

Harmony Triggering as a Segmental Property^{*}

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1. Introduction

Harmony is a process by which some property of a trigger segment spreads onto one or more undergoer segments. In some languages, any segment that bears a harmonizing property will trigger harmony, while in others some segments bearing that property will trigger harmony while others will not. This paper examines such cases in the nasal vowel-consonant harmony systems of several Malayo-Polynesian. Previous researchers have claimed that these languages have phonological inventories include both triggering and non-triggering nasal consonants.

I propose that the patterns of nasal harmony triggering in these languages are best analyzed by encoding a segment's status as a trigger of harmony within its subsegmental representation. This analysis is implemented within the Gestural Harmony Model (Smith 2016a, 2016b, 2017), in which the assumed unit of representation is a modified version of the dynamically-defined gesture of Articulatory Phonology (Browman & Goldstein 1986, 1989). Within this model, a phonological grammar may shape a language's inventory to include both harmony-triggering and non-triggering segments. The result is a new perspective on how a phonological grammar generates complex patterns of harmony triggering, as well as how such patterns arise through diachronic sound change.

The paper is organized as follows. Section 2 introduces the patterns of triggering of nasal harmony in the Malayo-Polynesian languages Acehnese and Rejang. Section 3 reviews how the triggering of harmony is represented in the Gestural Harmony Model and proposes an analysis of the harmony triggering patterns in both of these languages within that framework. Section 4 suggests possible historical reasons for such patterns of contrastive triggering to emerge. Section 5 concludes.

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2. Nasal Harmony in Acehnese and Rejang

Nasal harmony is common among the Malayo-Polynesian languages spoken in Indonesia and Malaysia. Several of these nasal harmony systems are described as exhibiting a contrast between triggering and non-triggering nasal consonants. For instance, in Acehnese, spoken in the Aceh region of Sumatra, some words exhibit nasal harmony triggered by a nasal consonant and affecting following vowels, glides, and glottals. However, other words containing nasal consonants do not exhibit harmony. Most interestingly, triggering and non-triggering nasal consonants differ in their distributions within a word.

When a nasal consonant occurs in a non-final syllable in Acehnese, it triggers progressive (rightward) harmony, as in (1). (All data are from Cowan (1981) and Durie (1985).)

- (1) a. [mãw̃ã] ‘rose’
 b. [mũh̃h̃ã] ‘expensive’
 c. [nãw̃õŋ] ‘soul’

When a nasal consonant occurs in a final syllable, there is a distinction between words in which the nasal consonant triggers harmony (2a-c) and words in which it does not (2e-f).

- (2) a. [mẽẽ] ‘fit, proper’ d. [miəb] ‘suck’
 b. [bunã] ‘true’ e. [tinaj] ‘to dwell’
 c. [glupũõŋ] ‘ear’ f. [mon] ‘dew’

Durie (1985) attributes this pattern to a distinction between plain nasals, which trigger the progressive nasal harmony that is common among Malayo-Polynesian languages, and so-called ‘funny’ nasals, which do not trigger harmony. In other words, Acehnese nasal consonants contrast in terms of whether or not they trigger nasal harmony.

Similarly, McGinn (1982) and Coady & McGinn (1982) propose a contrast in Rejang (another Sumatran language) between plain and ‘barred’ nasals, which differ in their ability or inability to trigger nasal harmony. As in Acehnese, nasals in non-final syllables always trigger harmony, while in final syllables nasals trigger harmony in some words and not in others, as in (3). The contrast in triggering ability may even result in minimal pairs, as in (3b) and (3e). As demonstrated by (3f), it is also possible for words to include both triggering and non-triggering nasal consonants.

- (3) a. [mĩõw̃ã] ‘coconut’ d. [tuŋew] ‘wait’
 b. [jamẽw̃] ‘party, meeting’ e. [jamew] ‘guava’
 c. [mõnõã?] ‘kill’ f. [mĩnae] ‘come here’

