Psycholinguistic evidence for syllable geometry
Italian and beyond

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Abstract

The present paper addresses issues concerning syllable structure. Section 1 is a plea for the complementarity and necessary convergence of theoretical and experimental research in the language sciences. Section 2 suggests that, on purely theoretical grounds, the issue of the internal organization of the syllable may receive conflicting answers. Section 3 is a short review of previous experimental investigations concerning English, showing that in this language the syllable clearly appears to have a right-branching structure. Section 4 presents evidence that, on both experimental and observational grounds, there exist exceptions to the alleged universality of right-branching in syllable geometry; indeed, Korean seems to exhibit left-branching. Section 5 reviews experimental work performed by the author and co-workers, demonstrating that the syllable structure of Italian is but weakly oriented towards the right-branching type; Italian may be regarded, in contrast to English, as a language with a 'low profile' geometry. Section 6 provides further evidence for the above findings concerning English and Italian, analysing the break point of natural lexical blends, which turns out to be quite different in the two languages. In the theoretical discussion of section 7, it is suggested that the two main facets of the syllable (peak and margins) play a different role in speech processing. The individuation of syllable peaks seems to be a necessary precondition, and in this restricted sense the syllable is likely to be a fundamental unit of the phonology of natural languages. Syllable margins, on the other hand, become only relevant at a much shallower level, where other factors come into play as well (low-level ones, such as phonotactics, and higher-order ones, such as stress and prosodic domains other than the syllable).

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1. On the complementarity of theoretical and experimental approaches

One important facet of the long-standing debate concerning the syllable is the problem of its internal structure. This may turn out to be obvious for those holding the view that the syllable is one of the constitutive units of phonology (possibly the most fundamental, as authors such as Kahn (1976) or Borowsky (1986) posit). Yet, even those who do not share that view, possibly denying any role whatsoever to the syllable in the phonological component (Dziubalska-Kołaczyk 1995), will have to address the problem of the internal geometry of the syllable, possibly only to show that it is the result of more fundamental phonological features.

There are two possible approaches to the issue of the hierarchical structuring of the syllable. One is based on language-internal evidence, the other on external (above all, psycholinguistic) evidence. The two approaches are obviously complementary, and should ideally converge to produce a satisfactory solution. The formulation of linguistically valid hypotheses, which is the specific goal of theoretical investigation, is of course the input of experimental research, for there is no sense in collecting experimental data (either spontaneously elicited or experimentally induced), without the guidance of detailed hypotheses. However, experimentation is not merely ancillary to theorizing; experimental research is often necessary to shed light on alternative solutions envisaged by competing theories. Thus, the relationship between theoretical and experimental work turns out to be a dialectical one: experimental investigation is guided by theory, but may help refining it, and in turn feeds further goals. On the other hand, experimentation is not self-sufficient, for its results are often difficult to interpret. The experimental technique is itself a factor of the output and has to be carefully scrutinized in a cross-methodological way, in order to weed out the possible artefacts of the procedure employed, or to isolate any disturbing elements (Derwing 1997). The availability of converging results, on the theoretical and experimental side, is ultimately the best guarantee of their validity.

2. Ambiguous evidence for syllable geometry.

The case at issue is a good example of this complementarity. Consider the language-internal evidence for the hierarchical organization of the syllable. This may be of two sorts: (a) distributional; (b) processual. Both provide evidence for internal structuring, but this evidence turns out to be rather ambiguous, in that virtually any constituent of the syllable may receive support.

First, take distributional evidence. This is the primary source of data, yielding non-trivial phonotactic generalizations such as those concerning: (i) the varying weight of the individual constituents of the syllable (in many languages - cf. Italian or Japanese -, more contrasts are available in *On* than in *Co*)[1]; (ii) the varying number of segments admissible in each constituent (e.g. some languages do not admit *Co*, or - cf. again Italian and Japanese - normally admit no more than one segment in this position, etc.); (iii) the possible structuring role of specific features (e.g. in English the maximum number of segments in *Co* is two, unless the point of articulation is coronal). However, distributional evidence may be tricky. First, there are occasional gaps which partly distort the overall picture (Treiman 1988). Second, not all observed regularities are sinchronically meaningful for syllable structure (Bertinetto, in preparation b). Moreover, and most embarrassingly, the question arises as to the proper interpretation of the facts. Is phonotactics the consequence or rather the source of syllabic organization? If the source, then phonotactics must obey other, more primordial constraints than the syllable, as a number of scholars have indeed suggested (Dziubalska-Kołaczyk 1995 and references therein). I know of no simple answer to this dilemma.

