Stress-Timing in Romance: re-characterisation within the 'Rhythm Space' and Implications for Rhythm Typology

1. Syllable-timed vs. Stress-timed?

Traditional dichotomy for language typology [14, 19] is grounded on the claim of regular syllable intervals vs. regular stressed-syllable intervals (isochrony claim). This is based on the assumptions:

- No shortening or lengthening of syllables as a function of stress
- vs. shortening of unstressed and lengthening of stressed syllables.

Measurements have failed to find any support for the isochrony claim. Differing degrees of lengthening and shortening as a function of stress *have* been found, however. Defence of the isochrony claim has had to retire to the level of perceived regularity, i.e. from the objective to the subjective.
It is usually assumed that Italian is a syllable-timed language and German or English are stress-timed. This assumption is based on structural differences a), b) and c) between the languages (cf. *Table* 1):

	Italian	**German**
a) Syllable structure	Relatively simple CV, CCV, CVC	Varies: simple-complex (CCC)V(CCC)
b) Vowel quantity?	No	Yes
c) Vowel duration?	Allophonic length in [+stress] open syllables	No length distinctions with [-stress]

Table 1 Structural differentiation of Italian and German.

Differences a) and b) separate Italian and German; c) brings them closer together.
Phonetic evidence is presented here to support the interpretation of Southern Italian dialects as a stress-timed language.

Distributional observations and durational measurements of tauto- and heterosyllabic VC sequences show that make a syllable-timed rhythmic structure untenable:

- the occurrence of complex codas (CVCC and CVCCC) with vowel timbre instability and clearly diphthongal vowels in all types of metrical structures, violating the single-branching rime principle with complex vocalic nuclei in closed syllables.
- the reduction and/or elision of unstressed vowels, in particular in final position.

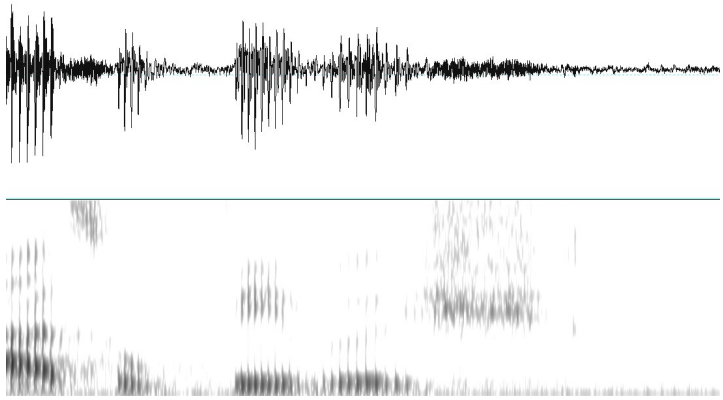
In addition, it is observed that metaphonic diphthongs (from etymologically short vowels) like the non-metaphonic diphthongs (from etymologically long vowels) are accented on the first element (i.e., are falling diphthongs) and both diphthong categories are seen to be equivalent in duration. It is discussed whether the two categories can be treated as phonologically equivalent in weight.

1.1 Super-heavy Syllables in the Southern Italian Dialects

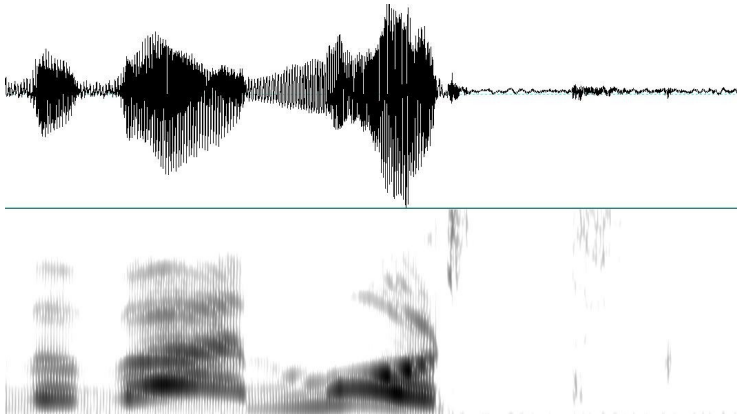
On the basis of this understanding of rhytmic type we examine the syllabic structure of several local dialects on the islands of Ischia and Capri, and the dialect of Pozzuoli (Naples). In this section we are examining mainly non-quantitative, word-based evidence for a tendency towards the 'stress-timed' end of the syllable-timed continuum according to the syllable-complexity criterium.

In particular, the consequences of final-syllable vowel reduction for the type of syllable structure in these dialects in contrast to standard Italian are considered in terms of where the dialects are situated on the continuum 'syllable-timed - stress-timed'.

Unstressed vowels in di- and polysyllabic words are often reduced to schwa or even deleted, word finally (pretonic reduction to schwa or raising; post-tonic reduction or deletion). The standard context for schwa loss is intonation-phrase final, independent of whether the word is nuclear or not, see *Spectro 1*:

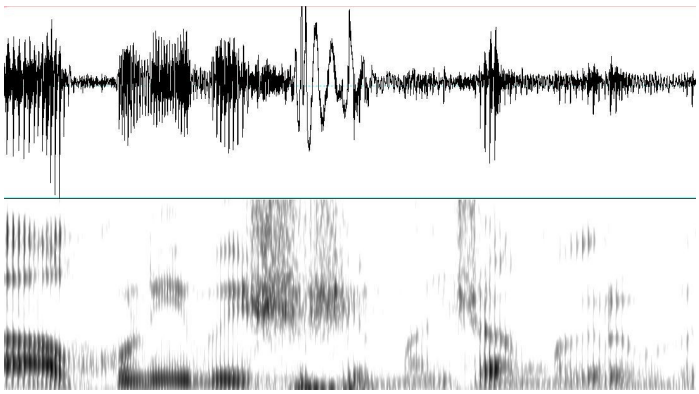


Spectro 1: '(la zuppa di) pesci / fish (soup)' [*vəɪɕː*] (Pozzuoli – BU) – [*əɪ*] = 179 ms., [*ɕː*] = 118 ms., phrase-final with schwa elision.



