# Chapter 5

## OTHER PROPOSALS

In this chapter I consider other proposals for the analysis of segmental transparency. The first of the alternative analyses is one calling on the gapped configuration. I argue that this alternative is weaker than the sympathy-based analysis proposed in the preceding chapters, because the sympathy-based approach obviates the need for transparency-specific gapped representations and brings segmental transparency into the larger realm of derivational opacity, a widespread phonological phenomenon with independent need for explanation. In addition, a gapping account offers no explanation for the asymmetry in blocking versus transparent outcomes for segments. In contrast, with the evaluation metric for opacity effects in grammar (discussed in 3.6), the sympathy-based account correctly predicts that blocking will be a less ‘marked’ outcome than segmental transparency for segments that are (gradiently) incompatible with nasalization. The second alternative I consider is the important representationally-driven account of nasal harmony proposed by Piggott (1992), where two different types of nasal harmony are posited. I argue that the fundamental advantage of the analysis of segmental transparency as an opacity effect proposed in the previous chapter is that it obtains a unified typology calling on only one basic type of nasal harmony. In addition, the unified analysis eliminates the need for any ad hoc representational assumptions. Finally, obviation of the gapped representation in the sympathy-based account offers an argument against further alternatives producing effects similar to gapping, such as violable feature expression or embedding of feature domains, which require parochial constraints to obtain segmental transparency.

### 5.1 A gapping alternative

I begin by considering an alternative calling on a violable NOGAP constraint, as in (1). This constraint prohibits linkage of a feature specification across an intervening segment. Because it is posited as violable in the alternative, which I will call the ‘gapping approach’, feature linkage may skip segments when compelled by a higher-ranked constraint.

(1) NOGAP
*   α β γ   where α, β, and γ are any segment
\ /
[F]

In nasal spreading contexts, NOGAP conflicts with the nasalized segment constraints. If NOGAP is dominated by a nasalized segment constraint, two outcomes are possible, either skipping of the segment for which nasalization is banned or blocking by this segment. The blocking outcome comes about if NOGAP dominates SPREAD[+nasal], as shown in (2) with a hypothetical form. Constraints against nasalized obstruents are collapsed here, as are constraints against nasalized sonorants. The bracketing in candidate (c) indicates that the [+nasal] linkage gaps across the [t]. Candidate (d) shows gapping across [t] and [l]. Here candidate (a), which respects both *NASOBS and NOGAP, wins over its competitors in (b-d), which fare better on spreading.

(2) Blocking: NOGAP >> SPREAD[+nasal]

| ãtala | *NASOBS | NOGAP | SPREAD[+nasal] | *NASSON |
|---|---|---|---|---|
| ☞ a. [ã]tala | | | **** | * |
| b. [ãt̃ãl̃ã] | *! | | | **** |
| c. [ã[t]ãl̃ã] | | *! | * | **** |
| d. [ã[t]ã[l]ã] | | *!* | ** | *** |

The tableau in (3) shows the skipping outcome. Here the reverse ranking of NOGAP and SPREAD[+nasal] holds. Once again, *NASOBS is respected in the winning candidate. Since SPREAD now dominates NOGAP, the winner, in (c), is the one which spreads [+nasal] to all of the segments except the obstruent. Note that candidate (c) incurs only one spreading violation. This is because in this form there is a single [+nasal] feature specification linked to all of the segments except [t], which is skipped. The candidate with blocking in (a) loses on SPREAD. We may observe that candidate (d), with skipping of both [t] and [l], loses by virtue of an extra spreading violation. In the optimal output, any segments whose nasalization constraints are dominated by SPREAD[+nasal] will undergo nasal spreading.

