

**Natalie Operstein.** (2010). *Consonant Structure and Prevocalization*. Amsterdam: John Benjamins. Pp x+234.

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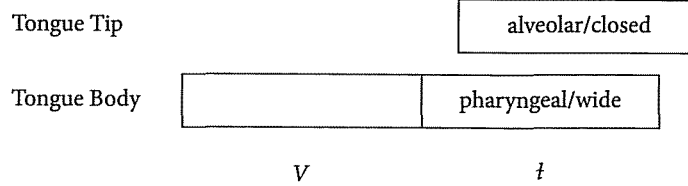
## 1. Overview

In this broad-ranging volume, Natalie Operstein unifies a number of previously unconnected phenomena under the new umbrella of consonant prevocalization, employing the rubric of Articulatory Phonology. The basic idea is that consonants include two gestures, a consonantal gesture and a vocalic gesture, and that when these become unpacked or decoupled, a subphonemic ‘prevowel’ will emerge. Once listeners perceive this prevowel as a bona fide segment, prevocalization occurs. The phenomenon of consonant prevocalization is well-known among historical linguists in the explanation of changes such as *sanctiu* > *saint* in French, and has received treatments in work such as Andersen 1972, who notes developments in Polish whereby diphthongization is followed by gradual erosion of the triggering consonant, such as dialectal Polish [koɲ] > [koj̥] > [koj] ‘horse’. However, I would contend that its pervasive recurrence and its consequences for theories of intrasegmental structure are largely below the radar of most theoretical phonologists, perhaps because of its similarity to diphthong formation; for example, the intrusive-*i* found in stressed final syllables closed with /s/ in Brazilian Portuguese (e.g. [gajs] ‘gas’) is often easily classified as the glide portion of a diphthong. Similarly, the prevocalization found in Southern dialects of American English (e.g. e<sup>[j]</sup>dge, sma<sup>[j]</sup>sh) is often remarked upon but without a direct causal link to the following consonant. Moreover, prevocalization may be less salient to phonologists because of the difficulty of witnessing the telescoped intermediate stage in diachronic change. On the other hand, for some linguists, prevocalization is the *only* route to consonant lenition; Foley 1977: 56 claims that all liquid vocalization (e.g. that of Cockney English, Serbo-Croatian, Brazilian Portuguese) passes through a prevowel stage. The representation of liquid vocalization to an open back vowel as necessarily proceeding through an intermediate stage of gestural decrowding with a prevowel, is reproduced from Operstein’s Figure 11 below, where the misphasing of the Tongue Body gesture and the Tongue Tip gesture leads to an earlier intrusion of the former before the latter:

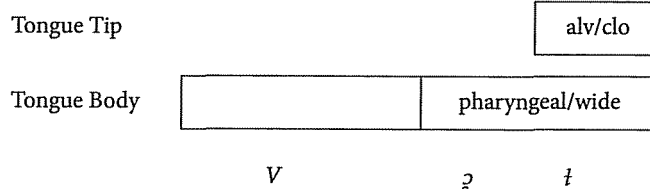
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<sup>1</sup> I thank Ricardo Bermúdez-Otero, Gean Damulakis, Noam Faust, John Harris, Natalie Operstein, Mário Coelho Silva, and Leo Wetzels for very rewarding discussion of these issues.

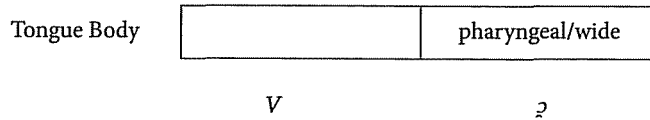
(a) Fully articulated [t]



(b) Prevocalized [t]



(c) Vocalized [t]