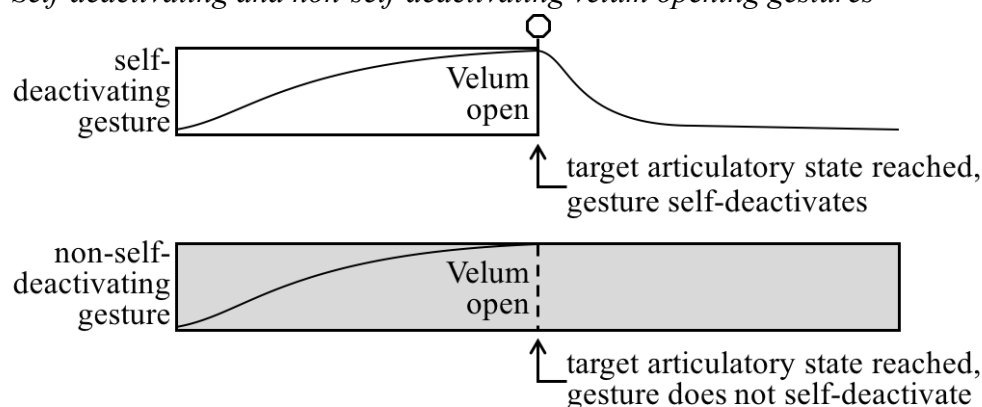
This paper analyzes these patterns of contrastive triggering in Acehnese and Rejang within the Gestural Harmony Model, following Smith (2017). The following section reviews how the triggering and undergoing of harmony are represented in this model before outlining how inventory shaping captures the harmony triggering patterns in these languages.

3. Contrastive Triggering in the Gestural Harmony Model

The units of representation assumed within the Gestural Harmony Model (Smith 2016a, 2016b, 2017) are an augmented form of the gestures defined within Articulatory Phonology (Browman & Goldstein 1986, 1989). These gestures are units of phonological representation that are specified for a goal articulatory state, such as ‘tongue tip closure’ or ‘velum opening.’ Each gesture is specified for several parameters that determine how that goal articulatory state is reached. The Gestural Harmony Model introduces an additional parameter specifying whether or not a gesture self-deactivates when its goal articulatory state is reached.

The effect of this parameter setting is illustrated in (4), which compares two velum opening gestures with different self-deactivation parameter settings. The top gesture is specified as self-deactivating, as indicated by the stop sign icon. When the gesture’s goal articulatory state, an open velum, is achieved, the gesture will automatically deactivate and the velum will return to its neutral, closed position. The bottom gesture, on the other hand, is specified as non-self-deactivating, rendering it a trigger of nasal harmony. As a result, it will remain active even after achieving its goal articulatory state, and will overlap any following gestures, the undergoers of harmony. (The horizontal length of each box indicates its duration, while the gradually climbing and falling lines within each box represent the timecourse of velum opening.)

(4) *Self-deactivating and non-self-deactivating velum opening gestures*

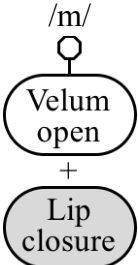
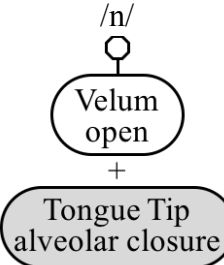
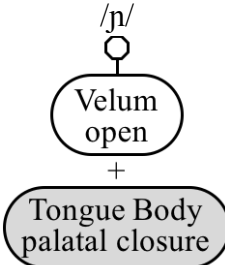
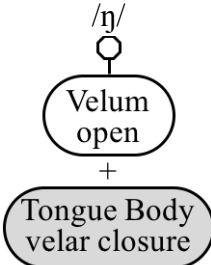
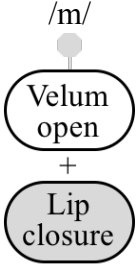
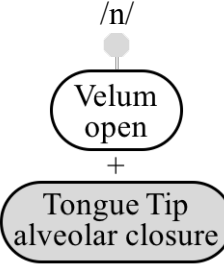
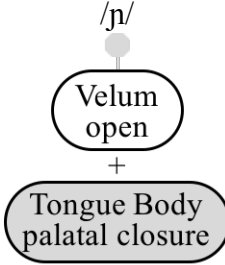
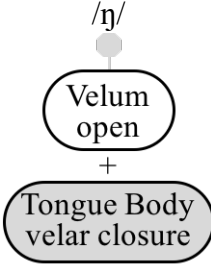


Smith (2017) proposes that harmony is not motivated by harmony-driving constraints, but rather is the result of a segment including a non-self-deactivating gesture as part of its subsegmental representation. Thus, the presence or absence of harmony in a language can be accounted for via the shaping of a language’s phonological inventory such that it contains either non-self-deactivating or self-deactivating gestures. More complex triggering patterns are the result of restrictions on the co-occurrence and distributions of self-deactivating and non-self-deactivating gestures. All of this is achieved via the interaction of markedness constraints that require gestures to be either self-deactivating or non-self-deactivating, and faithfulness constraints that require the preservation of a gesture’s underlying self-deactivation parameter. These constraints and their interactions are discussed in greater detail by Smith (2017).