(3) Skipping: SPREAD[+nasal] >> NOGAP

| ãtala | *NASOBS | SPREAD[+nasal] | NOGAP | *NASSON |
|---|---|---|---|---|
| a. [ã]tala | | **!** | | * |
| b. [ãt̃ãl̃ã] | *! | | | **** |
| ☞ c. [ã[t]ãl̃ã] | | * | * | **** |
| d. [ã[t]ã[l]ã] | | **! | ** | *** |

The constraints and ranking shown in (3) illustrate the alternative gapping approach to segmental transparency. Like the analysis proposed in chapter 3, segmental transparency is driven by nasalized segment markedness constraints (the analysis of transparency proposed by Kiparsky 1981 provides foundation for this approach, see also Archangeli and Pulleyblank 1994; Pulleyblank 1996). Where they differ is in the mechanism which obtains segment ‘skipping’ itself. In the gapping approach, this is achieved with a violable NOGAP constraint. However, the function of this constraint is specific to segmental transparency, it does no other work in the theory. In this respect, the gapping approach fails to offer an explanation for segmental transparency: under this account, transparency is a parochial phenomenon unconnected to other phonological events. On the other hand, by analyzing segmental transparency as the outcome of an opaque constraint interaction, the sympathy-based account brings transparency into the wider domain of opacity effects, a robust general kind of phenomenon in the phonology of languages. In addition, since the sympathy-based account makes use of independently-motivated mechanisms to obtain opacity effects and need not call on the gapped configuration, it fares better on theoretical economy than does the gapping approach.

A second drawback of the gapping approach concerns explanation of the cross-linguistic asymmetry in blocking versus transparent segments. Since the gapping approach obtains transparency through a rankable constraint, we expect that transparency of any portion of the nasalization hierarchy could be well-attested. The tableau in (4) illustrates a ranking in which all consonants behave transparent and vowels undergo nasalization.

(4) Skipping of all consonants

| ãtala | *NASOBS | *NASAPPROX | SPREAD[+nasal] | NOGAP | *NASVOWEL |
|---|---|---|---|---|---|
| a. [ã]tala | | | ***!* | | * |
| b. [ãt̃ãl̃ã] | *! | * | | | *** |
| c. [ã[t]ãl̃ã] | | *! | * | * | *** |
| ☞ d. [ã[t]ã[l]ã] | | | ** | ** | *** |

In the tableau in (4), constraints banning nasalized approximant consonants (collapsed here) move up to dominate NOGAP. This produces transparency of both [t] and [l] in the optimal output, an outcome which was not found in the cross-linguistic survey of nasal harmony. To limit transparent outcomes to obstruents alone, the gapping approach would require the fixed ranking in (5), which stipulates that NOGAP must always dominate *NASLIQUID (and by implication all lower-ranked nasalization constraints). NOGAP could thus only be dominated by constraints against nasalized obstruents, limiting transparency to this set of segments.

(5) NOGAP >> *NASLIQUID

The problem with this account of the limited set of segments that may behave transparent is that it does not offer any explanation for this limitation. The restriction of transparency to obstruents is simply a stipulation. Under the sympathy-based approach, this issue is handled by the evaluation metric for opacity effects (see section 3.6). By this evaluative measure, the cross-linguistic asymmetry between sets of blocking and transparent segments is explained by transparency as an opacity effect presenting a more difficult learning task. The posited increase in learning difficulty as more segments are added to the transparent set (by shifting more of the nasalization constraint hierarchy to P1) also contributes to the understanding of the limitation of transparency to obstruents. The sympathy-based account thus connects the asymmetry in sets of transparent and blocking segments to differences in the kind of mechanisms producing these outcomes. The gapping approach obtains both outcomes from straightforward constraint ranking, and thus must stipulate differences in the robustness of the effects. One could imagine embellishing the theory with a claim that the more segments that are gapped, the harder the language is to learn, but this would amount to a separate learning claim unrelated to anything else.

## 5.2 The variable dependency hypothesis

In his important cross-linguistic study of nasal harmony, Piggott (1992) makes an interesting proposal: there is not one but *two* types of nasal harmony in the languages of the world. The two types of nasal harmony patterns he posits have the following different properties. In the *blocking* pattern (Piggott's 'Type A') segments are divided exhaustively into sets of targets or blockers; there are no transparent segments. The blocking segments are a subset of the consonants which includes the obstruent stops, with hierarchical variation in the set of targets according to the implicational hierarchy outlined in chapter 2.[1] On the other hand, in the *transparency* pattern (Piggott's 'Type B'), all segments are divided into sets of targets or transparent segments — no segments block spreading. Transparent segments are obstruents and the remaining segments are targets; voiced stops may belong to the latter set.