Operstein's book in fact coins the term "Consonant Prevocalization", which had otherwise been analyzed in the literature as a series of unconnected facts with varying terminology (such as 'anticipatory vowel' or 'vowel infixation') that did not reflect an underlying cause due to the nature of a vocalic gesture within the consonant itself. While Operstein relates this prevocalization -- involving the gestural retiming of a complex, misphased consonant -- to the kind of intrusive vowels that occur *in between* two consonants, as in American English pronunciations of *sweet* as [s<sup>u</sup>wit], in this book she focuses more specifically on the fact that prevocalization is intimately tied to lenition. The seemingly diverse set of patterns between consonant lenition and the specific place features that the accompanying prevowels bear have never been treated so systematically. Operstein's book is truly commendable in bringing together so many such phenomena in a single place. A number of sundry curiosities that I have noticed in the literature such as the 'furtive' prevowel insertion with Tiberian Hebrew pharyngeal fricatives (e.g. /ruħ/ > [ruah] 'sg.'; cf. [ruhot] 'spirit, pl.') suddenly fall under an understandable rubric once one has read Operstein's distillation of numerous seemingly idiosyncratic vowel intrusions into a single coherent phenomenon. She points out that postvelar consonants and rhotics trigger pharyngeal offglides in cases such as Early Modern English *jury* [dʒʊəri], and cites a scintillating study by Delattre 1971 in which English listeners who heard German *Flur* /fluʁ/ played backwards transcribed it as [ɰaʊl]. This latter result points to an interesting fact, related to the subphonemic character of prevowels: Operstein notes (p.8) that such prevowels are frequently "not registered in the linguistic consciousness of the speakers", which seems to be true for the Maxakalí case discussed in Section 3 below -- although one sometimes cannot rule out the influence of entrenched orthography on this linguistic awareness. Indeed, Operstein is careful to point out (p.51) that prevocalized allophones are "synchronically ambiguous" -- and it is perhaps for this reason that they are often recruited for diphthongization, a point to which we return below.

The essence of the proposal is that *all* consonants (not just secondarily-articulated consonants such as /p<sup>i</sup>/ or /k<sup>w</sup>/) contain a C-Place and a V-Place gesture, which can be seen as a convergence of Clements' (1991) model together with Articulatory Phonology approaches such as Sproat & Fujimura (1993). Operstein's assertion is that prevocalization results from a gestural mistiming, whereby the V-Place

comes to be articulatorily sequenced *before* the C-Place, and hence a transitional vocalic element emerges.

One of Operstein's central claims is that the development of a prevocalic element before a consonant will also be accompanied by lenition or weakening of the consonant itself along other dimensions of stricture. (As she points out, this echoes Wetzels & Sluyters' 1995: 124 remark that the duration of the prevowel might directly eat into the duration of the following consonant). For example, she observes that palatal nasals and liquids become alveolarized, and specifically argues that turning a palatal into an alveolar constitutes a kind of lenition (p.22), as it involves reduction of the surface area of contact of the tongue and because it involves lowering of F2 values. As I will attempt to show throughout this review, some of these results would translate very straightforwardly into Backley's (2011) Element Theory model, in which palatal place is represented by a headed element  $|\underline{I}|$ , whereas alveolar place is an unheaded element  $|I|$ , and lenition may involve removal of headedness. Operstein's claim that prevocalization will be accompanied by voicing or unreleasedness (again, loss of the voiceless element or the release element in Element Theory) thus paves the way for exciting potential empirical research.

As part of the present review, I will present two case studies that figure prominently in Operstein's analysis, and by including additional information about these cases, will discuss aspects of the model that potentially require further work. It should go without saying that any large-scale synthesis in work such as Operstein's has among its many positive qualities the fact that it inspires further detailed investigation, and the brief case studies presented here are but two of many which are made possible by the overarching framework in the book.

## 2. Sibilant Prevocalization in Carioca Portuguese

The variant of Brazilian Portuguese spoken in Rio de Janeiro (henceforth 'Carioca Portuguese') well-known for the fact that the sibilant /s/ undergoes coda palatalization to  $[ʃ]$ , also exhibits a noteworthy phenomenon, namely prevocalization of  $[ʃ]$  by the glide  $[j]$ ; see Reinhard (1970) for an early description. Thus, while São Paulo Portuguese (henceforth 'Paulista Portuguese') has  $[gas]$  'gas', Carioca Portuguese has  $[gajʃ]$ ; similarly, where Paulista Portuguese has  $[tapa'ʒɔs]$  'Tapajos (river)', Carioca Portuguese has  $[tapa'ʒɔjʃ]$ . I shall now turn to additional aspects of the phenomena which are not as salient in the description within the book.

