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Vowel reduction and deletion in Apulian and Lucanian dialects with reference to speech rhythm

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Researchers in prosody tend to attribute the perception of speech rhythm to alternations between weak and strong syllables. However, acoustic correlates of prominence play a role in listener evaluations (for the Italo-Romance area see Russo 2010, Mairano 2011). Depending on speech rate and listener expectations, local variations in duration, intensity, and pitch can induce different perceptions. This being the case, the unstressed vowel reduction which characterises some of the varieties of southern Italy can be key, as different results may emerge depending on the chosen model and labelling accuracy for deleted or reduced vowels (Schmid 2004, White *et al.* 2009, Mairano & Romano 2007a-b, Romano *et al.* 2011, Marotta 2016).

This article presents the results of measurements on four dialects from this area. They are analysed within the control/compensation model (Bertinetto & Bertini 2010) as this method softens the effect of the inclusion of a greater number of consonants in consonant intervals resulting from the loss of vowels. In keeping with perception judgements, this model performs well since it succeeds in placing speech samples with deletion into the stress-based area, more so than those varieties with only strong reduction.

KEYWORDS: Apulian dialects, Lucanian dialects, vowel reduction, speech rhythm, control/compensation.

Introduction

Apulian dialects, as well as the eastern dialects of Lucania (also known as Basilicata), are upper southern Italo-Romance dialects whose “unstressed vowel systems are strongly reduced” (Loporcaro 1997: 341).[1]

Recent advances by Loporcaro (2015) on duration relationships between stressed and unstressed vowels and positional constraints shed new light on the phenomena of vowel reduction and schwa deletion described for Apulian dialects, beyond the basic observation that “post-tonic vowels in Puglia merge to [ə], which is deleted phrase-finally” (Loporcaro 1997: 341; cf. Filipponio & Cazzorla 2015). Several references are made to these facts in studies based on linguistic atlases and the descriptions of local linguists (Valente 1975, Melillo 1986) and a number of authors have given general accounts of reduction in

Apulian dialects (D'Introno & Weston 1997, Bucci 2013), with a systematic description by Bucci *et al.* (2018). As for Lucanian dialects, Avolio (1995: 38-39) highlights the existence of "una gamma continua […] di valori intermedi"[2] between the schwa and its total deletion.

An account of reduction phenomena at word boundaries based on quantitative measurements may lead to interesting insights, also in terms of contrastive analysis for a larger dialectological area and with reference to local varieties of Italian. However, it fails to establish a relation between native speaker perceptions and the acoustic facts (as shown in Romano & Manco 2004). Local dialects have specific vowel systems which are not the same as those used by speakers in their regional varieties of Italian (Filipponio & Cazzorla 2015).[3]

Therefore, a robust account of dialect features should concentrate on speakers who have the local dialect as their first language, with minimal interference from Italian. Good quality speech data are necessary: recordings collected in silent environments from speakers who have a deep dialect knowledge and are capable of evaluating the quality of their speech not only in terms of lexical phonetics, but also within the larger framework of timing and rhythm. In this study, the dataset used in Romano (2013) is reanalysed.

Several different experimental approaches to speech rhythm have been attempted for linguistic varieties in the larger Apulian region (Barry & Russo 2003, Schmid 2004, White *et al.* 2009, Giordano & D'Anna 2010, Avolio & Romano 2010), suggesting that languages spoken in Apulia may be described as stress-based within the framework of rhythm metrics.[4] This is congruent with auditory impressions and does not conflict with the fact that syllable structure has been described as strongly conditioned by isochronic principles (as addressed by Fanciullo 1988, Carosella 2005, Avolio & Romano 2010).[5]

As demonstrated in this paper, new types of consonant clusters occasionally emerge as a result of vowel reduction even without consistent variation in consonant duration indices. The most common metrics, from the ΔV and ΔC defined by Ramus *et al.* (1999), to the PVI introduced by Grabe & Low (2002), depend too much on decisions about whether the reduced vowel is dramatically shortened, or totally deleted and then restored under appropriate timing conditions (cf. Roca 1999, for French) or as a consequence of the realisation of intonation patterns that induce speakers to maintain or add a final schwa-like vowel (Grice *et al.* 2018).