Piggott's proposal that there are two different kinds of nasal harmony is driven by his theoretical grounding. Piggott assumes a representationally-driven, feature-geometric approach, and he adopts standard assumptions concerning segmental transparency and locality in this framework. Reasoning within this analytical model, he is led to the conclusion that there cannot be just one basic type of nasal harmony and he suggests a very interesting innovation: the two patterns arise from variable dependency across languages for the feature [nasal] in the feature geometry. The approach is sketched below. First (6) illustrates the segment structure Piggott (1992: 53) posits for nasal spreading in a language with transparency harmony, i.e. one in which all voiced segments are targets and voiceless obstruents are transparent. The account follows the standard feature-geometric assumption that locality is relativized to tiers, so that spreading must be between target nodes that are adjacent on their tier. This allows for segmental transparency if a segment is not specified for the target node in its structure. In transparency harmony, obstruents are transparent, so they must not contain the target node of spreading. Piggott suggests that in these languages [nasal] is a dependent of a 'Spontaneous Voicing' (SV) node, which is present in all sonorant segments and absent in obstruents. Spreading of [nasal] between SV nodes thus yields an outcome in which all sonorants are targetted and all obstruents are skipped. (6) shows this for Piggott's analysis of Southern Barasano (Tucanoan; Colombia). ('R' represents a root node.)

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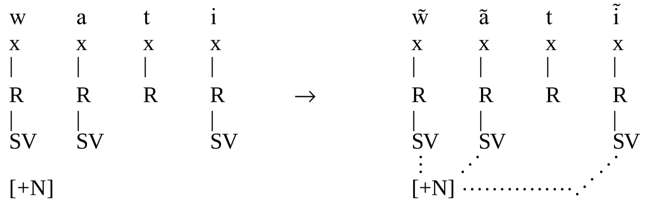
[1] Piggott (1992) obtains the effect of hierarchical variation in the set of targets from the 'Contrastive Nasality Principle' that he proposes. See Walker (1995) for empirical and theoretical arguments preferring a nasalized segment constraint hierarchy over the Contrastive Nasality approach.

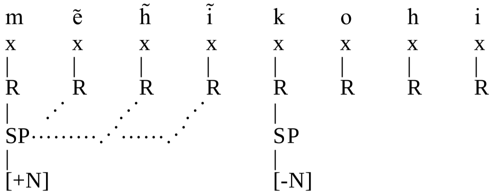
(6) Transparency in Spontaneous Voicing (SV) node spreading



In the majority of languages with the transparency kind of nasal harmony, voiced stops undergo nasal harmony. Since [nasal] can occur only in the representation of sonorants in these languages, Piggott proposes that voiced stops undergoing nasal harmony belong to the set of sonorants (see also Rice 1993). Piggott observes that in languages like Southern Barasano there is no phonemic contrast between voiced and nasal stops, and he posits the voiced stops as representing a series of sonorant stops in the inventory with context-dependent nasal or oral realizations.

In the case of the blocking type of nasal harmony, rather than behaving transparent, obstruents always belong to the set of blocking segments. This is not obtained by a structure for obstruent stops like that in (6), because there stops lack the target node and are thus expected to be skipped in spreading. For the blocking outcome, Piggott calls on the standard autosegmental assumption that line crossing is prohibited (Goldsmith 1976), and so blocking comes about when a segment is already specified for the kind of structure that is spreading. Piggott proposes that segment structure in the blocking kind of nasal harmony differs from transparency harmony in having [nasal] as a dependent of a Soft Palate (SP) node (after Sagey 1986), which is specified underlyingly in (some) consonants. Piggott analyzes blocking harmony as spreading of the Soft Palate node from root node to root node, so only segments underlyingly unspecified for a Soft Palate node will be targets and all other segments will block spreading. This is shown in (7) (From Piggott 1992: 38 on Warao, a language of Venezuela).

(7) Opacity in Soft Palate (SP) node spreading



Variability in the set of blockers is analyzed as variability in the set of segments which are specified underlyingly for the Soft Palate node (governed by Piggott's Contrastive Nasality Principle). This set will be a subset of the consonants which includes the obstruent stops.

