NODAL FAITHFULNESS IN HARMONIC SERIALISM*

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1. Introduction

Harmonic Serialism (HS) is a variant of the Optimality Theory (OT) model of phonology which has emerged in recent years (McCarthy 2010a, 2016, and references therein). Instead of being strictly parallel, HS introduces recursive derivational steps whereby an underlying form is slowly made more harmonic. This derivational system causes HS to make different typological predictions relative to parallel OT, and much remains to be done as the HS system is fine-tuned and fully built. One such lacking area is the interaction of HS with feature geometry (Blevins 1994; McCarthy 1988, 2008, 2016, 2018; Padgett 2002). The hierarchical structuring of segmental features implies that certain features are more closely associated than others. This causes a problem which is relatively unique to HS: limited feature changes. Since HS is limited to a single change per step, which restores feature geometry to a role of importance Some research on this topic does exist, but only in a limited fashion: the interaction of OT models in general and feature geometry seems to focus primarily on assimilation and segmental harmony rather than tree-internal changes.

The key question is the number of features which can be changed in a single step. Using data from Chilean Spanish, this paper will argue that changes in a fully-specified representation must be made to a single feature node. Changing one feature at a time is too limiting, and can prevent attested alternations. However, allowing a segment to change all at once seems too free. Furthermore, what research exists that touches on this interaction implies some sort of limit: McCarthy (2008, 2018) argues that HS deletion is a two-step process, involving first the deletion of the PLACE node, and then deletion of the ROOT. This implies some limit to how much of the geometry GEN can affect at each step.

In Chilean Spanish, there is a process of coda stop gliding, argued to be motivated by minimum sonority requirements for mora licensing drive feature changes. This paper proposes that in Chilean Spanish, coda gliding is driven by the *SEGMENTMORA constraint family, which bans obstruents from bearing morae. For stops, the ranking of *OBSTRUENTMORA >> IDENT[ROOT NODE], a faithfulness constraint which protects the ROOT node features as a unit, causes lenition through voiced obstruents directly to glides, skipping over liquids and nasals. This analysis is termed the “Nodal Faithfulness Model” (NF) in which feature changes are limited to the features of one node.

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2. Theoretical assumptions

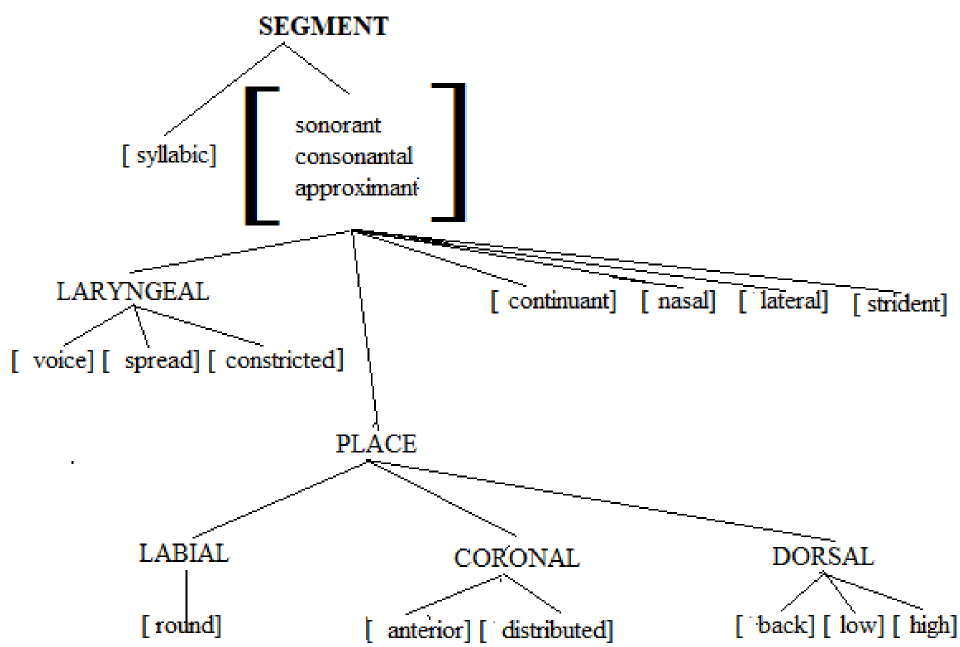
2.1 Harmonic Serialism

Harmonic Serialism (McCarthy 2010a, 2016) is a derivational variant of OT. While OT evaluation occurs in parallel, HS occurs in steps. Governed by a feature known as Gradualness, HS candidates are only allowed to be one ‘change’ away from their input (McCarthy 2016:1). Only one change, often considered to be a single faithfulness violation, can be made at each step in an HS derivation (McCarthy 2016:13-15). As in OT, the candidate which violates the least high-ranked constraints is selected by EVAL and ‘wins’ (McCarthy 2016:2) However, whereas in OT the derivation ends as soon as the winner is selected, in HS the winner is fed back into the derivation as the input of a new step. This loop repeats indefinitely until the winning candidate is entirely identical to the input at that step. This is called ‘convergence,’ and the convergent candidate becomes the output.