While sibilant palatalization in the coda in Carioca Portuguese occurs regardless of the position of stress, the prevocalization is found only in stressed syllables, and in the varieties under discussion here, only in stressed final syllables.<sup>2</sup> Thus, Carioca Portuguese exhibits prevocalization in words like  $[ʒe'zuʃ]$  'Jesus' and  $[a.veʃ'tɾujʃ]$  'ostrich' but not in  $[bo.nuʃ]$  'bonus' or  $[o.ni.buʃ]$  'bus'.<sup>3</sup> Importantly, such prevocalization also occurs accompanying the plural  $-s$  added to words with final stress, such as singular  $[ka'fɛ]$  'coffee' and  $[təm̃ɐdu'a]$  'anteater' versus their plurals  $[ka'fɛjʃ]$  and  $[təm̃ɐdu'aʃ]$ .

<sup>2</sup> I abstract away from the unsystematic prevocalization found in nonfinal stressed syllables in Carioca Portuguese (e.g. *nascer*  $[naj'sɛʃ]$  'to be born', *gosto*  $[gɔʃ'tu]$  'I like') which shows a high degree of hard-to-replicate inter- and intra-speaker variability.

<sup>3</sup> The prevocalization interacts in a pleasing way with loanword adaptation and epenthesis (Geon Damulakis, pers. comm.). Thus, /s/ is allowed as an underlying coda consonant, but /ʃ/ is not, and as a result, the words *jazz* and *trash* are adapted differently (though both undergo devoicing in the adaption):  $/dʒɛs/$  vs  $/tɾɛʃ/$ . The latter undergoes epenthesis at the stem-level, becoming  $tɾɛʃi$ . As a result of the phonological process of sibilant palatalization and prevocalization at a later stage of derivation, these end up as  $[dʒɛjʃ]$  vs  $[tɾɛʃi]$ , exhibiting a counterfeeding opacity effect with respect to the palatalization-epenthesis interaction that distinguishes underlying vs. derived instances of surface  $[ʃ]$ .

Recall that Operstein's general approach is to say that palatal consonants contain both a C-Place and a V-Place, and that prevocalization is a kind of 'fission' in which the inner vowel of a consonant is gesturally unpacked and hence surfaces before the C-Place gesture. What are we to make of the specific restriction of this prevocalization to final stressed syllables? While perhaps one might claim that stressedness somehow causes the unpacking of a consonant into its component C-Place and V-Place parts, the specific restriction to the *final* stressed syllable goes unexplained under this approach.<sup>4</sup> In addition, as nothing in the mechanics of articulatory unpacking per se restricts this to coda consonants, it is noteworthy that this prevocalization is found before the palatal sibilant, as in the examples above, but not before palatal liquids ([ku'ʎɛfi] 'spoon'), palatal nasals ([mẽ'ɲɛ] 'morning'), palatal affricates ([ma'ʃw.ɖzi] 'Matilde') or the palatal fricative ([no.ʒu] 'nausea') – although such prevocalization does occur in *European* Portuguese, which lacks the presibilant palatalization! Why should palatal sibilants alone be targeted in Carioca Portuguese, especially given that other palatal consonants *can* cause prevocalization in other languages (e.g. Southern varieties of American English he<sup>[ɪ]</sup>dge, sma<sup>[ɪ]</sup>sh, Sledd 1966, and Irish English, Harris 1987)?

While Operstein maintains that consonant prevocalization can often be restricted to a specific subset of the expected consonants (p.14), in this particular case, the Articulatory Phonology account does not provide any direct explanation of why the subset is what it is in a given language. I contend that an answer can be found specifically in the fact that word-final /s/ is the only coda consonant in Carioca Portuguese that can be non-moraic. Brazilian Portuguese is largely a weight-sensitive language, thus having the Weight-to-Stress principle, but it also has cases of lexical stress, which in turn necessitate the involvement of the Stress-to-Weight principle. In the case of stressed final syllables before non-moraic /s/, a conflict thus arises between the Stress-to-Weight Principle, demanding a heavy final syllable (and hence ideally a moraic coda consonant), and the fact that sibilants are not sonorous enough to be moraic (\*MORAIC-SIBILANT).

