

Reviews

Natalie Operstein (2010). *Consonant structure and prevocalization*. (Current Issues in Linguistic Theory 312.) Amsterdam & Philadelphia: John Benjamins Publishing Company. Pp. x + 234.

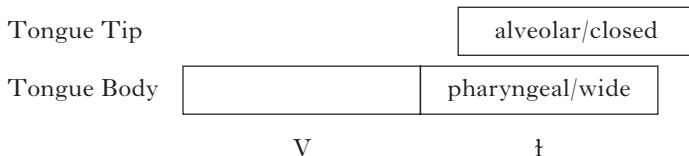
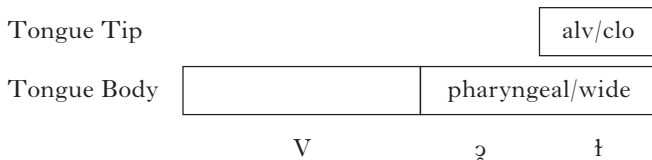
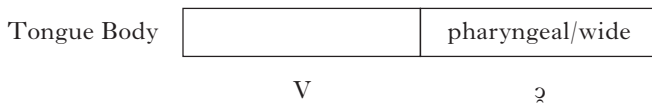
Andrew Nevins
University College London

1 Overview

In this broad-ranging volume, Natalie Operstein unifies a number of previously unconnected phenomena under the new umbrella of consonant prevocalisation, employing the rubric of Articulatory Phonology.* The core 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, prevocalisation occurs. The phenomenon of consonant prevocalisation 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 diphthongisation is followed by gradual erosion of the triggering consonant, such as dialectal Polish [kop] > [koj] > [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 prevocalisation found in Southern dialects of American English (e.g. *e^[i]dge*, *sma^[i]ish*) is often remarked upon, but without a direct causal link to the following consonant. Moreover, prevocalisation 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, prevocalisation is the *only* route to consonant lenition; Foley (1977: 56) claims that all liquid vocalisation (e.g. in Cockney English, Serbo-Croatian and Brazilian Portuguese) passes through a prevowel stage. The representation of liquid vocalisation to an open back vowel as necessarily proceeding through an intermediate stage of gestural decrowding with a prevowel is reproduced from Operstein (p. 53) in

* E-mail: A.NEVINS@UCL.AC.UK.

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* [t̥](b) *Prevocalised* [t̥](c) *Vocalised* [t̥]*Figure 1*

Prevocalisation and vocalisation of dark [t̥].

Fig. 1, where the misphasing of the Tongue Body gesture and the Tongue Tip gesture leads to an earlier intrusion of the former before the latter.

Operstein's book in fact coins the term CONSONANT PREVOCALISATION, which has otherwise been analysed in the literature as a series of unconnected facts with varying terminology (such as 'anticipatory vowel' or 'vowel infixation') that do not reflect an underlying cause, due to the nature of a vocalic gesture within the consonant itself. While Operstein relates this prevocalisation – 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^uwit], in this book she focuses more specifically on the fact that prevocalisation 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/ > [ruħ] 'spirit (SG)'; cf. [ruħot] '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* [dʒ^ʊri], and cites a scintillating study by Delattre (1971), in which English listeners who heard German *Flur* [flu^ʌɸ] played backwards transcribed it as [ɸaul]. 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 by the linguistic consciousness of the speakers’, which seems to be true for the Maxakalí case discussed in §3 below – although one sometimes cannot rule out the influence of entrenched orthography on this linguistic awareness. Indeed, Operstein is careful to point out (pp. 51–52) that prevocalised allophones are ‘synchronically ambiguous’ – and it is perhaps for this reason that they are often recruited for diphthongisation, a point to which we return below.

The essence of the proposal is that *all* consonants (not just secondarily articulated consonants such as /p^j/ or /k^w/) contain a C-Place and a V-Place gesture, which can be seen as a convergence of Clements’ (1991) model with Articulatory Phonology approaches such as Sproat & Fujimura (1993). Operstein’s assertion is that prevocalisation results from 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 alveolarised, and specifically argues that turning a palatal into an alveolar constitutes a kind of lenition (p. 22), because it involves reduction of the surface area of contact of the tongue and 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 [I] and alveolar place by an unheaded element [I], and lenition may involve removal of headedness. Operstein’s claim that prevocalisation will be accompanied by voicing or lack of release (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 considering additional information about these cases will identify aspects of the model that potentially require further work. It should go without saying that any large-scale synthesis 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 prevocalisation in Carioca Portuguese

The variant of Brazilian Portuguese spoken in Rio de Janeiro (henceforth ‘Carioca Portuguese’) is well-known for the fact that the sibilant /s/ undergoes coda palatalisation to [ʃ], and exhibits a further noteworthy phenomenon, namely prevocalisation of [ʃ] by the glide [j]; see Reinhardt (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 [ta.pa'ʒɔs] 'Tapajos (river)', Carioca Portuguese has [ta.pa'ʒɔj]. I shall now turn to additional aspects of the phenomena which are not as salient in the description within the book.