Spectro 2: '(papà è) morto / dad is dead' [*muɔ̈ɾ̥ˈth*] (Anacapri, Capri - GE) – [*uɔ̈*] = (falling metaphonic, see § 1.2), [*ɾ̥ˈth*] = [ɾ̥ˈ] (frication - fricative first part devoiced) = 70 ms.; [*th*] = 339 ms.

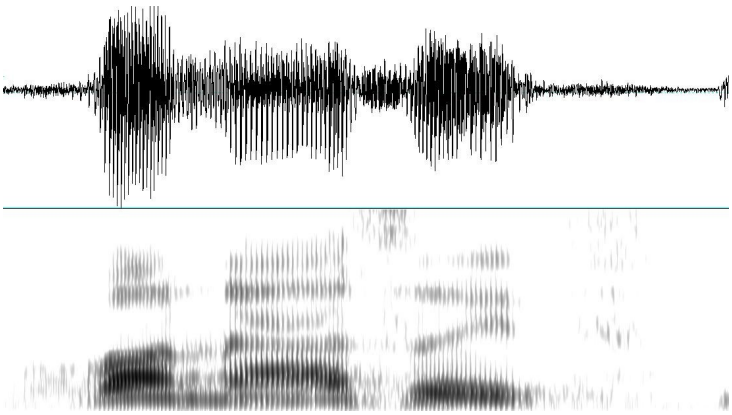
Phrase-medial schwa loss was, however, also found intermediate phrase boundary and appears to correlate with the frequency of phrase-final schwa loss, see *Spectro 3* :



Spectro 3: [ˈpɵɪʃ | ᵗʃɪ]‘(alcuni) pesci *ce li* (mangiamo crudi) / (a few) fish we (eat) them row’ (Pozzuoli – BU).

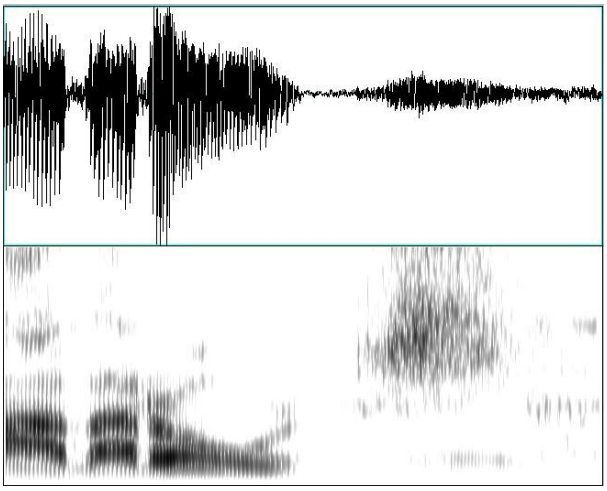
Between the subject (NP ‘alcuni pesci / a few fish’) and the verb phrase – usually seen as a potential intermediate phrase boundary – the schwa is elided; the post-alveolar consonant and the following fricative which belongs to the reflexive pronoun are almost fused in a consonant over-long (140 ms.). The short pause between the end of the first /ʃ/ and the following fricative (the *t* closure) onset indicates that there is not a time-conditoned elision of schwa. Transition from /ʃ/ to the following /ʃ/ is voiced, giving rise to one glottal period of ‘vocalic’ production, but there is no vowel percept.

Accompanying the loss of schwa is a strong tendency for final voiced consonants, even sonorants, whether single or geminate to be at least partially devoiced, see *Spectro 4* where the final /r/ also shows a strong devoicing and fricativisation (the realisations vary from a [r] + fricative cluster to an apical or laminal fricative):



Spectro 4: [sø̈ɪɾʰ] ‘(vanno la) sera / (they go in the) evening’ (Pozzuoli-BU) – [ø̈ɪ] = 251 ms., [ɾʰ] = 118 ms.

In the case of single sonorants, this can result in a phonetically complex consonant which increases auditorily the weight of the syllable (especially for Ischia), see *Spectro 5*, where we observe a ‘strengthening’ of the lateral by a fricative realisation:



Spectro 5: [A bAˈrɔɬ↓] ‘la parola / the word’ (Forío, Ischia-VT) – [ɾ] = 12 ms; [ɔ] = 74 ms.; [ɬ] = 193; [h] = 210 ms.

In *Spectro 5* /l/ shows behaviour that parallels that of /r/: single /l/ is often totally devoiced, becoming a lateral fricative or partially devoiced, forming a sequence of [l] + [ɬ].

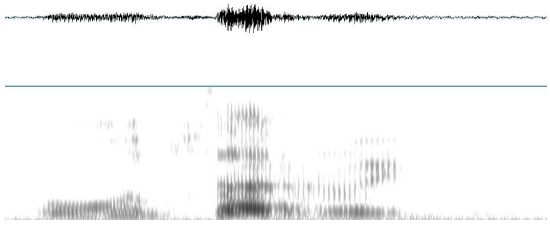
1.2 Falling *diphthongs in closed syllables*

Contrary to assumptions for Standard Italian, closed syllables were found containing a heavy diphthong. Diphthongal nuclei can be *falling* diphthongs, i.e., they have a post-nuclear glide and must be regarded as branching rhymes. They have durations equivalent to lengthened vowels under lexical stress, but can still occur in *closed* syllables (preceding a geminate consonant), resulting in a syllable structure which we call 'super heavy' (see *Spectros 6-8*).