2.2 Feature Theory

Feature geometry is the theory that segmental features are internally grouped, rather than simply constituting a mass of unstructured values (Hall 2007:313, Hayes 1989). For this paper, a feature [syllabic] is assumed, which acts as the differentiator between glides and vowels (Clements and Hume 1995). It represents a segment being a syllable nucleus. Little information is available on this feature, especially as regards its position in the tree. Thus, it has been positioned as dominated by the segment itself, apart from the ROOT node, to represent its status as something different than the other features.

(1) Sample Feature Tree (Hall 2007)



Each of these features accounts for a different contrast found in human speech. They are organized under their nodes in accordance with patterns of feature assimilation. Much research on feature geometry has been focused on feature transference, that is, which features assimilate alongside each other (Chin and Dinnsen 1991:329-332; Padgett, 2002:81-82). However, less attention seems paid to the matter of how these trees change in an HS environment. Thus, this paper intends to help fill the gap. Based on the idea that some features transfer between segments as a unit, that is, the node, this paper assumes that in HS, one step involves changes to one node. All features within that node can be changed in one step. However, any feature in a different node must be modified in a separate step.

If a node is deleted, then all its constituent nodes and features are automatically deleted. Thus, the PLACE node can be deleted in a single step, without having to dissolve it feature-by-feature, and without having to individually target any specified PLACE nodes such as CORONAL. However, based on McCarthy (2008, 2018), it seems that there is a limit to how many levels can be deleted at once. Since reduction to a glottal segment seems to always happen before full deletion in HS, it must be no more than one node can be deleted in one step, with the PLACE node always targeted first. Exactly how this restriction on node deletion works and why it is so is beyond the scope of this present study. For now, it is sufficient to note that such limitations exist.[1]

As regards constraints, since this system implies that since multiple features in a node can be changed in a single step, there should be constraints which protect nodes as a whole, without reference to how many changes were made. That is, there should be some set of constraints like IDENT[ROOT NODE], which is defined as being violated if any number of changes are made to the features in the ROOT node.

McCarthy (2008, 2018) argues that in HS, deletion is a two-step process: first the PLACE node is deleted, and then in a separate, subsequent step the remainder of the segment is deleted. In McCarthy (2008, 2018), this is argued to fall out from the definition of Gradualness: since only one unfaithful operation can be performed in a single step, there cannot be a deletion of both the PLACE features and the ROOT of the segment simultaneously. They are assumed to constitute separate operations.

All human speech segments exist on what is called the 'sonority scale' (Gussenhoven and Jacobs 1998). This paper assumes that in some languages, voicing matters more than [+/- continuant] when determining the hierarchy (Parker 2002:55, 226). That is, a voiced stop will be more sonorous than a voiceless fricative. Therefore, languages seem to vary in the ranking of *VOICELESSFRICATIVEMORA and *VOICEDSTOPMORA. At this present time, this analysis has little to say on why this variability exists.

Based on Hayes (1989) and Zec (1995), this paper assumes Moraic Theory. As per Zec (1995), not all moraic codas are created equally. Some languages will only permit segments of a minimum sonority to bear morae. If a language allows a lower-sonority

[1] There are several possible explanations for this limitation. It could be that the deletion process is only able to handle a limited amount of information at any given time, and therefore it simply cannot process the deletion of two nodes at once. It could also be that what seems to be a unified deletion process may in fact be several similar but distinct processes. On this assumption, nodal and segmental deletion may be separate processes. However, further research is needed to fully explain this pattern.

segment to bear a mora, then it will allow higher-sonority segments to do so. However, allowing a higher-sonority segment to bear morae does not necessitate that less sonorous segments will have the same license.

2.2.1 PLACE-Shifting in Nodal Faithfulness

A concern in the derivation below is the ability to shift around the specific place of a segment in a derivation, such as from alveolar to palatal. While such shifts are far from rare (Cummings, Madden, and Hefta 2017, Gow 2002, Friedrich, Eulitz, and Lahiri 2006). that is not grounds in itself to ignore the problem. Rather, a phonological model concerned with feature changes must have an account of how such shifts can occur. For the purpose of NF, there are two possible solutions. The first is the Specified PLACE Exception (SPE), in which the features of the Specific PLACE node of a segment (CORONAL, LABIAL, or DORSAL) can change their values "for free" at each step. This allows CORONAL segments to shift around within their domain, allowing for such derivations as /z/→[j] without intermediate palatalization or rhotacization.

