Movement types, Repetition, and Feature Organization in Hong Kong Sign Language

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Abstract

Movement is one of the major phonological parameters in sign phonology. However, there has been a lack of consensus on how to characterize it, in particular, how to organize movement types and their associated features in a phonological representation. In this chapter, we revisit features involving repetitions in Hong Kong Sign Language (HKSL) documented in a HKSL dictionary (Tang 2007). We propose the features [repeat] and [return] to capture the different realizations of "repetitions" in the lexical signs of HKSL, which may take the forms of non-repeated movements, unidirectional repetitions, bidirectional repetitions, repeated local movements, returned movements and trills. We argue that repetition in HKSL involves a set of independent features which can occur at various nodes of the feature hierarchy. We propose that there is a Movement Feature (MF) node in the feature geometry under which path or local movements are grouped as sister nodes. Orientation and aperture changes are then sister nodes under the local movement node. Repetition features may occur at either the MF node or at the path or local movement node, but not lower down because they do not co-occur with either the orientation or aperture change terminal nodes.

1. Introduction

There have been a number of approaches to represent movement in sign language. Some researchers like Liddell & Johnson (1986), Perlmutter (1992), and Sandler (1989) treat movement as a segment. Some regard it as a specifying property of a syllable with an initial or final state (e.g. "timing units" in Wilbur 1993, "X-slots" in Hulst 1993). Following Stack's argument (1988) that movement segments are redundant and movement can be viewed as a transition from A to B, Crasborn, Hulst & Kooij (2000:6) claim that there are no movement segments and all movement can be analyzed as a change of feature values. They put forward the Dependency Phonology Model in which the class nodes Config, Orientation and SelFing are set up to host the sequence of terminal features, capturing the change of states in path, orientation and aperture respectively. By claiming that "signs are single segments", Channon's (2002) OneSeg Model claims that signs are single segments and proposes a set of structurally unordered, static (place, handshape, etc.) and dynamic features including pathshape (Channon & Hulst 2011, this volume), direction, and [repeat] features, with the number of repetitions in a sign being non-contrastive. Adopting a rather different approach, Brentari's (1998:130) Prosodic Model captures the dynamic properties of movement by a set of prosodic features classified into class nodes Nonmanual, Setting, Path, Orientation and Aperture. This model also stipulates that there is a hierarchical organization of different types of dynamic changes, it reflects the organization of the executors (i.e. joints) and sonority hierarchy (i.e. prominence of corresponding joints).[1] Therefore, in our attempt to revisit the movement parameter of HKSL, we adopt Brentari's Prosodic Model and Sagey's (1986) Articulator Model of feature geometry as the framework of analysis.

Various names have been used to capture repetition phenomena (e.g. [redup] in Perlmutter (1990), [repeat] and [TM] in Brentari (1998) and Tang (2007), [repeat] in Channon (2002), and [repeated] in Kooij (2002). Most analyses of repetition treat repetitions and trills as independent of each other even though they share similar movement properties.

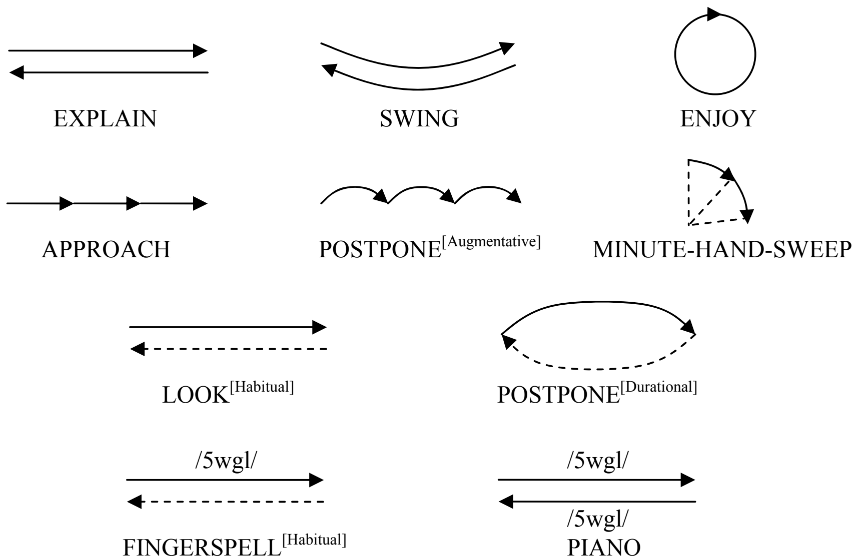
We assume at the outset that the dynamic properties of movement in signs can be characterized by a set of features which may be categorized into natural classes (i.e. "movement types").[2] Just as Sagey's (1986) Articulator Model of feature geometry groups place of articulation features like [±round] under Labial and [±anterior] under Coronal all under the Place class node according to the organization of the oral articulators, the classes for movement in sign language may stem from articulatory effects involving the various joints. These class nodes are organized into tiers and are related to each other. Just as manner features like [continuant] which characterize manners of articulation independent of specific articulators are discovered in spoken language, there may be independent features which characterize manners of sign articulation as well. Our study aims to categorize repetitions, trills and their associated features in HKSL, how they co-occur and organize themselves into tiers and whether this organization corroborates that of the PF node of the Prosodic Model. Brentari's model uses an independent, articulator-free [TM] feature to capture trills, but we argue that trills are phenomena which can be characterized by two independent features [repeat] and [return], in opposition to dependent features such as [open] and [close] that are defined by the finger joints and responsible for aperture change. Being independent manner features, they may be associated with different movement classes in the phonology of HKSL. We argue that positing these independent features allows us to capture repetitions at different levels of representations simultaneously, an intrinsic property of the signing modality. This means that even though repetition in our view is structurally ordered, its independent status allows it to occur at certain levels in the representation.