Many authors consider that, e.g. in Corato, a word such as *rotë* 'wheel' still has a final vowel, which is also written in their accounts. While recognising that in some cases a putative vowel may be absent from the spectrogram, e.g. D'Introno & Weston (1997) assume that the vowel is still phonologically present and has been exceptionally deleted. However, given the high number of deletions, it might also be argued that the dialect of Corato (and similarly also Apulian varieties described by Loporcaro with transcriptions that systematically omit the schwa) has undergone rephonologisation in the case of words with an original final vowel. The same process occurred in the history of languages such as French and English, which no longer have a final vowel in words like Fr. *rate* or Eng. *hate* (see the contribution by Baumann *et al.* in this issue for the chronology of final schwa deletion in English).

In this article, we will leave aside this interesting question of whether it is best to consider the final vowel to be lost in some varieties and then reinserted in some positions for prosodic reasons. The aim of this paper is rather to show how reduction phenomena and schwa deletion in the varieties in question may be studied with careful reference to acoustic data and with an approach to speech rhythm, such as that proposed by Bertinetto & Bertini (2010).

To this end, measurements were carried out on a wide variety of dialects of this area, scattered across two different provinces. Further, rhythm metrics were determined for a selection of these (Palazzo San Gervasio, PZ; Matera, MT; Corato, BA; Martina Franca, TA). As phonological studies have convincingly demonstrated which of these varieties have undergone systematic and irreversible deletion of certain vowels, we decided to exclude vowels with zero duration (as for cases where few uncertain vocalic traces remained, see §1 and Figure 2). Our analysis of similar speech samples from these dialects showed that our model is robust even when applied to samples for which labelling of reduction and deletion is determined on a phonetic basis.

1. Rhythm metrics

1.1. Definition

Many approaches to the evaluation of speech rhythm in the last twenty years have relied on basic measurements usually known as rhythmic metrics (see i.a. Ramus *et al.* 1999). Several methods have been devised to assess rhythmic metrics and correlate these with timing and isochronic principles. They usually try to account for a different perception of speech rhythm in samples of various languages by measuring the duration (*D*) of intervals of vowels (V) and consonants (C) (see Figure 1) and then calculating metrics with formulae such as the one shown below.[6]

$$\Delta D_{I_K} = \sqrt{\frac{\sum_{i=1}^{n}\left(D_{I_K i} - \overline{D}_{I_K}\right)^2}{n-1}}$$

In this case, the Delta (Δ*K* for short) gives an estimation of the variation of the duration of *K* intervals (I; *K* may be V or C). The measurement of the global timing of the sound duration is then described by two measures (ΔV and ΔC) which are assumed as indices of its rhythmic pattern (see Romano 2010 for a survey).

The values of the indices calculated with these formulae are plotted for each speech sample (see, for example, Figure 3 below). Other metrics have been proposed in order to estimate the variation in the duration of vowel *vs* consonant intervals (e.g. Grabe & Low 2002) and have been applied to the evaluation of speech rhythm for various selections of languages and conditions (variable speech rate, spontaneous *vs* read speech, etc.).

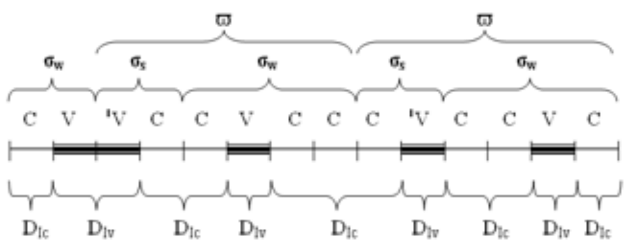

Figure 1. Graphic definition of basic V or C units on which rhythm metrics are calculated in studies following Ramus *et al.* (1999). A fictitious sound chain of a speech sample is shown with its weak-strong syllable alternations and foot structure (upper). Durations of vocalic and consonantal intervals (D_{IV} and D_{IC}) are shown (lower).

1.2. Relevant issues

These various metrics have been tested for a significant number of languages, giving quite interesting results on the basis of broad measures that do not account for syllable types and different intrasyllabic organisation models. As recently summarised by Marotta (2016: 491):

> Rhythm metrics only reflect the duration and clustering of segments, whereas the complexity of syllable structure and the reduction of unstressed vowels are fundamental to the perception of speech rhythm, in that more reduction and more consonant clusters indicates stress timing, while less reduction and shorter clusters means more syllable timing.