A driving force behind Piggott's analysis is the assumption that transparency occurs when a segment is skipped. With this assumption, Piggott argues that the transparency systems cannot be unified with the opacity ones, because if transparency harmony involved spreading of the Soft Palate node, the transparency of voiceless obstruents could not be explained. He points out that for voiceless obstruents to behave transparent, they would have to be unspecified for the Soft Palate node underlyingly; but this would simply make them into targets for the spreading of the Soft Palate node, and they would then be expected to undergo harmony rather than be skipped.[2]

Piggott thus posits two types of nasal harmony which differ in the node that spreads and in the dependency of [nasal]. Given the theoretical grounding in the assumptions of the representational-driven framework, the conclusion that there are two types of nasal harmony is the best possible account that is available. To restrict the variable dependency for [nasal], Piggott suggests that the difference in segment structure is parametrically determined, with [nasal] as a dependent of the Soft Palate as the unmarked option (1992: 51). The Spontaneous Voicing node affiliation for [nasal] is selected when there is no underlying contrast between voiced stops and nasals in the language. This parametric SP-node hypothesis makes a strong claim: it connects the transparent or blocking behavior of stops to the structure of the stop inventory of the language in a very particular way. It predicts that blocking harmony will occur only in languages where there is a contrastive distribution for voiced and nasal stops. However, this is not the case, a language we have already seen in chapter 2 provides a counter-example; this language is Epena Pedee (Choco; Colombia). Harms (1985, 1994) points out that Epena Pedee has three series of stops: voiced, voiceless unaspirated, and voiceless aspirated, as given in (8). The language does not have a contrastive distribution between voiced oral and nasal consonants; the realization of voiced stops as oral or nasal is predictable from context.

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[2] Note that calling on a parametrized specification of prosodic anchors, such as targetting of the mora (Archangeli and Pulleyblank 1994; Pulleyblank 1996), would not be successful in obtaining the needed transparency here. Both moraic and non-moraic segments act as targets in nasal harmony transparency patterns, and so a representationally-driven account must look at structure internal to the segment rather than above it. But see Piggott (1996) for a proposed suprasegmental approach to some nasal harmonies.

(8) Epena Pedee stops

| | | |
|---|---|---|
| p$^h$ | t$^h$ | k$^h$ |
| p | t | k |
| b/m | d/n | g/ŋ |

Since there is not a distinct series of nasal stops in the inventory structure of Epena Pedee, the parametric SP-node hypothesis predicts that the language will choose the Spontaneous Voicing structure for [nasal] and thus exhibit a transparency-type of nasal harmony. In fact, voiced and voiceless stops block left-to-right nasal spreading from a nasal vowel, as shown in (9). (A regressive syllable-bound nasal harmony which nasalizes all segments except voiceless stops is also apparent here; this was discussed in section 2.3.)

(9) Epena Pedee

| | | | |
|---|---|---|---|
| a. | /peɾõɾa/ | [peɾ̃õɾ̃ã] | 'guagua' (a groundhog-like animal) |
| b. | /dãwe/ | [nãw̃ẽ] | 'mother' |
| c. | /ɯ̃bɯsi/ | [ʔɯ̃$^m$bɯsi] | 'neck' |
| d. | /w̃ãhida/ | [w̃ãh̃ĩ$^n$da] | 'they went' (go+past+plural) |
| e. | /k$^h$ĩsia/ | [k$^h$ĩ$^n$siə] | 'think' |
| f. | /hõp$^h$e/ | [h̃õ$^m$p$^h$e] | 'a species of fish' |
| g. | /w̃ãit$^h$ee/ | [w̃ãĩ$^n$t$^h$ee] | 'go' (future) |

The problem that Epena Pedee presents for the parametric dependency account concerns the details of the connection between inventory structure and harmony type. Piggott suggests that when voiced oral and nasal stops do not contrast in an inventory, [nasal] is relevant for sonorant segments only, i.e. under these circumstances, [nasal] spreading will target only sonorant segments (via the SV node). Epena Pedee falsifies this claim. In addition, the blocking behavior of voiced stops in cross-morpheme spreading in Tuyuca (discussed in 3.3.4) provides evidence that voiced stops undergoing nasal harmony in a transparency-type of harmony can be true obstruents in their underlying character. In contrast, the unified analysis of nasal harmony is not presented with these problems. Because the nasalized obstruent constraint is violable, the unified analysis need not posit voiced stops as underlyingly sonorants when they are targetted in nasal harmony. Also, since it does not rigidly tie blocking and transparency to inventory structure, it actually predicts the occurrence of a language like Epena Pedee in which voiced and voiceless obstruent stops block nasal harmony; the lack of a contrastive nasal series of consonants presents no problem.

