

A GESTURAL SOLUTION FOR SOME GLIDE EPENTHESIS PROBLEMS

Eleonora Cavalcante Albano
LAFAPE, IEL, UNICAMP, Campinas, SP, Brazil

ABSTRACT

Palatal glide epenthesis between a non-front vowel and syllable-final [s] is problematic for Articulatory Phonology because it is not always reducible to gesture overlap or magnitude reduction. A non-derivational account assuming lexical “insertion” will, in turn, make it impossible to distinguish between “underlying” and “derived” glides. Brazilian Portuguese has some [j] epenthesis cases where the latter behave differently from the former. A conventional symbolic, autosegmental analysis can represent such a distinction, but leaves the associated phonetic variability and prosodic conditioning unexplained. This paper presents a proposal for accommodating the description of such phenomena within the framework of gestural phonology.

1. EPENTHESIS AND ARTICULATORY PHONOLOGY

Articulatory Phonology (henceforth AP) [1, 2, 3] attempts to achieve commensurable lexical and phonetic representations by assuming that gestures can take both qualitative and quantitative forms. Since dynamically-defined gestures are successful in accounting for continuous allophony [4, 5], there is reason to believe that commensurable discrete units might bridge the gap between phonetic processes and their phonologized or morphologized counterparts, shedding light on sound change and phonological acquisition.

Yet the predictions of the dynamic, gestural framework cannot be kept distinct from those of other, more traditional phonological models if the discrete gestural representation is confused with ordinary symbolic representation. To press this point, Browman and Goldstein [6, p. 173] exclude gesture insertion, deletion and substitution and require all speech processes to be explained through gesture overlap and magnitude reduction. Static, frozen allophony and allomorphy are attributed to lexical variants.

Vowel and glide epenthesis are problematic for AP when the relevant tongue body or lip gesture does not already take part in the gestural score. In many such cases, gesture overlap and magnitude reduction will not generate the correct results, albeit the “derived” acoustic segments differ phonetically from similar “underlying” ones occurring in similar or identical environments. The problem lies in finding a gesture score difference that can serve as a trigger for the observed phonetic differences, so that both the epenthetic and the non-epenthetic vowel gestures can be represented in the lexicon.

The need for such non-arbitrary lexical marking is even more obvious when there is evidence for lexical conditioning of the epenthesis process. In this case, the differentiated lexical representation must be reserved for the words attracting epenthesis.

Brazilian Portuguese (henceforth BP) has some palatal glide epenthesis processes that are relevant to this issue. They are not only lexically-conditioned but also phonetically variable.

Besides, they have some diachronic antecedents that remain phonetically unstable in spite of having become morphologized. Below some preliminary results of a series of studies of such phenomena are put together, leading to a discussion of the proper representation of the gesture construct in AP in connection with its possible role in a non-derivational approach to phonology.

2. PRE-FINAL GLIDE EPENTHESIS IN BP

2.1 The Palatal Glide, Stress, and Final [s]

Insertion of a palatal glide in stressed position before a final /s/ has long been noticed by BP grammarians [e. g., 7]. Only recently, however, has this process been regarded as variable and described within the framework of labovian sociolinguistics [8]. In Rio de Janeiro, it is reported to occur more frequently in stressed monosyllables where the final coronal fricative is realized as [ʃ] (the preferred variant in this dialect). It is also more likely to occur when lexical and sentence stress coincide. Both factors interact with sex and age.

Although no sociolinguistic survey has so far been reported for São Paulo, similar conditioning factors have been found by Pacheco [9] in a large *corpus* of recordings by two professional TV newscasters. The tie with sentence stress was found to be statistically significant and a tendency to alternate between inserting [j] and lengthening the monothong in the favorable environments was observed.

The advance of [j] epenthesis in São Paulo, where the favorite variant of the coda fricative is [s], shows that the palatal nature of the following consonant is not decisive to trigger it.

2.2 Lexical Conditioning

In 1957, Câmara [10, p. 42], working with schoolchildren's orthographic errors, noted a frequent hypercorrect use of *mas* (but) in place of *mais* (more). This was attributed to the teachers' efforts to stress the distinction in orthography due to its near loss in the oral language.

Nowadays, [j] epenthesis in *mas* is almost categorical in Rio de Janeiro, besides being well advanced in São Paulo as well as in other regions. Other words undergoing audible change in both dialects are: *três* (three), *faz* (s/he does or makes), and *mês* (month). This possibly indicates a lexical frequency effect, since all three words appear over 1,000 times in the 2,000,000 word NURC¹ *corpus* [11]. Among non-monosyllables, the process tends to affect *rapaz* (boy) and *mesmo* (even, really), both fairly frequent and tending to be used in single word exclamations.

