

49 Stress-timed *vs.* Syllable-timed Languages

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1 Introduction

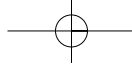
Rhythm characterizes most natural phenomena: heartbeats have a rhythmic organization, and so do the waves of the sea, the alternation of day and night, and bird songs. Language is yet another natural phenomenon that is characterized by rhythm. What is rhythm? Is it possible to give a general enough definition of rhythm to include all the phenomena we just mentioned? The origin of the word *rhythm* is the Greek word *ῥυθμός*, derived from the verb *ῥεῖ*, which means ‘to flow’. We could say that rhythm determines the flow of different phenomena.

Plato (*The Laws*, book II: 93) gave a very general – and in our opinion the most beautiful – definition of rhythm: “rhythm is order in movement.” In order to understand how rhythm is instantiated in different natural phenomena, including language, it is necessary to discover the elements responsible for it in each single case. Thus the question we address is: which elements establish order in linguistic rhythm, i.e. in the flow of speech?

2 The rhythmic hierarchy: Rhythm as alternation

Rhythm is hierarchical in nature in language, as it is in music. According to the metrical grid theory, i.e. the representation of linguistic rhythm within Generative Grammar (cf., amongst others, Liberman & Prince 1977; Prince 1983; Nespor & Vogel 1989; CHAPTER 43: REPRESENTATIONS OF WORD STRESS), the element that “establishes order” in the flow of speech is stress: universally, stressed and unstressed positions alternate at different levels of the hierarchy (see CHAPTER 40: STRESS: PHONOTACTIC AND PHONETIC EVIDENCE).

Two examples of stress alternation are given in (1) and (2), on the basis of Italian and English, respectively. The first level of the grid assigns a star (*) to each syllable, and is meant to represent an abstract notion of time; on the second, third, and fourth level, a star is assigned to every syllable bearing secondary word stress, primary word stress, and phonological phrase stress, respectively.



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(1)

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      *           *           *           *
    *   *       *   *       *   *       *
  *   *   *   *   *   *   *   *   *   *   *
* * * * * * * * * * * * * * * * * * * * *
    
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Domani mattina partiremo presto con il barcone nuovo di Federico
 'Tomorrow morning we will leave early with the new boat of Federico'

(2)

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      *           *           *           *           *
    *           *           *           *           *
  * *         *   *         *   *         *   *
* * * * * * * * * * * * * * * * * * * * *
    
```

Guinevere will arrive with Oliver tomorrow morning with a transatlantic

Indeed, these examples clearly show that in the two languages there is a similar alternation of stresses ranging from secondary word stress to primary word stress to phonological phrase stress.

The level that is problematic in the metrical grid is the basic level, i.e. the level corresponding to the syllable. This representation does not show any alternation, or any element that establishes order in movement: if we restrict our attention to this level, all syllables are represented with equal prominence. It is clear, however, that grids that are identical at all levels, as in the two following Italian and English sentences, may represent very different rhythms. In particular, the first level – which represents an abstract notion of time for syllables – does not represent important differences between languages, precisely because it is abstract: simple syllables and very complex ones receive identical representations.

(3) a.

```

      *   *           *
    *   *           *
  *   *   *   *
* * * * * * * *
    
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Domani Luca tornerà
 'Tomorrow Luca will return'

b.

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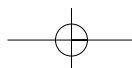
      *   *           *
    *   *           *
  *   *   *   *
* * * * * * * *
    
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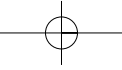
Tomorrow Albert will return

There are thus empirical differences in rhythm between languages that are not represented in a metrical grid. Long before the metrical grid theory was proposed, phoneticians (e.g. Pike 1945) had proposed the existence of *rhythmic classes* to account for the rhythmic differences between languages like English or German, on the one hand, and languages like Spanish or Italian, on the other.