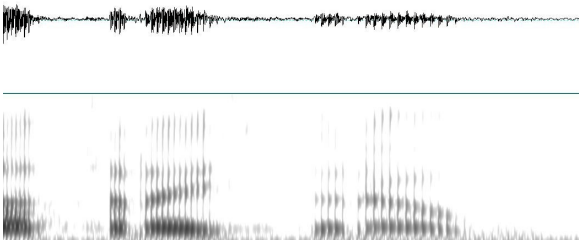
According to the literature Italian falling diphthongs, which only occur in open syllables, are considered phonologically 'heavy'. The first element is the vocalic nucleus, and the second element is considered non-vocalic, in effect forming a coda element. This analysis would lead maximally to a CVCCC structure in our dialects. Alternatively, the diphthong could be analysed as a branching nucleus, giving CVVCC. Both analyses represent a radical deviation from what is assumed to be the rule for Italian phonology.

We give measurements and contrast examples with a) normal heavy diphthongs in open syllable to show equivalent duration; b) with single and geminate consonants in other words.

In Pozzuoli, vowels corresponding to Standard /i, e/ are realised as [əʏ,əɪ, œ̆ɪ, ʏɪ], /u, o/ as [əʊ, əʊ, əɤ], see *Spectros 6* and *7* with falling diphthongs in closed syllable and loss of final schwa; the preceding nasal is breathy or completely devoiced (or sometimes in Ischia followed by strong aspiration):

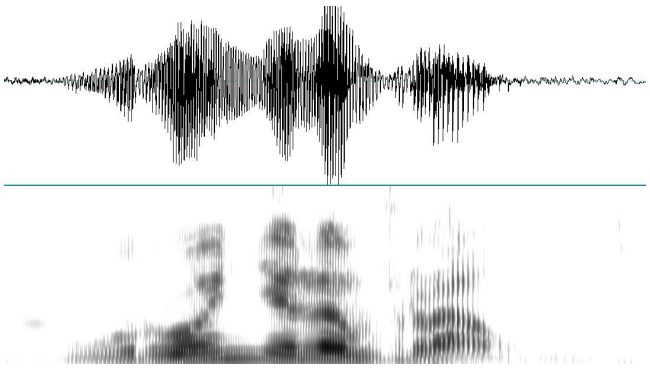


Spectro 6 [rəɪm̥ː] ‘(il gozzo a) remi (fishing boat with) oars’ (Pozzuoli - CI) – [əɪ] = 230 ms., [m̥ː] = 107 ms. (*vs*. falling diphtong in open syllable [k̟aˈmœ̆ɪz̥ɪ] ‘camice di’ – [œ̆ɪ] = 273 ms.).



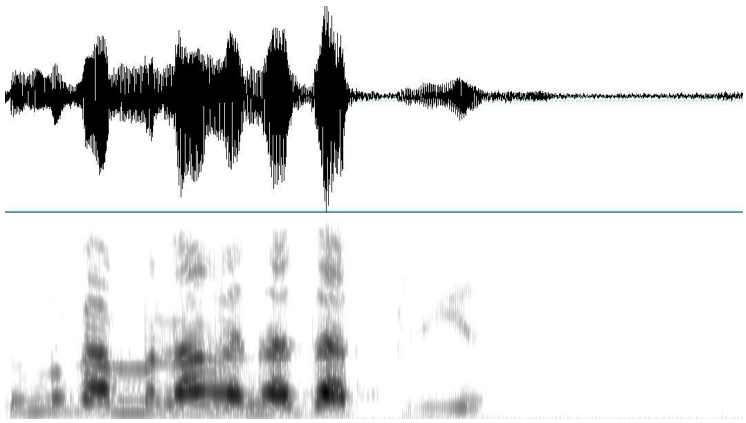
Spectro 7 [rəʊm̥^{b}]‘(e) si rompe (and) it breaks up’ (Pozzuoli - CI), [əʊ] = 193 ms., [m̥^{b}] = 177 ms. (*vs*. falling diphtong in open syllable [vʌ̃ˈlɛ̆ʊsə] ‘desideroso’ – [ɛ̆ʊ] = 258 ms.).

The *Ischian* diphthong corresponding to /o/ does have an open or mid-open onset rather than a mid-close onset, but it still has an unrounded and usually centralized quality: [**A**] (our symbol for an open vowel mid-way between Cardinal 4 and 5), [ɐ] or Cardinal 14 [ʌ], with a glide to a close-mid central-back rounded [4] [aʊ, Aʊ, ʌʊ], See *spectro 8*:

