Reconsidering the variable status of glottals in nasal harmony*

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1 Introduction

Nasal Harmony is a phonological process where nasalization can spread from a triggering segment to all target segments within a given domain (Schourup 1972, Cohn 1993, Walker 1998).[1] Not all segments, however, are equally compatible with nasalization. In any given language, some segments are prohibited from surfacing with nasalization and function as blockers of Nasal Harmony. Which segments act as blockers differs across languages, although general regularity exists. In particular, it has been noted that the class of nasalizable segments falls along the continuum in (1), which is based on the phonetic compatibility of realizing a particular class of segments with a lowered velum (i.e. as [+nasal]) (Schourup 1972, Cohn 1993, Walker 1998/2003). Nasal stops have been omitted from the partial hierarchy in (1), though they are the most compatible with the feature [nasal]. Glottals (ʔ and h) have been temporarily omitted from this partial hierarchy since their location in the hierarchy is unclear and the subject of the current study.

(1) Nasal Compatibility Hierarchy (partial)
Vowels > Glides > Liquids > Fricatives > Oral Stops

High *Compatibility with Nasalization* *Low*

The advantages of having a Nasal Compatibility Hierarchy (NCH) like that in (1) are two-fold. First, the hierarchy provides a rank ordering of which segments are more or less compatible with the feature [nasal], based primarily on phonetic grounding, both perceptual and articulatory (Schourup 1972, Cohn 1993, Walker 1998). For example, lowering the velum during the articulation of a fricative makes it more difficult to maintain the necessary pressure to maintain frication. In any particular language, all segments to the left of a given location in the hierarchy will allow nasalization to spread through or across them, while all segments to the right will block the spread of nasalization. We will see later that not only does the phonetic viability of nasalization play a role in the organization

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[1] Oral stops generally do not behave as targets of nasalization, but are instead transparent. Both targets and transparent segments pattern together with respect to Nasal Harmony (Walker 2003).

of the Nasal Compatibility Hierarchy, but so too do phonological aspects of various segments.

The second benefit of having such a hierarchy is that it makes testable and falsifiable claims about possible languages. The rank ordering of segments along the hierarchy allows several predictions to be made. For example, if nasalization spreads through fricatives, then it also necessarily spreads through liquids, glides, and vowels. Implications such as these are easily verified or falsified by examining the set of languages with Nasal Harmony. Indeed, we will see that Walker (1998/2003) provides a factorial typology which validates the basic ordering given in (1).

Because the NCH gives rise to a universal ranking of nasal markedness constraints, Nasal Harmony can be elegantly modeled in Optimality Theory by combining this set of nasal markedness constraints (2a) with a spreading constraint (2b) (Walker 1998/2003). The nasal markedness constraints are constraints on feature cooccurrence based on their order in the NCH. The spreading constraint requires all segments within a particular domain to surface with the feature [nasal].

(2) a. Nasal Markedness Constraints
*NASSEGMENTCLASS (e.g. *NASOBSSTOP = *[+nas, -cont, -son])

b. SPREADNASAL (Spread([+nasal], D)) (adapted from Walker 1998)
Let n be a variable ranging over occurrences of the feature specification [+nasal], and S consist of the ordered set of segments $s_1 \ldots s_k$ in a domain D. Let Assoc(n, s_i) mean that n is associated to s_i, where $s_i \in S$.

The relative ordering of the spreading constraint within the fixed ranking of the nasal markedness constraints determines which segments, if any, are allowed to undergo harmony and which segments block harmony. Interleaving the spreading constraint throughout this hierarchy yields a factorial typology that accounts for the presence or absence of Nasal Harmony and is cross-linguistically valid. This set of possible systems, along with an example language, is provided in (3).