While procedurally advantageous, this solution has two distinct problems. The first is that it predicts specific PLACE mutability for all three PLACEs, which does not seem to match the empirical evidence (*Ibid*): rather, only CORONAL seems to show this mutability. The second is that the SPE is a largely *ad hoc* element in NF, with no real evidence to support it beyond theoretical necessity. Both of these problems are solved in the second possible solution,[2] which is to underspecify the features of the CORONAL node. With the exception of the CORONAL nasals, /n/~/ɲ/, there are no place-contrasts among the CORONAL segments of Chilean Spanish. It is thus possible to assume that the specific place-features of that node are not underlyingly specified. The PLACE features are thus not present during the derivation, and consequently do not need to have their values changed at any step. This solution is much more palatable than the SPE, though it comes with a new set of predictions and implications which are further discussed in Section 6.2.

2.3 Gradualness

Following from McCarthy (2008, 2018), this paper assumes that deletion is a multi-step process, minimally taking two steps but potentially taking longer under the right conditions. One path to deletion, following McCarthy, would see the PLACE node deleted, reducing the segment to a glottal segment like [h ʔ]. Then the resulting glottal segment can be fully deleted. The potential for PLACE-deletion is available at every step, and must be continually blocked by some constraint, generally MAX. This is directly relevant for the Chilean Spanish analysis, and indirectly relevant for the assumptions about feature changing. The fact that a node such as PLACE can be deleted as a unit, rather than each

[2] This second solution was brought to my attention by several individuals at CLA 2020, to whom I am deeply indebted.

constituent feature needing to be deleted individually, implies that changes can occur to nodes as units, rather than necessarily changing one feature at a time.

This paper also assumes that the epenthesis or deletion of a mora occurs in a single step, governed by faithfulness constraints (Elfner 2006, Morén 1999): the only candidates to be considered are the mora-bearing candidate and the non-moraic candidate (McCarthy 2007, McCarthy 2016). Thus, changes to the moraic structure in a candidate would violate those faithfulness constraints which target morae, and are thus unfaithful operations.

2.3.1 Nodal Faithfulness Model

Thus far in this section, the paper has focused on establishing a great body of assumption on a variety of topics. In each subsection, more details have been added to a growing proposal for the analysis. This proposal has been called herein the 'Nodal Faithfulness Model' of feature geometry-HS interaction. Following from the assumptions outlined in subsection 2.2, in this model, any number of features may be changed in a single step, so long as they are immediately grouped under the same feature node. These features are referred to as the 'constituent features' of that node. For example, [high, back, low] are the constituent features of the DORSAL node. For the purpose of this model, some terminological distinctions are necessary. A segment has two nodes which can be described as 'place:' the 'bare' PLACE node, which is dominated by the ROOT node, and the 'specified' PLACE node, which represents the actual place of articulation for the segment, being LABIAL, CORONAL, or DORSAL. The bare PLACE node will often be referred to simply as the PLACE node, and it is this node which is deleted in general PLACE-deletion.

3. Data

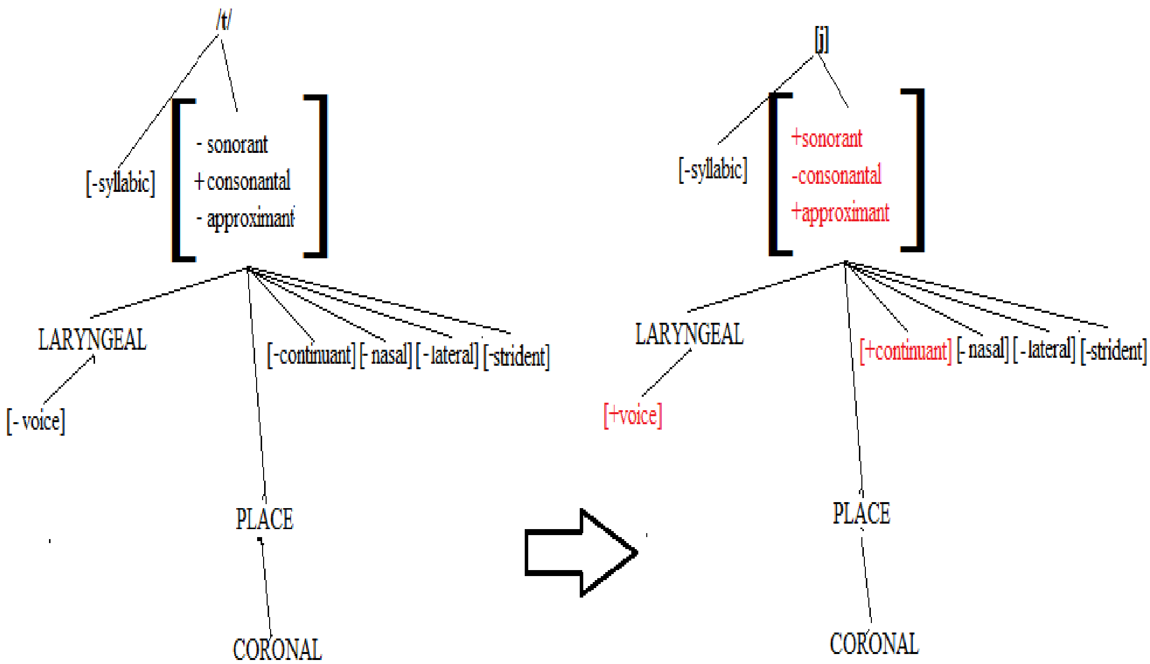
The specific data this paper makes use of is drawn from Pineros (2001), each of which discussed a different aspect of the phenomena under discussion.