3 Linguistic rhythm as isochrony

The idea that languages have different rhythms was first advanced by Lloyd James (1940), who observed that the rhythm of Spanish recalls that of a machine gun



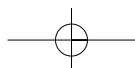


and that of English that of messages in the Morse code. Indeed, this is the same difference as we hear in sentences like (1) and (2), pronounced by native speakers of Italian and English, respectively. Subsequently, Pike (1945) in an attempt to provide empirical support for this dichotomy, proposed that this difference between Spanish and English was due to the requirement of isochrony at different levels. That is, languages would differ according to which chunks of speech must have similar durations, i.e. must be isochronous. The requirement of isochrony would hold between syllables in Spanish, and between interstress intervals in English. This proposal accounted for the fact that the syllables of Spanish or Italian, but not those of English or Dutch, are similar in quantity. Spanish, and languages with a similar rhythm, were thus referred to as syllable-timed, and languages with a rhythm similar to that of English as stress-timed. In subsequent work along the same lines, Abercrombie (1967) proposed that this was a general pattern of temporal organization for all languages of the world. Like Spanish and Italian, French, Telegu, and Yoruba are also syllable-timed. And, like English, Russian and Arabic are also stress-timed. A third rhythmic class was later added by Ladefoged (1975) to account for Japanese, whose rhythm differs both from that of English and from that of Spanish. According to Ladefoged, in Japanese, isochrony is maintained at the level of the mora, a sub-syllabic constituent that includes either onset and nucleus, or a coda. Japanese – and languages with a similar rhythm, e.g. Tamil – were thus characterized as mora-timed.

In terms of metrical or prosodic phonology, this proposal amounts to establishing that, in the languages of the world, the requirement of isochrony holds at one of three phonological constituents: going from the smallest to the largest of the three, the mora (μ), the syllable (σ) or the foot. The three different types of isochrony are illustrated in (4).

- (4) a. stress-timing
 $\acute{\sigma}\sigma \acute{\sigma}\sigma\sigma \acute{\sigma}\sigma \acute{\sigma}\sigma \acute{\sigma}\sigma\sigma \acute{\sigma}\sigma$
 □ □ □ □ □ □ □ □
- b. syllable timing
 CV CCVC CV CV CVC
 □ □ □ □ □ □ □ □
- c. mora timing
 $\mu \mu \mu \mu \mu$
 CV V CV C CV
 □ □ □ □ □ □ □ □
 $\sigma \sigma \sigma \sigma$

The different types of isochrony are mutually exclusive: isochrony of both syllables and feet would be possible only in an ideal language – to the best of our knowledge not attested – in which all the syllables were of the same type and in which secondary stresses were maximally alternating. Syllabic isochrony is also incompatible with mora isochrony: it would be compatible only in a language in which all syllables had the same number of moras. This case is attested, to the best of our knowledge, only in Hua, a language spoken in Botswana (Blevins 1995), and the West African language Senufo (Fasold & Connor Linton 2006), both reported to have only CV syllables.



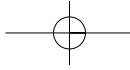
It is important to observe that this three-way distinction into rhythmic classes was not meant to deny the relevance of stress for either syllable- or mora-timed languages. Different levels of stress are, in fact, undeniable cross-linguistically. In terms of the phonology of rhythm, the distinction was meant to identify different rhythms exclusively at the basic level.

According to this conception of rhythm, as isochrony maintained at one of three different levels, belonging to one or the other group would have consequences for the phonology of a language. For example, if feet are isochronous, the syllables of polysyllabic feet should be reduced in duration, while the only syllable of a monosyllabic foot should be stretched.