(3) Typology of Nasal Harmony Systems (Walker 1998/2003)

a. No Nasal Harmony (e.g. Spanish)
*NASOBSSTOP » *NASFRIC » *NASLIQ » *NASGLIDE » *NASV » **SPREADNAS**

b. NH spreads through vowels (e.g. Barasano)
*NASOBSSTOP » *NASFRIC » *NASLIQ » *NASGLIDE » **SPREADNAS** » *NASV

c. NH spreads through vocoids (e.g. Malay)
*NASOBSSTOP » *NASFRIC » *NASLIQ» **SPREADNAS** » *NASGLIDE » *NASV

d. NH spreads through sonorants (e.g. Ijo)
*NASOBSSTOP » *NASFRIC» **SPREADNAS** » *NASLIQ » *NASGLIDE » *NASV

e. NH spreads through fricatives and sonorants (e.g. Scottish Gaelic)
*NASOBSSTOP» **SPREADNAS** » *NASFRIC » *NASLIQ » *NASGLIDE » *NASV
f. No segments block NH (e.g. Tuyuca)
SPREADNAS »*NASOBSSTOP » *NASFRIC » *NASLIQ » *NASGLIDE » *NASV

Though the NCH appears to be highly regular and cross-linguistically valid, the location of glottals in the hierarchy has remained problematic. Section 2 will discuss previous attempts to locate glottals within the hierarchy, consider the implications of such analyses, and show that none of these previous attempts to locate glottals in the NCH have been successful. Section 3 will consider an alternative approach to the apparent problematic behavior of glottals by analyzing glides as the source of the variability in the hierarchy. Section 4 will consider a case study from Sundanese that provides evidence for the revised Nasal Compatibility Hierarchy.

2 Glottals and the Nasal Compatibility Hierarchy

2.1 The location of glottals

Though the NCH appears to be a well-behaved, universal, and a cross-linguistically sound ranking, glottals (h and ʔ) appear to defy the regularity that otherwise exists in the hierarchy. In an early look at the typology of Nasal Harmony, Schourup (1972) noted that in his sample of over ten languages, glottal segments appeared to be highly nasalizable, occurring between vowels and glides in the NCH. In other words, he found that if nasalization spreads through glides, then it necessarily spreads through glottal segments as well. His hierarchy of nasal compatibility is provided in (4).

(4) Vowels > h, ʔ > w, j > r, l > obstruents (Shourup 1972)

Looking at a number of additional languages, Cohn (1993) noted that the placement of glottals in the NCH was not always consistent with the hierarchy provided by Schourup. In particular, she argued that there were languages in which nasalization was allowed to spread through glides but was blocked by glottals. In order to account for these cases, Cohn posited two paths of nasalization. The main path follows the partial hierarchy given in (1), while a separate path controls nasalization of glottals. In this way, glottals are given a special status in the hierarchy, having their own separate, independent path of nasalization. Cohn argued that the special status of glottals is due to a structural difference between glottals and other segments. She argued that the feature [nasal] must attach to the supralaryngeal node, which is absent in glottal segments, thus explaining their special status.[2]

[2] Walker & Pullam (1999) argue that glottal segments can be both phonologically and phonetically nasal, directly contradicting the notion that glottals cannot be nasalized due to a lack of a supralaryngeal node. Lowering the velum, the articulatory manifestation of the feature [nasal] is

(5) vowels > { glottals (Cohn 1993)
w, j > r, l > obstruents

More recently, Walker (1998) compiled a database of over 75 languages with Nasal Harmony in order to generate a more complete typology and analysis of Nasal Harmony. Walker noted, as did Cohn, that glottals do not always appear to lie between vowels and glides on the NCH. Walker thus attributed a special status to glottal segments, arguing that they either pattern as highly nasalizable (appearing between vowels and glides in the hierarchy as in (6a)) or as relatively unnasalizable (patterning with the obstruents as in (6b)).

(6) a. Vowels > Glottals > Glides > Liquids > Fricatives > Oral Stops
b. Vowels > Glides > Liquids > Fricatives, h > Oral Stops, ʔ
(after Walker 1998)

The term "Variable Ranking Hypothesis" will be used here to refer to both Cohn's and Walker's analysis where glottal segments have a special status in Nasal Harmony, whether that be the result of a separate path for nasalization of glottals or a variable location of glottals in the hierarchy. The next section will discuss the predictions of the Variable Ranking Hypothesis and show that these predictions do not hold.

