one parameter node in the phonological representation (hence, if, e.g., the number of path movement were what defines a syllable, a simultaneous compound would be taken to be monosyllabic because

the root in its representation would have only one M node).

Now, the DOH and the IOH make different predictions about the possibility of partial assimilation of handshape regarding simultaneous compounding, as they do regarding sequential compounding. Both the DOH and the IOH predict that total assimilation and partial assimilation of orientation are possible, but the possibility of partial assimilation of handshape is predicted to be possible only by the IOH and not by the DOH. The predictions of the DOH and the IOH are presented in Figures 8 and 9 along with the representation of each assimilation possibility.

(a) Total assimilation

(b) Partial assimilation (O)

(c) Partial assimilation (HS)
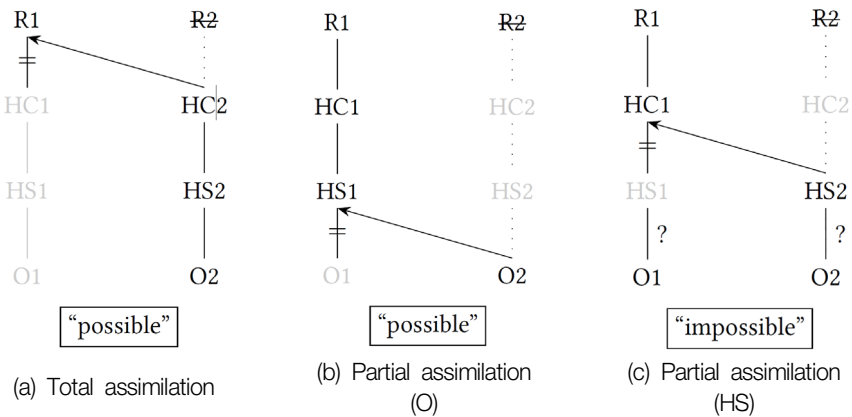
Figure 8. Predicted assimilation patterns in simultaneous compounding under the DOH

(a) Total assimilation

(b) Partial assimilation (O)

(c) Partial assimilation (HS)
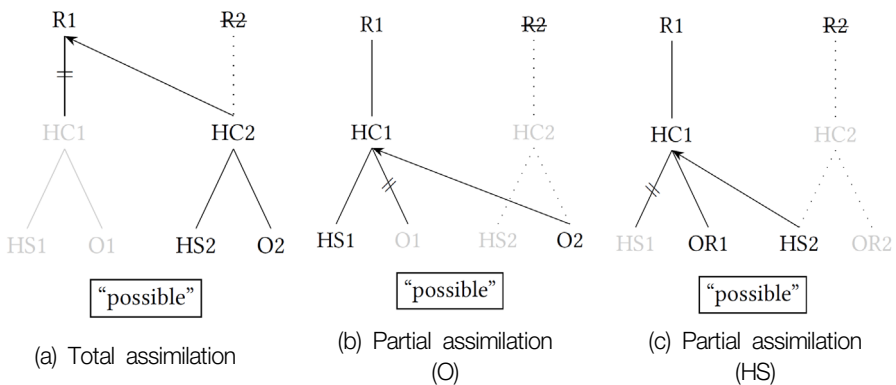
Figure 9. Predicted assimilation patterns in simultaneous compounding under the IOH

The only difference between the representations of sequential compounds in Figures 5 and 6, on one hand, and those of simultaneous compounds in Figures 8 and 9, on the other, is that the root from which feature(s) spread to the other node undergoes deletion in the latter (which is indicated by a strikethrough in Figures 8 and 9), and as a result, the node(s) dominated only by the deleted root is eliminated from the representation (which is indicated by a dotted line and a gray font in Figures 8 and 9). Importantly, since assimilation should occur before deletion in simultaneous compounding, there will be no difference between the sequential and simultaneous compounding in the possibility of assimilation itself. As deletion occurs after assimilation, it does not affect the possibility of assimilation, and thus, assimilation patterns must be the same between the two types of compounding. This amounts to saying that basically the predictions that the DOH and the IOH make are the same whether the compound sign is formed sequentially or simultaneously.

4. Assimilation in simultaneous compounds in KSL

4.1 Total assimilation of handshape and orientation

Both the hypotheses on the status of orientation (one that takes it to be a subcategory of handshape, i.e., the DOH, and the other that takes it to be an independent category which has an equal status with that of handshape, i.e., the IOH) predict that concurrent assimilation of handshape and orientation can be attested in simultaneous compounds. Not surprisingly, the predictions are borne out as assimilation of handshape and that of orientation do co-occur in some of the simultaneous compounds in KSL. Take for instance the compound sign for 'currency exchange (e.g., from USD to KRW)' in KSL, shown in Figure 10. The compound for 'currency exchange' in Figure 10 is formed by combining the sign for 'money' and the sign for 'exchange', shown in Figures 11a and 11b, respectively. As one can clearly see by examining the compound sign in Figure 10, on one hand, and its component signs in Figures 11a and 11b, on the other, the handshape and orientation specifications of the compound sign are both from a single sign, namely, the sign for 'money' (whereas the movement and location are from the sign for 'exchange', which we will not discuss here).