2.3 Prosodic Conditioning

Besides *mas/mais*, a number of word pairs have their distinction neutralized or at least obscured by glide epenthesis: *çês/seis* (you pl./six), *lês/leis* (you read/laws), *paz/pais* (peace/parents), *pôs/pois* (s/he put/so), *rês/reis* (cattle/kings), *sós/sóis* (alone pl./suns) *vás/vais* (that you go/you go). Study of the monothongal

forms under various speech rate and prosodic conditions shows a relationship between glide epenthesis and pre-pausal lengthening.

Below spectrograms of [pas] from *A pasta chegando* (the briefcase coming) and *A paz tá chegando* (peace is coming), uttered at a normal rate, are time aligned with a spectrogram of the same syllable from *...em paz. Tá...* (...in peace. It is...), uttered at a faster rate. Though the latter should be longer due to pre-pausal lengthening, fast speech compression reduces it to approximately the same length as the others. Note, however, that the fricative noise is shortened while the VC transition is lengthened, resulting in a [j]-like off-glide:

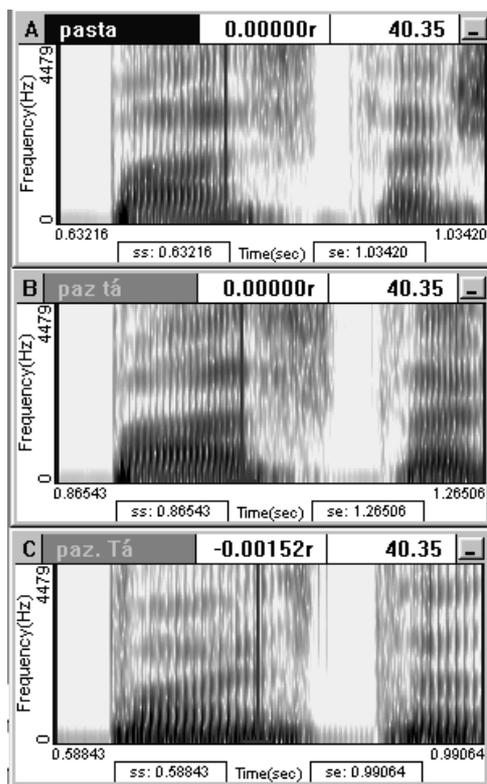


Figure 1. [a]-[s] transitions in environments with different sensitivity to [j] epenthesis.

For this subject, who belongs to the conservative epenthesis avoiding group, F_2 differences at transition ends are significant at $p < .001$ across boundaries and rates. Paired comparisons with α set at .05 show that F_2 at the cursor is significantly higher in the condition shown in (c) than in those shown in (a) and (b). Such effects are still more pronounced in subjects who are more frequent epenthesis users.

The glide-like sound of the transition in (c) is perceptible in informal listening to phonetically-trained ears. Controlled tests including naïve listeners will shortly be conducted.

This connection between [j] epenthesis and prosodically motivated lengthening may be related to what de Jong [12] has recently called the lesser compressibility of the coda. In order for a rime to be lengthened under maximal compression, the coda gesture must overlap with the nucleus gesture without getting shortened. This explanation is specially appealing because it can

also rationalize the effect of sentence stress reported by both Callou [8] and Pacheco [9].

2.4 Acoustic Phonetic Differences from Other Glides

The need for representing epenthetic [j] differently from its non-epenthetic counterparts is supported by vowel quality differences. Below *paz*, uttered by the same speaker as in Figure 1, with and without epenthesis, is contrasted with *pais*. An attempt was made to control for speech rate, but the utterance in (b), which is rather idiomatic, tends to come out slightly faster than those in (a) and (c). The same experiment will shortly be replicated with a metronome.

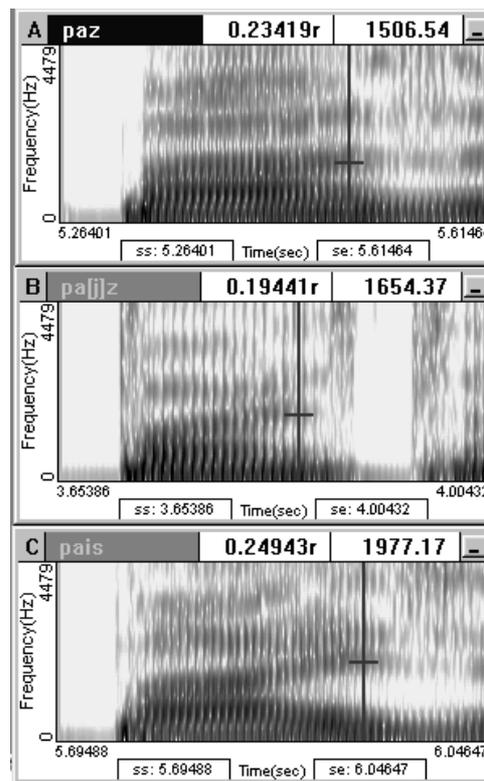


Figure 2. *Paz*, with and without [j] epenthesis (b and a, respectively), contrasted to *pais* (c).