2.2 Predictions of the Variable Ranking Hypothesis

The majority of languages with Nasal Harmony follow the NCH of (4), where glottals are more compatible with nasalization than are glides. The existence of languages which do not follow the expected hierarchy in (4) created the necessity of attributing a special, variable status to glottal segments. While such a theory may account for the behavior of glottals, it also provides testable and verifiable implications. If we assume that glottal segments can pattern with the obstruents as required by the Variable Ranking Hypothesis, then several predictions are made. First, if glottals can pattern with obstruents, then there should be languages in which vowels and glides undergo nasalization, but in which liquids, obstruents, and glottals block the spread of Nasal Harmony. An examination of Walker (1998) reveals one language (Rejang) in which this prediction holds. Second, if glottals can pattern with obstruents, then there should be languages in which nasalization passes through vowels, glides, and liquids, but is blocked by obstruents and glottals. Of the 16 languages in Walker's database that allow spreading through liquids, none exhibit blocking by glottals. Third, if the Variable Ranking Hypothesis were correct, then there should be languages in

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possible in both h and ʔ. Furthermore, Walker & Pullam argue that phonologically nasalized glottals can exist, providing an example of underlying /h̃/ from Arabela.

which nasalization spreads through all sonorants and through fricatives, but is blocked by oral stops and glottal stop. Of the four languages that allow spreading through fricatives but not through oral stops, none exhibit blocking by glottal stop. Finally, if glottals exist on a completely independent path of nasalization, as hypothesized by Cohn (1993), then there should be languages in which all non-glottal segments allow nasalization to spread across them, but where glottals block nasalization. Of the 29 languages that allow spreading across all segments including obstruents, none exhibit blocking by glottals.[3] Of the four predictions made by the Variable Ranking Hypothesis, only the first was verified by the actual set of languages in Walker's database.[4] In other words, glottals only pattern variably in relation to glides on the NCH.

According to Walker (1998), eight languages (four of which are dialects of a single language) exhibit the ordering of constraints in (7). In these languages, Nasal Harmony passes through vowels and glottals, but is blocked by glides, liquids, and obstruents.

(7) …*NASLIQ » *NASGLIDE » SPREADNAS » *NASGLOTTAL » *NASVOWEL

A search of Walker's database also provides an example of a language which shows the reverse order of glides and glottals in the scale. The resulting ordering of the constraints is provided in (8).

(8) …*NASLIQ » *NASGLOTTAL » SPREADNAS » *NASGLIDE » *NASVOWEL

Allowing glottals a special status in nasal compatibility creates several testable hypotheses. Of the four predictions made by the Variable Ranking Hypothesis, only the first one holds. We found that glottal segments only exhibited a variable ranking in the hierarchy when they were compared with glides. No other segments exhibited compatibility reversals with glottals. The remaining predictions were falsified. The next section will examine a possible alternative analysis to the variable status of glottals in the NCH.

3 Glides and nasalization: An alternative analysis

Before proposing a revision to the NCH, we turn briefly to a discussion of glides. It has long been held that glides, or semi-vowels, are simply non-syllabic counterparts of vowels (e.g. Kaye & Lowenstamm 1984, Steriade 1984, Levin 1985, Rosenthall 1994, Harris & Kaisse 1999). This type of glide will be referred

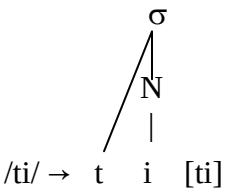
[3] Walker (1998) points out that in normal speech, Kaiwá allows spreading through all segments including obstruents and glottals. In slow speech, however, it appears that glottal stop can block nasalization.

[4] Although the argument here rests on the absence (i.e. possible typological gap) of languages which would validate the tenets of the Variable Ranking Hypothesis, the evidence is still promising.