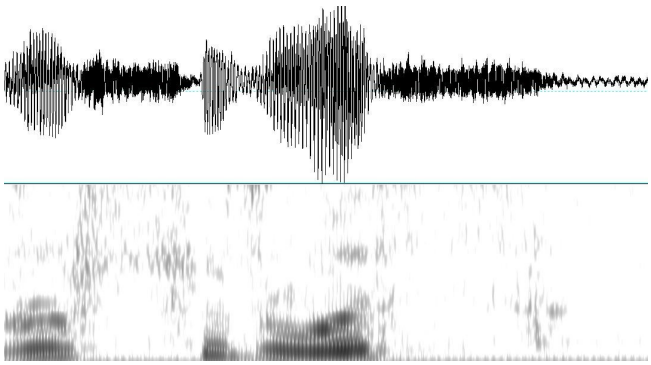


Spectro 8 [*fr*Aʊn̥^{t}] ‘(il bernoccolo) in fronte / (bump) on the forehead’ (Forío, Ischia - VT) – [Aʊ] = 160 ms., [n̥] = 240 ms. (with a previous part of the [u] weakened) [t] = 160 ms. (cf. also [ɾəˈb̥a̲ʊjːe̞]; [b] closure = 234 ms.; [au] = 356 ms. – [a] = 149 ms. + [(a̲)ʊ] = 215 ms.; [j] = 151 ms.; [e̞]= 92 ms. or in open syllable [fəʷd͡ʒj̈a̲ʊsə̤] ‘sfiziosa’; [d] (closure) = 62 ms.; [z] = 57 ms.; [j̈] = 59 ms.; [j(a)] = 57 ms.; a = 83 ms.; [(a)ʊ] = 100 ms.; [s] = 66 ms.; [ə] = 35 ms.).

Metaphonic diphthongs are realised as falling. They are accented on the first element, i.e. are falling diphthongs which, like the non-metaphonic diphthongs, can occur in closed as well as open syllables. Both categories are seen to be equivalent in duration and to coincide in quality. The second element of the metaphonic diphthong is centralised: [iː$^{(ə)}$]/[uː$^{(ə)}$] (or [uə̯], [uə̞], [uə̤], [uʌ̈] [uɔ̤̈]). The area of the vowel space on which the formants converge in the second element is approx 500Hz for F1 and 1500 Hz for F2 which support the auditory impression of a movement towards the neutral vowel schwa. The intensity trace (dB), showing the relative energy in the two parts of the diphthong also confirmed the auditory impression of a falling-intensity diphthong.
Comparisons are made of falling metaphonic and non-metaphonic diphthongs to ascertain whether both categories can be considered phonologically heavy, see *Spectros 9 and 10*:



Spectro 9 [aˈpːɾiẹsː] ‘appresso / behind’ (Anacapri, Capri – AN) – [i̯ẹ] = 195 ms., [sː] = 180 ms.



Spectro 10 [ɾʊsːə ɾʊo̯sː] ‘grosso grosso / big big’ (Anacapri, Capri -AN) – [ʊo̯] = 240 ms., [sː] = 213 ms.

There is a change of F0 in [ʊ] ↔ [o̯].

Our observations from the analyzed data show the following regularities in post-lexical syllable structure which deviate from what is considered acceptable in Standard Italian:

- Loss of final schwa resulting in a closed syllable due to surface resyllabification

- without shortening of the preceding tonically lengthened vowel,
- independent of the mono- or diphthongal nature of the preceding vowel
- Presence of consonant clusters in the coda due to loss of final schwa or of quasi-clusters at the phonetic level due to fricativization and lengthening of the final part of a sonorant: [*rh*], [*lɬ*] (Pozzuoli: [ˈmːɛ̝ɪᵊlɬ] 'mele/apples').
- Long falling diphthongs independent of the presence and structure of a coda.

Together with the tendency for durational and spectral reduction (centralisation) in other, non-final non-tonic vowels, these observations indicate a general tendency towards *variation* in phonetic syllable weight (= number of segments, duration and spectral definition of the vowel).

These phenomena are discussed with regard to their potential implications for the rhythmic structuring of these dialects. The resulting syllable structures must be classified as 'super-heavy', extending the range of legitimate syllable types in the direction of what is more usually found in tradition 'stress-timed' languages.

Thus, the evidence discussed above points to a position on the syllable- to stress-timed continuum of these Southern Italian Dialects which is further towards the stress-timed pole than can be expected for Standard Italian.

Quantitative analysis and instrumental confirmation of our hypothesis is done on our recordings in sections 3 and 4.

2. Are there objective, measurable differences?

In recent studies of rhythmic properties of languages [10, 22, 6], variation measures have been shown to differentiate languages along a syllable- to stress-timed continuum. Both variation in syllabic nuclei and variation in the intervocalic period appear to play a role. New ways of measuring rhythmic differences have been proposed [6, 10, 15, 20, 21, 22]. These are derived from syllable structure and prosodic differences between languages [8, 9, 18].

The measurements are all *durational*. They reflect the effects of syllable-complexity on the timing of syllable sequences (= inter-vowel variability), vocalic lengthening and shortening (= inter-consonantal variability).

The *variability* of vocalic and consonantal intervals is calculated and plotted on two axes (vowel axis vs. consonant axis, see *Figure* 1):

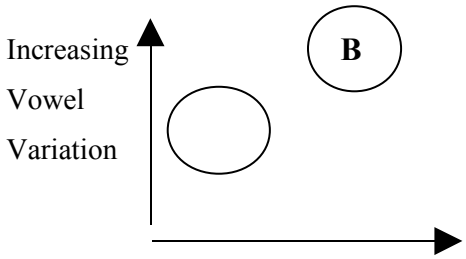


Figure 1 Schematic distribution of 'syllable-timed' languages (A: low variation in the duration of vowel and consonant intervals) and 'stress-timed' languages (B: high variation in the duration of vowel and consonant intervals).

3. Measurements

Rhythm measures are calculated according to [6, 10, 20, 21, 22; 17].