F_2 differences at the third pitch period to the left of the fricative noise are significant at $p < .0001$. For this subject, the values in condition (b) are higher than those in condition (a) and lower than those in condition (c), with α set at .05. Horizontal cursors, corresponding to the right top readings, approximately indicate LPC-measured F_2 .

It follows that epenthetic [j] should be regarded as distinct from “true” [j], being probably the result of a gradient process that can, in this case, be attributed to gesture overlap.

3. ACHIEVING A GESTURAL SOLUTION

3.1 Discrete Gesture Overlap in the Lexicon

Within the current AP framework, gesture overlap is a quantitative, phonetic process which should not, in principle, appear in the lexical gesture score. Discrete gesture overlap is, however, just what is needed to mark the epenthesis triggering

lexical variants of the words that tend to undergo it. Thus, in order to account for lexical effects on gradient sociolinguistically conditioned speech processes, AP should allow for a qualitative binary distinction between consecutive and partially overlapping gestures – with further details remaining, of course, numerical.

This will, however, only account for the occasional epenthesis of conservative subjects, which meets the prediction that the vowel transition should correspond to an average of the V and C constriction locations, sounding rather centralized. More innovative subjects as to this change will actually produce a front vowel, which is nevertheless distinct from the “underlying” one:

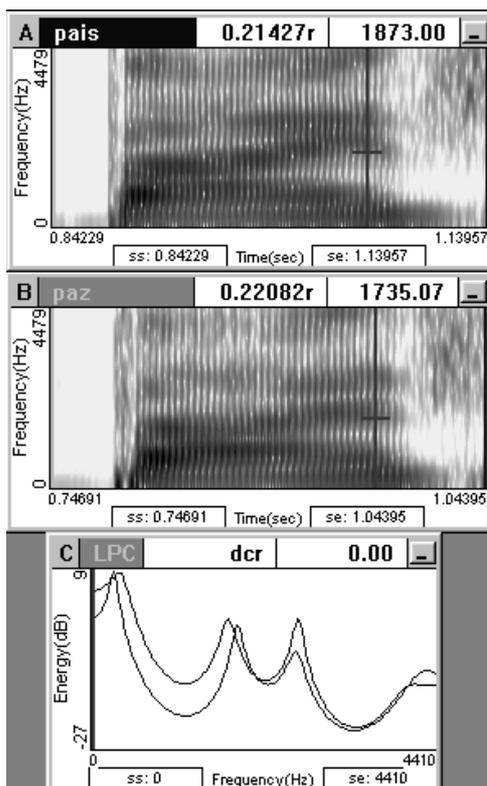


Figure 3. *Pais* contrasted to *paz* in the speech of a frequent epenthesis user.

For this subject, both F_1 and F_2 differences are significant at $p < .01$ for 5 repetitions of the test sentences. F_1 is higher and F_2 is lower in the epenthetic glide, giving it a lax quality, as shown by the spectra in (c). Distinct gesture scores seem, once again, necessary for representing them, since, besides applying variably, epenthesis does not entirely efface the original lexical distinction.

The question now arises whether overlap in the discrete gesture score is sufficient as a means of marking a lexical variant as subject to the variable epenthesis process.

3.2 Transitional [j] as a Result of [s] Vocalization

The problem with using discrete gesture overlap as a lexical mark for epenthesis is that it requires further stipulations to obtain the right vowel quality in the phonetics. Besides the greater fronting of [a] shown by the innovative as compared to the conservative subject above, there is the problem of obtaining a true front glide

from an average of the constriction locations of [s] and a back vowel. Words with back vowels, such as *nós* (we), *pôs* (s/he put), *luz* (light), do undergo the variable process at different rates in different dialects [8, 9].