Figure 10. CURRENCY-EXCHANGE

This under the view on simultaneous compounding presented in Section 3 means that toal assimilation of handshape and orientation occurs when the compound sign for 'currency exchange' is formed.

(a) MONEY   (b) EXCHANGE
Figure 11. Components of CURRENCY-EXCHANGE

More specifically, the sign for 'money' has the ✎-handshape (the tips of the thumb and the index finger touching each other while the other fingers extended and spread) and has the orientation feature [neutral].[4] The sign for 'exchange', on the other hand, has the ⑂-handshape (all fingers extended) and has the orientation feature [supine]. The compound sign for 'currency exchange' has exactly the same handshape and orientation as the sign for 'money': the handshape of the compound is ✎ and its orientation can be specified as [neutral]. So, the compound can be taken to involve the phonological process of total assimilation of handshape and orientation (and consequent deletion of the

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4   For convenience, we will use the handshape fonts created by the Centre for Sign Linguistics and Deaf Studies, The Chinese University of Hong Kong (available at http://www.cslds.org/v4/resources.php?id=1), to represent handshape, while using feature specifications to represent orientation.

source root), which can be accounted for under either the DOH or the IOH as illustrated in Figures 12a and 12b. In the figures, we are assuming that the sign for 'exchange' constitutes the target (R1) while that for 'money' the source (R2), under the considerations that the former is a predicate whereas the latter is an argument (hence, it is more natural to take the latter to be incorporated into the former, not vice versa), and the former has path movement while the latter does not (hence, a more economical account can be obtained if the former is the target since it will require less spreading processes), and so on.
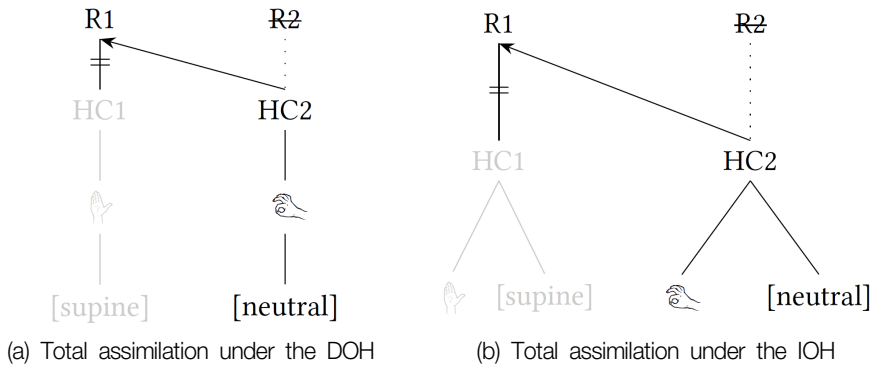
(a) Total assimilation under the DOH   (b) Total assimilation under the IOH
Figure 12. Representations of CURRENCY-EXCHANGE

So, a case like the compound for 'currency exchange' shows that total assimilation does occur in simultaneous compounding in KSL, as expected by either the DOH or the IOH. Other cases of simultaneous compounding that show total assimilation and thus can be analyzed in the same way include compounds for 'money transfer' (MONEY/SENDING), 'female club' (WOMAN/CLUB), 'learn' (BOOK/PRACTICE), 'rich' (MONEY/BEST), etc., all of which have both the handshape and orientation specifications from a single component of the compound.

　　A simultaneous compound like CURRENCY-EXCHANGE is formed by combining two lexical signs. But a novel sign can also be formed by incorporating a finger-spelled alphabet into a lexical sign, which is often referred to as *initialization* in the sign linguistics literature (Bellugi and Newkirk 1981; Sandler and Lillo-Martin 2006; Meir 2012; Ji 2022). In ASL, for example, the sign for 'room' is formed by combining the finger-spelled alphabet 'R' and the lexical sign for 'box' as in R/BOX (= ROOM), while

the sign for 'office' is formed by combining the finger-spelled alphabet 'O' and, again, the lexical sign for 'box' as in O/BOX (= OFFICE) (Sandler and Lillo-Martin 2006). Importantly for our purposes, some of the instances of initialization in KSL show total assimilation of handshape and orientation, as predicted by both the DOH and the IOH.