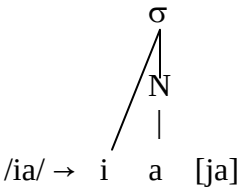
to as *non-phonemic* or *derived*. While it is true that glides are often the non-syllabic realization of vowels, it is also true that a second class of glides exists. This second type of glide is distinct from the first set and is not derived from underlying vowels (Levi 2004). This second set of glides will be referred to as *phonemic* or *underlying*. The main difference between these two sets of glides lies in their features. Whereas non-phonemic glides share their features with vowels, phonemic glides remain distinct (see Levi 2004 for several possible feature differences between phonemic glides and vowels/non-phonemic glides).

If an underlying vowel is the most sonorous segment in a particular domain, it will surface as syllabic, as in (9a). If, on the other hand, a more sonorous segment exists, and if the parameters of the language allow it, an underlying vowel can be parsed in a syllable peripheral position. In this situation, the underlying vowel will surface phonetically as a glide, as in (9b). Though the surface realization of /i/ is different in (9a) and (9b), featurally these two segments are identical (Levi 2004).

(9) a. Underlying Vowel → Surface Vowel



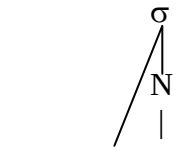
b. Underlying Vowel → Surface Glide



Underlying or phonemic glides, on the other hand, exist as underlying segments, distinct from underlying vowels. Though the phonetic outputs of (9b) and (10) are both combinations of a glide followed by a vowel, the phonological difference between them remains.[5] The glide plus vowel sequence resulting from /ia/ is featurally distinct from that derived from /ja/.

[5] Levi (2004) provides several examples where the phonological difference between phonemic and non-phonemic glides remains on the surface and is relevant to other phonological processes in the language (e.g. labial glides in Karuk).

(10) a. Underlying Glide → Surface Glide



In the previous section we saw that the only variability in the NCH concerned the ordering of glottals and glides in the hierarchy. Instead of targeting glottals as the source of the instability in the hierarchy, let us consider instead that the glides are the heart of the variability. Because two types of glides exist, it is not unreasonable to assume that they reside in different locations in the NCH. In fact, since the hierarchy (and corresponding markedness constraints) are based on feature cooccurrence, the two glides must necessarily lie in different locations in the hierarchy since they are featurally distinct. A revised NCH is proposed in (11) in which these two types of glides occupy different locations in the NCH. The derived or non-phonemic glides, being nonsyllabic parses of underlying vowels and featurally identical to them, exhibit the highest tolerance for nasalization along with vowels. Underlying glides, while still highly compatible with nasalization, lie to the right of glottals on the revised NCH. The only difference between the revised NCH and that outlined by Shourup is the addition of non-phonemic glides in the hierarchy.

(11) Revised Nasal Compatibility Hierarchy

Vs, Non-phonemic Gls > Glottals > Phonemic Gls > Liqs > Frics > Oral Stops

High *Compatibility with Nasalization* *Low*

With this revision to the NCH, there is no longer a need to attribute any special status to glottal segments. It is important to notice that the new hierarchy in (11) does not simply shift the variability from glottal segments to glides. Independent evidence from several phonological processes (e.g. vowel harmony, consonant harmony, reverse sonority clusters, and epenthesis) in a diverse set of languages confirms the existence of these two types of glides (Levi 2004). Given that these two types of glides are derived from two different sources and remain featurally distinct, it is reasonable to expect them to pattern differently with respect to Nasal Harmony. Indeed, since the nasal markedness constraints are restrictions on feature cooccurrence and since the non-phonemic glides and vowels are featurally identical, this *revision* or *addition* to the NCH and the corresponding markedness constraints is not really a revision, but more of a clarification. Since non-phonemic glides are featurally identical to vowels, and since compatibility of nasalization is based on feature cooccurrence, non-phonemic glides must pattern with vowels in terms of nasalizability.