Now consider the processual evidence, which constitutes the very core of phonological investigation. Here the proofs for the conspicuous role of the syllable and of its different constituents abound. As to the syllable, take for instance: (α) the different vocalic inventory in open vs. closed syllables, also reflected in historical developments (e.g. Loporcaro 1996 with respect to several Italian dialects); (β) the various phonological processes studied by scholars such as Kahn (1976), Borowsky (1986), Vennemann (1988a) etc.; (γ) the contrast 'sanfter vs. scharfer Silbenschnitt' originally proposed by Trubeckoj (1939) and recently revived by Vennemann (1991; 1994). As to syllable constituents, there is evidence that they all may play an important role. The role of the *Bo* is assessed, e.g., by: (a,i) place assimilations such as English 'velar softening' or Italian palatalization of velars before front vowels; (a,ii) isochronic relationships between *On* and *Nu* in languages such as Japanese (Kubozono 1995). The role of *Rh* is assessed e.g. by: (b,i) nasalization of vowels before nasal *Co*; (b,ii) isochronic relationships between *Nu* and *Co* in languages such as Swedish or Italian (in careful pronunciation).

The problem here is that one and the same language may often provide contradictory evidence. One such language is Italian, quoted in connection with both the *Bo* and the *Rh* (cf. points (a,i) and (b,ii)). Indeed, this seems to be the rule rather than the exception, as is abundantly demonstrated by Clements & Keyser (1983); and this argument has been used by Vennemann (1988a) to suggest that the specific organization reached by the syllable in a given language is the result of conflicting forces, which implement a situation of potential instability, possibly leading to phonetic changes. In addition, one often observes phonological processes involving intersyllabic sequences, such as place assimilations in nasals before heterosyllabic consonants. Thus it is not the case that the various syllable constituents delimit the domain of phonological processes. And even where such processes tend to involve one specific constituent, the evidence is not decisive, because one cannot easily rule out the hypothesis that the reason for this tendency is to be sought outside the syllable proper.

One might therefore conclude, as some scholars indeed have, that the syllable is not a primary unit of the phonological component. While I admit that this is a viable solution, I would like to defer the discussion of this point to a later section of the paper, and turn now to the other kind of evidence, namely external (psycholinguistic) evidence.

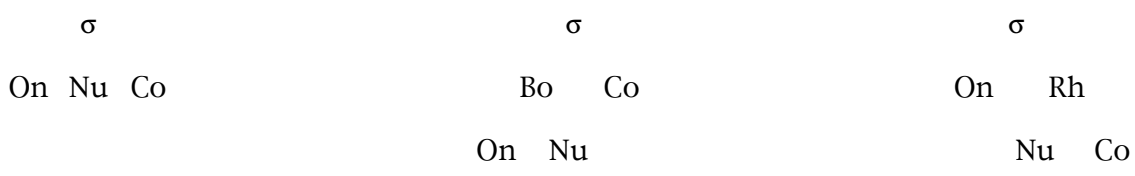
3. Experimental investigations of syllable structure.

Such evidence has mostly come, in recent years, from a body of carefully controlled experiments performed by a number of researchers (e.g. Rebecca Treiman and Bruce Derwing). Although these techniques of investigation have also been exploited for other purposes (particularly for studying the problem of intersegmental cohesion), in this paper I shall only consider experiments bearing on the issue of the internal hierarchy of the syllable.

In the case of English, to which these experiments were first applied, the syllable structure proved to be right-branching. That is, of the three possibilities depicted below, the one appropriate to represent the internal hierarchy of the English syllable is (1c):

1 I shall make use of the following abbreviations: ***Co*** = coda, ***Nu*** = nucleus, ***On*** = onset, ***Bo*** = body (i.e., *On*+*Nu*), ***Rh*** = rhyme (i.e., *Nu*+*Co*).

(1) (a) flat (b) left-branching (c) right-branching



The evidence for this comes from a variety of sources. The following is a short survey.

Treiman et al. (1982) and Treiman (1983) have shown that the attraction between *Nu* and *Co* is stronger than the attraction between *Nu* and *On*. Interestingly, this particular aspect of phonological competence is refined over time, up to the age of adolescence (Treiman 1985; Derwing et al. 1988). This concurs with the finding that the *Rh* is more easily detachable than the *Bo* (Fowler et al. 1993). By contrast, internal cohesion has been proved to be stronger within a multisegmental *On* than within a multisegmental *Co* (Treiman 1983; 1986), and again this tendency becomes stronger over time (Derwing et al. 1988).