However, as we show below, we assume that the standard deviation of vocalic intervals ΔV and similar metrics may account for the presence or absence of vowel reduction. In this view, stress-timed languages (as defined by Pike 1945 and Abercrombie 1967) are expected to show higher ΔV (and ΔC) than syllable-timed languages.

This method implies a series of decisions about the vocalic or consonantal status of a number of sounds. Each sound has to be identified and classified as either consonantal or vocalic following a careful evaluation of its phonological status.[7] When labelling different degrees of reduction, including cases of deletion, a difficult choice has to be made according to the phonological properties of the analysed language and the phonetic cues of each vowel (see Mairano & Romano 2007b for the procedure used).[8]

The example in Figure 2 refers to the sentence *(...) Cë derìvë d'Aquaròttë du nòmë...*[9] "(...) It derives from *Aquaròttë* from the name...", realised by a speaker of the Corato dialect in a spontaneous conversation (about the origins of the toponym). Word-final schwa in words such as *derìvë*, *Aquaròttë* and *nòmë* has been labelled by various linguists as a virtual vowel of uncertain extension or "of zero duration" (the phonological labelling in Figure 2 reflects this traditional view).

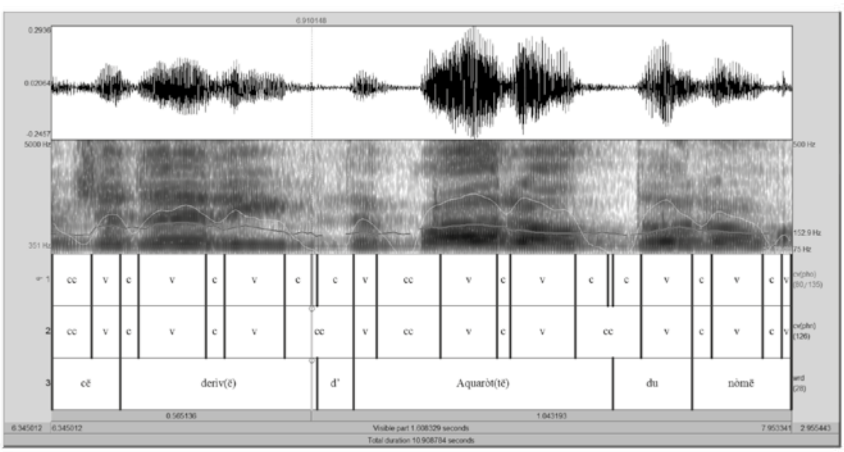

Figure 2. PRAAT Window with a waveform and a spectrogram of a speech sample from Corato. The labelling is made with reference to a traditional schwa representation (upper) as opposed to a narrow phonetic representation (lower).

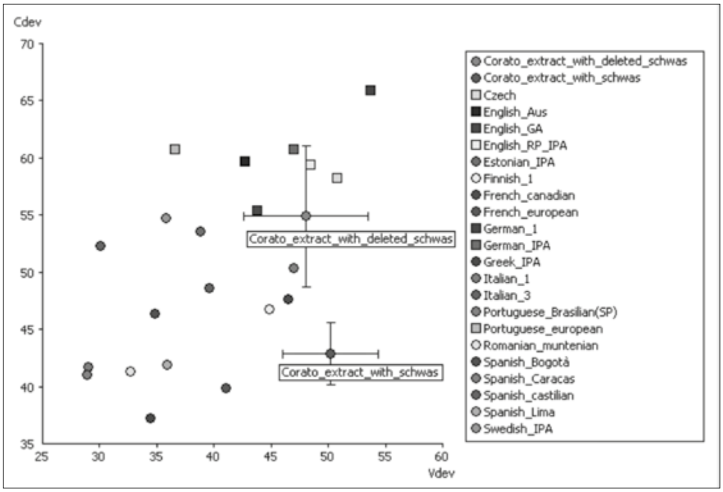

Figure 3. Position on the Delta plot with metrics calculated in the two conditions shown in Figure 2 and discussed above.

In this case, the narrow phonetic notation in Figure 2 suggests that one should consider the final vowels of the first two words to have been lost, as the acoustic cues are not sufficient to consider the schwa to have been maintained. The deletion creates a /vd/ cluster at the boundary between *derìvë* 'derives' and *dë* (*d'*) 'from', and /td/ between *Aquaròttë* and *du* 'from the'.[10] The consequences of these two different choices on rhythm metrics are shown in the plot of Deltas in Figure 3.