The basic dichotomy between syllable- and stress-timing was largely taken for granted until various phoneticians, on the basis of measurements in different languages, showed that isochrony was not present in the signal. It was shown that interstress intervals in English vary in duration proportionally to the number of syllables they contain, so that the duration of the intervals between consecutive stresses is not constant (Shen & Peterson 1962; O'Connor 1965; Lea 1974). A similar result was obtained for Spanish: syllable duration was found to vary in proportion to the number of segments they contain. Interstress intervals, instead, were found to have similar durations, an unexplainable fact if isochrony is a characteristic of the syllabic rather than the foot level (Borzone de Manrique & Signorini 1983). Similarly, Dauer (1983), on the basis of an analysis of several syllable-timed languages (Spanish, Greek, and Italian), and of English as an example of stress-timed language, concluded that the duration of interstress intervals does not differ across the different languages. Rather, the timing of stresses reflects universal properties of rhythmic organization. Similar conclusions are reached by den Os (1988): in a comparative study of Italian and Dutch utterances she showed that if the phonetic material of the two languages is kept similar – by selecting utterances in the two languages with an identical number of segments and syllables – their rhythm in terms of isochrony is similar.

The difference in rhythm of “machine-gun” languages and “Morse-code” languages is, however, an undeniable fact. If isochrony between different types of constituents is not at the basis of this clear rhythmic difference, what are the factors responsible for it?

Dauer (1983) observed that various phonological properties distinguish the two groups of languages: for example, “syllable-timed” languages have a smaller variety of syllable types than “stress-timed” languages, and they do not display vowel reduction (see CHAPTER 82: REDUCTION). These two characteristics are responsible for the fact that syllables in syllable-timed languages are more similar to each other in duration. In Spanish and French, for example, more than half of the syllables (by type frequency) consist of a consonant followed by a vowel (CV) (Dauer 1983). In Italian, 60% of the syllable types are CV (Bortolini 1976). The illusion of isochrony thus finds its origin in different phonological characteristics of languages and not in different temporal organizations. These considerations, together with the existence of languages that are neither clearly classifiable as syllable-timed nor as stress-timed, such as Catalan, European Portuguese and Polish, led Nespó (1990) to draw the conclusion that there is no rhythm parameter. Establishing different rhythms as the cause – rather than the effect – of various phonological phenomena would in addition not account for the fact that very similar phenomena apply to eliminate arhythmic configurations in, for example, English and Italian. In both



languages, adjacent primary word stresses constitute a stress clash and are eliminated in much the same way (Liberman & Prince 1977; Nespor & Vogel 1979, 1989).

That languages vary in their rhythm is a fact. However, from these studies it can be concluded that it is not different rhythms that trigger different phonological phenomena. Rather, different rhythms arise as a consequence of a series of independent phonological properties (cf. also Dasher & Bolinger 1982).

4 Infants' sensitivity to rhythmic classes

Linguists were not alone in investigating rhythmic classes. The discovery in developmental psychology that newborns are capable of discriminating a switch from one language to another (Mehler *et al.* 1987; Mehler *et al.* 1988) triggered further experiments to explore which cues were responsible for this early human ability. In particular, the grouping of languages into different rhythmic classes attracted the attention of cognitive scientists interested in understanding how language develops in the infant's brain. Mehler *et al.* (1996) relied on the classification of languages into syllable-timed, stress-timed, and mora-timed to advance a proposal as to how infants may access the phonological system of the language they are exposed to. In particular, they proposed that the rhythmic class of the language of exposure determines the unit exploited in the segmentation of connected speech: infants exposed to stress-timed languages would use the stress foot (that is, the interstress interval), those exposed to syllable-timed language the syllable and those exposed to a mora-timed language the mora (Cutler *et al.* 1986; Otake *et al.* 1993; Mehler *et al.* 1996).

Most convincing are a number of experiments carried out with French newborns, which show that they are able to discriminate English from Japanese, but not English from Dutch, in low-pass filtered sentences, that is, in sentences whose segmental information is reduced, while prosodic information is largely preserved (Nazzi *et al.* 1998). In order to show that rhythm – rather than any other property of the test languages – is responsible for this discrimination ability, Nazzi *et al.* also tested newborns on a set of randomly intermixed English and Dutch sentences, and showed that they discriminate these from a set of randomly intermixed Spanish and Italian sentences. However, the discrimination ability disappears when the newborns are tested on a set of English and Spanish sentences *vs.* a set of Italian and Dutch sentences. Thus the intuitions that many phoneticians shared about different rhythms in English and Italian, for example, is confirmed by newborns' sensitivity to this distinction. It is thus clear that some physical property must be present in the signal to account for this difference, but until recently it has not been clear what this property was.