2. Characteristics of repetition

2.1 Directionality

Repetitions can be unidirectional or bidirectional. Newkirk ([1981] 1998:174-178) performed a descriptive analysis on reduplication patterns in ASL. What he calls "reduplication" includes repetitions within ASL signs, both inflectional and basic (i.e. lexically specified).

(1) Reduplication patterns in ASL (Newkirk 1998)



As observed in (1), repetitions in signs show up with different parameters. One of them is directionality. For examples, in ASL EXPLAIN and SWING contain bidirectional paths but with different shapes, straight or arc. ENJOY is not bidirectional but has a circular shape of movement. These signs have the common property that "the reduplicating unit … must begin in the same position in space, and in the same configuration of fingers, wrists, and so on each time it is repeated in order for the exact reduplication to occur". The second group of signs, including APPROACH, POSTPONE$^{[Augmentative]}$ and MINUTE-HAND-SWEEP, like the first group, also have different path-shapes, but contrasting with the first group, they are "reduplicated without returning to the initial starting point".[3] The final group involves signs with unidirectional repetition as in LOOK$^{[Habitual]}$ and POSTPONE$^{[Durational]}$. It is different from the first and second groups by having "a linking movement complementary to the lexical movement … inserted to bring the active hand(s) back to the starting position for the next cycle". Newkirk ([1981], 1998) provided further justification that the first half-cycle of the unidirectional repetition is lexical while the second is outside of the lexical domain. FINGERSPELL$^{[Habitual]}$ in ASL is specified with a unidirectional path overlaid with the wiggling of the finger but the lexical movement occur only with the first half-cycle but not the remaining half-cycle which is merely a transition. In contrast, the wiggling of the fingers for the sign PIANO occurs in a bidirectional path movement in both the first and the returning half-cycles. In (1), he used solid arrows to represent "lexical" movement and the dotted ones to imply that the return of the articulator to the original setting is merely a "linking movement" (i.e. transitional movement) which is not phonologically specified.

Newkirk's ([1981], 1998) did not propose any phonological features for directionality in repetitions. The Prosodic Model attempts to capture directionality in unidirectional and bidirectional repetitions by positing [repeat] as a heterogeneous path feature with diacritics rather than default values: [repeat]:identical (a unidirectional path), [repeat]:at 90º angle (a cross shape path), and [repeat]:at 180º angle (a bidirectional path).

2.2 Trills

Another form of repetition widely discussed in the literature is trills. Hulst (1993:217) defines trills as having "a rapidly repeated activity which can be executed during a path movement or while the hand is motionless, i.e. not moving along a path". It is also called "trilled movement" or "secondary movement" by some researchers, and has different formal names in different frameworks: [+trilled] in Padden & Perlmutter (1987), [trill] in Sandler

(1989) and (1993), [oscillated] in Liddell (1990) and Hulst (1993), [W] as the secondary movement feature for wiggling in Perlmutter (1992), and [TM] in Brentari (1996) and (1998). In this chapter we use the term "trills" rather than "trilled or secondary movement" because we do not posit "trills" as an isolated movement type but as a subtype of repetitions analyzable into a set of distinctive features. This is contrary to Brentari (1996) who considers trills and repetitions to be phonetically related but phonologically distinct.

There are several common properties of trills: 1) they are not restricted to a specific movement type because they "are produced at a variety of articulatory sites" (Brentari 1996:44, 1998:164), 2) they can be superimposed on signs with and without a path movement (Liddell 1990, Hulst 1993:217), and 3) trills co-occur only with paths or locations (Brentari 1996:51).

In the Prosodic Model, trills are perceived as having non-repeated counterparts and are symbolized with a prosodic feature [TM] directly under the PF node. Under a different approach, trills have been analyzed as iterated versions of local movements and reduplications have been accounted for by copying a skeletal template (Stack 1988, Sandler 1989, Liddell 1990). The templatic account can explain morphological reduplication because the templatic copying operates at the level of morphology; however, there is an inadequacy in explaining the non-morphological, lexically specified repetitions observed in Newkirk ([1981] 1998). In this chapter, we will argue for a unified account of unidirectional and bidirectional repetitions as well as trills by proposing two phonological features, one for repetition and the other for returning movement, both can be specified at the lexical level.

3. Analysis of movement in HKSL

3.1 Working assumptions

To offer a unified account of repeated unidirectional and bidirectional movements as well as trills, we propose to re-conceptualize the feature [repeat] and to introduce a new feature [return]. We argue that these two features will capture the various realizations of repetitions as reported in different sign languages and especially in HKSL. The working definitions of [repeat] and [return] are as follows:

(2) [repeat] – The movement in the articulation repeats itself, regardless of count. It refers to the commonly observed repetitions and trills in sign articulation.