While sibilant palatalisation in the coda in Carioca Portuguese occurs regardless of the position of stress, the prevocalisation is found only in stressed syllables, and in the varieties under discussion here, only in stressed final syllables.¹ Thus, Carioca Portuguese exhibits prevocalisation in words like [ʒe'zuʒj] 'Jesus' and [a.vef'truj] 'ostrich' but not in ['bo.nu] 'bonus' or ['o.ni.bu] 'bus'.² Importantly, such prevocalisation also occurs accompanying the plural -s added to words with final stress, such as singular [ka'fɛ] 'coffee' and [tə.mɛ.du'a] 'ant-eater' *vs.* their plurals [ka'fɛj] and [tə.mɛ.du'aj].

Recall that Operstein's general approach is to say that palatal consonants contain both a C-Place and a V-Place, and that prevocalisation 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 prevocalisation 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.³ In addition, as nothing in the mechanics of articulatory unpacking *per se* restricts this to coda consonants, it is noteworthy that this prevocalisation is found before palatal sibilants, as in the examples above, but not before palatal liquids ([ku'ʎɛfi] 'spoon'), palatal nasals ([mɐ'ɲɛ] 'morning'), palatal affricates ([ma'tʃiw.ɕji] 'Matilde') or palatal fricatives ([no.ʒu] 'nausea') – although such prevocalisation does occur in *European* Portuguese, which lacks the presibilant palatalisation! Why should palatal sibilants alone be targeted in Carioca Portuguese, especially given that other palatal consonants *can* cause prevocalisation in other languages (e.g. Southern varieties of American English *he^[i]dge*, *sma^[i]sh* (Sledd 1966), and Irish English (Harris 1987))?

While Operstein maintains that consonant prevocalisation 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

¹ I abstract away from the unsystematic prevocalisation found in non-final stressed syllables in Carioca Portuguese (e.g. *nascer* [naj'sɛfi] 'to be born', *gosto* [gɔʒj.tu] 'I like'), which shows a high degree of hard-to-replicate inter- and intra-speaker variability.

² The prevocalisation interacts in a pleasing way with loanword adaptation and epenthesis (Gean Damulakis, personal communication). 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 are adapted with a voiceless sibilant): /ɕʒɛs/ *vs.* /tɾɛʃ/. The latter undergoes epenthesis at the stem level, becoming [tɾɛ.ʃi]. As a result of the phonological process of sibilant palatalisation and prevocalisation at a later stage of derivation, these end up as [ɕʒɛj] *vs.* [tɾɛ.ʃi], exhibiting a counterfeeding opacity effect with respect to the palatalisation–epenthesis interaction that distinguishes underlying and derived instances of surface [ʃ].

³ Operstein (p. 154) suggests that the prevocalisation before sibilants is similar to the prothetic vowel in #sC words like *escola* 'school'. However, these exhibit the prothetic vowel regardless of coda palatalisation, cf. Paulista Portuguese [is'kɔ.lɐ], Carioca Portuguese [iʃ'kɔ.lɐ].

weight-sensitive language, and thus has 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 ‘pseudo-plurals’ (Bermúdez-Otero 2007), namely monomorphemic nouns ending in /s/ that have non-final 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* and *pâncreas*, and indeed, in Bisol’s (2013) tabulation, 422 words, or 32% of her total count of s-final words, have penultimate stress, 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-)moraicity of final /s/ plays no role in stress assignment. Note that pseudo-plural names such as *Carlos* [‘kaf.ɫoʃ], which do not attract stress to the final syllable, in fact allow diminutive forms with apparent ‘infixing’, such as *Carlinhos* [‘kaʃ’li.noʃ] or *Douglinhas* (from *Douglas*). No other unstressed final coda consonants block pluralisation, nor do they productively allow diminutive infixation. Under Bermúdez-Otero’s proposal, the infixation is perfectly straightforward: the final /s/ is analysed as a ‘pseudo-plural’ suffix, and added on a word-level cycle *even in the singular forms*, after the diminutivisation 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 non-moraic.