5 Rhythm as alternation at all levels

If isochrony is not responsible for the machine-gun and Morse-code effects, we should ask which characteristics in the signal are responsible for it. That is, what is there in the signal that would account for the clear rhythmic differences of languages belonging to different classes? Or what is the element that establishes

order at this level? Ramus *et al.* (1999) answered this question starting from the hypothesis that newborns hear speech as a sequence of vowels interrupted by unanalyzed noise, i.e. consonants; this hypothesis is known as the *Time-Intensity Grid Representation* (TIGRE; Mehler *et al.* 1996). Ramus *et al.* (1999) proposed that, at the basic level, the perception of different rhythms is created by the way in which vowels alternate with consonants. It is thus the regularity with which vowels recur that establishes alternation at this level: vowels alternate with consonants. Starting from the observation that as we go from stress-timed to syllable-timed and then to mora-timed languages the syllabic structure tends to get simpler – and the observation that simple syllables imply the presence of proportionately greater vocalic spaces – vowels would occupy less time in the flow of speech in stress-timed languages than syllable-timed languages. Likewise, in syllable-timed languages vowels would occupy less time than in mora-timed languages, which have the largest amount of time per utterance occupied by vowels. This difference is clear from the rough division into Vs and Cs in the three sentences in (5)–(7). Notice that, in agreement with Ramus *et al.* (1999), glides are treated as Cs if prevocalic and as Vs if post-vocalic.

(5) English

The next local elections will take place during the winter

CVCVCCCCVVCVVCVCCCCVCCCVCVVCCVCCVCCVCCV

(6) Italian

Le prossime elezioni locali avranno luogo in inverno

CVCCVCCVCCVCCVCCVCCVCCVCCVCCVCCVCCVCCVCCV

(7) Japanese

Tsugi no chiho senkyo wa haruni okonawareru daro

CVCVVCVVCVCCVVCVVCVVCVVCVVCVVCVVCVVCV

Ramus *et al.* (1999) tested this idea on a corpus of eight languages: English, Polish, and Dutch, representatives of the stress-timed category, French, Italian, Spanish, and Catalan, representatives of the syllable-timed category (Abercrombie 1967) and Japanese, representative of the mora-timed languages (Ladefoged 1975). They observed that languages from the same rhythmic class had similar values for %V – i.e. a similar amount of time occupied by vowels in the speech stream – as compared to languages from different rhythmic classes. The computation of %V was carried out on the basis of a careful segmentation, on the basis of both auditory and visual cues from the spectrogram (cf. Ramus *et al.* 1999). Given the assumption that newborns do not retain the difference between individual Cs and individual Vs, for each sentence only the vocalic and consonantal intervals were measured. Adjacent vowels and adjacent consonants are thus treated as vocalic and consonantal chunks, respectively. A second measure that clusters the languages into three groups is the standard deviation of the duration of consonantal intervals (ΔC), i.e. a broad measure of the regularity with which vowels recur. Both measures are related to syllable structure. A high %V implies that the repertoire of the possible syllable types is restricted, thus also that the consonantal intervals do not vary a great deal, given that there are no languages in which all syllables