The latter constraint is arguably a general fact of Portuguese phonology which the learner gleans from the phenomenon of 'pseudoplurals' (Bérmudez-Otero 2007), namely monomorphemic nouns ending in /s/ that have nonfinal stress and identical singular and plural forms. There are a significant number of such nouns in Portuguese, e.g. *virus*, *bonus*, *onus*, *anus*, *humus*, *bilis*, *iris*, *pâncreas*, and indeed, under Bisol's 2013 tabulation, 422 words, or 32% her total count of *s*-final words are penultimate-stressed, hardly a handful of exceptions. My own view is therefore that nouns ending in /s/ need to be lexically marked for final, penultimate, or antepenultimate stress; in other words, the (non-)moracity of final /s/ plays no role in stress assignment. Note that pseudoplural names such as *Carlos* ['kaʎ.loʃ] which do not attract stress to the final syllable in fact allow diminutive forms with apparent 'infixing', such as *Carlinhos* [kaʎ'li.ɲoʃ] or *Douglinhas* (from *Douglas*). No other unstressed final coda consonants block pluralization, nor do they productively allow diminutive infixation. Under Bérmudez-Otero's proposal, the infixation is perfectly straightforward: the final /s/ is analyzed as a 'pseudo-plural' suffix, and added on a word-level cycle *even in the singular forms*, after the diminutivization morphology is computed, thereby obviating the possibility of a singular-plural distinction in these nouns. Summing up, word-final /s/, whether for plurals or pseudo-plurals, is nonmoraic.

Once we adopt the proposal that nouns such as [tapa'ʒɔjʃ], [ʒe'zujʃ] 'Jesus' and [a.veʃ'trujʃ] 'ostrich' have a nonmoraic word-level /s/, a new explanation for the glide

<sup>4</sup> At one point (p.154) Operstein suggests that the prevocalization before sibilants is similar to the prothetic vowel in #sC words like *escola* 'school'. However, these exhibit the prothetic vowel regardless of coda palatalization, cf. Paulista Portuguese [is'kɔ.lə], Carioca Portuguese [iʃ'kɔ.lə].

prevocalization suggests itself: Carioca Portuguese adds a glide to the final syllable in this phonological context in order to achieve the Stress-to-Weight Principle at the word-level. Pseudoplurals are only found with word-final [ʃ] (or [ʒ], in cases of regressive voicing assimilation, e.g. [ʒe'zujʒ mi'ninu] 'jesus child') in Carioca Portuguese. The restrictions of prevocalization to *word-final* sibilants (as opposed to word-internal position, or other palatal consonants) can be explained in terms of an independent property of the language: its nonmoraic final sibilants. Interestingly, some lects of Paulista Portuguese have developed prevocalization before [s] in a small handful of lexical contexts that etymologically did not contain it, e.g. [majs] 'but', [a'fiojs] 'rice', thereby confirming that the tendency for a SWP effect in final syllables is exerting a pressure throughout the language.

The insertion of a glide in the coda in precisely such contexts creates a heavy syllable.<sup>5</sup> In this sense, glide-insertion in presibilant stressed final vowels in Carioca BP is entirely akin to *raddoppiamento sintattico* in Italian, (e.g. *colibrí* [ko.li.'bri], but *colibrí blu* [ko.li.'brib 'blu], 'blue hummingbird', with SWP-satisfying gemination in the analysis of Borrelli 2002): it creates a heavy syllable when it can, but the word in isolation 'survives' if there is no context for the process in question to apply. Thus the singular [təmẽdu'a] 'anteater' does not spontaneously manifest a glide, but as soon as the following sibilant provides the context for glide insertion, it takes place.

While this particular case study is but one of many in the book, I contend that its exploration illustrates some aspects of the analysis more generally, and would like to suggest that Operstein's application of the gestural unpacking analysis to this particular case instantiates the adage 'When you have a hammer, everything looks like a nail'. While in the case at hand, the relationship between the palatal sibilant and the preconsonantal glide may have had its phonetic and diachronic origins in a kind of gestural mistiming, this mistiming was phonologized to specifically word-final sibilants as a solution to the conflict between SWP and \*MORAIC-SIBILANT, and a complete account of prevocalization should include metrical and moraic considerations and the 'exaptive' beneficial phonological side-effects for which such prevowels serve as precursors.