(3) [return] – Movement that returns to the original configuration after displacement or any dynamic changes.

We also adopt the following definitions from Brentari (1998) to characterize the dynamic changes in HKSL:

(4) Path movement: Paths are articulated by shoulder and elbow joints, resulting in spatial changes of the hand in the signing space.
(5) Local movement: Orientation changes are articulated by flexion and extension of the wrist joints and rotation of the forearm. Aperture changes are articulated by finger joints.

Although these categories entail strong articulatory effects as they are defined in terms of the joints of the manual articulators, we argue that such characterization will ultimately enable us to capture systematically the different movement types as well as the associated patterns of repetitions.[4] This path-local movement distinction has been widely observed by many researchers (Sandler 1987, 1989, Stack 1988, Liddell 1990, Hulst 1993:216, Brentari 1998:129,130, Kooij 2002).

A second level of categorization is based on the co-occurrence of these dynamic changes, yielding a distinction between simple and complex movement. Simple movement involves one dynamic change while complex movement is defined as having at least two different but simultaneous dynamic changes types.

3.2 Results

With these working definitions in place, we proceed to the analysis of movement in the lexical signs of HKSL. Our analysis is based on the distribution of movement types and repetition in the 1376 lexical signs documented in Tang (2007)[5] and shown in Table 1. The great majority of the signs are monomorphemic; however, some are bimorphemic signs but their movements are so phonologically compressed that one complex movement results. Also, the signs may be one-handed or two-handed. As for the two-handed signs, either the movement of the dominant and non-dominant hand is identical due to the "symmetry condition" (Battison 1978) or the dominant hand moves and the non-dominant hand becomes the POA (place of articulation).

Table 1. Observations on movement types in HKSL based on Tang (2007)

Type of movement	No movement	Non repeated	Repeated	Trills only	Trills plus non-repeated path	Trills plus repeated path	Totals
No movement type	162						**162**
Path		349	156				**505**
Orientation		44	2				**46**
Aperture		22	7				**29**
Path|Aperture		133	22				**155**
Path|Orientation		94	19				**113**
Orientation|Aperture		6	0				**6**
Path|Orientation|Aperture		14	1				**15**
Other movement types				317	20	8	**345**
Totals	**162**	**662**	**207**	**317**	**20**	**8**	**1376**

3.2.1 Signs with no movement

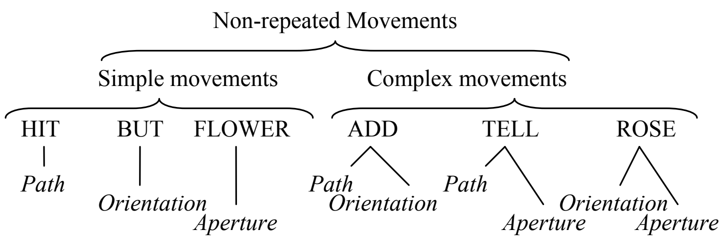
Out of 1376 signs in our analysis, 162 signs display a hold at POA rather than a path or local movement in the lexical entry. Under these circumstances, the well-formedness constraint in the phonological representation is satisfied by a transitional movement of the articulator to the POA. An example is the sign TOILET which is realized by a static handshape held at neutral space with "protruded lips", as shown in Figure 1. For the signers with whom we have consulted, all agreed that TOILET is a static sign and the path of the articulator to the POA is meaningless and not part of the sign articulation. In contrast with the finding from previous research in ASL that signs are not well-formed without movement (Wilbur 1987, Stack 1988, Brentari 1990), these signs may suggest a typological difference on sign well-formedness. By the way, no movement signs in HKSL happen to be good evidence supporting movement as a category because all movement features as a whole can be totally absent in a sign.

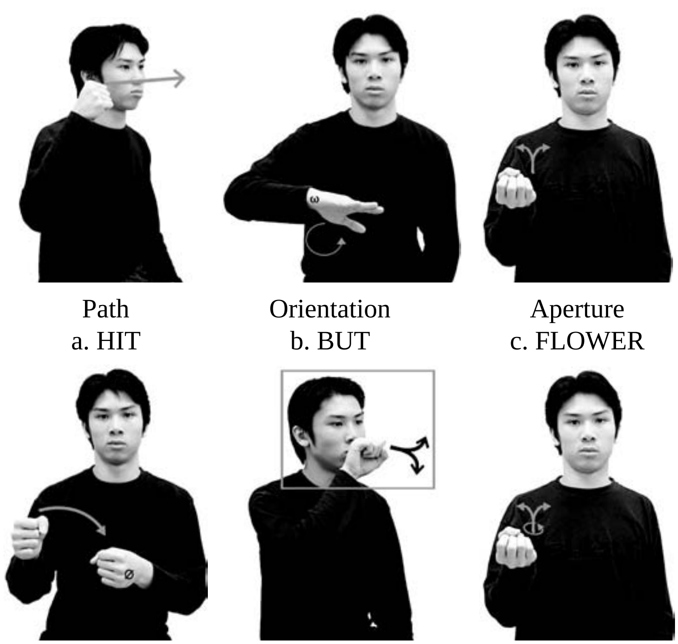
Figure 1. TOILET

3.2.2 Simple and complex movements

(6) summarizes the co-occurrence pattern of movements in HKSL. Similar to reports from other sign languages, the three movement types can either occur independently or be combined with each other. Illustrations of the signs are found in Figure 2a-f. In Figure 2a-c, HIT, BUT and FLOWER have simple path, simple orientation change and simple aperture change respectively. Figure 2d-f show examples of complex movements: ADD, TELL and ROSE (i.e. the simultaneous combination of Path|Orientation, Path|Aperture and Orienation|Aperture movements respectively).[6]