The Ramus' measures are:
%V – Proportion of vowels within ips ('inter-pause stretches')
Δ V – Standard deviation of vowel durations within ips
Δ C – Standard deviation of consonant durations within ips

The Grabe and Low' measures are:
PVI-V and PVI-C (PVI = **P**airwise **V**ariability **I**ndex):
The average durational difference from one vowel to the next vowel or one consonant to the next consonant.

The *Basic Formula* is as follows:

(i) Non-normalized consonantal PVI:

$$^{r}\ PVI = \left[\sum_{k=1}^{m-1} |d_k - d_{k+1}| / (m-1)\right]$$

(ii) Normalized vowel PVI (for vowels to correct for tempo fluctuations):

$$nPVI = 100 \times \left\lceil \sum_{k=1}^{m-1} \left| \frac{d_k - d_{k+1}}{(d_k + d_{k+1})/2} \right| / (m-1) \right\rceil$$

Before the application of 'interval-based' instrumental analysis methods, we looked first for structural evidence to support the interpretation of these variants as more stress-timed (see §§ 1, 1.1, 1.2). The scalar model of rhythm implied by the measures just discussed is theoretically grounded in the structural discussion made by [8, 9], in which rhythm is seen as the total effect created by the interaction of a number of phonetic and phonological segmental and prosodic properties. Before the statistical treatment of the instrumental data, we therefore considered in section 1 some phonetic effects in Southern Italian dialects which have implications for the realised phonotactic structure and therefore also for assumptions about rhythm.

3.1 Problems?

A number of studies have reported encouraging differentiation of languages reminiscent of the syllable-timed vs. stress-timed distinction. But very small amounts of read material have been analysed.
The structural basis of the measurements implies dependency on the nature of the speech material = *Representativity problem*.
Individual speakers and *speaking style* may be expected to result in different variability measurements.
Tempo measurements are a function of phone- and syllable duration and must therefore be confounded with rhythm measures.
The systematic effect of tempo on rhythm measures has been explicitly considered in own recent studies [4, 5, 6, 25], where semi-spontaneous recordings of regional italian and German are also classified for tempo: *Slow*, *Normal* and *Fast syllable rate* and *phone rate*.
A number of other measures are calculated by [6, 23; 25], to offer illumination of the rhythm-tempo relationship: the ratio of number-of-consonants/number-of-vowels (as a rough measure of syllable complexity in an ips or in a corpus) and the ratio of vowel-duration/ consonant-duration (as a measure of the temporal structuring of the syllable), etc.

3.2 Speech material and methods

Corpora had been segmented and labelled, providing the segmental identities and durations which form the basis of the rhythm measures. Pauses, hesitations and other interruptions had also been annotated, so it was possible to identify prosodically uninterrupted 'inter-pause stretches' (ips).
Taking the fact that perceived rhythm and measured rhythm both depend on realised utterances (rather than underlying structural properties), it is important to consider the possibility that spontaneous speech regularly contains reductions and elisions that are not equally well described for different languages.
German for instance has been well documented as regards the types of reductions that occur [12], but quantitative studies on the frequency of reductions are still needed. Work on Italian has not been long established, but reduced forms appear to be more common than traditional descriptions. Comparison of spontaneous Italian with a number of other languages indicate that the similar spontaneous speech processes occur despite large differences in underlying structure [2, 4, 5]. This consideration adds further uncertainty to any hypothesis of distinctive rhythm measures for semi-spontaneous Italian and spontaneous German (see *Table* 2)[1]:

Lang.group	**%V**	**Δ V**	**Δ C**	**PVI-V**	**PVI-C**
Naples	54.2	59.8	51.5	39.2	56.4
Pisa	55.1	65.4	51.0	43.0	58.9
German	42.0	42.2	64.5	55.0	65.1

Table 2. Ramus (%V, Δ V, Δ C) and Grabe-Low (PVI-V, PVI-C) rhythm measures for the Naples, Pisa and German speaker groups.

As showed from the average group values given in *Table* 2, what is most striking about the measures is the much higher vowel variability of the Italian speakers. They are further from the Spanish values found in previous studies even than English and German [4, 5, 23, 25].

[1] The Italian here consists of semi-spontaneous speech recordings from the AVIP/API regional Italian database (*Archivio Varietà Italiano Parlato*, ftp://ftp.cirass.unina.it - Map-Task dialogues) and the German is the Kiel Corpora of read and spontaneous speech [12, 13].

In view of the rhythm-typology assumptions that have been made about the rhythm measures examined here, and which have to some extent been substantiated in previous studies, reasons for the unexpected results reported above need to be considered. These may lie in the amount of speech material, in the type of speech material, or in the selection of speakers.
As far as the amount of material analysed is concerned, already 841 Italian and 635 German ips (in [4, 5]) are considerably more speech material than has been analysed and reported on previously. These findings cannot therefore be discounted as less reliable than those from previous work.

4. What differences are there between the languages?

4.1 Treated samples of AVIP/API and IPDS corpora

In view of the changes in rhythm values that have been presented in our previous studies, the question remains to be answered whether the overall differences for instance between German and Italian reported in section 3.2 above are consistently found for the different articulation rates. One-way ANOVAs were performed by [4, 5, 23, 25], for each articulation rate separately, with speaker group as independent variable and the 5 measures (Δ C, Δ V, %V, PVI-C and PVI-V) as dependent variables. The results are given in *Table* 3:

Measure	Slow	Medium	Fast
%V	***(N=P)>G	***(N=P)>G	***(N=P)>G
Δ V	***(N=P)>G	***(N=P)>G	***P>N>G
Δ C	n.sig. (N=P=G)	**N>G; (P=N), (P=G)	***(N=P)>G
PVI-V	n.sig. (N=P=G)	***(G=P)>N	***(G=P)>N
PVI-C	n.sig. (N=P=G)	***(N=P)>G	***(N=P)>G

Table 3 Rhythm mesures for slow, medium and fast articulation rate.