Most crucially to the analysis of the nasal harmonies of Acehnese and Rejang, patterns in which segments appear to contrast in their ability or inability to trigger harmony occur when both non-self-deactivating and self-deactivating gestures are included in a language's phonological inventory. I propose, in keeping with previous work on both Acehnese and Rejang, that the triggering and non-triggering nasal consonant series in the phonological inventories of these languages are accompanied by two different types of velum opening gestures: non-self-deactivating and self-deactivating. Such an analysis is made possible by adopting the Gestural Harmony Model, in which a gesture's ability to trigger harmony is encoded by the setting of its self-deactivation parameter. For each pair of nasal consonants in the inventory of Rejang, for instance, one is specified as a non-trigger of nasal harmony, accompanied by a self-deactivating velum opening gesture; and one is specified as a trigger, accompanied by a non-self-deactivating velum opening gesture.

To illustrate, the inventory of nasal consonants in Rejang can be represented gesturally as in (5):

(5) *Rejang nasal consonant inventory*

Non-triggers	/m/	/n/	/ɲ/	/ŋ/
				
Triggers	/m/	/n/	/ɲ/	/ŋ/
				

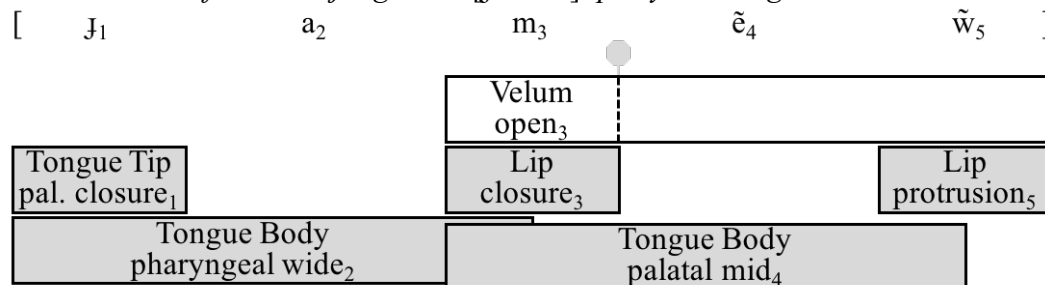
The nasal consonants in the Rejang inventory are represented in (5) as sets of concurrently active gestures, one specified for oral closure at some location along the vocal tract and one specified for opening of the velum. Crucial to the analysis of both Rejang and Acehnese in the Gestural Harmony Model is the fact that this inventory contains self-deactivating and non-self-deactivating velum opening gestures, which serves to divide the inventory into sets of triggers and non-triggers of nasal harmony. Whether a word exhibits nasal harmony is determined by which type of nasal consonant, and therefore which type of velum opening gesture, is included in that word.

This is illustrated for the Rejang words [jamẽw̃] ‘party, meeting’ and [jamew] ‘guava,’ which contrast only in the ability of the [m] to trigger nasal harmony. The figure in (6) depicts a gestural score for [jamẽw̃] ‘party, meeting,’ in which the [m] includes a non-self-deactivating velum opening gesture. This gesture remains active until the end of the word

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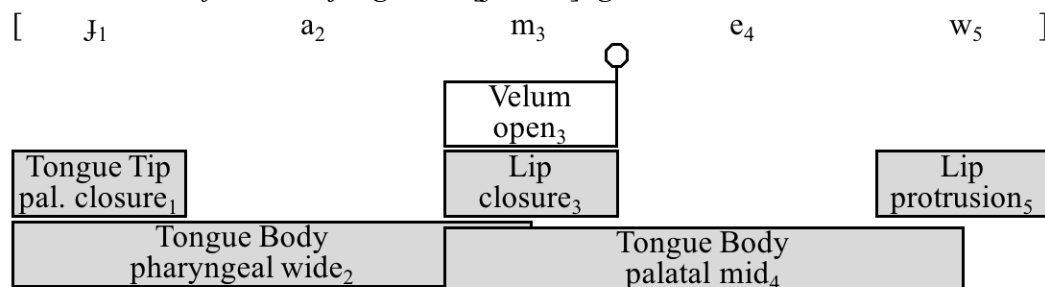
and overlaps all following gestures, resulting in their nasalization. (Subscripts for each segment in the transcription match the subscripts of its composite gesture or gestures.)

- (6) *Gestural score for the Rejang word [jamẽw̃] ‘party, meeting’*



In contrast, the gestural score for [jamew] ‘guava’ in (7) includes an [m] with a self-deactivating velum opening gesture. This gesture is active only during the production of [m], and deactivates once the velum has opened fully. As a result, the following gestures are not overlapped, and they surface as oral rather than nasal.