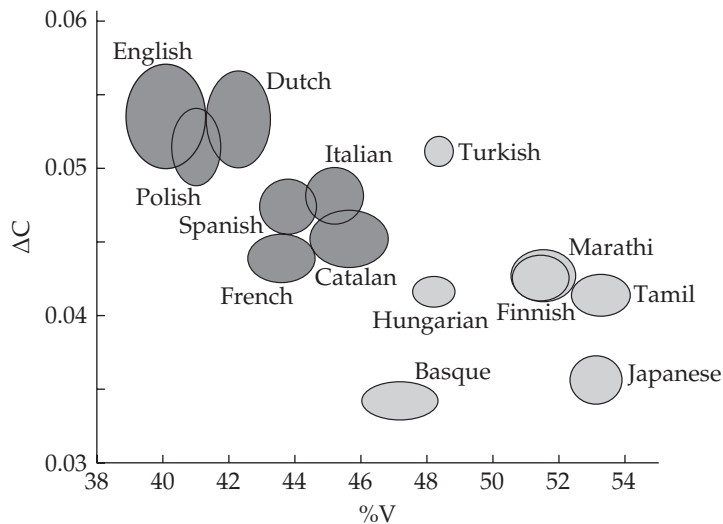
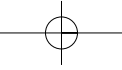


Figure 49.1 ΔC , the standard deviation of the consonantal intervals, *vs.* %V, the amount of time per utterance spent in vowels, for 14 languages. The width of the ellipses along the two axes represent standard errors of the mean along the axes. Dark ellipses represent head-initial languages, and light ellipses head-final languages. Turkish, Hungarian, Basque, Finnish, Marathi, and Tamil are from unpublished results. Data for the remaining languages are from Ramus *et al.* (1999).

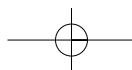
are complex. Rather, even in languages with the greatest variety of syllable types, the basic syllable type – CV – is the most unmarked (Blevins 1995; Rice 2007). See Figure 49.1.

Thus, according to this proposal, rhythm is alternation at all levels: of consonants and vowels at the basic level and of stressed and unstressed syllables, feet, and words at subsequent levels. This order in the flow of speech is always established by the alternation of more and less audible elements.

6 Other proposals

The analysis proposed by Ramus *et al.* (1999) is not the only one to rely on a purely acoustic-phonetic description of the speech stream in trying to understand the basis of linguistic rhythm. In Ramus *et al.* the %V and ΔC variables do not consider the relative ordering of long and short intervals inside an utterance. That is, sequences like CCV:CCV:CV.CV and CCV:CV.CV.CCV: (where V: is a long vowel, as opposed to VV, which denotes two different adjacent vowels) will yield identical values for their two variables.

Grabe and colleagues therefore chose to examine the *pairwise variability indices* (PVI) in the vocalic and intervocalic intervals in speech (e.g. Low *et al.* 2000; Grabe & Low 2002). This measure is meant to capture a little more of the (local) temporal patterns in speech by considering the variability of all *pairs* of vocalic or intervocalic intervals.



The raw pairwise variability index is given by the formula in (8):

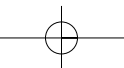
$$(8) \quad rPVI = \left[\frac{\sum_{k=1}^{m-1} |d_k - d_{k+1}|}{(m-1)} \right]$$

where m is the number of intervals, and d_k is the duration of the k^{th} interval. Thus, for example, in a language with only simple syllable types, the average durational variability between successive consonantal intervals will be less than in a language with many syllable types. The former language will therefore have a lower consonantal PVI than the latter.

These authors showed that also the PVI of the vocalic and intervocalic intervals in speech captures some of the rhythmic distinctions between languages. Thus, as in Ramus *et al.*, these authors too find a measure – the pairwise variability of the vocalic intervals – that separates stress-timed languages (higher PVI) from syllable-timed languages (lower PVI). However, there remain some discrepancies between these measures and those of Ramus *et al.* For example, while %V and ΔC clearly separate Japanese (“mora-timed”) from the “syllable-timed” languages, this difference is not apparent with PVIs. Since one of the purposes of a theory of grammar in general and of rhythm in particular is to account for first-language acquisition (cf. §8 below), infants’ discrimination or lack of it between a “syllable-timed” and a “mora-timed” language would help decide which of the two theories makes the correct prediction. The fact that Nazzi *et al.* (2000) found that 5-month-old infants raised in an American English environment discriminate Japanese from Italian leads us to prefer the %V and ΔC proposal.