Our impression on listening to the passage is of stress-timing and it is on this basis that a decision is taken about the labelling and the phonological status of these final schwas. In our study, deletion has always been assumed when no trace remains of a presumed vowel in both spectral and temporal domains. If this presumed vowel is discarded, the obtained classification is also more in line with expectations based on previous observations on dialects within this area.

In practice, a reduction of unaccented vowels in a passage such as that in Figure 2 can be assumed, which would imply classification as a syllable-timed language according to the method tested above. This would cause an increase in ΔV, but would leave ΔC relatively stable (in the plot above this would cause the sample to fall in the position of "Coratino_extract_with_schwas"). If we rather consider the vowel to have been deleted (in the cases in which we can assume this indisputably), this could result in a stabilisation in ΔV, but cause ΔC to raise towards the position of stress-based samples. The fact that the sample

"Coratino_without_schwa" finishes in the region associated with stress-based languages, in the same area as English, German, and Czech, leads one to believe that the dropping of schwa cooccurs with length variation in the vocalic intervals and that vowel length thus contributes in Corato to the constrast between vowel qualities (as noted in Romano 2013, a detail overlooked by Bucci *et al.* 2018).[11]

In summary, therefore, the choice of considering vowels to be extremely reduced or deleted (e.g. by placing a threshold at 25 ms) can have dramatic consequences for the position of samples analysed according to traditional metrics.

1.3. Control vs *Compensation Indexes*

We may consider a hypothetical situation such as that of Figure 4 for a given language.

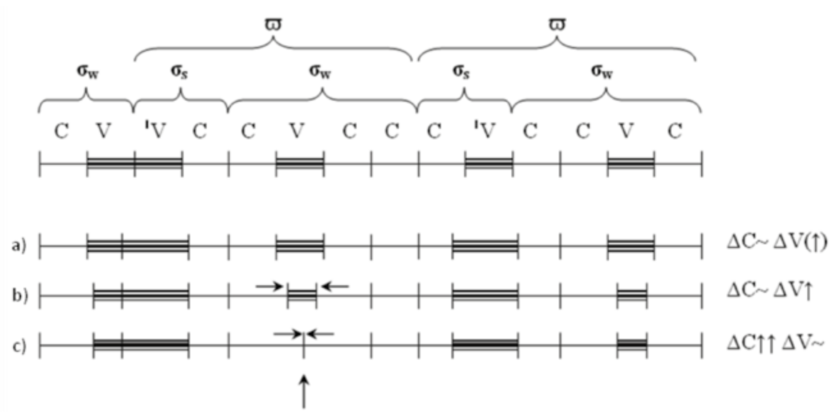

Figure 4. The effects of vowel reduction and deletion on Deltas (and other rhythmic metrics).

In the case of a limited reduction, metrics would show a relative stability in the duration of surrounding consonant clusters and a significant ΔV increase. Under the same conditions, in the absence of compensation phenomena and when deletion may be assumed, ΔV would remain relatively stable but ΔC would be increased excessively. In this case, introducing normalisation of the number of phonological positions, the effects of deletion would be attenuated and it would resemble more a reduction phenomenon (thus according to auditory impressions). This is the reason for which we adopt indexes known as CCIs (*Control* vs *Compensation Indexes*, cf. Bertinetto & Bertini 2010) when assuming total deletion.

The formulae shown below allow us to calculate rhythm metrics with normalisation of the duration (d_k) of sequences of Vocalic (V) and Consonantal (C) Intervals, respectively:

$$CCI(V) = \frac{100}{n_{I_V} - 1} \cdot \sum_{k=1}^{n_{I_V}-1} \left| \frac{d_k}{n_k} - \frac{d_{k+1}}{n_{k+1}} \right| \quad \text{and} \quad CCI(C) = \frac{100}{n_{I_C} - 1} \cdot \sum_{k=1}^{n_{I_C}-1} \left| \frac{d_k}{n_k} - \frac{d_{k+1}}{n_{k+1}} \right|$$

with n_{IV} and n_{IC} the numbers of V and C intervals in the speech sample and n_k the number of segments in the *k* interval.