These results show a systematic differentiation of German and the Italian groups for both Ramus' vowel measures for all three articulation rates, with some over-differentiation by Δ V for the fast rate, since it also differentiates

Pisa and Naples. Δ C also differentiates German and the Italian groups to some extent, though not at the slow rate, and only partially at the normal rate. The PVI measures behave very differently. PVI-C differentiates German and the Italian groups at the normal and fast rate but does not separate them at the slow rate. PVI-V also fails to separate the speaker groups at the slow rate and only differentiates the German and the Naples speakers at normal and fast rates, grouping the German and Pisa speakers together.

The Ramus values show most clearly, that with increasing articulation rate, the rhythm values of all three speaker groups move from a position usually associated with stress-timing to a position much closer to Spanish (as calculated in [10]). In particular, German consonant variability (Δ C) moves from a position for the slow rate which is much more extreme than the value found previously [10] for Polish to a value equal to Spanish. The vowel variability (Δ V) decreases only slightly. By contrast, for both Italian speaker groups there is a dramatic reduction in both Δ C and Δ V with increasing articulation rate, but the Δ C values for the fast rate are only slightly lower than the value found previously [10] for English, and the Δ V values are slightly higher.

The Grabe and Low values also show the strong reductions of consonant variability (PVI-C) with articulation rate, the Italian values approximating those found previously for Spanish, and the German value lying even lower. However, the normalised vowel variability values (PVI-V) remain much higher than those previously found for Spanish, and change comparatively little from slow to normal to fast, even for the Italian groups.

4.2 Discussion

The results of the rhythm calculations carried out on the Kiel Corpus and the AVIP spontaneous German and Italian emphatically confirm the assumptions made in the introduction and in the § 3.2 that rhythm 'classification' is dependent on the speech material and the speaking style. Firstly, the average values found here for spontaneous Italian and German deviate considerably from values previously found for read speech. Secondly, the average values for different speakers (producing different material in their own personal style) varied widely. Thirdly, the speaker-group values for different articulation rates varied considerably, and in a systematic way.

Most interesting is the way in which the rhythm values change with articulation rate. For both languages, there is a reduction in variability with increasing rate. In both languages, too, there is a negative correlation between (increasing) articulation rate and (decreasing) syllable complexity, expressed in the Cn/Vn quotient for interpause stretches (ips). However, this correlation is considerably higher for German, indicating that the greater initial complexity of German syllables allows greater scope for simplification. This stronger pattern in German is also reflected in an increasing vowel proportion (%V) with increasing syllabic articulation rate, despite a decrease in %V with increasing phone rate. Italian, on the other hand, shows an almost constant %V over the three articulation rates.

The most surprising result is the generally greater vowel and consonant variability found for the Italian than for the German material. In terms of the original conception underlying both the Ramus and the Grabe and Low rhythm measures, this is supposed to indicate a greater tendency towards 'stress timing'. While we are prepared to accept that consonant gemination and allophonic vowel lengthening under stress may move Italian away from the syllable-timed position it is traditionally assumed to have towards a more stress-timed position, and while rapidly spoken German can be expected to move towards a more syllable-timed position, it is hard to accept the reversal of positions that the results show as genuine 'rhythmic statements'. As we argued above, the rationale behind both Ramus', Grabe and Low's measures cannot be accepted as reflections of rhythm in an auditory sense, because they do not capture the alternation of complex and less complex syllables; they separate the vocalic and the intervocalic measures.

However, we are still left with the puzzle, that, in the material investigated, variability in the Italian vowels and consonants was greater than the German.....

4.3 *Measuring rhythm: results on this method for Southern Italian Dialects*

The step is now to quantify data from Italian dialects spontaneous speech recordings to illuminate the relationship between the structural criteria assumed to underlie rhythm type and the rhythm measures employed to differentiate rhythmic types.

The type of data on which this exploration is based consists therefore of spontaneous speech recordings. Two speakers from Pozzuoli (CI, aged 45; BU, aged 54) and two from Ischia (VJ, aged 45 and CA, aged 50 from

Forío) were recorded during conversations in which they spoke freely about the words and expressions used in their work and their life in the local community. Similar recordings of conversations with inhabitants of Capri provide comparable data (GE, aged 69 and AN, aged 44 from Anacapri).

The structural features found in the dialects that offer support for a divergence from this traditional assumption are: a) Long vowels or long diphthongs in closed syllables; b) Neutralisation of vowel timbre in unstressed syllable; c) Loss of unstressed vowels (see §§ 1, 1.1, 1.2).

The *vowel-realisation* criterion traditionally offers support for a separation also of Bulgarian and German as stress-timed from Italian as syllable-timed. However, the picture seems to be less clear in reality (cf. [6] and §§ 4.1, 4.2). Italian is considered to have no vowel reduction. However, we showed [24] that there is neutralisation of the mid-close vs. mid-open opposition and considerable phonetic centralisation in unstressed position.