For instance, the sign for '(Microsoft) Windows' is formed by combining the finger-spelled alphabet 'W' and the sign for 'system', as illustrated in Figure 13.
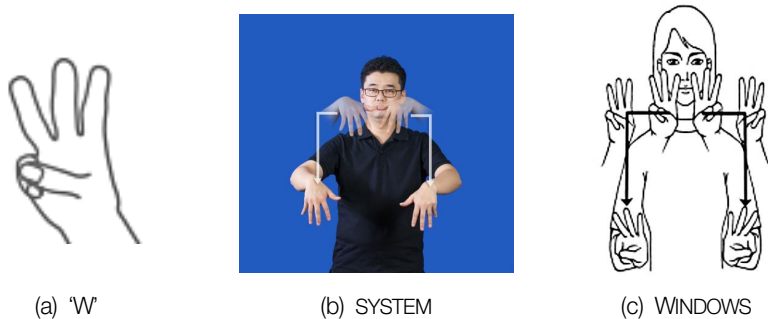
(a) 'W'   (b) SYSTEM   (c) WINDOWS
Figure 13. Initialization in KSL and its components

Notice that the sign for 'Windows' in Figure 13c has the -handshape and the orientation features [up] and [back]. These specifications must come from the finger-spelled alphabet 'W' in Figure 13a, not from the sign for 'system' in Figure 13b, as the former has the -handshape and the orientation features [up] and [back] (the iconic meaning of the finger-spelled alphabet will disappear if the orientation of the hand is different), while the latter has the -handshape and the orientation features [down] and [palm].

As in the case of 'currency exchange', both the DOH and the IOH can capture the assimilation pattern involved in the formation of the sign for 'Windows' in Figure 13c. The representations of the sign for 'Windows' are shown in Figures 14a and 14b. In the representation of the DOH in Figure 14a, the hand configuration node of R2 spreads to R1 (before R2, the source root, is deleted), and this causes the orientation features of R2 to belong to R1 since the orientation node is dominated by the handshape node, which in turn is dominated by the hand configuration node; consequently, both the handshape and the orientation of R2 are realized in R1. In the representation of the IOH in Figure 14b, the hand configuration node of R2 spreads to R1 as well (again, before

R2 is deleted), and the result is the same: both the handshape and the orientation of R2 are realized in R1 as both are dominated by the hand configuration node.
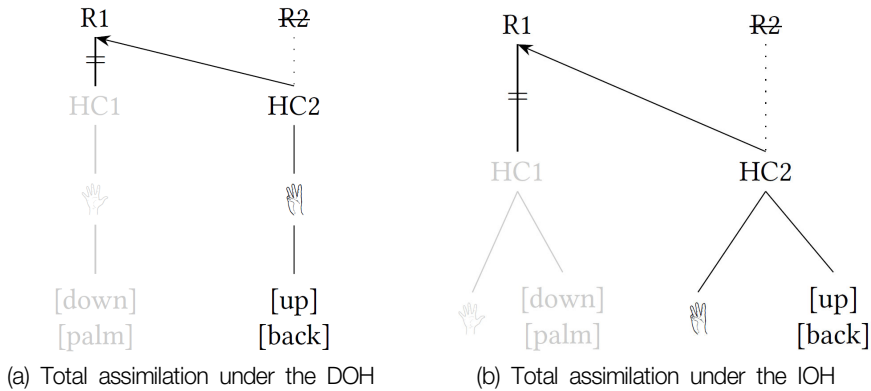

(a) Total assimilation under the DOH   (b) Total assimilation under the IOH

Figure 14. Representations of WINDOWS

So, a case like the sign for 'Windows' shows that total assimilation can be observed in the sign formed through initialization, and this can also be easily accounted for under the DOH or the IOH. Other examples formed via initialization in KSL that exhibit total assimilation and thus can be analyzed in the same way include signs for 'team' (T/GROUP), 'taxi' (T/VEHICLE), and 'T-shirt' (T/NECK).[5]

Two remarks are in order regarding the sign formed through initialization and regarding hand configuration. As for initialization, the handshapes of finger-spelled alphabets are often excluded from the phonological analysis of sign language, because they are considered to be 'borrowed forms' from foreign language (i.e., spoken language) representations. However, the fact that they are excluded from many phonological analyses does not mean that they have to be so for the analysis of the relationship between handshape and orientation. In fact, the analyses that set aside the handshapes of

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5   Initialization is generally considered to be a process in which the *handshape* of a lexical sign is replaced by the *handshape* of a finger-spelled alphabet. That is, it in general does not involve assimilation of orientation. In fact, as will be noted in Section 4.3, most instances of initialization in KSL exhibit partial assimilation of handshape. In addition, all instances of initialization that exhibit total assimilation in KSL seem to be those that involve a finger-spelled Roman alphabet, rather than a finger-spelled Korean alphabet (Hangul). The fact that initialization with total assimilation only involves a finger-spelled Roman alphabet might be just an accident, or it might be motivated by some mechanism in the phonological system of KSL. This issue will not be addressed in this paper. What matters for the current purpose is that the DOH and the IOH do not differ as to the possibility of total assimilation in initialized signs.