Another possibility is to consider transitional [j] as the result of an offset of the critical constriction for [s], in a gesture score such as in Figure 4, where CD and CL stand, respectively, for constriction degree and constriction location (left blank for the vowel):

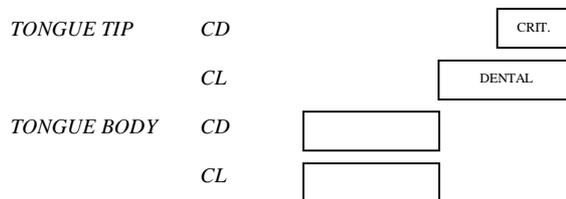


Figure 4. Hypothetical gesture score for [j] arising from partial vocalization of [s] through critical constriction offset.

This alternative is attractive because it attributes epenthetic [j] to a partial vocalization of [s] in a favorable environment. It is as if overlap between a lengthened vowel and a weakened [s] were phonetically expected. The mean constriction location problem disappears, since the place of “insertion” is inherently specified as coronal. Articulatorily, the front glide could arise from a passive movement of the tongue body as the tongue tip moves slowly to achieve the critical constriction for [s].

As it stands, AP does not allow for such a solution, since it requires the tract variables constriction degree and location to have the same duration [2, p. 208], in spite of the fact that two dynamic equations are actually needed for specifying their movement in the model as currently implemented.

Is a relaxation of the equal duration constraint desirable? Or would it be preferable to mark the lexical variants subject to the variable epenthesis process with a more arbitrary device, such as partial gesture overlap, and leave the coronal specification of the glide to the phonetics? The answer must lie in whether or not a gesture score such as that of Figure 4 is necessary for representing lexical processes.

4. MORPHOLOGIZED CASES

4.1 The Tripartite Plural of ‘ão’

One of the problems in the lexical phonology of Portuguese, both European and Brazilian, is the plural of nouns and adjectives ending in orthographic *ão* [ɐw̃], which splits into three classes partially explainable through diachrony: *ãos* [ɐw̃s] and *ões* [ɐw̃s]². The latter, which is by far the most frequent in spite of its lack of transparency, involves an alternation of both vowel and glide which seems extremely arbitrary from a conventional symbolic point-of-view, but is readily comprehensible when expressed in gestural terms.

If gesture edges are allowed to align with labels marking the edges of morphological constituents, the preference for *ões* can be seen as the result of a leftward expansion and sliding of the labial gesture while [s] is partially vocalized, as if in an attempt to clearly separate the stem from the plural affix.

4.2 A Non-Concatenative Gestural Solution

Figure 5 shows gesture scores for both singular *ão* and plural *ões*, aligning morphological constituent labels with gesture edges:

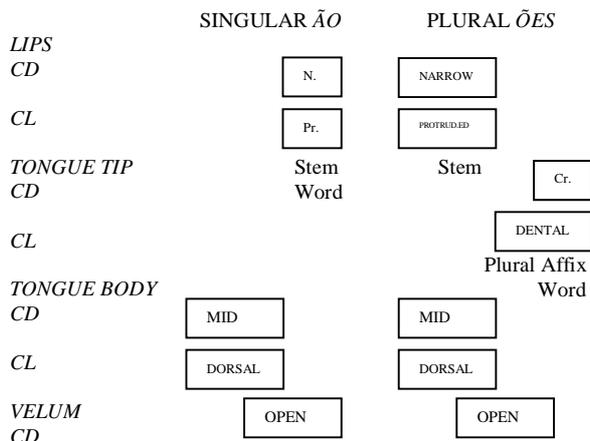


Figure 5. Hypothetical gesture scores for relating *ão* to *ões*.

This analysis recasts into gestural terms an old proposal by Natural Phonology [13] to derive this kind of Romance plural through epenthesis and not through recapitulation of the diachronic vowel in the underlying form [14]. The grounds for positing partial overlap of the nasal and vowel gestures come from Sousa [15], who found oral beginnings for nasal vowels in an acoustic phonetic study of BP. The advantage of the non-concatenative gestural solution is that the lexical marking of the singular words in each plural class can be accomplished entirely in terms of morphological labeling of gestures, as in Figure 6:

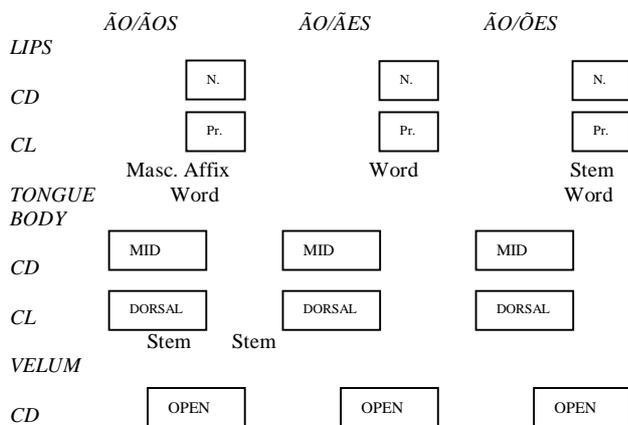


Figure 6. Hypothetical morphologically-labeled gesture scores for differentiating singular endings in *ão* as to plural class.