### 3. Obstruent Lenition and Prevocalization in Maxakalí

One of the more striking cases of prevocalization in the literature is found in the Macro-Jê language Maxakalí, spoken in Minas Gerais, Brazil, as this language exhibits prevocalization before the obstruents /p,t,c,k/ (and the corresponding nasals m,n,ɲ,ŋ), particularly in word-final position (stress is always word-final in Maxakalí). This pattern would in itself seem to counter the trend that Operstein observes in which consonant prevocalization "tends to target weak consonants, especially sonorants and fricatives, and weak prosodic positions" (p.21); while one might perhaps say that codas are a weak position, stops are not weak, and stressed syllables are not weak, and so in the absence of an explicit hierarchy or calculus for strength (e.g. Escure 1977, Cyran 2010), it is hard to know whether prevocalization in an unstressed fricative onset would be more likely or less likely than prevocalization in a stressed plosive coda.

Ever since the article of Gudchinsky, Popovich & Popovich (1970), the nature of and the very optionality of this process in Maxakalí has interested many phonologists. In particular, these stop consonants can optionally develop a prevowel, and then themselves undergo deletion, in which case the prevowel is the only remaining 'trace' of

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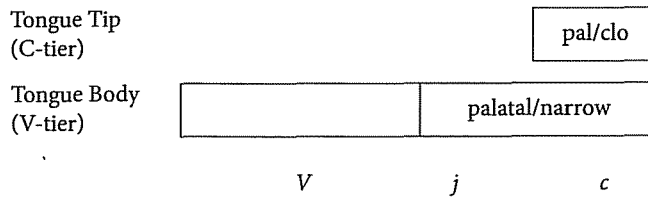
<sup>5</sup> Post-tonic syncope in English (e.g. cases such as *family* > ['fæm.li]) and Tonkawa (see Gouskova 2003) also arguably takes place due to the Stress-to-Weight principle, as it frees up a following onset consonant to become the coda of the preceding syllable.

the lenited consonant (similar, perhaps, to the ‘compensatory diphthongization’ in Majorcan Catalan, as analyzed by Mascaró 1985). As will be discussed in greater detail below, each consonant has a ‘dedicated’ prevowel when it undergoes lenition: velar consonants lenite to [u], palatal consonants lenite to [j], dental consonants lenite to [ɜ], and labial consonants lenite to [ɐ]. Examples for each place of articulation are shown below with Maxakalí orthography on the left, in which <x> represents a voiceless palatal stop with affricate and fricative allophones and <y> represents its voiced counterpart. Accompanying soundfiles may be found on the online supplement to this review.

a. xupup ‘nose’	[ʃu'puɾpʰ] / [uʃʃu'puɾɟ]
b. yĩm ‘arm, hand’	[uʃʃĩm] / [uʃʃĩɟ]
c. xetxox ‘rat’	[ʃɛtʃuɟ'hɛɟ] / [ʃɛɟʃuɟ]
d. nãhãn ‘annatto’	[nã'hãn] / [nã'hãɟ]
e. kokex ‘dog’	[ku'kɛɟ] / [ku'kæɟ]
f. mũnũytut ‘cow’	[muʃʃũɟtut] / [muʃʃũɟtutɟ]
g. xupxak ‘papaya’	[ʃuɾpʰʃakʰ] / [ʃuɾpʰʃa]
h. yĩxõg ‘tongue’	[uʃʃĩxõg] / [uʃʃĩxõɟ]

The process is analyzed in Operstein’s model as similar to the misphasing found with liquids that eventually leads to liquid vocalization, and her Figure 16 is reproduced below, showing this for the prevocalization found with palatal stops.

Prevocalization of /c/



The lenition process in Maxakalí, however, involves the following more detailed questions: 1) What determines the vocalic quality of the prevowel? 2) To what extent can this prevocalization apply in non-final, unstressed syllables? 3) What conditions the varying rates of prevocalization with different places of consonantal articulation? 4) To what extent does sentential position (i.e. nuclear stress) further condition prevocalization?