finger-spelled alphabets are mostly those of the inventory and geometry of the distinctive features of handshape, i.e., the analyses about what features of handshape there are and how they are organized in the phonological system of sign language. For the purpose of current study, however, the fact that the handshapes of finger-spelled alphabets cannot be taken to be native ones does not matter. Even if one cannot derive the features that collectively form the handshape of a given finger-spelled alphabet, it does not necessarily mean that the handshape *as a whole* cannot replace the handshape node in the phonological representation of a sign. The handshape of a finger-spelled alphabet may be registered as a whole, rather than being derived through a combination of distinctive features, but it must still be represented in the handshape node in the representation of parametric categories. Moreover, not only initialization is a process that plays a productive role in the formation of many signs, but also the assimilation patterns found in the compound signs formed by combining lexical signs and those found in the signs formed by combining a finger-spelled alphabet and a lexical sign seem to be the same. So, if the purpose of a phonological theory is to account for the phonological patterns of a given language, there is no a priori reason why signs formed via initialization should be excluded from the analysis. Rather, they must also be taken into account. For these reasons, we do not limit the scope of the paper to the compound formed by lexical signs, but instead consider the sign formed through initialization as well as the compound formed through lexical signs.

Another issue that needs to be made clear is the existence of the hand configuration node. We have been assuming in the paper that handshape and orientation are grouped together as hand configuration in sign phonology. The assumption has been made to capture the tendency that the assimilation process involved in sequential and simultaneous compounds generally targets both handshape and orientation at the same time, such as the ones discussed in this section. Theoretically, it is possible under the DOH that handshape is dominated directly by the root like the other two parameters, and orientation is dominated by handshape. And under the IOH, it is theoretically possible that handshape and orientation are dominated directly by the root. In this view, total assimilation can be said to involve assimilation of handshape under the DOH, and it can be said to involve assimilation of handshape as well as assimilation of orientation under the IOH. The results are exactly the same. Although the predictions of the two views (one with the category of hand configuration, and the other without it) are the same regarding the possibility of total assimilation, it is conceptually more appealing to say

that total assimilation is more frequent than partial assimilation because assimilation of hand configuration, which has the equal status with the other major parameters such as movement and location, is more unmarked than assimilation of handshape or orientation, which are more specific categories than the other two major parameters. If handshape and orientation are directly associated with the root (under the IOH), total assimilation, which is more frequent, must be said to involve two instances of assimilation (one with handshape and the other with orientation); it seems rather hard to give a natural explanation to why a phonological process involving two instances of assimilation occurs more frequently than one involving a single instance of assimilation. For this reason, we assume the existence of hand configuration in this paper. But note that the existence or absence of the hand configuration node in the phonological representation does not affect the argument that we intend to make. Whether it exists or not, the pattern of simultaneous compounds would show whether orientation is a category dependent on handshape or independent of it.

4.2 Partial assimilation of orientation

It is also predicted by both the DOH and the IOH that assimilation of orientation to the exclusion of handshape can be found in simultaneous compounds. The Online Dictionary of Korean Sign Language that we consulted for the study seems to have no example of two-sign simultaneous compound that shows partial assimilation of orientation, but there is an example of three-sign simultaneous compound in the dictionary which shows partial assimilation of orientation. The compound sign for 'parking' illustrated in Figure 15 is the one. The compound for 'parking' is composed of the sign for 'place', the finger-spelled Korean alphabet 'c', and the sign for 'vehicle' as illustrated in Figure 16.[6] As shown in Figure 15, the dominant hand of the compound for 'parking' has the 👋-handshape and has the orientation feature [neutral]. The illustrations in Figure 16 show that the handshape and the orientation of the compound are from different signs composing the compound. The handshape of the compound is from the finger-spelled Korean alphabet 'c', and the orientation is from the sign for 'vehicle'.[7] That is, the formation of the compound for 'parking' involves assimilation of

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6 In this paper, Korean alphabets are given in the Yale romanization of Korean.