The CCI model is grounded in an analysis of the reduction of vowels (V) and consonants (C) in a gestural overlap framework.

For qualitative descriptions of language timing, well established models predict temporal patterns as a result of the coupling of two oscillators (O'Dell & Nieminen 1999).[12] In this view, speech timing is assumed to result from the superimposed effects of two main conditioning cyclical activities. Each of these cycles may be described as depending on an oscillator. On the one hand, the mandibular oscillator imposes an emerging frame for syllables beginning in the early stages of language acquisition (MacNeilage & Davis 1998). On the other hand vocalic pulses show strong/weak alternations depending on stress regularities (Allen 1975, Barbosa 2006). The effects of the coupling of these oscillators (syllabic *vs* accentual) are studied within the scope of the sentence (see O'Dell & Nieminen 1999).

The CCI model proposes a revisited dichotomy not involving the stress-/syllable-timing axis but contrasting more controlling languages *vs* more compensating languages. Here a further type of oscillation is also described which couples vocalic *vs* consonantal gestures (Bertinetto & Bertini 2010). The CCI indexes are applied to two levels of organisation: a phonotactic level, which is based on the coupling of the vocalic and consonantal oscillators, and a phrasal level, which shows the effects of the coupling of the accentual and syllabic oscillators (see O'Dell & Nieminen 1999).

The grouping of languages into rhythmic classes is thus reanalysed in terms of an interplay of these two levels of organisation. At the first level the duration of inter-V-onset intervals is related to the number of intervening consonants, while the second level allows the coupling of the accentual and syllabic oscillators to be evaluated. CCI(V) and CCI(C) may account for control *vs* compensation effects at the first level, since in control languages the relative incompressibility of unstressed vowels is associated with simplified phonotactics. On the other hand, in languages which show compensation at this level (V to V), the compressed consonant intervals define more complex and variable clusters, reflecting a greater tendency to vocalic compression (in terms of duration).

The formulae defining the Interstress Interval are here applied to the phonotactic oscillator relating the duration of inter-V-onset intervals – from one V-onset to the next – to the number of intervening consonants. The Intervocalic Interval is regulated by a parameter which is greater when the vocalic oscillator prevails on the consonantal oscillator.

This allows us to predict that the consonantal oscillator should emerge as dominant as tempo increases, for the consonants between two vocalic gestures cannot be compressed beyond a certain threshold, whereas vowels allow for more compression. In controlling languages, however, due to the relative incompressibility of unstressed Vs, the vocalic oscillator should partly compensate this effect. Reduction of unstressed syllables also occurs in controlling languages, but to a lesser extent. Conversely, intra-syllabic durational compensation is larger in compensating than in controlling languages, especially (but not only) in unstressed syllables. These predictions have all been confirmed in simulations by Bertinetto & Bertini (2010) and Romano & Mairano (2010) and are here discussed with specific considerations for the various samples analysed.

Plotting CCI values on two-dimensional diagrams (such as in Figure 6 below) determines three main regions (Bertinetto & Bertini 2010: 54-55): (1) one along the bisecting line for samples where we expect a control (and a balancing between CCI(V) and CCI(C)), (2) one in the lower right-hand side where compensating languages should fall (since local fluctuations in vocalic intervals are larger than those of the corresponding consonant intervals), and (3) one in the upper left-hand side where less plausible samples may occasionally show a compensation in consonant intervals.

2. Data and method

Eight speakers were involved in the experiment. Four of them (two for each Apulian dialect, i.e. Corato and Martina) recorded about 900 frame sentences for more than 300 entries of a dialectological questionnaire.[13] All the interviews took place in 2004 and were conducted entirely in the local dialect with the help of a native speaker. Three sentences were elicited for each word:

1. *X*. (with declarative intonation);
2. *Sò' ddétt X ddò' vòlt,* 'I said X twice,' (with continuation intonation);
3. *Sò' ddétt X ttrè vvòlt.* 'I said X three times.' (with declarative intonation).[14]

The speakers were all male speakers aged about 40. Both speakers from Corato spent all their lives in their native town, whereas speakers from Martina have spent the last 4 and 10 years respectively in Turin. These speakers were recorded in 2016. They were retained because they were at ease with the task and uttered all sentences in a spontaneous and natural manner.