Some of these questions are treated in Silva & Nevins (2014), a report on an experimental elicitation of consonant prevocalization in Maxakalí conducted with 18 speakers (9 men, 9 women; 3 from 3 different age groups). Prevocalization occurred less with older (45+) speakers than younger (15-30 or 31-45) groups, and there were no gender differences. Similar rates of prevocalization were found for oral and nasal consonants. Of interest was a significantly greater rate of prevocalization in word-final position than in word-internal position (three times greater in the former in Experiment 1), the greater rate of prevocalization in postverbal (e.g. sentence-final) rather than preverbal position, and the hierarchy of prevocalization rates by Place (Dental > Palatal > Labial > Velar). The first two sets of findings, which we might call the Prominence Effect, suggest that in order to integrate the results with Operstein’s overall model, we must say that V-Place (vocalic melody) is preferentially drawn to strong syllable nuclei, a finding resonant with Operstein’s brief remarks about consonant prevocalization in careful enunciation and emphatic pronunciation in Irish English (p.14-15). Again, this

would suggest that somehow prevocalization before obstruents in stressed positions is linked to creation of heavy diphthongs. In other words, while prevocalization looks like a case of lenition, its occurrence in a stressed syllable closed by an obstruent (both in Carioca Portuguese and in Maxakali) might actually be construed as a kind of fortition, in creating a stronger, diphthongal vowel.

Our final set of findings, which we might call the Place Effect, call for a more nuanced interpretation. It may simply have been the case that prevocalization occurred first with palatals (as word lists from Martius 1867 suggest), where it shows a remarkably consistent rate, particularly with palatal nasals and then generalized to all nasals, and then perhaps to palatal stops and then both stops and nasals at all places of articulation, with the relative rates of each tracking the diachronic ‘age’ that each process has been entrenched in the language. However, it would seem that understanding the Place Effect – a quantitative tendency in our results, not noted in the literature -- first requires a discussion of the quality of the prevowel for each of these places of articulation. As noted above, velar consonants lenite to [u], palatal consonants lenite to [j], dental consonants lenite to [ɜ], and labial consonants lenite to [ʁ] (although it is worth pointing out that this latter fact requires further phonetic confirmation, as at least to our non-native ears some tokens seemed rounded). The unrounded nature of the prevocalic allophone of labial (and to a certain extent, coronal) consonants is in itself noteworthy, and Wetzels & Sluyters (1995) suggest that the mid vowels [e,o] produced by prevocalization of /t,p/ respectively essentially lose their color and hence lose their coronal or labial character. By contrast, Operstein (p.58ff) suggests that in labial consonants and coronal consonants, the default tongue body setting is centralized, citing a range of phonetic work on the topic. This is a reasonable assertion to make, but what seems to have remained unexplained is why the V-Place gesture in Maxakali that becomes unpacked from the consonant is explicitly connected only with the Tongue Body, and not with the Tongue Tip or Lips; it would seem that more details of why an asynchronous execution of these gestures results in the Tongue Body gesture preceding the Lip gesture needs further development.

All of this brings us back to the Place Effect: why is prevocalization more common with acute consonants than with grave consonants? While the Articulatory account alone is silent on this, it would seem to be inherently related to the lenitability of these places of articulation. Under an Element Theory model applied to Maxakali, suppose that /p/ is composed of |U|, /t/ is composed of |A|, /c/ is composed of |I|, and /k/ is composed of /U,I/. All non-|U|-bearing elements would undergo lenition first, which could characterize the Grave effect.<sup>6</sup> Operstein’s book contains an enlightening discussion of how dentals are often ‘dark’ (i.e., in addition to their Tongue Tip gesture, they contain a noncontrastive central or retracted Tongue Body component) as opposed to light palatals. As such, a proposal in which dental explicitly contain |A| would capture this.

In terms of explaining the quality of the prevowel, suppose that all non-|I| bearing elements would simply lose their headedness. If /a,u,i/ are |A|,|U|,|I| respectively, and /uɥ/ is unheaded |U,I| (namely, high and non-labial grave), /ɤ/ is unheaded |U| (namely non-labial grave), while /ɜ/ is unheaded |A| (essentially a schwa), then the particular pairing of labials with unrounded back vowels can be understood: when decoupled, they lead to a non-labial grave vowel. In fact, as Janson (1986) and MacNeilage & Davis (2000) note, labial consonants are often paired with