7 The non-dominant hand of the compound for 'parking' appears to have come from the sign for 'place', but the orientation of the non-dominant hand of the signs for 'parking' and 'place' differ from each other:

handshape from the fingerspelled Korean alphabet 'c' as well as assimilation of orientation from the sign for 'vehicle', which in turn means that partial assimilation of orientation (as well as partial assimilation of handshape, for that matter) takes place in forming the compound for 'parking'.
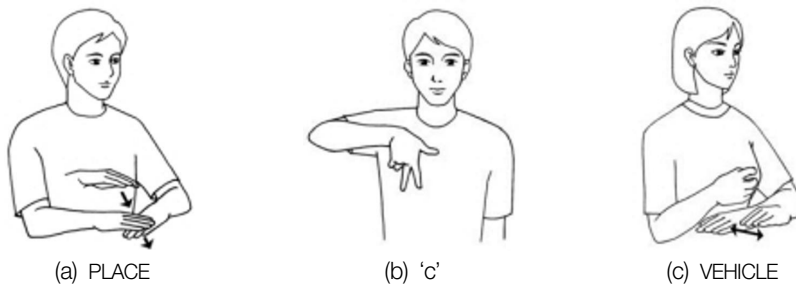

Figure 15. PARKING

(a) PLACE   (b) 'c'   (c) VEHICLE

Figure 16. Components of PARKING

Both the DOH and the IOH correctly predict that partial assimilation of orientation can be involved in the formation of a compound like the sign for 'parking'. This is illustrated in Figure 17. According to the DOH, represented in Figure 17a, the orientation feature of R3, [neutral], spreads to R2, resulting in deletion of the orientation features [down] and [palm] originally associated with R2. Then, R3 is deleted. The -handshape of R2, which now dominates the orientation node with the feature [neutral], spreads to R1, resulting in deletion of the -handshape as well as the orientation feature [prone]

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in the case of the compound for 'parking', it is [supine]; whereas, in the case of the sign for 'place', it is [prone]. There might be a phonological reason why such an orientation change occurs in the formation of the simultaneous compound, but as addressing the change would take us too far afield, we will not discuss this issue in this paper, leaving it to future research.

originally associated with R1. Then, R2 is deleted.

(a) Partial assimilation of orientation
under the DOH

(b) Partial assimilation of orientation
under the IOH
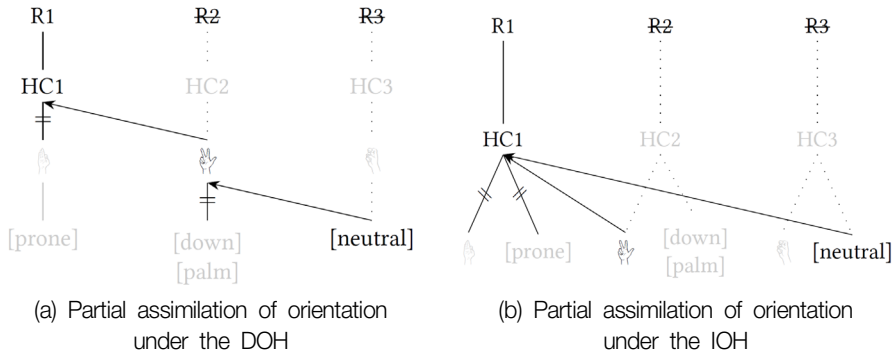
Figure 17. Representations of PARKING

As a result of the series of assimilation processes, the orientation feature which is originally from R3 and the ⚇-handshape which is originally from R2 are both realized in R1. Turning to the representation under the IOH shown in Figure 17b, the ⚇-handshape of R2 and the orientation feature [neutral] of R3 independently spread to R1, resulting in deletion of the ⚇-handshape and the orientation feature [prone] originally associated with R1. Then, R2 and R3 are deleted, along with the other nodes dominated by R2 and R3. This way, the ⚇-handshape from R2 and the orientation feature [neutral] from R3 can both be realized in R1 under the IOH.

The case of the compound for 'parking' discussed in this section shows that partial assimilation of orientation in principle can be involved in the formation of a simultaneous compound in KSL. Such a pattern can be successfully accounted for by both the DOH and the IOH as the representations in Figure 17 show.

4.3 Partial assimilation of handshape

The crucial difference between the DOH and the IOH is that the latter predicts that partial assimilation of handshape can occur in simultaneous compounding whereas the former predicts that it cannot. Careful examination of simultaneous compounds in KSL reveals that partial assimilation of handshape *can* be taken to occur, indicating that the IOH is correct after all.

One of the simultaneous compounds in KSL that involve partial assimilation of

handshape is the compound for 'human rights' shown in Figure 18. As shown in the figure, the dominant hand of the sign for 'human rights' can be said to have the 〰-handshape and the orientation feature specified as [palm] (relative to the place of articulation, i.e., the upper arm).

Figure 18. HUMAN-RIGHTS in KSL

The compound for 'human rights' are composed of two lexical signs, one for 'human' and the other for 'right', each of which is shown in Figure 19a and Figure 19b, respectively. Importantly, the sign for 'human' in Figure 19a has the 〰-handshape and the orientation features [up] and [radial]; whereas, the sign for 'right' has the 〰-handshape and the orientation feature [palm].