Because the glottals are sandwiched between two kinds of glides in the revised NCH, we expect to find cases in which vowels and glides are targets of nasalization but in which glottals block spreading (as in (8)), as well as cases in which the reverse holds (as in (7)). In the former case, the glides that undergo nasalization must be non-phonemic, while in the latter they must be phonemic. This prediction is in fact borne out by the languages in Walker's database. Furthermore, the revised NCH does not make any false predictions about the behavior of glottals with respect to other segments in the hierarchy, as did the Variable Ranking Hypothesis. The next section will provide data from a language with both types of glides and show that they pattern differently with respect to nasalization.

4 Sundanese: Evidence for the Revised Nasal Compatibility Hierarchy

Sundanese is an Austronesian language of Indonesia spoken in West Java. Sundanese is relevant for the current discussion because both phonemic and non-phonemic glides exist in the language and behave differently with regard to Nasal Harmony. Nasal Harmony in Sundanese spreads left-to-right from a nasal stop and is blocked by supralaryngeal consonants and phonemic glides. Nasalization spreads through vowels, non-phonemic glides, and glottals. The fact that the two glides in Sundanese behave differently provides evidence for their separate locations in the NCH. The data in (12a-c) show that nasalization spreads through vowels, non-phonemic glides, and glottals.[6] The data in (12d-g) show that nasalization is blocked by oral stops, fricatives, liquids, and phonemic glides.

(12)	a. /ɲiar/	[ɲĩjãr]	'seek (active)' (Cohn 1990)
	b. /mi-asih/	[mĩʔãsih]	'love (active)'
	/nuus/	[nũʔũs]	'dry (active)'
	c. /mahal/	[mãɦãl]	'expensive'
	/mihak/	[mĩɦãk]	'take sides (active)'
	d. /ŋatur/	[ŋãtur]	'arrange (active)'
	e. /ŋisər/	[ŋĩsər]	'displace (active)'
	f. /ŋaluhuran/	[ŋãluhuran]	'be in a high position (active)'
	/ŋarahɨtan/	[ŋãrahɨtan]	'wound (active)'
	g. /ŋawih/	[ŋãwih]	'sing (active)'
	/mawur/	[mãwur]	'spread (active)'
	/ŋajak/	[ŋãjak]	'sift (active)'

[6] Glottal stop in Sundanese is not phonemic, though it patterns with /h/ as nasalizable.

The difference between phonemic and non-phonemic glides is evident in (13). The non-phonemic glides in (13a) allow nasalization to pass through them, whereas the phonemic glides in (13b) do not. In order to account for their different behavior, Cohn (1990) was forced to assume that the glides in (13a) do not have any phonological status in the language, and therefore cannot block the spread of Nasal Harmony, a phonological process. Cohn based her arguments on two phonetic aspects of the non-phonemic glides. First, the weakening of formants during the phonemic glides is greater than during the non-phonemic glides. Second, the duration of VGV sequences is longer when the glide is phonemic than when it is non-phonemic. Unfortunately, these acoustic observations were made with only a small number of tokens and no statistics were performed on the data, so it is unclear how reliable and robust these observations are. Because Cohn was restricted to a single type of phonological glide, the only explanation for the different behavior of the two types of glides in Sundanese was to assume that the non-phonemic glides did not have a phonological status in the language. The fact that the non-phonemic glides are inserted as transitional glides does not preclude their having a phonological status in the language.

(13) a. Non-phonemic Glides

[ɲĩjãr]	'seek (active)'
[ɲãw̃ũr]	'say (active)'
[ɲãj̃ĩjãn]	'wet (active)'

b. Phonemic Glides

[ŋĩwat]	'elope'
[mãwur]	'spread'
[ŋãjak]	'sift (active)'

It is certainly not the case that transitional, non-phonemic glides cannot have phonological status, as Cohn (1993) herself points out. Transitional, non-phonemic glides in Madurese (another Austronesian language) clearly function in the phonology. Their phonological status is evident by examining the relationship between glide insertion, Nasal Harmony, and reduplication. In Madurese reduplication, the final syllable of the root is copied and surfaces as a prefix on the root (Stevens 1985, Cohn 1993). As shown in (14), the transitional glides undergo Nasal Harmony and also surface in the reduplicated forms, in a location where they are no longer transitional. Since reduplication is sensitive to both glide insertion and Nasal Harmony, Cohn (1993) concluded that they must both be part of the lexical phonology. Thus, the inserted glides have a phonological status in the language.