Independent of the particulars of assumptions about inventories, the variable dependency analysis is faced with two more general kinds of drawbacks. The first point concerns the ad hoc nature of the representational solution. To distinguish the two patterns, variable dependency must be stipulated for [nasal]; however, there is no independent motivation for the variable dependency of [nasal] or for other features. The second point concerns asymmetries in the potential sets of transparent segments, target segments, and blocking segments. By positing two different types of nasal harmony, the variable dependency account offers no explanation of the complementarity between segments that can undergo nasalization and those that behave transparent. We have seen that *all segments* have the potential to block nasal spreading. Further, all segments *except obstruents* have the potential to undergo nasal harmony (pattern as targets), and *only obstruents* ever act transparent. This complementarity is a flag that target and transparent segments are different realizations for one kind of segmental patterning, namely undergoers of nasal harmony. This is the line of explanation taken in the unified account proposed in chapters 2 and 3, leading us to the finding that with respect to the feature [nasal], Universal Grammar gives us one basic kind of language, not two.

## 5.3 Other approaches to segmental transparency

Some recent approaches to segmental transparency in an optimality-theoretic framework move away from claims about the organization of features in transparent segments and instead focus on the possibility of interrupting the domain of a feature that has spread across a span of segments (e.g. Smolensky 1993; Cole and Kisseberth 1994, 1995). The idea unifying these accounts is that the domain of a feature specification can cover a continuous span of segments (e.g. all of the segments in a word), but the realization of

this featural property on all of the segments within this domain is violable, with a mark incurred for each segment realized with an opposing feature specification (similar in spirit to the gapping approach considered in 5.1). Smolensky (1993) formulates this violable constraint as *EMBED, which prohibits the occurrence of a root node parsed into a feature domain embedded within another of an opposing specification; for example, *EMBED$_{[\text{-nasal}]}$ bans the occurrence of [-nasal] within a span of [+nasal] segments. This is illustrated by the representation in (10).

(10) An embedded feature domain structure:
[$_{+\text{N}}$w̃ã[$_{-\text{N}}$t]ĩ]

The structure in (10) will incur one violation with respect to *EMBED$_{[\text{-nasal}]}$ for the occurrence of [-nasal] [t] within the [+nasal] span of segments from [w̃] to [ĩ]. The violation of *EMBED can be compelled by a segmental markedness constraint, such as *NASOBSSTOP. A related line is taken by Cole and Kisseberth (1994, 1995) with their constraint, EXPRESSION, which requires that a phonetic feature [F] must be expressed on every element in an F-domain. This take on segmental transparency posits the domain of [+nasal] as spanning the entire word in [$_{+\text{N}}$w̃ãtĩ], with EXPRESSION violated by [t], again driven by the markedness of nasalizing this segment.

Like the NOGAP approach considered earlier, these accounts have in common with the sympathy-based analysis I have proposed the idea that segmental transparency is driven by markedness constraints; i.e. a segment behaves transparent in order to avoid the occurrence of some dispreferred feature combination. The way in which these accounts differ from the sympathy-based approach is that they call on constraints specific to segmental transparency (e.g. *EMBED, EXPRESSION) in order to obtain the surface-transparent outcome. These constraints do no other work in the grammar other than obtaining segmental transparency. In contrast, the analysis of segmental transparency as a derivational opacity effect makes no use of parochial representational configuration or device such as embedding, feature expression, or gapping. Outside of Faith, the analysis of nasal harmony calls only on constraints on feature cooccurrence and spreading. Transparency is achieved through sympathetic faith, a mechanism independently-motivated for the widely attested range of phenomena known as opacity effects in phonology. On the grounds of theoretical economy, the analysis of segmental transparency as an opacity effect is thus to be preferred. It is conceivable, however, that an approach might be developed which utilized *EMBED (or perhaps EXPRESSION) to capture a broader range of phonological phenomena, for example, if the notions underlying embedding or feature expression could be elaborated to extend to other kinds of derivational opacity, then this would be an interesting alternative to pursue, and one generally in harmony with the analysis proposed here.