Both the analysis proposed by Ramus *et al.* and that proposed by Grabe & Low start with an initial categorization of the speech stream into vocalic and intervocalic intervals. A different approach is proposed by Galves *et al.* (2002), who try to avoid any analysis into categories (e.g. vowels and consonants). Instead, they use a measure of sonority, as estimated directly from the spectrogram. In particular, they use a procedure that maps regions of the spectrum as more or less stable (i.e. constant) over short periods of time, as measured by the entropy from one time-slice to the next. This is a fully automatic procedure, and the value for each set of time-slices of the spectrogram goes from 0 to 1. Values close to 1 correspond to a regular spectrum with little variation (low entropy), typical of sonorants, and values close to 0 reflect noisy spectra (high entropy), as might be expected for obstruents. These authors then consider measures of mean and variation in the “sonority” of time-slices as analogues of Ramus *et al.*’s measures, i.e. %V and ΔC . This proposal has the great advantage of being based on an automated method. And the authors succeed in roughly replicating the observation of Ramus *et al.* on their corpus. They can segregate the stress-, syllable-, and mora-timed languages in a similar, though less precise manner. An alternative attempt to automatically determine the rhythmic class of a language has been elaborated in Singhvi *et al.* (in progress). It consists of algorithms for vowel and consonant recognition based on a variety of acoustic features, that allow to compute %V and ΔC directly from the speech stream.

As noted earlier (§3), linguistic rhythm does not correspond to isochrony at the level of different phonological units in speech. In order to nevertheless capture the intuition of rhythmicity, O’Dell & Nieminen (1999) propose a *coupled-oscillator model* for speech rhythm. In this model, a lack of overt isochrony is seen as a result of a tension between two rhythmic oscillators, one for stress-groups (roughly, feet)



and one for syllables. In a general mathematical model of two coupled oscillators, a single parameter determines which of the two oscillators (e.g. the foot or the syllable oscillator) is dominant. It turns out that this parameter can be directly estimated from speech: for stress-timed languages it is large (>1 , corresponding to a dominant foot-oscillator), and for syllable-timed languages it is small (≤ 1 , corresponding to a dominant syllable oscillator). Thus, in this approach, the idea is that simple, overt isochrony in speech might be constrained by the requirement for temporal coordination across hierarchically organized phonological units in speech (see also Cummins & Port 1998).

7 Rhythm and related properties of grammar: Implications for language acquisition

Given infants' sensitivity to basic rhythmic properties of languages, as proposed above, the issue must be addressed of the sort of implications that this sensitivity could have for language acquisition. The questions that should be addressed are, thus: do the different rhythmic cues reflect specific grammatical properties? And, might the infant be able to use such cues to bootstrap the related properties?

Although there is no one-to-one mapping between phonology and syntax, the two are correlated (cf., amongst many others, Selkirk 1984; Nespor & Vogel 1986, 2008; Morgan & Demuth 1996). On the one hand, it has been shown that the acoustic correlates of prosodic phenomena that signal phonological constituency can allow disambiguation of otherwise ambiguous sequences of words (Cooper & Paccia-Cooper 1980; Nespor & Vogel 1986, 2008; Price *et al.* 1991). On the other hand, typologists have documented several aspects of phonology and syntax that go together (e.g. Whaley 1997). Indeed, typological studies have revealed a wealth of correlations between different aspects of language, such as morphology, phonology, and syntax. Thus, Greenberg (e.g. 1963) observes that whether a language is VO or OV is correlated with many other grammatical properties of the language. For example, he notes that verb-final languages almost always have a case system. In addition, Koster (1999) observes that most OV languages have flexible word order. In a typological study, Donegan and Stampe (1983) suggest that languages with simple syllabic structures tend to be verb final. Similarly, Fenk-Oczlon and Fenk (2005) find that languages with simple syllables tend to have postpositions (i.e. to be OV) and richer case systems.