At least one speaker for each dialect recorded a version of the Aesop's fable *The North Wind and the Sun* by reading it one's own dialect and producing a fluent speech sample.[15] Vowel and consonant intervals were labelled in order to extract valid estimations for Deltas (Ramus *et al.* 1999) and CCIs (Bertinetto & Bertini 2010).[16]

The entire corpus is available online for Corato, <www.lfsag.unito.it/ark/coratino.html> (the Martina corpus is now available at <www.lfsag.unito.it/ark/martina_franca.html>).[17]

3. Results

Deltas offered fairly interesting cues as regards to the placement of the speech samples along the continuum between syllable-based and stress-based regions in the plots (see Figure 5 in reference to data analysed for some other languages by Romano 2010). Nevertheless, they failed to concur with impressionistic expectations and, as shown in §1.2 above, showed a certain sensitivity to notation choices in the case of the deletion of unstressed vowels.

On the contrary, CCIs work as robust metrics for predicting the fluctuation in C intervals after schwa deletion and compensation in V intervals (Figure 6). In fact, the CCIs are computed following a phonologically-driven model in which geminates and diphthongs count as the number of segments they represent phonologically and not just as V or C intervals.[18]

Languages falling in the proximity of the bisector (or above it) are oriented towards a controlling rhythm model in which local fluctuations of C and V intervals tend to be of the same order of magnitude or Cs fluctuate even more than Vs (Bertinetto & Bertini 2010: 55). Our samples fall in the lower region, where the V fluctuations are larger than those of the Cs, and therefore the languages they represent are oriented towards a compensating model. Stress-based languages present comparatively more local variation in Vs than in Cs, as a consequence of a considerable V-reduction in unstressed syllables. These languages also have relatively simple phonotactics, which may be a reason for their placement among the syllable-based languages in Figure 5.

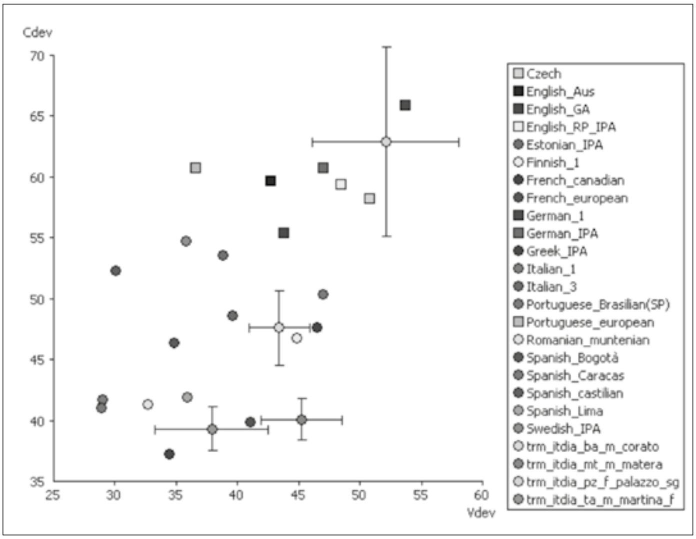

Figure 5. Values of speech rhythm metrics following Ramus *et al.* (1999) (Vdev = ΔV; Cdev = ΔC). Northern dialects (Corato and Palazzo S.G.) show more variation in ΔC than southern dialects (Matera and Martina F.) with the speech sample from Palazzo S.G. clearly placed within the area of stress-based languages.

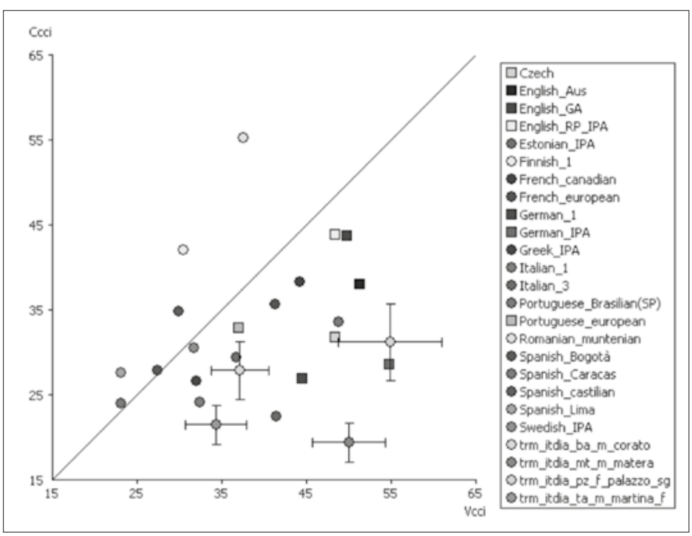

Figure 6. Values of speech rhythm metrics following Bertinetto & Bertini (2010). Apulian dialects (Corato and Martina F.) show less variation in CCI(V), whereas Corato and Palazzo show more variation in CCI(C). However, all the samples are in the area of compensating languages.