(a) HUMAN   (b) RIGHT
Figure 19. Components of HUMAN-RIGHTS

It is obvious from the comparison between the illustration in Figure 18, on one hand, and the illustrations in Figures 19a and 19b, on the other, that the handshape of the compound sign for 'human rights' is from the sign for 'human', while the orientation of the compound sign is from the sign for 'right'. That is, the handshape of the sign

for 'human', to the exclusion of its orientation, is part of the elements constituting the compound sign for 'human rights'. This means under the approach adopted in this paper that partial assimilation of handshape occurs when the compound is formed. This is what is expected only by the IOH, and not by the DOH. Consider the representations in Figure 20. In Figure 20a, the handshape of R2 spreads to R1 before R2 is deleted. Now, when the -handshape is delinked from HC1 as a result of handshape spreading, the orientation feature [palm] must also be delinked from the root node since the orientation node is dominated by the handshape node.

(a) Partial assimilation of handshape under the DOH

(b) Partial assimilation of handshape under the IOH
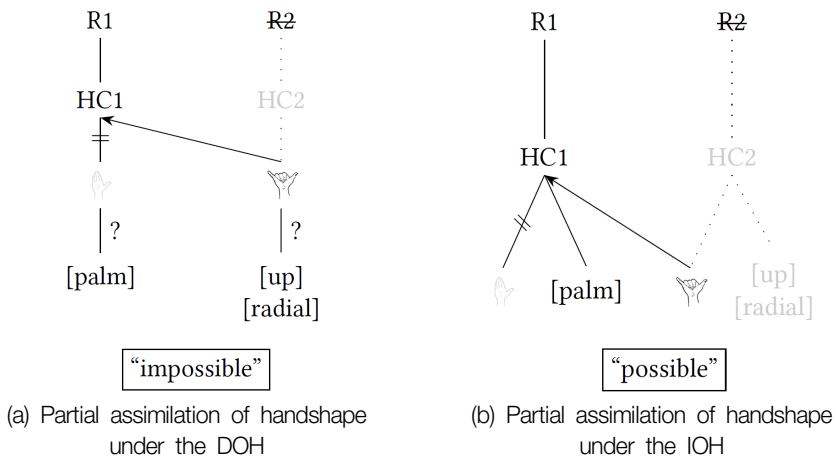
Figure 20. Representations of HUMAN-RIGHTS

In addition, when the -handshape of R2 spreads to R1, the orientation features of R2, i.e., [up] and [radial], must also spread to R1 because, again, the orientation node is dominated by the handshape under the DOH. That is, the orientation feature of R1 cannot stay the same when the handshape of R1 assimilates to that of R2 under the DOH. As for the representation under the IOH shown in Figure 20b, the handshape of R2 spreads to R1 before R2 is deleted, and then, the -handshape of R1 deletes as a result of assimilation. At this point, there is a crucial difference between the DOH and the IOH: under the IOH, even though the handshape of R1 is deleted, the orientation feature, [palm], of R1 can stay intact. Also, the orientation features, [up] and [radial], of R2 do not need to spread to R1 along with the handshape of R2, since the orientation node is not dominated by the handshape node according to the IOH. The orientation node can

simply be deleted as the source root, R2, is deleted. So, as the formation of the compound for 'human rights' can be accounted for by the IOH but not by the DOH, it can be considered to support the view that orientation is independent of handshape.

Other examples that involve partial assimilation of handshape include the compounds for 'hotel' (LUXURIOUS/INN), 'weekly' (WEEK/DURING), and 'department store' (HUNDRED/ECONOMY). One might think that the sign for 'weekly' is an instance of number incorporation rather than an instance of simultaneous compounding between lexical items, since on the surface the sign for 'weekly' appears to consist of the sign for '7' and the sign for 'during'. However, this must not be the case considering the fact that the sign for 'during' cannot be incorporated by a number sign productively. So, for example, the meaning 'for three days' cannot be expressed by incorporating the sign for '3' into the sign for 'during' as in *3/DURING; in fact, for any natural number n, the meaning 'for n days' cannot be expressed by incorporating n into the sign for 'during' as in *n/DURING. In order to express this meaning, the number and the sign for 'during' must be produced sequentially as in, e.g., 3^DURING for 'for three days'. We interpret this to mean that the sign for 'during' cannot be a target for number incorporation in KSL. So, the sign for 'weekly' must have been formed through combining the sign for 'during' with the sign for 'week', which happens to have (most likely iconically) the handshape for '7'.