Once we adopt the proposal that nouns such as [ta.pa’ʒɔjʃ], [ʒe’zujʃ] and [a.veʃ’tɾujʃ] have a non-moraic word-level /s/, a new explanation for the glide prevocalisation suggests itself: Carioca Portuguese adds a glide to the final syllable in this phonological context in order to obey the Stress-to-Weight Principle (SWP) at the word level. Pseudo-plurals are only found with word-final [ʃ] (or [ʒ]) in cases of regressive voicing assimilation, e.g. [ʒe’zujʒ mi’ni.nu] ‘Jesus child’) in Carioca Portuguese. The restrictions of prevocalisation 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 non-moraic final sibilants. Interestingly, some lects of Paulista Portuguese have developed prevocalisation before [s] in a small handful of lexical contexts that etymologically did not contain it, e.g. [majs] ‘but’ and [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.⁴ 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 humming-bird’, with

⁴ 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.

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 [tə.mɛ̃.du'a] 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 phonologised to specifically word-final sibilants as a solution to the conflict between SWP and *MORAIC SIBILANT, and a complete account of prevocalisation should include metrical and moraic considerations and the ‘exaptative’ beneficial phonological side-effects for which such prevowels serve as precursors.

3 Obstruent lenition and prevocalisation in Maxakalí

One of the more striking cases of prevocalisation in the literature is found in the Macro-Jê language Maxakalí, spoken in Minas Gerais, Brazil, as this language exhibits prevocalisation 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 prevocalisation ‘tends to target weak consonants, especially sonorants and fricatives, and weak prosodic positions’ (p. 21); while one might perhaps say that the coda position is weak, stops 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 prevocalisation in an unstressed fricative onset would be more or less likely than prevocalisation in a stressed plosive coda.

Ever since Gudschinsky *et al.* (1970), the nature 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 the lenited consonant (similar, perhaps, to the ‘compensatory diphthongisation’ in Majorcan Catalan, as analysed 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 to [j], dental consonants to [ɜ] and labial consonants to [ɣ]. 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.⁵

⁵ The back unrounded nasal vowel [ɣ] in the relevant forms in (1) is a 3rd person possessor prefix, and [-hej] in the word for ‘rat’ is a feminine suffix. These are irrelevant to the phenomena under consideration here, but are still produced in elicitation.

Links to sound files for the examples in (1) can be found in the online version of the journal, at http://www.journals.cambridge.org/issue_Phonology/Vol32No02.

(1) xupup	‘nose’	[tʃw'pʷɔɣpʷ]	/ [ũtʃw'pʷɔɣ]
yīm	‘arm, hand’	[ũ'ɲĩɣm]	/ [ũ'ɲĩʒ]
xetxox	‘rat’	[tʃɛttʃuj'hɛj]	/ [tʃɛʒ'tʃuj]
nāhān	‘annatto’	[nā'hān]	/ [nā'hāʒ]
kokex	‘dog’	[ku'kɛjç]	/ [ku'kæj]
mūnūytut	‘cow’	[mūnmūjɲç'tuɔɔɣ]	/ [mūnmūj'tuɔɔɣ]
xupxak	‘papaya’	[tʃwɔɣp'tʃakʷ]	/ [tʃwɔɣp'tʃa]
yīxōg	‘tongue’	[ũɲĩ'tʃōŋ]	/ [ũɲĩ'tʃō]

The process is analysed in Operstein’s model as similar to the misphasing found with liquids that eventually leads to vocalisation, and her Fig. 16 (p. 66) is reproduced as Fig. 2, showing this for the prevocalisation found with palatal stops.

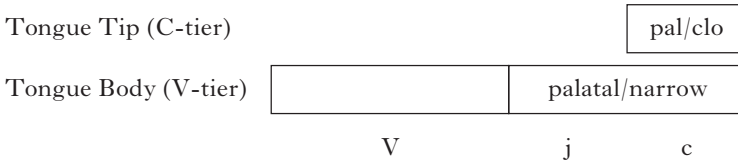


Figure 2
Prevoicalisation of [c].

The lenition process in Maxakalí, however, involves the following more detailed questions: (i) what determines the vocalic quality of the prevowel?; (ii) to what extent can this prevocalisation apply in non-final, unstressed syllables?; (iii) what conditions the varying rates of prevocalisation with different places of consonantal articulation?; and (iv) to what extent does sentential position (i.e. nuclear stress) further condition prevocalisation?