- (7) *Gestural score for the Rejang word [jamew] ‘guava’*



The Gestural Harmony Model’s distinction between self-deactivating and non-self-deactivating gestures successfully accounts for the patterns of contrastive triggering in Rejang, and can be extended to other languages that display similar harmony triggering patterns. However, this analysis must account for one more aspect of this harmony triggering pattern. The full inventory depicted in (5), which contrasts nasal consonants according to their ability to trigger harmony, only holds in the final syllables of words in both Rejang and Acehnese. Recall that in non-final syllables in both of these languages only non-self-deactivating, harmony-triggering velum opening gestures are permitted. The distributional distinction between self-deactivating and non-self-deactivating gestures can be understood as a case of contrast preservation in the privileged position of the stressed syllable, as both Acehnese and Rejang exhibit final stress according to Durie (1985) and McGinn (1982). This can be accounted for by an analysis that utilizes positional faithfulness constraints (Beckman 1997, 1998) that preserve a gesture’s self-deactivation parameter setting in a final syllable, and neutralize that parameter setting to non-self-deactivating elsewhere.

As pointed out by Smith (2017), the Gestural Harmony Model’s approach to the apparent contrastive nature of harmony triggering in Rejang, Acehnese, and other languages avoids several pathologies associated with the use of morpheme indexation

(Pater 2000, 2009) to harmony-driving constraints. Among these pathologies is the undesirable ability of an indexed affix to trigger harmony within a stem, a pattern that Finley (2010) claims is unattested. The representation of harmony-triggering ability as a property of a trigger segment also straightforwardly accounts for differences in distribution among the triggering and non-triggering nasal consonants in Acehnese and Rejang. Constraint indexation, on the other hand, is unable to account for such distributional differences, as it operates at the level of the morpheme rather than the segment. The morpheme-constraint indexation approach is also unable to account for forms such as the Rejang [mĩnae] ‘come here,’ which contains both triggering and non-triggering nasals.

4. Contrastive Triggering and Diachronic Change

Questions remain concerning how and why patterns of contrastive triggering arise within harmony systems. This section examines the possibility that contrastive triggering patterns arise as an intermediate step within a process of diachronic change in which a harmony system is either developing or eroding. By representing harmony as the result of a specified gestural parameter, the development or erosion of a harmony system, with an intermediate period exhibiting contrastive triggering, can be viewed as the result of gradual lexical diffusion (Wang 1969) of either self-deactivating or non-self-deactivating gestures.

While the current study focuses on contrastive triggering of nasal harmony in Acehnese and Rejang, similar triggering patterns have also been noted in other Malayo-Polynesian languages, including Bukar-Sadong, a Land Dayak language, and Iban, also known as Sea Dayak, by Scott (1957, 1964) and Court (1970). In these languages, the non-triggering nasal consonants have usually been described as either homorganic nasal-stop sequences or prenasalized stops. The inability of these nasal elements to trigger progressive nasal harmony can then be attributed to the fact that the obstruent portion blocks the spread of harmony, rather than a difference in the representation of a nasal consonant’s velum opening gesture. However, many sources that describe these nasal-stop sequences and prenasalized stops also note that they are usually produced in a way that is similar or identical to simple nasal consonants. Scott (1957) describes the production of voiced obstruents following nasals in Iban as ‘very gentle’ (p. 511). Taking this a step further, Court (1970) states that in many of Malayo-Polynesian languages the voiced stop portion of a homorganic nasal-stop sequence disappears entirely. Similarly, non-triggering nasal consonants in Acehnese are analyzed by Cowan (1981) as prenasalized stops that have fused into a simple nasal consonant.

While the synchronic status of non-triggering nasal consonants in these languages remains uncertain, they are almost certainly derived from prenasalized stops or nasal-stop clusters. McGinn (1982) and Coady & McGinn (1982) point to a number of cognate pairs between Rejang and Indonesian, a variety of Malay, to show that the ‘barred’ (non-triggering) nasal consonants of Rejang correspond to nasal-stop clusters in related languages. For instance, the word for ‘guava’ is [jamew] in Rejang, and [jambu] in Indonesian.