Although the presence of rich phonotactics is generally considered a correlate of interstress isochrony, CCIs show that this is not by itself an index of compensating tendencies (Bertinetto & Bertini 2010: 56). The most important discriminating factor appears to be the amount of vowel reduction, which can be used to differentiate more northern varieties (Palazzo and Corato) from more southern ones (Martina and Matera). While deletion seems more frequent in the former (thus leading to higher CCI(C)), reduced vowels in the latter lower CCI(C) but give a stress-based impression, which is especially true of the Matera sample.[19]

Conclusions

In this paper, a selection of interpausal speech pieces extracted from speech samples from various Apulian and Lucanian dialects have been analysed and discussed with respect to the vowel deletion described for these varieties. Decisions made during sample labelling about whether vowels have been lost or maintained have consequences for the positioning of the analysed samples in the various areas defined by rhythm metrics.

Samples from Martina F., Corato and Matera in the Delta plot, although labelled on the basis of phonetic annotation, unexpectedly fall near the area usually occupied by the samples of syllable-based languages. This is a little surprising, as these dialects behave as compensating languages at the intersyllabic level (for possible explanations see Loporcaro 2011: 105-108, Schmid 2004). Only the samples from Palazzo S.G. fall within the stress-based area. Such a result suggests a very different classification not confirmed by auditory impressions: with respect to speech rhythm, the Palazzo sample does not sound particularly different to the other samples.

A better positioning, which maintains the unity of the group while still distinguishing different grades of reduction, was obtained with the CCI metrics. In particular, the values measured for both groups of dialects (Apulian and Lucanian) offer proof in favour of a placement of the related languages in the area of compensating languages. The observable differences between the two groups seem to be explicable through different speaking styles of individual speakers, with local variability in reduction/loss. The different manifestation of deletion is worthy of further investigation on the basis of the data in which the effect of speech rate can be adequately tested.

Acknowledgements

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Notes

1 "The eastern Lucanian dialects are a continuation of those of Puglia" (Fanciullo 1997: 349). Other contributions in Maiden & Parry (1997) contextualise these dialects within southern Italo-Romance.

2 "A continuous range […] of intermediate values".

3 This may account for why I found a 10-vowel system for the Corato dialect (Romano 2013), while Bucci *et al.* (2018) preferred to refer to a 7-vowel system.

4 See Mairano & Romano (2010) for a review. Most neutral Standard Italian samples cluster with those of languages usually considered to be syllable-based, whereas samples with a strong regional accent or dialect samples appear rather to be stress-based (Giordano & D'Anna 2010).

5 Compensation principles mainly rely on an almost equal syllable length. Onset and coda are usually not so complex. The rhyme of the syllables closed by segments in the coda position and the one of open syllables tend to show a similar duration in their realisations, that is vowel lengthening in open syllables compensate the rhyme length with an extra-length filling the coda.

6 These models are known to account for just the temporal dimension of speech rhythm. We know that the perception of this phenomenon may rely also on other variables (Romano 2010, Tilsen & Arvaniti 2013).

7 Several choices depend on preliminary phonological assessments and phonetic evidence (see Mairano & Romano 2007a-b), such as assuming sonorants as possible nuclei in some variety and in particular contexts (e.g. German *sei*[nn̩m]*antel*) or rhotic diphthongs (AmE *d*[ɑɚ]*k*) rather than sequences of vowel + *r* (*d*[ɑɹ]*k*).

8 Recent papers (Pouplier & Goldstein 2010) have shown that acoustic evidence is often not sufficient to reveal the presence of speech targets. Nevertheless, in this paper only fine acoustic observations are made when taking decisions about the consistency of the speech chain. Even though phonological considerations would be required before excluding or not a sound from the count of segments in the intervals for the calculation of metrics, the uncertain status of final schwa in these dialects mean that we account here only for the consequences on rhythm metrics of different representational choices (with and without schwa).