(14) Madurese Reduplication (Stevens 1985, Cohn 1993)

/mɔa/	mɔ̃w̃ã	'face'	w̃ã-mɔ̃w̃ã	'faces'
/nɛat/	nɛ̃j̃ãt	'intention'	j̃ãt-nɛ̃j̃ãt	'intentions'

In Sundanese, it is not necessary to assume that the non-phonemic glides are not relevant to the phonology of the language.[7] The behavior of the two kinds of glides in Sundanese can be easily accounted for with the revised NCH. That phonemic glides function as blockers in Nasal Harmony and that non-phonemic glides act as targets of harmony results directly from the location of these two types of segments on the NCH. The constraint ranking of Nasal Harmony in Sundanese is given in

(15) Constraint Ranking for Sundanese

*NASSTP » *NASFRC » *NASLQ » *NASGL » SPRDNAS » *NASGLTTL » *NASV/DERGL

Spreading nasalization through the transitional, non-phonemic glides creates a low ranking violation and is therefore allowed, as illustrated in tableau (16). Since *NASALVOWEL/DERIVEDGLIDE is ranked below SPREADNASAL, candidate (16d) emerges as the winner.

(16) /ɲaur/ → [ɲãw̃ũr] 'say (active)' (transitional, non-phonemic glide)

		*NAS STOP	*NAS FRIC	*NAS LQ	*NAS GL	SPRD NAS	*NAS GLTTL	*NASV/ DER.GL
	a. ɲawur					**!**		
	b. ɲãwur					**!*		*
	c. ɲãw̃ur					**!		**
☞	d. ɲãw̃ũr					*		***
	e. ɲãw̃ũ̃r			*!				

Alternatively, spreading through underlying, phonemic glides does not occur because the spreading constraint is ranked below the markedness constraint banning nasalization of phonemic glides. Thus, in this case, candidate (17b) emerges as the winner.

[7] Hume (1995) implicitly assumes that both types of glides are phonologically relevant in Sundanese.

(17) /mawur/ → [mãwur] 'spread' (underlying, phonemic glide)

	*NAS STOP	*NAS FRIC	*NAS LQ	*NAS GL	SPRD NAS	*NAS GLTTL	*NASV/ DER.GL
a. mawur					****!		
☞ b. mãwur					***		*
c. mãw̃ur				*!	**		*
d. mãw̃ũr				*!	*		**
e. mãw̃ũr̃			*!				

The fact that glottals do not block Nasal Harmony in Sundanese is also easily accounted for with revised NCH. Because both *NASGLOTTAL and *NASVOWEL/DERIVEDGLIDE are ranked below SPREADNAS, the behavior of glottals and non-phonemic glides is analogous. That is, nasalization is allowed to spread across both classes of segments. An example of nasalization across a glottal is provided in (18).

(18) /mahal/ → [mãɦ̃ãl] 'expensive'

	*NAS STOP	*NAS FRIC	*NAS LQ	*NAS GL	SPRD NAS	*NAS GLTTL	*NASV/ DER.GL
a. mahal					**!**		
b. mãhal					**!*		*
c. mãɦal					**!	*	*
☞ d. mãɦ̃ãl					*	*	**
e. mãɦ̃ãl̃			*!				

The data in Sundanese illustrate that the two kinds of glides can behave differently with respect to Nasal Harmony. The derived, non-phonemic glides pattern with vowels in being highly nasalizable. This is not surprising, given that these kinds of glides are derived from vowels and have identical feature representations (Levi 2004). The phonemic glides, on the other hand, are featurally distinct from vowels and therefore are free to occupy a different location in the nasalizability hierarchy. These two types of glides occur on either side of glottals in the NCH, which explains the apparent special status of glottals. Once both types of glides are admitted into the NCH, the special status of glottal segments disappears, being replaced by a more detailed, finely divided scale of nasalizability.