(1) Stop Gliding (Pineros 2001)

a) /ad̲kirir/ → [aj̲.kirir] "to acquire"
b) /et̲niko/ → [ej̲.niko] "ethnic"

This data shows a clear pattern of coda stop gliding in Chilean Spanish. This lenition occurs for both voiced and voiceless stops. The general pattern is that coronal stops lenite to the coronal glide [j]. A sample UR-SR mapping, describing /t/→[j] can be seen in the following feature trees, with changes indicated in red:

(2) /t/→[j] derivation



Also important is the shifting of specific PLACE features for the coronal stops. The stops in Castilian Spanish[3] /t d/ are traditionally described as dentalized [t̪ d̪], that is, [+anterior, +distributed] (Sadowsky and Salamanca 2012). The shift to [j] thus requires a changing of the specific PLACE features, with [anterior] valuing as negative. However, if the CORONAL node is assumed to be underspecified, then these features are not present in the derivation, and do not require their values to be changed.

4. Constraints

This includes constraints such as WEIGHT-BY-POSITION (WBP), which requires codas to bear morae. It also includes the *SEGMENTMORA constraint family (Zec 1995), which ranks *OBSTRUENTMORA>> *SONORANTMORA. These are both constraint "families" with fixed internal rankings. They represent the sonority scale's interaction with mora licensing, and thus are largely consistent across all languages. Furthermore, they are always ranked *OBSTRUENTMORA>>*SONORANTMORA, since all sonorant segments are more sonorous than any obstruent segment. *OBSTRUENTMORA has some cross-linguistic variation. Depending on the language in question, *VOICELESSFRICATIVEMORA may outrank *VOICEDSTOPMORA, while in others *VOICEDSTOPMORA>> *VOICELESS

[3] Without a clear reason to assume otherwise, this analysis will assume that Chilean Spanish stops are equally dentalized. This study was unable to uncover any clear information regarding potential phonetic differences between Castilian and Chilean Spanish coronal stops.

FRICATIVEMORA. This depends on whether the language in question finds [continuant] or [voice] to matter more for determining sonority. Note also that vowels do not participate in this scale. Since in most languages vowels come with underlying mora, and are recognized as the most sonorous of all segments, there is no clear reason to ever ban moraic vowels. Thus, a [-consonantal, +syllabic] segment vacuously satisfies both *OBSTRUENTMORA and *SONORANTMORA.

(1) WEIGHT-BY-POSITION (Hayes 1989): assign a violation mark for every coda which does not have a mora attached.
(2) *OBSTRUENTMORA: assign a violation mark for every obstruent segment which bears a mora.
  a. *VOICELESSSTOPMORA>>*VOICELESSFRICATIVEMORA>>*VOICEDSTOPMORA>>*VOICEDFRICATIVEMORA
(3) *SONORANTMORA: assign a violation mark for every sonorant segment which bears a mora.
  b. *NASALMORA>>*LIQUIDMORA>>*GLIDEMORA

The faithfulness constraints required are organized below. Unlike markedness constraints, which have a great diversity of formulations and motivations, faithfulness constraints are largely grouped into three types: DEP, IDENT, and MAX. DEP constraints represent bans against the addition or epenthesis of new segments or features in a candidate, but is unconcerned with changes to the value of those features. IDENT disfavours changes to the features of existing segments, while ignoring the addition or deletion of features or segments. Lastly, MAX protects against deletion.

This analysis makes use of one DEP constraint.

(4) DEP[mora]: do not add a mora to a segment.

The most diverse set of faithfulness constraints in this analysis are the IDENT constraints. Two kinds of IDENT constraints are used here: featural IDENT, and nodal IDENT. Featural IDENT constraints refer to specific feature values. In contrast, nodal IDENT constraints refer to the configuration of feature values in a node. Nodal IDENT constraints are violated once by any number of feature changes inside of a single node.

In contrast to the notation of the *SEGMENTMORA constraints, the IDENT[NODE] constraints are distinct from the IDENT constraints for their constituent features. IDENT[NODE] constraints, such as IDENT[ROOT NODE] and IDENT[CORONAL NODE] are derived from the assumption that multiple features can be changed in a single step as long as they are grouped under a single node. If this is a possible step, then it stands to reason that languages could have phonological preferences regarding the integrity of those nodes as units, in addition to constraints protecting the individual features. This allows these changes to occur simultaneously, without needing to change each feature individually.

(5) IDENT[voice]: assign a violation mark for every output segment which does not match the [voice] feature of its input correspondent.

(6) IDENT[continuant]: assign a violation mark for every output segment which does not match the [continuant] feature of its input correspondent.

(7) IDENT[ROOT NODE]: assign a violation mark for every output segment which does not match the ROOT node features [sonorant, approximant, consonantal] of its input correspondent.