9 The symbol *ë* is used here for a presumed schwa (as in the Albanian language).

10 The whole sentence was *cë derìvë dë Aquaròttë du nòmë "acqua ròttë…"*, '(people are disputing) whether *Aquarottë* derives from *acqua ròttë* [broken water]…'.

11 Short vowels are: [ɪ] (/i/: *déšt* 'finger' [ˈdɪʃt]); [ɛ] (/*e*/: *tèrr* 'earth' [ˈtɛr(ː)]); [a] (/a/: *vákk* 'cow' [ˈvak(ː)]); [ɔ] (/*o*/: *vòkk* 'mouth' [ˈvɔk(ː)]); [ʊ] (/u/: *frótt* 'fruit' [ˈfrʊt(ː)]). Long (broken) vowels are: [ɘi] (/iː/: *féil* 'thread(s)' [ˈfɘiʅ] or *véitr* 'glass' [ˈvɘitr̥], not well distinguished from the local realisation of Italian stressed /e/ in open syllables); [ɛ̈i] (/*e*ː/: trad. *nèiv* 'snow' [ˈnɛ̈iv̥] nowadays often *néiv* [ˈnɘiv̥] or *mèis*

'month' [ˈmɛ̈is]); [ɔ̈o] (/aː/: *kàop* 'head' [ˈkɔ̈op]); [ʌʊ] (/oː/: trad. *vòuš* 'voice' [ˈvʌʊ(t)ʃ] nowadays often *vóuč* [ˈvɵʊtʃ] or *nëpòut* 'nephew/grandson' [nəˈpʌʊt]); [ɵu] (/uː/: *lóup* 'wolf/ves' [ˈlɵup], not well distinguished from the local realisation of Italian stressed /o/ in open syllables). Two traditional diphthongs are instead analysed as having vowels in hiatus: [i.ë]/[ijə]/[ɪjə] (< /je/: *vëtijëdd* 'calf' [vəˈtijəd(ː)]; [u.ö]/[uwə]/[ʊwə] (< /wo/: *suwënn* 'sleep' [ˈsuwən(ː)]).

12 The duration of the interstress interval is described as a function of the number of syllables and of two clocks whose contributions are regulated by a coupling strength, called the *r*-parameter. For given values of this parameter both oscillators have the same influence; but for other values the overarching accentual-oscillator may be dominant or subordinated to the syllabic-oscillator.

13 The other four recorded only limited sections of the questionnaire, so their productions were only used for comparative purposes.

14 Words (here indicated by *X*) come from the *ALiR* questionnaire (Tuaillon & Contini 1996).

15 All samples have been published here: <www.lfsag.unito.it/ark/table_ita.html>.

16 The intervals numbered about 700 for both Cs and Vs. Each recording had a total length between 40 and 50 s. About 3000 segments were grouped in intervals. For Corato 150 intV and 156 intC; for Martina F. 195 intV and 189 intC; for Palazzo S.G. 172 intV and 166 intC; for Matera 173 intV and 175 intC. The speech tempos of these four samples were quite homogeneous for Corato, Matera and Palazzo S.G. (between 3 and 3.5 syllables/s), whereas a slightly higher value was calculated for Martina F. (4.8 syllables/s). Nevertheless, the latter was a sample with a stronger schwa preservation.

17 These samples served to establish the main trends in schwa preservation or deletion (see §3).

18 Geminates are labelled |CC| (and not |C|C|), as well as diphthongs are |VV| (and not |V|V|). |C|C| is reserved for a rearticulated geminate while |V|V| labels vowels in hiatus.

19 This dialect retains schwas more often than the northern varieties of Corato and Palazzo. These vowels are often not marked by local authors. This can be seen in the orthography employed by contemporary poets such as Angelo Sarra or Emanuele Ricciardi (recorded by Tortorelli 1981), who are inclined to write, e.g. *matarras* (it. *materese* 'from Matera'), or *scttet ndarr* (it. *gettato in terra* 'thrown on the ground'), without writing the vowel which would render possible the perception of /tt/ in *scttet* (> *sc'ttet*; Tortorelli 1981: 142), or even *and'ch* (it. *antico* 'ancient') without writing the stressed vowel.

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