Some of these questions are treated in Silva & Nevins (2014), a report on an experimental elicitation of consonant prevocalisation in Maxakalí conducted with 18 speakers (9 men, 9 women; 3 each from 3 different age groups). Prevocalisation occurred less with older (45+) speakers than younger (15–30 or 31–45) groups, and there were no gender differences. Similar rates of prevocalisation were found for oral and nasal consonants. Of interest was the significantly greater rate of prevocalisation in word-final position than in word-internal position (three times greater in the former in the experimental results), the greater rate of prevocalisation in postverbal (e.g. sentence-final) than preverbal position, and the hierarchy of prevocalisation 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 prevocalisation in careful enunciation and emphatic pronunciation in Irish English (p. 15). Again, this would suggest that prevocalisation before obstruents in stressed positions is somehow linked to the creation of heavy diphthongs. In other words, while prevocalisation looks like a case of lenition, its occurrence in a stressed syllable

closed by an obstruent (both in Carioca Portuguese and in Maxakalí) might actually be construed as a kind of fortition, creating a stronger, diphthongal vowel.

Our next set of findings, which we might call the place effect, call for a more nuanced interpretation. It may simply have been the case that prevocalisation occurred first with palatals (as word-lists from Martius 1867 suggest), where it shows a remarkably consistent rate, particularly with palatal nasals, and generalised to all nasals, and then perhaps to palatal stops and subsequently to 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 previous 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], palatals to [j], dentals to [ɜ] and labials to [ɣ] (although it is worth pointing out that this latter fact requires further phonetic confirmation, as 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 prevocalisation of /t p/ respectively essentially lose their colour and hence their coronal or labial character. By contrast, Operstein (pp. 58ff) suggests that in labial consonants and coronal consonants, the default tongue-body setting is centralised, 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 Maxakalí 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 Lips gesture are required.

All of this brings us back to the place effect: why is prevocalisation 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 Maxakalí, suppose that /p/ is composed of |U|, /t/ of |A|, /c/ of |I| (underlining indicates headedness) and /k/ of unheaded |U,I|. All non-|U|-bearing elements would undergo lenition first, which could characterise the grave effect.⁶ 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 non-contrastive central or retracted Tongue Body component), as opposed to light palatals. A model in which dentals explicitly contain |A| would capture this.

In terms of explaining the quality of the prevowel, suppose that all non-|I|-bearing elements simply lose their headedness. If /a/, /u/, /i/ are |A|, |U|, |I| respectively, and /u/ is unheaded |U,I| (i.e. high and non-labial grave), /ɜ/

⁶ 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 characterisation 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.

is unheaded [U] (i.e. non-labial grave) and /3/ is unheaded [A] (essentially 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 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 *maoidheamh* /mi:v/, which surfaces as [m^wi:ɸb] (p. 172), and in a flourish of scholarship, she unearths prescient remarks in Rosapelly (1898) to the effect that labial consonants may have a retracted tongue body. 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 suggest that both alternatives demand further attention. What Operstein's work decidedly encourages, in fact, is a closer look at the internal structure not only of secondarily articulated consonants, but of *all* consonants. If one wants to formulate a predictive theory all such prevocalisation phenomena, then the prevocalisation of velars with a palatal glide in Jamaican English *bag* [bajg] (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: diphthongisation vs. prevocalisation and articulatory magnitude

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

The largest unresolved question still seems to be why palatal prevocalisation should always be more prominent and widespread after back vowels (attested in the survey and mentioned on page 13) under the 'consonantal decrowding' model. It would seem that a principle of diphthong formation is often at work behind the scenes, precisely as formalised by Mascaró (1985) 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 are distinct from what is found for transitional preglide and coronal consonant in Estonian, and I would maintain that more detailed phonetic evidence of this type is needed. If, in particular, prevocalisation is more perceptible (and hence more robust) when the prevowel takes on the opposite phonological colour 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 consonantalisation 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 prevocalisation is 'prosodically driven retiming'). However, since Operstein's work does not as yet integrate any of these latter measurements into the account (and in fact, it is not clear whether there is any consistency in whether prevocalisation is supposed to happen more in unstressed syllables or stressed syllables), the jury is still out as to whether the Articulatory Phonology model has specific advantages. Needless to say, these questions could not have even begun to have been formulated prior to Operstein's cataloguing, synthesis and problematisation of consonant prevocalisation as a coherent, recurrent and rich phenomenon.