(8) IDENT[CORONAL NODE]: assign a violation mark for every output segment which does not match the CORONAL node features [anterior, distributed] of its input correspondent.

5. Analysis

In coda position, Chilean Spanish /t d/→[j]. This paper proposes that this phenomenon results from a minimum sonority requirement for mora-bearing segments: only [+sonorant] segments may licitly bear morae. Note that the derivations in this subsection will focus on underlyingly unvoiced segments. This is for comprehensiveness' sake: the voiced equivalent undergoes the same procedure, omitting only the voicing step itself. The initial step of this present derivation is simple: mora insertion.

Table 1. Step 1: Mora insertion

etniko	WBP	*VoicelessStopMORA	DEP[mora]
a. → et.ni.ko | μ		*	*
b. et.ni.ko	*!		

The derivation is presented with the choice to either insert a mora or not.[4] DEP[mora] disfavours the addition of any mora not present in the input, while *OBSTRUENTMORA disfavours the addition of morae to any obstruent. However, WBP demands that codas bear a mora. Candidate (a) violates DEP[mora] and *OBSTRUENTMORA in order to obey WBP. Candidate (b) violates WBP to satisfy *OBSTRUENTMORA and DEP[mora]. Since WBP is ranked higher, candidate (a) wins, and the output of Step 1 is fed into the next step.

The addition of the mora now places the input under the purview of the *OBSTRUENTMORA, and must contend with that constraint family's internal structure.

Table 2. Step 2: Voicing

et.ni.ko | μ [-voice] [-continuant]	*VOICELESS STOP MORA	*VOICELESS FRICATIVE MORA	*VOICED STOP MORA	IDENT [voice]	IDENT [continuant]

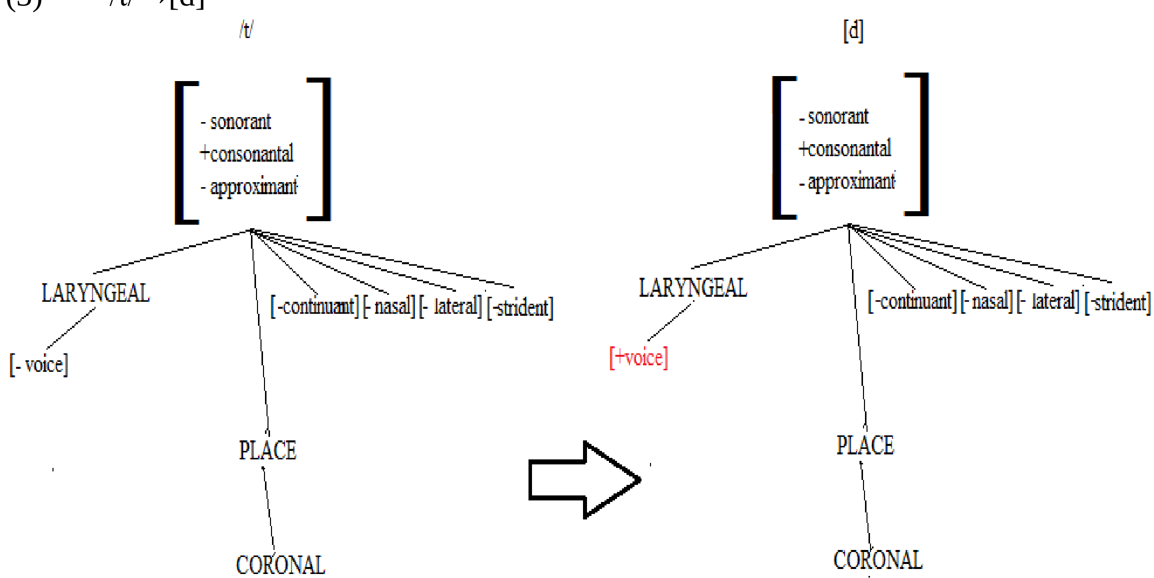
[4] Features changes are possible at this step, but this analysis assumes that WBP is undominated, and thus mora insertion is expected to be the first step in practice.

a. →ed.ni.ko | μ [+voice]			*	*	
b. et.ni.ko | μ [-voice]	*!				
c. es.ni.ko | μ [+continuant]		*!			*

Candidate (b) attempts to remain identical, violating *VOICELESSSTOPMORA to satisfy IDENT[voice], and IDENT[continuant]. Candidate (c) violates IDENT[continuant] to satisfy *VOICELESSSTOPMORA, though in doing so it also violates *VOICELESSFRICATIVEMORA. Candidate (a) violates IDENT[voice] and *VOICEDSTOPMORA by voicing to [d], allowing it to satisfy *VOICELESSSTOPMORA.