<sup>6</sup> Operstein in fact mentions the affinity of labials and velars in terms of the quality of prevowels they trigger (p.70), explicitly referring to the possibility of a characterization in terms of a feature [+grave], although it is unclear how this acoustic feature would be formally incorporated into the Articulatory Phonology model she proposes.

unrounded back vowels in babbling and in preferred CV inventories. Operstein notes that unrounded prevowels are also found before labials in Gaelic forms such as *maíoidheamh* /mi:v/, which surfaces as [mwi:<sup>3</sup>b] (p.172), and in a flourish of scholarship, she unearths prescient remarks to this effect that labial consonants may have a retracted tongue body in Rosapelly 1898. While the Element Theory account I have sketched here (essentially a representation in terms of *acoustic* signatures), is certainly not satisfactory in its current form, it has insights to offer that go beyond the articulatory mistiming account in *its* current form, and I would contend that both alternatives demand further attention. What Operstein's work decidedly incentivizes, in fact, is a closer look at the internal structure not only of secondarily-articulated consonants, but *all* consonants. If one wants to formulate a predictive theory all such prevocalization phenomena, then the prevocalization of velars with a palatal glide in Jamaican English *bag* [baig] (p.133, assuming that this is not an adaptation of [æ]) will require either a serious rethinking of the component gestures of velar stops, or a principled division of which phenomena should be taken as evidence for intrasegmental structure and which should not.

#### 4. Conclusion: Diphthongization vs. Prevocalization and Articulatory Magnitude

Operstein's exploration of consonant prevocalization eventually brings one towards a theory of consonant-vowel interactions that goes much further than this phenomenon alone, and indeed, she touches on consonant postvocalization, and even its interaction *with* prevocalization, eventually proposing a theory of Germanic umlaut with its origins in prevocalization and later monophthongization (p.137). She tentatively suggests (p.192) that further work on prevocalization has the potential to unveil as-of-yet unknown properties of Proto-Indo-European laryngeal vocalization as well.

The largest unresolved question still seems to be why should palatal prevocalization always be more prominent and widespread after back vowels (attested in the survey and mentioned on p.13) under the 'consonantal decrowding' model? It would seem that a principle of diphthong formation is often at work behind the scenes, precisely as Mascaró (1985) formalized it for Majorcan Catalan. Operstein cites the important study of Lehiste (1965) in which the overall duration, the duration of glide portion, and mutual binding of formant transitions between vowel and glide in diphthongs is distinct from the transitional preglide found with coronal consonants in Estonian, and I would contend that more detailed phonetic evidence of this type is needed. If, in particular, prevocalization is more perceptible (and hence more robust) when the prevowel takes on the opposite phonological color from the preceding nucleus (as in the case of palatal prevowels attracted more often towards low, back nuclei), then it seems to implicate a perceptual principle of diphthongal dispersion (see, e.g. Kubozono 2001, Nevins 2012), yet again indicating that a complete explanation involves more than just gestural unpacking.

Operstein's specific implementation in terms of Articulatory Phonology is, in my view, not necessarily incompatible with feature-geometric proposals of a similar nature, such as Wetzels & Sluyters (1995), which propose the creation of a contour segment that shares many of the original place features of the consonant, but involves a [+vocalic] root node (similar in its formal nature to the mechanism of consonantalization of high vowels in Uyghur proposed in Kaisse 1992). Naturally, Operstein's typological catalogue of the possible variation that the resulting segments display requires a re-examination of exactly which place features the sponsoring consonant may bear. The specific potential advantage of an Articulatory Phonology implementation is the ability to discuss the effects of timing and magnitude on each of these gestures, and thereby tie them to specific predictions about duration, prosodic conditioning, and constriction degree (see



for example p.42 where it is explicitly claimed that consonant prevocalization is “prosodically-driven retiming”). However, since as of yet, Operstein’s work does not integrate any of these latter measurements into the account (and in fact, it is not clear whether there is any consistency in whether prevocalization is supposed to happen more in unstressed syllables or stressed syllables) the jury remains still out as to whether the Articulatory Phonology model has specific advantages. Needless to say, these questions could not have even begin to have been formulated prior to Operstein’s cataloguing, synthesis, and problematization of consonant prevocalization as a coherent, recurrent and rich phenomenon.

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