(6) Examples of signs with non-repeated movements (simple and complex)





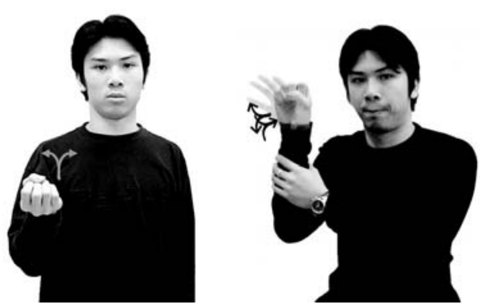
Path a. HIT | Orientation b. BUT | Aperture c. FLOWER

Figure 2. Path|Orientation d. ADD | Path|Aperture e. TELL | Orienation|Aperture f. ROSE

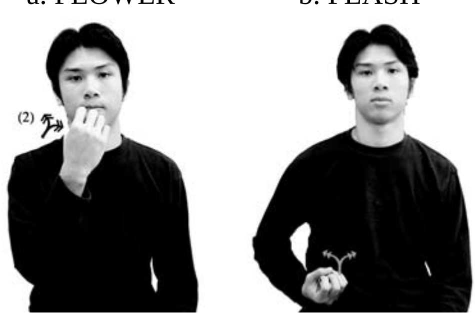
3.2.3 Non-repeat, return, full repetition and trills

Signs marked “repeat” in Table 1 show full articulation during the repetition (referred to as “full repetition” in the subsequent discussion). This contrasts with “trills” in the last column where the movements are diminished and uncountable. In HKSL, trills may occur independently under path, orientation, or aperture changes. In complex movements, they may be combined with non-repeated and repeated path movement.

Table 1 also summarizes the results of signs showing repetitions in form of either ‘repeat’ or ‘trills’. The data shows that there are different types of repetitions in the language. Descriptively, all the signs in Figure 3a-d have aperture changes of the “5” handshape. However, FLOWER has a non-repeated opening movement, but FLASH contrasts with FLOWER in back-tracking the movement to the original aperture. On the other hand, HONG_KONG contrasts with FLOWER in that HONG_KONG repeats the opening sequence twice with a transitional movement in between. Finally, PAGER is realized by trills between the opening and closing of “5” handshape without a specific end-state (i.e. the end-state is nondeterministic and without phonological significance).



“non-repeat” “return”
a. FLOWER b. FLASH



“full repetition” “trills”
Figure 3. c. HONG KONG d. PAGER

The identification of these four independent realizations of repetitions in HKSL is based on "phonemic contrast". The first type is "non-repeat", which includes signs that have one movement type which does not repeat. This is a common sign type in HKSL as shown in Table 1. The second type is "return", which requires a return of movement to its original state (path or handshape configuration) and this returning movement is part of the lexical specification. This is similar to Newkirk's bidirectional type. The third type is "full repetition" which does not require the returning movement as part of the lexical specification and the final state of the second movement is identical to the final state of the first movement. The fourth type is trills. They refer to uncountable repetitions and the returning movement is part of the lexical specification. Another piece of evidence showing that "trills" are distinct from "full repetition" is that "full repetition" always has a specific end-state while "trills" do not. This can be shown by their different behaviour in phrase-final position where the signs are lengthened. Signs with "full repetition" lengthen themselves with a "hold" at the final state while "trills" just prolongs as a whole.

In this analysis, we have attempted to distinguish two kinds of return in the signs of HKSL. Only those signs like FLASH or PAGER will be specified with the [return] feature in the lexical entry. Signs like HONG_KONG will have a [repeat] but not [return] feature because the returning movement is not part of the lexical specification. Adopting the feature [return] has an advantage over the feature "bidirectional" as proposed in Brentari's model because bidirectional applies to paths only. In our proposal, [return] can capture either the "returning" of movement to the original setting of the "bidirectional" path or the original handshape configuration and orientation. [Return] can even capture "trills" which we assume are one type of repetitions.

Here we focus on the repetitions that lexically specify for a returning movement like EXPLAIN, SWING and ENJOY in ASL mentioned in (1), which we analyse as having both [repeat] and [return]; as well as those with transitional movement back to the starting position or configuration like LOOK[Habitual], POSTPONE[Durational] and FINGERSPELL[Habitual], which have [repeat] but not [return]. However, we decide to leave the signs like APPROACH, POSTPONE[Augmentative], MINUTE-HAND-SWEEP and GRANDMOTHER in ASL aside because these signs, although specified with [repeat] without [return], must have additional "displacement" specification realizing as stepping through space after each iteration. Our preliminary conjecture is that these signs involve [repeat] plus additional setting changes and more research is needed to capture these signs adequately.