The faithful candidate (b) is eliminated by markedness considerations: moraic voiceless stops are the most marked of the sonority curve, and without a high-ranked faithfulness constraint to protect it a change must be made. Thus, the choice comes down to either frication, as fricatives are more sonorous than stops, or voicing, since a voiced segment is more sonorous than a voiceless one. In this situation voiced stops seem to be more sonorous than voiceless fricatives. Since it is one step to either [s] or [d], and [d] is the more sonorous choice, candidate (a) wins (Parker 2002:55, 226). This derivation can be seen in tree form below, in (3). Features which have changed value are marked in red.

(3) /t/→[d]



Note that there was no option for lenition directly from [t] to [z], even though both [s d] were offered as options. This is because while [s d] are each only one step away from [t], their changes are focused on different feature nodes. The feature [continuant] is dominated directly by the ROOT node, while [voice] is part of the LARYNGEAL node. Thus, both of these features cannot be changed at the same time. Only one of the two nodes under consideration can be altered. Thus, [z] was not a licit option at this step.

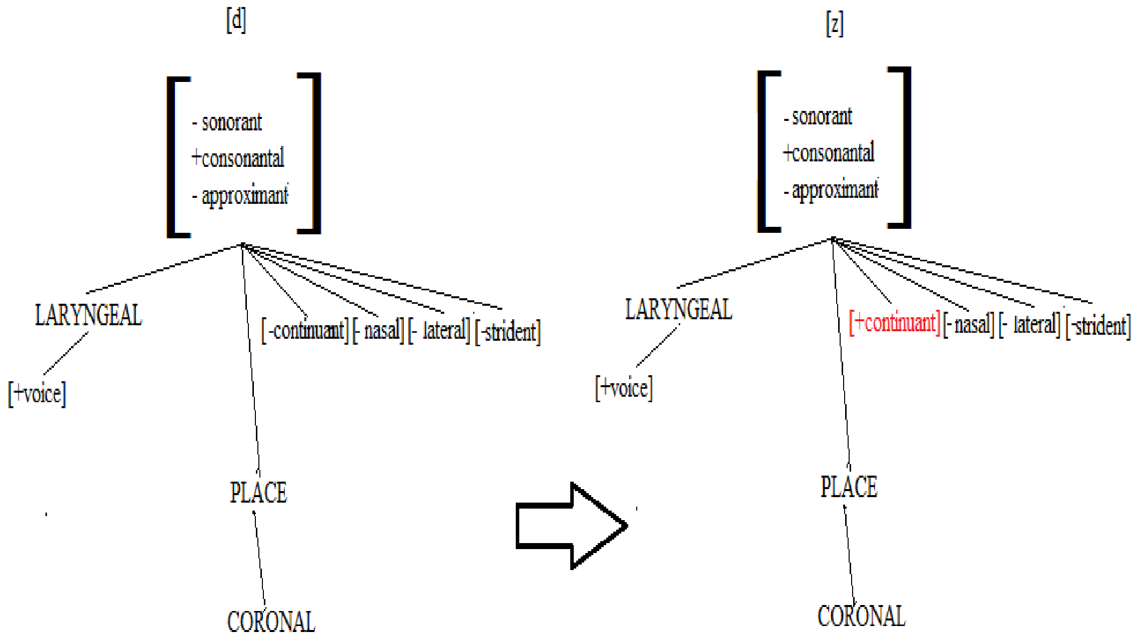
In Step 3, however, [z] finally comes under consideration.

Table 3. Step 3: Frication

ed.ni.ko | μ [+voice] [-continuant]	*VOICED STOP MORA	*VOICED FRICATIVE MORA	IDENT [continuant]	*z
a. ed.ni.ko | μ [+voice] [-continuant]	*!			
b. → ez.ni.ko | μ [+voice] [+continuant]		*	*	*

The choice here is whether to converge or to lenite further. Candidate (a) is faithful, satisfying IDENT[continuant] and avoiding the markedness violation on *VOICEDFRICATIVEMORA. However, in doing so it violates *VOICEDSTOPMORA, which is the highest-ranked of the three constraints. In contrast, candidate (b) obeys *VOICEDSTOPMORA by changing to [+continuant], though this in turn violates the lower-ranked *VOICEDFRICATIVEMORA and IDENT[continuant]. Thus, the ranking clearly favours candidate (b).

(4) [d] →[z]



The frication of the input leads the derivation to its next, most crucial step. The proper derivation of this step will require some explanation, as well as a new assumption not yet used in this derivation. Important to note is that this derivation must, if done properly, converge on the output [j]. In terms of fully specified representations, this involves a shift from a dental place to a palatal place.

As discussed in 2.2.1, there are two possible solutions to PLACE-shifting under the Nodal Faithfulness Model: the Specified PLACE Exception, or Underspecification. The latter of these solutions is better grounded, a discussed above, and thus it will be applied at this step. If the CORONAL node is underspecified, then the following step is possible.