Several authors have proposed functional explanations for these observed correlations (e.g. Comrie 1981; Cutler *et al.* 1985; DuBois 1987; Hawkins 1988; Fenk-Oczlon & Fenk 2004, amongst others). From the point of view of acquisition, these correlations suggest that any cues in the input that lead to the acquisition of a single property might also provide cues and biases for acquiring all the (functionally) related properties. Thus, a cue to a phonological property might also provide cues to morphology and syntax. Indeed, there have been some concrete proposals for how phonology might allow infants to bootstrap a basic syntactic property like word order (Nespor *et al.* 1996; Christophe *et al.* 1997; Nespor *et al.* 2008).

Given that newborns show great sensitivity to rhythmic classes, we can speculate that this ability might be useful in bootstrapping various properties of their target language. As we saw in §5, languages from the different rhythmic

classes differ in their syllabic structure: going from a low %V to a high %V, languages go from having more complex to having simpler syllabic structures. Typologists have in fact observed that various morphosyntactic properties are correlated with the complexity of syllables in a language (Gil 1986; Fenk-Oczlon & Fenk 2004) and, in addition, with its rhythmic patterns (Donegan & Stampe 1983). The computation of %V might therefore offer cues to very different properties of the language of exposure.

Shukla *et al.* (in progress) hypothesize that the correlates of linguistic rhythm, %V and ΔC , have consequences for acquiring correlated morphosyntactic properties like agglutination and word order. These researchers extend the results from Ramus *et al.* to a larger and more varied set of languages. The results indicate that there is a tendency for languages with a low %V to differ from languages with a high %V in head direction, degree of agglutination, richness of the case system, and flexibility of word order. Thus, it is proposed that a simple syllabic structure is correlated with agglutination: if many suffixes can be attached to a word, complex syllabic structure would make these words excessively long and possibly hard to parse.

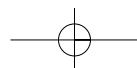
The question remains why agglutination is found almost exclusively in head-final languages. Two different reasons, both syntactic in nature, have been given. In van Riemsdijk (1998), the explanation for the correlation between head-finality and agglutinative morphology is based on head adjunction, the syntactic device that assembles independent, phonetically realized morphemes in complex words. A principle states that head adjunction can take place only between linearly adjacent heads; since heads are adjacent in head-final languages, while they are separated by intervening specifiers in head-initial languages, head adjunction – and thus agglutination – is expected to take place in OV languages only.

More recently, Cecchetto (2010) assumes that morphological conflation, responsible for fusional morphology, requires that a direct syntactic dependency be established between a selecting head and a selected one. However, in head-final languages this dependency would go backwards, since the selecting head linearly follows the selected one, and backward dependencies are disfavored, for processing reasons (e.g. Fodor 1978). As a consequence, in head-final languages affixes cannot be fused, and result in agglutination instead.

If there is indeed a syntactic explanation for the correlation between head direction and agglutination, the identification of the rhythmic class of the language of exposure would be one of the mechanisms that would assist the infant in the bootstrapping of both the favored morphological operations and word order in the language to which they are exposed.

8 Concluding remarks

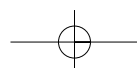
In conclusion, linguists' intuitive notion of stress-timed and syllable-timed rhythm is most likely a consequence of the phonological organization of different languages, which can be captured by two relatively simple acoustic-phonetic cues, such as %V and ΔC . Languages appear to be grouped into three rhythmic classes: one corresponding to so-called stress-timed languages, one to so-called syllable-timed languages and one to so-called mora-timed languages. The rhythmic class to which a language belongs appears also to determine the segmentation unit used by its



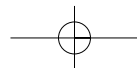
native speakers. Rhythm tends also to be correlated with a constellation of phonological, morphological and syntactic properties of the language. The observation that newborns segregate languages on the basis of their rhythmic class suggests that this ability may be utilized in the acquisition of various such properties of their target language directly from the input.

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