3.2.4 *Filling the gap of co-occurred orientation and aperture change with repetition*

As for the non-repeated signs, Table 1 shows that the movement types are combined to form complex movements in HKSL. However, those showing a combination of orientation and aperture changes are few and this complex local movement with repetition does not seem to occur unless there is also path movement as none shows this combination with repetitions. Although not included in Tang (2007), a variant of the sign FREE_OF_CHARGE subsequently identified in HKSL requires both orientation and aperture changes as well as repetition. This variant that we have uncovered in the course of time is shown in Figure 4, which does show this co-occurrence pattern.

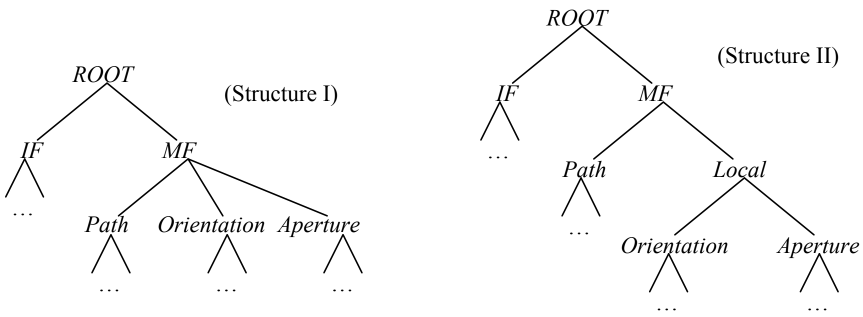
Figure 4. FREE_OF_CHARGE

In this section, we have descriptively categorized the HKSL sign data in terms of movement types and repetition types. In what follows, we will put forward a formal analysis of the movement types as class nodes in the phonology of HKSL. We will analyze the nature and distribution of [return] and [repeat] in the movement types and how a combination of the values of these two features captures the four patterns of repetitions observed in HKSL.

3.3 Analysis of movement types as class nodes

Our analysis is couched within the general concept of feature geometry developed by Clements (1985), Sagey (1986) as well as Brentari (1998) that dependent features can be categorized into class nodes which in turn may be organized hierarchically. In what follows, we will propose a Movement Feature (henceforth MF) class node under which there are Path, Local, Orientation and Aperture nodes in the feature geometry. (7) below offers a flat structure under the MF node (Structure I) which contrasts with Structure II which has a hierarchical organization of movement types, created by adding a Local node that groups orientation and aperture changes together. We will argue for Structure II based on analysis of [return] and [repeat] as independent, articulator-free features.

(7) Organization of movement class nodes



As mentioned, we call the class node formed from all movement features the MF class node. The co-occurrence patterns of the movement types shown in Table 1 suggest Path, Orientation and Aperture may appear on their own or combine with each other systematically, so they are shown as class nodes. As mentioned in Section 1, the definition of movement types is based on the involvement of the joints at different levels of realization. This is in line with the concept of "articulatory independence" (Halle 1982:98-99)[7] because the three basic movement types are initiated by three sets of independently functioning joints: shoulder and elbow joints for Path, wrist joint for Orientation and finger joints for Aperture. Similar phenomena of "articulatory independence" have been found in spoken language where researchers refer to it as "co-articulation or multiple articulations". This involves two or even three places of articulation in "complex segments". Hence, in the "articulator tiers" and the "articulator node hierarchy" models developed by Sagey (1984, 1986:38), Labial, Coronal and Dorsal are not features but are class nodes immediately dominated by the Place class node. This motivates us to propose a structure of basic movement types: Path, Orientation and Aperture as class nodes under the MF node, as shown in Structure I. The question is whether MF contains a flat or a hierarchical structure, (more specifically, whether there is a Local node), and whether [repeat] and [return] are articulator independent features, issues to which we now turn.

Independent, articulator-free features are those features which are not restricted to specific movement types. In what follows, we are going to show how [return] and [repeat] are specified in signs with single and complex movement types. Our observation is that the distribution of these articulator-free features is least restrictive in single movement types, as signs can be found which demonstrate either [return], [repeat] or a combination of both.

Table 2. Distribution of [return] and [repeat] over different simple movement types

Patterns of repetitions with their features			***Path***	***Orientation***	***Aperture***
Non-repeat	:	∅	PUT	BUT	FLOWER
Return	:	[return]	RESUME	SHARE	FLASH
Full repetition	:	[repeat]	PRINT	MAID	HONG_KONG
Bidirectional / Trills	:	[return] [repeat]	EARTHQUAKE	OR	PAGER

In Table 2, [return] and [repeat] feature specifications can be realized in all basic movement types. This observation offers some preliminary hints that they are articulator-free features. However, specifying [return] and [repeat] in complex movements leads to distributional constraints. In order to examine this issue, we analyze the patterns of co-occurrence between [repeat] and [return] within the possible movement combinations. The results are summarized in the following three tables,[8] where each table corresponds to one of the three logical possibilities for complex movement: aperture and orientation (Table 3), path and orientation (Table 4), and path and aperture (Table 5).

Note that not all signs in the tables are lexical in nature. Some are overlaid with morphosyntactic features through movement modulations, and are underlined, to distinguish them from lexical signs. Because our data set has less than 2000 signs, it is possible that unattested combinations (marked by "*") are merely accidental gaps. However, it seems more likely that these gaps are systematic, because as we will show that, the gaps can be explained by the combination of our proposed hierarchical structure for movement features, and constraints on where repetition features can and cannot occur in the structure.