It is important to point out here that creating this revised NCH and its corresponding revision to the universally ranked nasal markedness constraints does not require any reference to the source of the surface glide. The nasal markedness constraints remain constraints on the surface cooccurrence of

features. Since both surface vowels and surface non-phonemic glides share the same features, both types of segments will incur the same violations if they are nasalized. Because phonemic glides are featurally distinct from vowels, a different markedness constraint is violated. The difference in the violations of the two glides is due to their different features on the surface and does not require any knowledge of the sources of the two glides.

5 Conclusion

The Nasal Compatibility Hierarchy as originally outlined by Shourup (1972) was unable to explain the apparent instability and variability of glottal segments in the hierarchy. As a result, a special status was attributed to glottal segments, either as lying on a separate path of nasalization (Cohn 1993), or varying cross-linguistically between two locations in the hierarchy (Walker 1998). The analysis provided here rejects the notion that glottals are typologically special and argues instead that they are completely regular. Two types of evidence were forwarded in support of this claim.

First, the predictions of the Variable Ranking Hypothesis, which was based on glottals having a special status, are not compatible with the actual set of languages discussed in Walker (1998). In no language did glottal segments pattern with obstruents with regard to nasalization. Instead glottals always act as highly nasalizable. Second, glottals only appear to have a variable ranking in relation to glides. Since two types of glides exist cross-linguistically (Levi 2004), they can occur in the hierarchy in different locations. The non-phonemic glides, being derived from vowels and featurally identical to them, occupy the highest place on the NCH, whereas the phonemic glides occur lower in the hierarchy and are less compatible with nasalization. Glottals are sandwiched between these two types of glides. By including both types of glides in the hierarchy, the apparent variability of glottals is explained. In some languages, glottals are more compatible with nasalization than glides (when the glides are phonemic), while in others they are less so (when the glides are non-phonemic). This apparent reversal in the order of glides and glottals on the NCH is thus explained by admitting two types of glides into the ranking. Furthermore, the revised NCH is consistent with the languages that exist and does not make any false predictions about possible languages, as was the case with the Variable Ranking Hypothesis.

It is important to note that the revision to the NCH does not simply shift the problem of "variability" from the glottals to the glides. Independent evidence for the existence of two types of glides is found from a variety of phonological processes in a diverse set of languages. It is therefore reasonable to assume that both types of glides should be admitted into the NCH and that the non-phonemic glides should pattern with vowels. Furthermore, the predictions of the revised NCH match the actual data found cross-linguistically.

The different location of these two types of glides on the NCH shows that though the scale is grounded in phonetics (both articulatory and perceptual), the phonological representation of these segments also plays a role. Since there is no a priori reason to believe that phonemic and non-phonemic glides are inherently phonetically different, their different behavior in Nasal Harmony must be attributed to their different phonological status.[8]

Based on the existence of two kinds of glides, phonemic and non-phonemic, we have argued that there is no need to attribute a special status to glottal segments in the Nasal Compatibility Hierarchy. Instead, the apparent variability of glottals in the hierarchy is due to two types of glides which are located at two different locations in the NCH, sandwiching the glottals between them. As a result, the NCH can be seen as a regular and stable hierarchy. Whether glides undergo nasalization is determined both by their phonological status in the language and by where a language places the division between nasalizable and non-nasalizable segments. Whether glottals, and all other segments, undergo nasalization is only determined by where a language places the division between nasalizable and non-nasalizable segments.

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[8] Cohn (1990/1993) did argue for a phonetic distinction between the two types of glides in Sundanese, though the number of measurements taken was small and no statistics were calculated. It remains to be determined whether a robust and stable phonetic difference exists between these two types of glides cross-linguistically.

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