Table 4. Step 4: Gliding

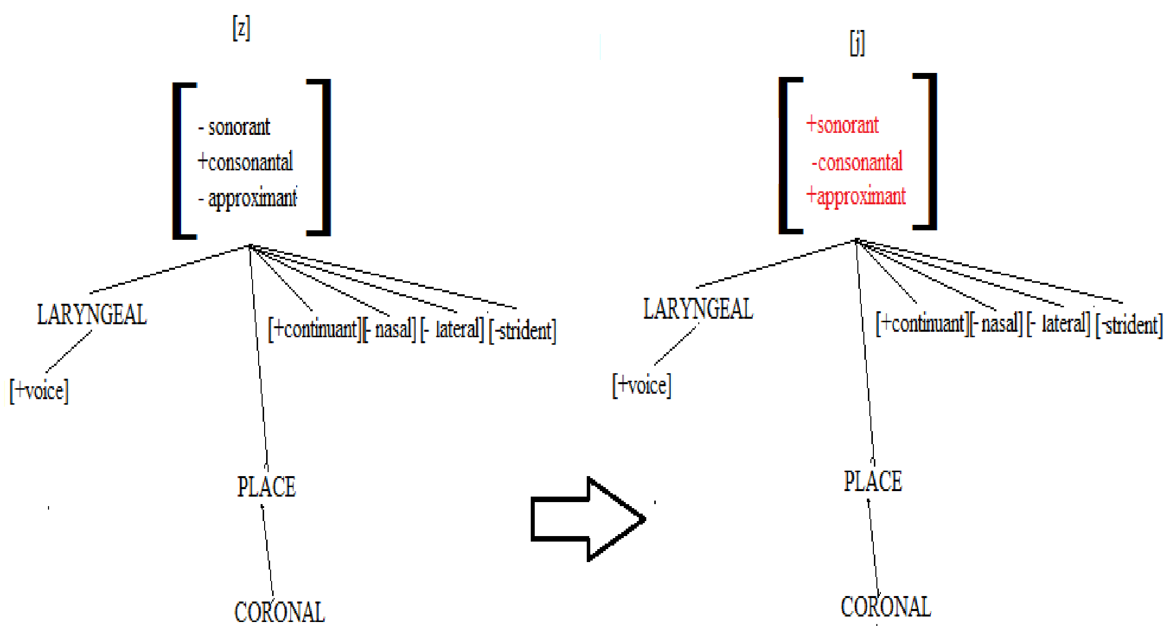
ez.ni.ko | μ [+voice] [+continuant]	*VOICED FRICATIVE MORA	IDENT [ROOT NODE]	*LIQUID MORA	*GLIDE MORA
a. ez.ni.ko | μ [+voice] [+continuant]	*!			
b. er.ni.ko		*	*!	

| μ [+voice] [+continuant] [+approximant]				
c. →ej.ni.ko | μ [+voice] [+continuant] [+approximant]		*		*

Candidate (a) is fully faithful, satisfying IDENT[ROOT NODE] while violating *VOICEDFRICATIVEMORA. Candidates (b) and (c) both violate IDENT[ROOT NODE] to satisfy *VOICEDFRICATIVEMORA. IDENT[ROOT NODE] is equally violated by both (b) and (c), and thus the greater number of feature changes in (c) does not cause it to fail. This causes a tie, allowing moraic sonority principles to take effect. Thus, candidate (d) wins due to *GLIDEMORA ranking below *LIQUIDMORA.

The feature changes can be seen in (6), below.

(5) [z]→[j]



This brings the derivation to its final step, convergence.

Table 5. Step 5: Convergence

ej.ni.ko | μ [+voice] [+continuant] [-anterior, +distributed] [+approximant] [-syllabic]	IDENT[Syllabic]	*GLIDE MORA
a. →ej.ni.ko | μ [+voice] [+continuant] [-anterior, +distributed] [+approximant] [-syllabic]		*
b. e.i.ni.ko | [+syllabic]	*!	

At this step the derivation can either converge or continue on to fully vocalize. Vowels, after all, naturally bear morae and thus would be exempt from minimum sonority concerns. Thus, from a markedness perspective, they would be the most favoured mora-bearers. This is borne out in the tableau through the absence of any markedness constraint disfavouring it. What candidate (b) does violate, however, is the relevant faithfulness constraints. As mentioned in subsection 3.3, this paper does not make claims regarding of the position of the feature [syllabic], save that it does not seem to be in the same place as the ROOT node features [consonantal, sonorant, approximant]. Thus, IDENT[syllabic] is used to represent the faithfulness restriction against, among other things, glides becoming vowels. IDENT[syllabic] ranks above *GLIDEMORA, indicating that it is better to avoid changing a segment's syllabicity than for a glide to be moraic.[5] Thus, candidate (b) is eliminated and the faithful candidate, (a) wins. Thus the derivation reaches convergence.

[5] Note that several other constraints might also prevent full vocalization just as effectively as IDENT[syllabic]. ONSET bans onsetless syllables, which a new vowel would naturally form. Similarly, VOWELHIATUS, which disfavours adjacent vowels, would be violated by the resulting V.V sequence. Further research would be required to determine which of these constraints is actually preventing vocalization in Chilean Spanish. For this present analysis, however, IDENT[syllabic] functions adequately, and will continue to be used.