Besides illuminating the description of Portuguese morphophonology, the possibility of representing partially vocalized [s] in a gesture-based lexicon helps explain why the glide in the extra-heavy plural syllable is phonetically unstable and similar to the epenthetic one resulting from ongoing sound change, as reflected in the occurrence, attested in written poetry, of rimes such as *vãs* (vain, pl.) and *mães* (mothers) [7, p. 38].

5. CONCLUSION: EXTENDING THE SCOPE OF AP

The potential of AP to account for lexical conditioning of sound change together with lexical processes resulting in frozen morphophonological alternations was strongly supported in this paper. The solutions achieved here for the Portuguese problems successfully confront the criticism that AP cannot meet the discreteness requirements of a phonological theory [16].

However open to controversy, the question as to what kinds of qualitative differences in gesture organization should be allowed in a lexicon such as envisaged here constitutes a challenging and rewarding avenue for research.

ACKNOWLEDGMENTS

This work was supported by *CNPq* grant no. 52.4110/96-4 and *FAPESP* grant no. 93/0565-2. Many of the ideas exposed here were developed in seminars held at *LAFAPE (Laboratório de Fonética Acústica e Psicolinguística Experimental, IEL, Universidade Estadual de Campinas)* throughout 1997-8. Thanks are due to all participants for discussion.

NOTES

1. NURC stands for *Projeto Norma Urbana Culta*, a nationwide dialectal survey conducted in the 70's. Transcription files are available from *CEDAE (Centro de Documentação Alexandre Eulálio, IEL, UNICAMP)*.
2. Transcriptions are for dialects where the final coronal fricative is [s].

REFERENCES

- [1] Browman, C. and Goldstein, L. 1986. Towards articulatory phonology. *Phonology*, 3, 219-252.
- [2] Browman, C. and Goldstein, L. 1989. Articulatory gestures as phonological units. *Phonology*, 6, 201-251.
- [3] Browman, C. and Goldstein, L. 1990. Tiers in articulatory phonology. In Kingston, J. and Beckman, M. (eds.) *Papers in laboratory phonology: between the grammar and the physics of speech*. Cambridge: Cambridge University Press, pp. 341-376.
- [4] Pierrehumbert, J. and Talkin, D. 1992. Lenition of /h/ and glottal stop. In Docherty, G. and Ladd, R. (eds.) *Papers in laboratory phonology II: gesture, segment, prosody*. Cambridge: Cambridge University Press, pp. 90-117.
- [5] Kröger, B. 1993. A gestural production model and its application to reduction in German. *Phonetica*, 50, 213-233.
- [6] Browman, C. and Goldstein, L. 1992. Articulatory phonology: an overview. *Phonetica*, 49, 155-180.
- [7] Bechara, E. 1978. *Moderna gramática portuguesa*. São Paulo: Cia. Editora Nacional, 23rd edition.
- [8] Callou, D. 1998. A ditongação no português do Brasil: estudo de dois casos. Unpublished manuscript, Universidade Federal do Rio de Janeiro.
- [9] Pacheco, V. 1999. Ditongação diante de [s] de coda em noticiários de TV paulistanos. Unpublished manuscript, LAFAPE, IEL, UNICAMP.
- [10] Câmara, J. M. 1972 [1957]. Erros escolares como sintomas de tendências linguísticas no português do Rio de Janeiro. In *Dispensos*. Rio de Janeiro: Fundação Getúlio Vargas, pp. 35-46.
- [11] Françoze, E. and Rehder, P. R. 1999. A Brazilian Portuguese lexical database. Software under construction. LAFAPE, IEL, UNICAMP.
- [12] de Jong, K. 1998. Temporal constraints and characterizing syllable structuring. Abstract, *LabPhon 6 Meeting Handbook*, University of York.
- [13] Hooper, J. B. 1976. *An introduction to natural generative phonology*. New York: Academic Press.
- [14] Mateus, M. H. 1975. *Aspectos da fonologia portuguesa*. Lisbon: Centro de Estudos Filológicos.
- [15] Sousa, E. M. G. 1994. Para a caracterização fonético-acústica da nasalidade no português do Brasil. Unpublished master's thesis, LAFAPE, IEL, UNICAMP.
- [16] Clements, G. N. 1992. Phonological primes: features or gestures? *Phonetica*, 49, 181-193.