We give here measures for 10 fluent sections of spontaneous speech from the Neapolitan dialect of Ischia (Forío, a total of 33.62 sec). The average PVI scores for one speaker is: Raw PVI (Consonant interval) 52.52, Normalized PVI (Vowel interval) 55.98. The average percentage vocalic interval in the utterances is 54.9%. Compared to our earlier data and to data in the literature these measures are different to some extent, but only in the consonantal measure: the %V value of 54% is clearly equivalent to the Italian values we got for Bari, Pisa and Napoli and much higher than any of the German or Bulgarian values (they never reached 50%, even at the fastest tempo, cf. [6]).

Our values for Bari, Pisa and Napoli are (from the AVIP/API corpus): Raw PVI-C Bari 61.6, Pisa 58.9, Napoli 56.4; Norm V-PVI Bari 41.6, Pisa 43.0, Napoli 39.2. So the speaker consonant variability is lower (there is no support for 'stress timing'), but the vowel variability is considerably higher (pushing the vowels away from syllable timing). For comparison, our German values were: Raw PVI-C - German 68; Norm PVI-V - German 55. The values from [10] are: German 59.7/55.3, English 64.1/57.2, French 50.4/43.5, Spanish 57.7/29.7. In terms of text-dependent variation in the values, [10] publish the following values for 3 different parts of their material: PVI-C German 52.1/57.0/55.9; English 65.6/65.0/54.4; French 49.3/49.7/44.3; Spanish 60.3/56.9/54.7; PVI-V German 57.6/65.3/58.7; English 55.2/53.6/56.1; French 39.4/38.7/42.0; Spanish 26.4/27.7/26.0.

We compare these values with the variation over 10 utterances of the dialectal speaker's:

Raw PVI-C	Norm PVI-V
56.4	45.2
37.1	52.7
44.6	63.7
36.7	64.5
54.6	51.3
71.7	55.6
55.3	60.2
44.8	65.7
49.7	51.2
74.3	49.7

Here it is the mapping onto the two-dimensional rhythm-typology chart of the C-PVI (x-axis) and V-PVI (y-axis) values for – from left to right at y = 55 or above - italian dialectal speaker, German [10], English [10] and our German (spontaneous speech). The lower group (y = 45 or lower) are French, Napoli, Spanish, Pisa and Bari (from left to right):

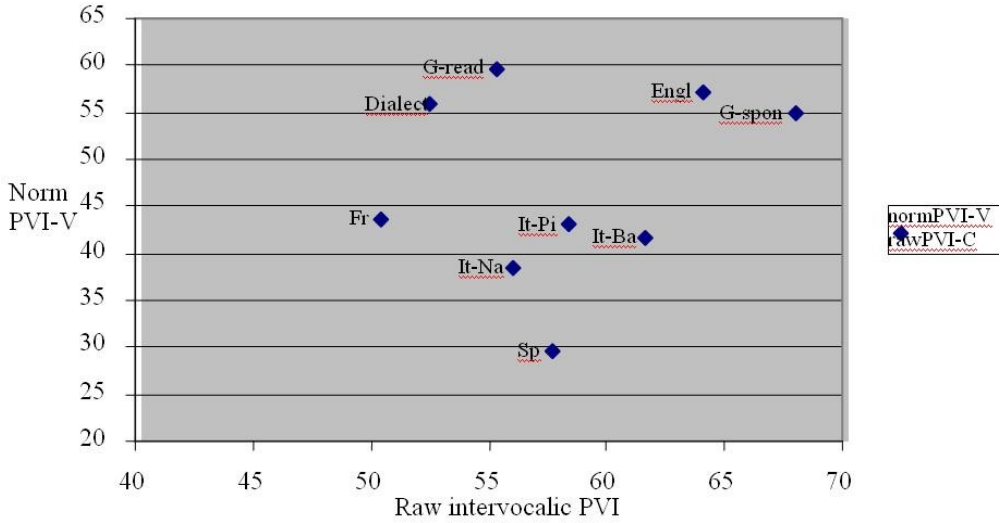


Figure 2 Norm PVI-Vowel and raw PVI-Cons (interconsonantal interval) values for an italian dialectal speaker from (Ischia, Naples) compared to regionally accented speakers of Standard Italian from Bari, Naples and Pisa, and compared to English, French and Spanish read

speech (from [10]) and to German read and spontaneous speech.

The values above and the *Figure* 2 show a 'rhythm plot' in which the PVI-V groups the dialectal speaker with 'stress-timed' languages against the traditional typology expectation.
Similar recordings of conversations with inhabitants of other areas (Pozzuoli) provide comparable data, in rhythmic terms, for this island dialect and parallel analyses have been carried out for Capri dialect.
In summary, the main focus in our discussion of data was on language's and regional variety's rhythmic status in typological terms, in order to illustrate inner-regional commonalities and differences. On the basis of extensive corpora, our sets of measures show the tendency of several several Italian Dialects towards positions in the rhythm space associated with 'stress-timing'. These results have consequences for the rhythm-typology.

References

[1] Asu, Eva Liina / Nolan, Francis (2005) "Estonian rhythm and the Pairwise Variability Index", *Procedeengs Fonetik 2005*, Department of Linguistics, Götemborg University, 29-32. http://www.ling.gu.se/Konferenser/fonetik/2005.

[2] Barry, William John / Andreeva, Bistra (2001) "Cross-language similarities and differences in spontaneous speech patterns", *Journal of the International Phonetic Association* (*JIPA*) 31.1, 51-66.

[3] Barry, William John / Russo, Michela (2002) "Gradi di elisione dello schwa finale nelle varietà di Ischia e Pozzuoli (NA): un'analisi strumentale e implicazioni fonologiche", Agostino Regnicoli (ed.), Proceedings of *XII Giornate di Studio del Gruppo di Fonetica Sperimentale (GFS)*, Macerata, 13-15 Decembre 2001, Roma: Il Calamo, 59-64.