6. Discussion and future research

6.1 Discussion

This analysis also introduced the idea of nodal faithfulness constraints, that is, faithfulness constraints which target a node generally rather than any specific feature within. These constraints are necessary for this model to function. They are not, as might initially seem, interchangeable with IDENT constraints for those features. IDENT[ROOT NODE] is not simply the sum of IDENT[sonorant], IDENT[approximant], and IDENT[consonantal]. Those constraints exist independently in CON, and are ranked relative to IDENT[ROOT NODE]. Nodal faithfulness constraints represent a logical corollary to nodal feature changes. If it is possible to change multiple features at once within a node, it is logical that languages might have restrictions against those wholesale changes, in addition to any preferences regarding changes to the individual features.

For example, IDENT[ROOTNODE] is equally violated by changing [approximant, sonorant] as by the changing of [approximant, sonorant, consonantal]. This is what allows [z] to lenite directly to [j], while /r/ can remain *in situ*. However, a language could have the ranking IDENT[consonantal]>> IDENT[ROOT NODE]. In this case, while IDENT[ROOT NODE] would be equally violated by [z]→[r] and [z]→[j], IDENT[consonantal] would be violated only by [z]→[j]. Such a language would lenite to [r] rather than [j].

Unrelated to the above, but nonetheless interesting, NF predicts that, since [nasal] is not in the same node as [sonorant], nasalization of stops must first add [+nasal], becoming a nasalized stop, and then become [+sonorant] to become fully nasalized. This specifically concerns instances where the segment nasalizes independently of any harmonizing force; in the case of nasal assimilation, the harmonizing segment simply connects to the [nasal] feature of the other nasal segment. Further research on languages with prenasalized stops would be required to test this prediction.

6.2 Future research

This analysis predicts that in HS, the ranking of IDENT[ROOT NODE] is key to the output of sonority-driven lenition. If a language ranks IDENT[ROOT NODE]>> *OBSTRUENTMORA, then obstruent lenition will not go further than a voiced fricative, as any further change would require changes to the ROOT node. Furthermore, if IDENT[ROOT NODE]>>*SONORANTMORA, liquids and nasals will not lenite to glides. However, if *SONORANTMORA>>IDENT[ROOT NODE], then all coda segments will lenite to glides. These predictions assume that individual IDENT features are ranked below IDENT[ROOT NODE] and *OBSTRUENTMORA>>*SONORANTMORA. A high-ranking IDENT[nasal], for example, would prevent nasals from leniting to glides. Given this, the predictions of NF should be tested against a typology of coda lenition processes.

An open question left by this analysis is how the current system would interact with complex codas. The analysis in Section 5 relies on there being only one segment under consideration in the coda. How the *OBSTRUENTMORA and *SONORANTMORA constraints would interact with complex codas remains undetermined.

Another open question, and one arguably more pressing, is the matter of Underspecification. The assumption of a partially underspecified representation was introduced in order to solve the problem of PLACE-shifting in a derivation, and has thus far been limited to the CORONAL node. However, there is as yet no principled reason to assume that only the CORONAL node would be underspecified. Thus, it is reasonable to consider how far Underspecification could go in the Nodal Faithfulness Model. Answers to this question are beyond the scope of this present paper, but deserve consideration in a future study. At present, it seems reasonable to assume that even in a Harmonic Serialism framework, underlying representations are not fully specified in the lexicon.

7. Conclusion

The interaction of feature geometry and HS is an under-discussed field. Little research exists to shed light on how the gradual changes of HS interact with the hierarchical organization of features. This paper has proposed the Nodal Faithfulness Model as a solution. In the beginning of this paper, it was asserted that changing a single feature at a time was too limiting a solution, while allowing the total change of one segment into a featurally unrelated one was too broad. The analysis of Chilean Spanish has been used to show that instead changes must be at the level of the feature node.

This analysis has shown that when dealing with feature geometry in HS, one node and the details of the PLACE node can be changed in a single step. Any number of features, as long as they are in the same node, can have their features changed.

This interaction of feature geometry and HS was shown to rely on the concept of nodal faithfulness: constraints such as IDENT[ROOT NODE] which protected the features in or dominated by their specified nodes as a unit. This allowed changes such as having Chilean Spanish [z] glide directly to [j] without passing through intervening [r], since it was an equal violation of IDENT[ROOT NODE] for both candidates. These nodal faithfulness constraints allow for the kind of limited but flexible feature changes that HS requires to be able to derive attested outputs.

The Nodal Faithfulness Model is a method of structuring and limiting potential candidates. It strives to incorporation feature geometry into HS. Strict limits are placed on the potential ‘next steps’ from each segment, which predicts paths for segmental changes. By limiting a single step to one node, NF disallows large ‘jumps’ between segments, requiring instead that the changes to each node be harmonically improving. Incorporating Underspecification theories into this model solves certain problems such as PLACE-shifting in derivations. This model thus has implications in terms of segmental processes beyond lenition, with potential consequences for language typology.

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