It appears, then, that the patterns of contrastive triggering of nasal harmony in Rejang, Acehnese, and other Malayo-Polynesian languages have their basis in diachronic sound change. In earlier forms of these languages, there may have been a single velum opening gesture that did not self-deactivate, resulting in nasal harmony in that language. However,

some nasal consonants that included this non-self-deactivating velum opening gesture were immediately followed by obstruents, which blocked the spread of nasality. In these forms, extended activation duration of the velum opening gesture never surfaced. Eventually, the obstruent portion of these nasal-stop sequences was lost, which may have led to the reanalysis of the short duration of velum opening gestures during these sequences as the result of self-deactivation. There would then have been two contrastive types of nasal consonants: one accompanied by a non-self-deactivating velum opening gesture, and one accompanied by a self-deactivating gesture.

Some languages may be on the verge of losing this contrast through an additional process of diachronic change, however. While most varieties of Rejang maintain the contrast between triggering and non-triggering nasal consonants, McGinn (1982) states that the Kebanagung variety of Rejang has lost this distinction. Instead, in this language nasal harmony is triggered by all nasal consonants, and minimal pairs such as [jamẽw̃] ‘party, meeting’ and [jamew] ‘guava’ are homophones, both surfacing as [jamẽw̃]. Contrastive triggering, then, appears to have been an intermediate step along the path toward the development of fully productive nasal harmony in Kebanagung Rejang. Instead of a phonological inventory containing both self-deactivating and non-self-deactivating velum opening gestures, Kebanagung Rejang can be analyzed as having an inventory containing only non-self-deactivating velum opening gestures.

A similar case can be made for the status of contrastive triggering of tongue root harmony in Classical Manchu as an intermediate step in the diachronic progression of a harmony system. In Classical Manchu, a Tungusic language spoken in Manchuria between the seventeenth and nineteenth centuries, some words exhibit within- and across-morpheme tongue root harmony while others do not (Zhang 1996). Smith (2017) analyzes this as the result of a contrast between self-deactivating and non-self-deactivating tongue root advancement gestures. Tongue root harmony was a robustly attested phenomenon in Classical Manchu, and according to Ard (1981) can be reconstructed in Proto-Tungus. However, according to Zhang (1996) and Li (1996), its descendant languages, Modern Manchu and Xibe, exhibit no productive vowel harmony patterns.

This change can be analyzed as the result of the gradual replacement of non-self-deactivating tongue root gestures by their self-deactivating counterparts. The phonological inventory of Proto-Tungus likely contained vowels that included non-self-deactivating tongue root advancement gestures, rendering them triggers of harmony. By the time period in which Classical Manchu was spoken, however, in some words these gestures had been replaced by self-deactivating tongue root advancement gestures. This gradual replacement of non-self-deactivating gestures by self-deactivating gestures appears to have continued throughout the development of Modern Manchu and Xibe, in which harmony now holds only among an extremely limited set of morphemes. Proto-Tungus, Classical Manchu, and Modern Manchu and Xibe represent three stages in the gradual spread of self-deactivating tongue root advancement gestures throughout the lexicon, a process known as lexical diffusion (Wang 1969). Eventually, this lexical diffusion of self-deactivating gestures led to the total replacement of non-self-deactivating gestures and the erosion of harmony.

Both Rejang nasal harmony and Classical Manchu tongue root harmony, then, represent intermediate steps of diachronic change of a harmony system. In the case of Rejang, the standard dialects represent an intermediate state in the development of fully productive nasal harmony, while has already developed in the Kebanagung dialect. In the

case of Classical Manchu, contrastive triggering occurred during a period of erosion of the language's tongue root harmony, which was likely productive within its ancestor language but is entirely absent from its descendants. Whether the status of contrastive harmony triggering as an intermediate step in the development or erosion of a harmony system suggests that contrastive triggering patterns are somehow unstable is left to future research.

5. Conclusion

The Gestural Harmony Model analyzes the contrastive triggering of nasal harmony in Acehnese and Rejang as the result of the presence of both self-deactivating and non-self-deactivating gestures in the phonological inventories of these languages. This model has a number of advantages, including the ability of the phonological grammar to reference gestures' self-deactivation parameters in order to determine not only the presence or absence of triggers and non-triggers of harmony, but also their distributions. At the same time, the Gestural Harmony Model avoids some of the pathological predictions made by analyses relying on grammatical mechanisms commonly reserved for patterns of phonological exceptionality.

The Gestural Harmony Model also makes it possible to model the development or erosion of a harmony system as the diffusion of non-self-deactivating and self-deactivating gestures throughout a language's lexicon. This establishes patterns of contrastive triggering as intermediate steps along the diachronic path toward or away from a language having a fully productive harmony system. This is in keeping with the patterns of diachronic change that have been proposed for Rejang and Classical Manchu, as well as their ancestor and descendant languages. The Gestural Harmony Model, then, provides a valuable new perspective on both diachronic and synchronic patterns of harmony triggering.

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