REFERENCES

- Andersen, Henning (1972). Diphthongization. *Lg* 48. 11–50.
- Backley, Phillip (2011). *An introduction to Element Theory*. Edinburgh: Edinburgh University Press.
- Bermúdez-Otero, Ricardo (2007). Spanish pseudoplurals: phonological cues in the acquisition of a syntax-morphology mismatch. In Matthew Baerman, Greville Corbett, Dunstan Brown & Andrew Hippisley (eds.) *Deponency and morphological mismatches*. Oxford: Oxford University Press. 231–269.
- Bisol, Leda (2013). O acento: duas alternativas de análise. *Organon* 28. 281–321.
- Borrelli, Doris (2002). *Raddoppiamento sintattico in Italian: a synchronic and diachronic cross-dialectal study*. New York & London: Routledge.
- Clements, G. N. (1991). Place of articulation in consonants and vowels: a unified theory. *Working Papers of the Cornell Phonetics Laboratory* 5. 77–123.
- Cyran, Eugeniusz (2010). *Complexity scales and licensing in phonology*. Berlin: De Gruyter Mouton.
- Delattre, P. (1971). Pharyngeal features in the consonants of Arabic, German, Spanish, French, and American English. *Phonetica* 23. 129–155.
- Escure, Geneviève (1977). Hierarchies and phonological weakening. *Lingua* 43. 55–64.
- Foley, James (1977). *Foundations of theoretical phonology*. Cambridge: Cambridge University Press.
- Gouskova, Maria (2003). *Deriving economy: syncope in Optimality Theory*. PhD dissertation, University of Massachusetts, Amherst.

- Gudschinsky, Sarah C., Harold Popovich & Frances Popovich (1970). Native reaction and phonetic similarity in Maxakalí phonology. *Lg* **46**. 77–88.
- Harris, John (1987). On doing comparative reconstruction with genetically unrelated languages. In Anna Giacalone Ramat, Onofrio Carruba & Giuliano Bernini (eds.) *Papers from the 7th International Conference on Historical Linguistics*. Amsterdam: Benjamins. 267–282.
- Janson, Tore (1986). Cross-linguistic trends in the frequency of CV sequences. *Phonology Yearbook* **3**. 179–195.
- Kaisse, Ellen (1992). Can [consonantal] spread? *Lg* **68**. 313–332.
- Kubozono, Haruo (2001). On the markedness of diphthongs. *Kobe Papers in Linguistics* **3**. 60–73.
- Lehiste, Ilse (1965). Palatalization in Estonian: some acoustic observations. In Viktor Kõressaar & Aleksis Rannit (eds.) *Estonian poetry and language: studies in honor of Ants Oras*. Stockholm: Vaba Eesti. 136–162.
- MacNeilage, Peter F. & Barbara L. Davis (2000). On the origin of the internal structure of word forms. *Science* **288**. 527–531.
- Martius, Carl Friedrich Philipp von (1867). *Beiträge zur Ethnographie und Sprachenkunde Amerika's zumal Brasiliens*. Vol. 2: *Zur Sprachenkunde: Woitersammlung Brasilianischer Sprachen*. Leipzig: Fleischer.
- Mascaró, Joan (1985). Compensatory diphthongization in Majorcan Catalan. In Leo Wetzels & Engin Sezer (eds.) *Studies in compensatory lengthening*. Dordrecht: Foris. 133–146.
- Nevins, Andrew (2012). Vowel lenition and fortition in Brazilian Portuguese. *Letras de Hoje* **47**. 228–233.
- Reinhardt, Karl J. (1970). Intrusive /j/ before /S/ in Brazilian Portuguese. *Word* **26**. 101–106.
- Rosapelly, Charles Léopold (1898). Caractères du vocaloïde: leur importance dans la distinction des consonnes. *Mémoires de la Société de Linguistique de Paris* **10**. 122–134.
- Silva, Mário Coelho & Andrew Nevins (2014). Ethnosociophonology and consonant lenition in Maxakalí. *Revista Linguística* **10:2**. 47–60.
- Sledd, James (1966). Breaking, Umlaut, and the Southern drawl. *Lg* **42**. 18–41.
- Sproat, Richard & Osamu Fujimura (1993). Allophonic variation in English /l/ and its implications for phonetic implementation. *JPh* **21**. 291–311.
- Wetzels, Leo & Willebrord Sluyters (1995). Formação de raiz, formação de glide, e 'decrowding' fonético em Maxakalí. In Leo Wetzels (ed.) *Estudos fonológicos das línguas indígenas brasileiras*. Rio de Janeiro: UFRJ. 103–149.