Table 3. Distribution of [return] and [repeat] in Orientation|Aperture complex movements

Orientation		*Aperture*		**Examples**
[return]	[repeat]	[return]	[repeat]	
–	–	–	–	ROSE
–	–	+	–	*
–	–	–	+	*
–	–	+	+	*
+	–	–	–	*
+	–	+	–	WASTE_EFFORT[Distalized]
+	–	–	+	*
+	–	+	+	*
–	+	–	–	*
–	+	+	–	*
–	+	–	+	FREE_OF_CHARGE
–	+	+	+	*
+	+	–	–	*
+	+	+	–	*
+	+	–	+	*
+	+	+	+	*

Table 4. Distribution of [return] and [repeat] in Path|Orientation complex movements

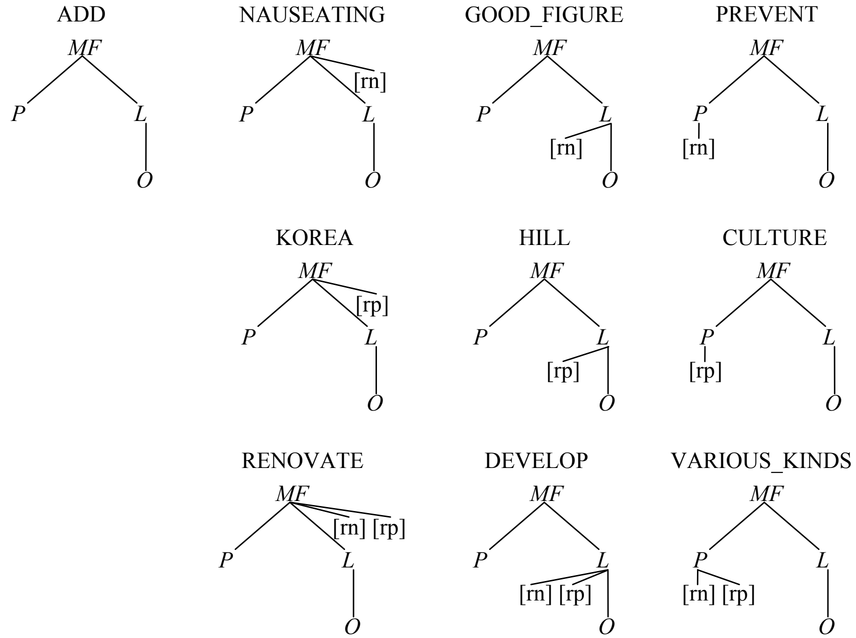
Path		*Orientation*		**Examples**
[return]	[repeat]	[return]	[repeat]	
–	–	–	–	ADD
–	–	+	–	GOOD_FIGURE
–	–	–	+	HILL
–	–	+	+	DEVELOP
+	–	–	–	PREVENT
+	–	+	–	NAUSEATING
+	–	–	+	*
+	–	+	+	CL[An animate entity jumps summersault]
–	+	–	–	CULTURE
–	+	+	–	*
–	+	–	+	KOREA (name sign)
–	+	+	+	DEVELOP[Reduplicated]
+	+	–	–	VARIOUS_KINDS
+	+	+	–	*
+	+	–	+	*
+	+	+	+	RENOVATE

Table 5. Distribution of [return] and [repeat] in Path|Aperture complex movements

Path		***Aperture***		**Examples**
[return]	[repeat]	[return]	[repeat]	
–	–	–	–	TELL
–	–	+	–	NIKE (name sign)
–	–	–	+	JELLYFISH
–	–	+	+	WALK
+	–	–	–	FAMOUS
+	–	+	–	OVERNIGHT
+	–	–	+	*
+	–	+	+	CL[A 2-legged entity walks back and forth]
–	+	–	–	PREPARE
–	+	+	–	*
–	+	–	+	VEGETABLE
–	+	+	+	WALK[Reduplicated]
+	+	–	–	FO_TAN (name sign)
+	+	+	–	*
+	+	–	+	*
+	+	+	+	PIANO

Taken together, some systematic patterns are found. Table 3 shows that the distribution of [return] and [repeat] in Orientation|Aperture complex movement is so restrictive that there are thirteen unattested combinations in this table. Note that all the twelve pairs with either [repeat] or [return] specified in different values have no attested signs in HKSL. The last unattested combination shows that trills specified with both [repeat] and [return] are not possible in complex movements involving Orientation and Aperture. Table 4 and Table 5 show that Orientation and Aperture share similar distribution of [return] and [repeat] when they combine to form complex movements with Path. For Path|Orientation and Path|Aperture, both tables show many attested forms except for rows 7, 10, 14 and 15. Taken together, these systematic distributions of [repeat] and [return] (henceforth [rp] and [rn] in some figures) in different combinations of Path, Orientation and Aperture support that Orientation and Aperture form a natural class on its own, namely Local movement. This observation also corroborates the claim made by Hulst (1993), Brentari (1998) and Kooij (2002) that Path movement forms its own class of movement while orientation change and aperture change form a class of Local movement. This is supporting evidence to justify that Path and Local (henceforth P and L in some figures) are sister class nodes under MF with Local having further subdivisions into Orientation and Aperture (henceforth O and A in some figures) as shown in Structure II of (7).