In addition to the compounds that are formed by two lexical signs, initialized signs also involve partial assimilation of handshape. For example, the sign for 'joy' illustrated in Figure 21 has the ⚡-handshape and its orientation feature is specified as [fingertips].

Figure 21. JOY in KSL

The sign for 'joy' is formed by combining the sign for 'enjoy' and the finger-spelled

Korean alphabet 'k', which are shown in Figures 22a and 22b, respectively. The sign for 'enjoy' has the ⬙-handshape and its orientation feature is specified as [fingertips], while the finger-spelled Korean alphabet 'k' has the ⬙-handshape and its orientation features are [down] and [palm].


(a) ENJOY   (b) 'k'

Figure 22. Components of JOY

Again, when comparing the illustrations in Figures 21 and 22, it is obvious that the sign for 'joy' is composed of the handshape of the finger-spelled Korean alphabet 'k' and the orientation of the sign for 'enjoy'. That is, the sign is formed through partial assimilation of handshape. An example of initialized signs as such supports the IOH, which claims that orientation is a category independent of handshape. The representations of the DOH and the IOH for the initialized sign for 'joy' are shown in Figure 23.
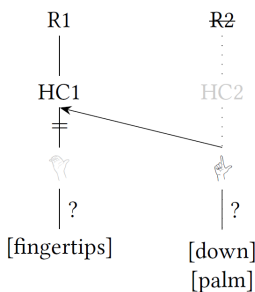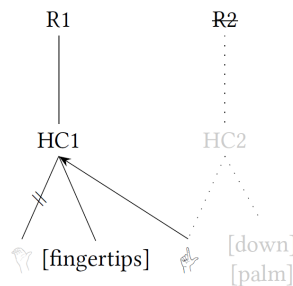
(a) Partial assimilation of handshape   (b) Partial assimilation of handshape
             under the DOH   under the IOH

Figure 23. Representations of JOY

In the representation of the DOH shown in Figure 23a, the ⪢-handshape spreads to HC1, and then the handshape of HC1 is delinked. As before, the orientation feature [fingertips] originally associated with R1 and the orientation features [down] and [palm] originally associated with R2 are problematic here. As the ⪢-handshape is delinked from HC1, the orientation feature [fingertips] must be delinked as well since the orientation node is dominated by the handshape node. Since the orientation features, [down] and [palm], of R2 are also dominated by the handshape node, when the ⪢-handshape spreads to R1, the orientation features must also spread to R1. However, as the illustration in Figure 21 shows, this is not the case. In the representation under the IOH shown in Figure 23b, on the other hand, the ⪢-handshape is delinked from HC1 when the ⪢-handshape of R2 spreads to HC1; but the orientation feature of R1, [fingertips], can still be dominated by HC1. In other words, the orientation feature can stay the same while the handshape assimilates. In addition, the orientation features of R2 do not have to spread to R1 along with the handshape, since it is directly dominated by HC2, not by the handshape node. The orientation features of R2 then can be deleted as the source root, R2, is deleted. There are many initialized signs that show partial assimilation of handshape, such as the signs for 'magazine' ('c'/BOOK), 'philosophy' ('ch'/KNOWLEDGE), 'deacon' ('c'/EXECUTIVE), 'prophecy' ('yey'/SPEAK), and 'environment' ('h'/SURROUNDINGS).

4.4 Summary and some remarks

In this section, we have shown that simultaneous compounds in KSL show total assimilation of handshape and orientation, partial assimilation of orientation, *and* partial assimilation of handshape. The first two types of assimilation are predicted by both the DOH and the IOH, but the last type of assimilation is predicted by the IOH but not by the DOH. Based on this, we conclude that orientation must be independent of handshape, rather than being its subcategory, in sign phonology.

An anonymous reviewer points out that the current analysis does not offer an account of the apparent lack of partial assimilation of handshape in a language like ASL; and s/he raises the possibility that the relative relations between orientation and handshape might be parameterized such that in a language like KSL, orientation is independent of handshape, whereas in a language like ASL, orientation is dependent on handshape. First of all, it needs to be noted that the lack of partial assimilation of handshape in ASL has