In his recent analysis of vowel harmony, Pulleyblank (1996) also argues against using an ad hoc representational configuration, such as gapping, to obtain segmental transparency. The representations Pulleyblank assumes for words with transparent segments are similar to those proposed under the account proposed here, with a separate occurrence of a feature specification on either side of the transparent segment. For example, a word with a high [ATR] vowel transparent to [RTR] harmony has an output representation like that in (11). (I set aside here the question of whether the vowel features should be linked to the consonants as well, see Ní Chiosáin and Padgett 1993, 1997 for discussion.)

(11) Representation of segmental transparency in [RTR] harmony

```
[RTR]  [ATR]  [RTR]
  |      |     / \
t ɛ k  k i  l  ɛ ɛ n
```

To realize this kind of outcome, Pulleyblank does not analyze segmental transparency as a kind of derivational opacity, rather he proposes to interpret violations of the constraint driving spreading in a certain way. Assuming that feature alignment to the morpheme or word edge is the spreading imperative for harmony, Pulleyblank suggests that constraint evaluation is 'locally-determined' (1996: 325-326). Informally he describes this as meaning that the local domain for some feature specification [F] is the class of segments that could be associated to [F] without producing line crossing (an ill-formed representation; Goldsmith 1976). Consider the representations in (12). The set of segments to which [+nasal]$_i$ could potentially be linked without producing line crossing are (A-E); these are the 'local domain' for this occurrence of [+nasal]. Segment (G) is not in the local domain for [+nasal]$_i$, since linking this feature occurrence to (G) would produce line crossing. As a consequence, under local evaluation, rightward alignment for [+nasal]$_i$ is violated for segments (B-E) in (12a) for [+nasal]$_i$ and it is fully satisfied for [+nasal]$_i$ in (12b). [+nasal]$_j$ incurs one violation with respect to rightward alignment in each case.

(12) Local domains

```
a. [+nasal]i    [+nasal]j          b.  [+nasal]i [+nasal]j
    |              |                    / / | \ \    |
    A B C D E F G                      A B C D E F G
```

What this means for spreading is that sprouting feature occurrences on the other side of a transparent segment can fair better on alignment than a blocking outcome. Evaluated with respect to local domains, (13a) with segmental transparency will incur one violation on rightward spreading for [+nasal], but (13b) with blocking will incur two violations.

(13) Local domains in nasal spreading

```
a. [+nasal] [+nasal]          b. [+nasal]
     / \       |                   / \
    w̃  ã  t  ĩ                    w̃  ã  t  i
```

Pulleyblank's approach to segmental transparency is a very interesting one, and of the alternatives, it is most closely in harmony with the understanding of locality argued for in chapters 2 and 3. In applying the local domain interpretation of alignment to nasal harmony there are questions about the assumptions it would require concerning the binary versus monovalent status of features, although I will not pursue those issues here. There are two general reasons for preferring the derivational opacity account. The first comes back to the matter of theoretical economy. Analyzing segmental transparency as an opacity effect obviates the need for restricting constraint evaluation to local domains. Adding the local domain requirement to the evaluation of alignment constraints builds a further degree of complexity into the computation: not only must reference be made to the edge of the MCat, but also to boundaries within the MCat circumscribing the limits of alignment without line crossing. A theory of derivational opacity is independently required, and so the assumption of this complex kind of local domain evaluation need not be invoked. The second point concerns the matter of learnability noted in 5.1. Analyzing segmental transparency as an opacity effect posits transparency as a more 'marked' outcome for incompatible segments than blocking, as given by the evaluation metric outlined in 3.6. It thus contributes to the explanation for the greater range of segments exhibiting blocking in nasal harmony. Alternative accounts which derive segmental transparency simply through constraint ranking without derivational opacity offer no insight into why blocking of spreading is a more common outcome in general than transparency.