(8) Structures of Path|Local signs with different landing sites for [return] and [repeat]

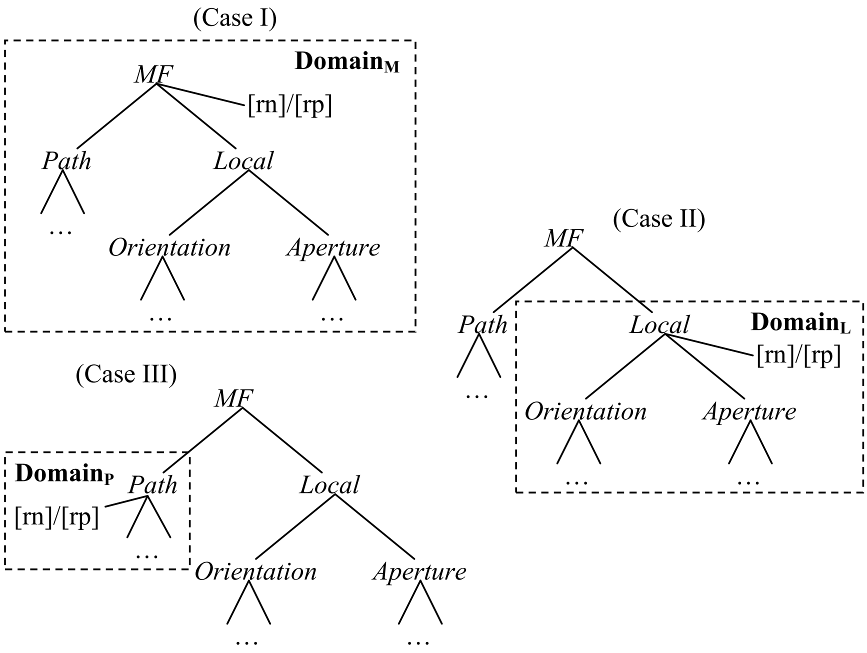


Recall that Table 4 and Table 5 show that Aperture patterns with Orientation when each combines with Path under different [return] and [repeat] specifications, we would expect that Path|Orientation and Path|Apecture share similar underlying structures. The signs in (8) show the possible structures of Path|Orientation movements. In (8), the sign ADD shows Path|Local movement without specifying for [return] and [repeat]. The next column of signs, including NAUSEATING, KOREA and RENOVATE, show that [return] and/or [repeat] are specified at the MF node. By inheritance, the features specified at MF are realized at both the Path and Local nodes. For the signs GOOD_FIGURE, HILL and DEVELOP, the features [return] and/or [repeat] are specified at the Local node only. For signs like PREVENT, CULTURE and VARIOUS_KINDS, the features are specified at the Path node only. These different distributions of features suggest that they may occur in three phonological domains – one dominated by MF node (i.e. including both Path and Local categories), the other two dominated by Local and Path class nodes. Crucially, [return] and [repeat] do not occur as dependents of Orientation or

Aperture. The conventional trilled movements in HKSL signs like RENOVATE, DEVELOP and VARIOUS_KINDS are represented by a combination of [return] and [repeat] features at MF, Local or Path nodes respectively.

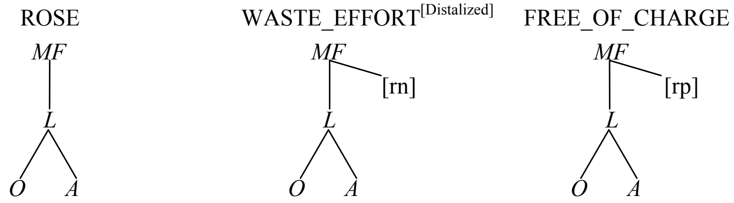
The question is how to represent [return] and [repeat] in more than one phonological domain in one feature geometry. We assume that through dominance in a feature geometry, specification of [return] and [repeat] under MF affects other class nodes dominated by MF. (9) shows the three possible nodes at which [return] and [repeat] are specified. They are MF, Local and Path nodes. Cases I to III in (9) correspond to the distribution of the different repetitions expressed in terms of [repeat] and [return] in the current model, as shown in (8). These structures provide a structural account for the different domains of [return] and [repeat].

(9) The three possible domains of [return] and [repeat]



It is observed that the realization of [return] and [repeat] in Orientation and Aperture are always identical, that is if Orientation is specified or not specified for [return], so is Aperture. (10) shows the structures of the three attested combinations in Table 3.

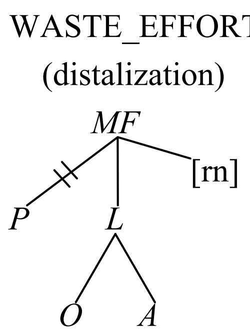
(10) Structures of attested Orientation|Aperture signs



Signs in (10) show no Path class node because we assume that for complex movements involving both orientation and aperture changes with no path movement, the Path node is just not specified with Orientation and Aperture class nodes required. ROSE is not specified with any [return] and [repeat], while WASTE_EFFORT[Distalized] and FREE_OF_CHARGE are specified as having [return] and [repeat] respectively. That [return] and [repeat] have to occur in both Orientation and Aperture or neither implies that Orientation and Aperture nodes should get these feature specifications from one of their mother nodes, but this argument does not decide which mother node it should be, the Local or the MF node. We argue that these two features are specified at the MF rather than the Local node, as shown in (10). The evidence comes from the citation form WASTE_EFFORT. In the underlying structures of the two signs, the path node is specified with [return] or [repeat] at the MF node. Distalization of WASTE_EFFORT involves the delinking of Path node as shown in (11) below.