been claimed based on sequential compounds, not on simultaneous compounds. So there is a possibility that partial assimilation of handshape may be found in ASL after all, if the scope of the data is extended to include simultaneous compounds as well as sequential compounds. Now, for argument's sake, suppose that partial assimilation of handshape (in either sequential or simultaneous compounds) is not attested in a language like ASL, and it is attested in a language like KSL. In this case, it is true that the view in the paper (i.e., the IOH) does not provide an answer to why partial assimilation is not attested in a language like ASL, but at the same time it is also true that the opposite view (i.e., the DOH) does not provide an answer to why partial assimilation is attested in a language like KSL. Putting aside parametrization (which is a very interesting and plausible possibility, but would have to be left to future research), we believe that the IOH is still a more promising hypothesis than the DOH even though both the hypotheses have some unresolved issues. As for the IOH, partial assimilation of handshape that it predicts to be possible is not attested in some sign languages; this may be explained by saying that the grammars of those languages allow partial assimilation of handshape but it happens not to exist. That is, its lack could be an accidental gap. Perhaps, it may also be said that partial assimilation of handshape does exist in those languages, but it simply has not been found yet. That is, there might be a gap in our knowledge of sign languages. On the other hand, according the DOH, partial assimilation of handshape should not exist, but it does in KSL as shown in this section. This is a problem that does not seem to be easily overcome: if the grammar systematically blocks some phenomenon from occurring, it should never occur. Therefore, although there are some issues on the IOH, it is still a more promising view considering the data presented in this paper. The unresolved issues of the IOH (including the task of exploring the possibility of parametrization) are left to future research.

5. Conclusion

The purpose of this paper was to examine the status of orientation. We argued that orientation has an equal status with handshape based on the assimilation process in simultaneous compounds in KSL. We first discussed the different views on orientation whether it should be represented in relative terms or in absolute terms, and concluded that orientation can be more appropriately represented in relative terms. Then, we

discussed the two hypotheses on the status of orientation: one which takes orientation to be a subcategory of handshape and the other which takes it to be independent of handshape. To evaluate the predictions made by the two hypothesis, three types of assimilation in simultaneous compounds were discussed: total assimilation of handshape and orientation, partial assimilation of orientation, and partial assimilation of handshape. Both hypotheses predict total assimilation of handshape and orientation as well as partial assimilation of orientation. Crucially, partial assimilation of handshape is only allowed by the hypothesis that assumes orientation is independent of handshape. We have shown that simultaneous compounds in KSL involve not only total assimilation and partial assimilation of orientation but also partial assimilation of handshape. Such a result supports the view that orientation is an independent category, and has an equal status with handshape. We hope that the discussion in this paper helps to advance our understanding of simultaneous compounds in KSL as well as relative relations between the parametric categories in sign phonology.

References

Battison, Robbin. 1978. *Lexical borrowing in American Sign Language*. Silver Spring: Linstok Press.

Bellugi, Ursula and Don Newkirk. 1981. Formal devices for creating new signs in American Sign Language. *Sign Language Studies* 30(1): 1-35.

Brentari, Diane. 1990. *Theoretical foundations of American Sign Language phonology*. PhD Dissertation. Chicago: The University of Chicago.

Brentari, Diane. 1998. *A prosodic model of sign language phonology*. Cambridge, MA: The MIT Press.

Choi, Youngju. 2021. Defininte orientation of sign languages based on negative suffix of Korean Sign Language. Paper presented at *the International Seminar on Sign Language Reserach 2021.* Gwangju, Korea. October 23.

Crasborn, Onno A. and Els van der Kooij. 1997. Relative orientation in sign language phonology. In Jane A. Coerts and Helen de Hoop (eds.). *Linguistics in the Netherlands 14*, 37-48. Amsterdam: John Benjamins.

Greftegreff, Irene. 1992. Orientation in indexical signs in Norwegian Sign Language. *Nordic Journal of Linguistics* 15(2): 159-182.

Ji, Youngsuh. 2022. The varieties of coinage method of the sign language place names of Gwangju Metropolitan City [In Korean]. *The Journal of Linguistic Science* 102: 151-190.

Meir, Irit. 2012. Word classes and word formation. In Roland Pfau, Markus Steinbach, and Bencie

Woll (eds.), *Sign language: An international handbook*, 77-111. Berlin: De Gruyter Mouton.

Sandler, Wendy. 1989. *Phonological representation of the sign: Linearity and nonlinearity in American Sign Language*. Berlin: De Gruyter Mouton.

Sandler, Wendy and Diane Lillo-Martin. 2006. *Sign language and linguistic universals.* Cambridge: Cambridge University Press.

Stokoe, William C. 1960. Sign language structure: An outline of the visual communication systems of the American deaf. *Studies in linguistics: Occasional papers 8*. Buffalo: University of Buffalo.

Stokoe, William C. 1978. *Sign language structure.* Silver Spring: Linstok Press.

van der Hulst, Harry. 1996. On the other hand. *Lingua* 98(1): 121-143.

van der Kooij, Els. 2002. *Phonological categories in Sign Language of the Netherlands: The role of phonetic implementation and iconicity*. PhD Dissertation. Netherlands Graduate School of Linguistics.

Won, Seongok, Yumi Kim, Ki-Hyun Nam, and Sungwan Kim. 2021. *Korean Sign Language grammar* [In Korean]. Seoul: National Institute of Korean Language.

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