[4] Barry, William John / Russo, Michela (2003) "Measuring rhythm. Is it separable from speech rate?", *AAI Workshop*, *Prosodic Interfaces*, Amina Mettouchi / Gaëlle Ferré (ed.). Nantes: Université de Nantes, UFR Lettres et Langage, AAI (Acoustique, Aquisition, Interprétation), 15-20.

[5] Barry, William John / Russo, Michela (2004) "Isocronia oggettiva o soggettiva? Relazioni tra tempo articolatorio e quantificazione ritmica",

Federico Albano Leoni / Francesco Cutugno / Massimo Pettorino / Renata Savy (ed.), *Il parlato Italiano*, Napoli, 13-15 febbraio 2003, Napoli: D'Auria, cdrom A02.

[6] Barry, William John /Andreeva, Bistra / Russo, Michela / Dimitrova, Snezhina / Kostadinova, Tania (2003) "Do Rhythm Measures Tell us Anything about Language Type?", Maria-Josep Solé / Daniel Recasens / Joaquin Romero (ed.), *Proceedings of the 15th Internaional Congress of Phonetic Sciences*, Barcelona, 3-9 August 2003, Barcelona: Causal Productions Pty Ltd, 2693-2696.

[7] Bertinetto, Pier Marco (1981) *Strutture prosodiche dell'italiano*. Firenze: Accademia della Crusca.

[8] Dauer, M. Rebecca (1983) "Stress-timing and syllable-timing reanalyzed", *Journal of Phonetics* 11, 51-62.

[9] Dauer, M. Rebecca (1987) "Phonetic and phonological components of language rhythm", *11th International Congress of Phonetic Sciences*. Tallinn, Estonia: U.S.S.R. / Academy of Science of the Estonian S.S.R., vol. 5, 447-450.

[10] Grabe, Esther / Low, Ee Ling (2002) "Durational Variability in Speech and the Rhythm Class Hypothesis", in Carlos Gussenhoven / Natasha Warner (eds.), *Papers in Laboratory Phonology VII*. The Hague: Mouton de Gruyter, 515-546.

[11] Kohler, Klaus J. (1990) "Segmental reduction in connected speech in German: Phonological facts and phonetic explanations", in William J. Hardcastle / Alain Marchal (ed.), *Speech Production and Speech Modelling*, Dordrecht: Kluwer, 69-92.

[12] IPDS (1994) *The Kiel Corpus of Read Speech*, Kiel: Institut für Phonetik und digitale Sprachverarbeitung, vol. 1, CD-ROM #1.

[13] IPDS (1994-1997) *The Kiel Corpus of Spontaneus Speech*, Kiel: Institut für Phonetik und digitale Sprachverarbeitung, vol. 1-3, CD-ROM #2-4.

[14] Lloyd, John A. (1940) *Speech signals in telephony*, London: Sir I. Pitman & sons.

[15] Low, Ee Ling (1998), *Prosodic prominence in Singapore English*. Doctoral dissertation, University of Cambridge.

[16] Low, Ee Ling / Grabe, Esther (1995) “Prosodic patterns in Singapore English”, Kjell Elenius / Peter Branderud (ed.), *XIIIth International Congress of Phonetic Sciences*, Stockholm: KTH and Stockholm University, vol. 3, 636-639.

[17] Low Ee Ling / Grabe Esther / Nolan Francis (2000) “Quantitative characterisations of speech rhythm: syllable-timing in Singapore English”, *Language and Speech* 43, 377-401.

[18] Nespor, Marina (1990) “On the rhythm parameter in phonology”, Roca Iggy M., (ed.), *Logical Issues in Language Acquisition*, Dordrecht: Foris,157-175.

[19] Pike, Kenneth L. (1945) *The intonation of American English*, Ann Arbor: University of Michigan Press.

[20] Ramus, Franck, (1999) *Rythme des langues et acquisition du langage*. Doctoral dissertation, Paris: EHESS.

[21] Ramus, Franck (2002) “Acoustic correlates of linguistic rhythm: Perspectives”, Bernard Bel / Isabelle Marlien (ed.) *Proceedings of the 1st International Conference on Speech Prosody*, Aix-en-Provence, 11-13 April 2002, Aix-en-Provence: Laboratoire Parole et Langage, 115-120.

[22] Ramus, Franck / Nespor, Marina / Mehler, Jacques (1999) “Correlates of linguistic rhythm in the speech signal”, *Cognition* 73, 265-292.

[23] Russo, Michela / Barry, William John (2004a) “In che misura l’italiano è ‘iso-sillabico’? Una comparazione quantitativa tra l’italiano e il tedesco”, Paolo D’Achille (ed.) *Generi, Architetture e forme testuali*. Firenze: Cesati, 387-401.

[24] Russo, Michela / Barry, William John (2004b) “Interaction between Segmental Structure and Rhythm. A Look at Italian Dialects and Regional Standard Italian”, *Folia Linguistica* 38, 3-4, 277-296.

[25] Russo, Michela / Barry, William John (2008) “Isochrony reconsidered. Objectifying relations between Rhythm Mesures and Speech Tempo”, Plinio A. Barbosa, Sandra Madureira et César Reis (éd.), Proc. of Speech Prosody 2008, Fourth Conference on Speech Prosody, May 6-9 2008, Campinas (Brazil), São Paulo : Capes, Fapesp, CNPq - Campinas : IEL, Unicamp, Motorola, Editora RG, cdrom.