It is also noticed that only three of the four possible [return] and/or [repeat] specifications are shown here, that is, there is no [return] and [repeat] coexistence in Orientation|Aperture movement. We suspect that it is a lexical gap due to physiological constraint which prohibits trills from occurring when there are both orientation and aperture change.

(11) Derivation of WASTE_EFFORT[Distalized]



Until now, we have shown in (8) the structures of ten attested combinations of [return] and [repeat] in Path|Orientation movements as listed in Table 4. However, two other attested combinations in Table 4 are left untouched. They are represented by CL[An animate entity jumps summersault] in row 8 and DEVELOP[Reduplicated] in row 12. Interestingly, these two forms, together with their Path|Aperture counterparts CL[A 2-legged entity walks back and forth] and WALK[Reduplicated], represent classifier predicates and signs with aspectual modulation. These signs with rich morphology may have undergone morphological processes, bypassing the lexical constraints in HKSL phonology.

(12) Structures of signs with multiple [return] and [repeat] specifications

CL[An animate entity jumps summersault] DEVELOP[Reduplicated]

CL[A 2-legged entity walks back and forth] WALK[Reduplicated]

In (12), these signs with rich morphology can access more than one phonological domains. For instance, the classifier predicates can access both Domain_P and Domain_L while the signs with morphological reduplications can access both Domain_M and Domain_L. All other signs in Table 4 and Table 5 should conform to the lexical constraints in HKSL phonology, if there are any. As it stands, one possible lexical constraint as observed in (8) is that a lexical sign may access only one of the three possible domains of [return] and [repeat] at a time.

4. Conclusion

This chapter offers some preliminary analysis of movement in HKSL. We have identified the co-occurrence patterns of movement types and four patterns of repetitions in the signs of HKSL. We have invoked the features [repeat] and [return] which we assume may occur in multiple phonological domains. These two features can account for the different patterns of repetitions in HKSL, namely non-repeated movement, unidirectional repetitions, bidirectional repetitions, repeated local movements and trills. Invoking [return] enables us to distinguish returning movements between those that are required by the lexeme as part of the lexical specification and those that are transitional movements. Also, that [return] and [repeat] are perceived as features captures repetitions not only in path but also local movements. This differs from Brentari (1998) in which [repeat] is perceived as a path feature only. These finer distinctions can be adequately explained by a feature geometry that grouped Orientation and Aperture as sister nodes in a Local domain which itself is sister to the Path node and both are dominated by the MF domain in the structure. By formulating the lexical and post-lexical constraints of movement and organizing the MF classes in a hierarchical manner, a phonological template for HKSL results which we hope will encourage more in depth analysis in future research and potentially pave the way for the analysis of the morpho-phonology of HKSL.

Notes

1. The Prosodic Model views the root node of a feature geometry as dominating all feature specifications of a lexeme (Brentari 1998:25,26). This model distinguishes between Inherent Features (IF) which specify the fixed properties during the lexeme's production and Prosodic Features (PF) which specify the lexeme's dynamic properties (i.e. movements). In our chapter, we will leave aside the IF node and focus on the feature organization of the PF or Movement Features (MF). It is more appropriate to use the term MF rather than PF here because our investigation has not yet touched upon any prosodic constituent like syllable.
2. Movement features refer to those "distinctive features" which cross-classify the movement inventory and lead to lexical contrasts. According to Clements and Hume (1996), "class nodes" designate functional grouping of features into classes.
3. In ASL, the repeated arcs without returning to the original location is not necessarily inflectional as in POSTPONE$^{[\text{Augmentative}]}$ but can be lexical as in GRANDMOTHER (Rachel Channon, personal communication).
4. In this chapter, we are not focusing on showing the distinctiveness of the terminal features under class nodes of movement types but organization of the class nodes based on feature geometry. For discussion on the distinctiveness of terminal features hosted by these class nodes, readers can refer to Mak (In prep).

5. Most photos of signs illustrated in this chapter are extracted from Tang (2007). And those signs listed in Table 2 to 5 are supplemented with video clips included in this volume. We thank our deaf informants/models Kenny Chu and Pippen Wong for the photos and video clips.
6. In the following, the notation A|B is conventionally used to denote simultaneous co-occurrence of A and B.
7. Halle (1982:98-99) states that "consonantal occlusions are produced by three distinct active articulators: the lower lip, the front part of the tongue, and the tongue body. Since the position of each of these three articulators is independent of the other two, it should be possible to produce consonants with more than one occlusion."
8. In these tables, "+" denotes presence and "−" denotes absence of the [return] and [repeat] specifications. The signs presented in these tables were collected from a deaf informant by asking him to provide as many possible signs of each type as he could. Therefore, some of these signs have not been documented in Tang (2007) and are not included in Table 1.

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