In a substitution task, Treiman (1983: experiment 4) has shown that when taught alternative strategies, English subjects perform significantly better if they manipulate the entire *Rh* instead of the *Co* alone (experiment 3), or the *On* alone instead of the entire *Bo*. In two phoneme monitoring tasks, Treiman et al. (1982) have shown that the initial consonant is detected significantly faster when embedded in CV or CVC sequences than when embedded in a CCV sequence. Besides replicating the preceding result with children between ages 4.6 and 6.5 (which involved the use of an appropriate technique entailing puppets with funny names), Treiman (1985) has shown that children between ages 7 and 9.4 are very sensitive to syllabic structure. The task performed demonstrates that the substitution of the first two segments is significantly easier in CCV than in CVC sequences, while the substitution of the last two segments is significantly easier in CVC than in CCV sequences. When performed by adults (Treiman 1986, exp. 7), the substitution task yielded still sharper results.

Additional support for the right-branching model comes from Fowler (1987), who asked her subjects to exchange either the initial or the final consonant in two simultaneously presented CVC nonsense words. Performance was faster and more accurate for exchanges of initial consonants (coinciding with the *On*) than for exchanges of final consonants (coinciding with the *Co*).

Finally, Berg (1989; 1991) observes that English speech error corpora show that *On* errors are far more common than *Co* errors, even more so after normalization of the data (i.e., after taking into account the different frequencies of these positions). He remarks that a prevalence of *On* errors has also been reported for other Germanic languages, such as German, Dutch and Swedish.

Although the references cited represent only a part of the available literature, they make it sufficiently clear that the syllable in English has a strong right-branching tendency. The results of several experiments, using different methods, converge towards the same outcome. Even a potentially embarrassing objection put forward by Davis (1989) has been shown to be irrelevant. A convinced supporter of the flat structure model of the syllable, Davis argued that most experimental results gathered on the internal structure of the syllable are misguiding, inasmuch as they wrongly suggest a predominance of the *On*+*Rh* structure, without considering the interfering influence of other structural properties. In particular, Davis observed that much of the argument on which the right-branching model is based can be explained away by the fact that, in the experiments to which he refers, the *On* consonant is also the word-initial consonant. Now, we know, from English speech error corpora, that word-initial consonants are more liable than any other consonant to undergo disruption, and this is true of other languages as well (Berg 1991 cites other Germanic languages such as German, Dutch and Swedish). Thus, the fact that subjects perform better when manipulating word-initial rather than non-initial consonants (possibly final, when the test word is monosyllabic), does not constitute conclusive evidence with respect to the issue of syllable geometry. This may simply be due to the contribution of higher-order prosodic factors, which undoubtedly play a substantial role in speech performance. I shall call the specific factor referred to by Davis the 'marginality' factor (in the sense of 'close to the margins of the word')

Immediately counterattacked by Fudge (1989) on theoretical grounds, Davis' objection demanded nevertheless appropriate experimental scrutiny. The challenge was taken up by Fowler et al. (1993; cf. also Treiman et al. 1995). These authors have shown that, for English at least, the hypothesis put forward by Davis does at first sight seem relevant. When subjects were asked to perform *On*, *Co*, *Bo* or *Rh* substitutions in one of two visually presented disyllables of the type $C_1VC_2C_3VC_4$, they were consistently faster and more accurate when performing the task on the first than when on the second syllable (cf. experiments 3). However, with trisyllables of the type $C_1VC_2VC_3C_4VC_5$, a substitution task respectively concerning C_2, C_3, C_2V or VC_3 showed a clear advantage of *On* over *Co*, and of *Rh* over *Bo*

(experiment 4). The same result was replicated with oral presentation of the stimuli and without time-limit (experiment 5). It thus appears that when the marginality factor is minimized, as in the middle portion of a polysyllable, the internal hierarchy of the syllable turns out to be a very effective predictor of subjects' behaviour.

4. Possible exceptions to the Universal Rhyme Hypothesis.

Although the experimental evidence for right-branching syllable structure in English is overwhelming, the significance of this finding would not be particularly compelling if it turned out that all languages behave in the same way, as the advocates of the so-called 'Universal Rhyme Hypothesis' suggest. If this were the case, the objection might be raised that this result depended on some hidden experimental artefact, rather than being a true reflexion of the internal organization of the syllable as such. Actually, one reassuring datum is the fact that the evidence gathered on English stems from a variety of experimental techniques; this in itself reduces the risk of artefactuality to a tolerable minimum. But the real solution to this dilemma is the availability of conflicting cross-linguistic data.

Fortunately, this seems to be the case. Experimental investigations carried out on Korean have repeatedly demonstrated that in this language the structure of the syllable is likely to be left-branching. In a series of word-blending experiments, Derwing et al. (1993) and Wiebe & Derwing (1994) have shown that, both in blending preference tasks and in blend-learning tasks, the type Bo_1+Co_2 significantly prevail over the type On_1+Rh_2 (where the integers refer to 'Word$_1$' and 'Word$_2$'). The same result was obtained via the method of 'sound similarity judgements', in which subjects are asked to rate the degree of similarity of two acoustic stimuli. As it happens, Korean speakers reliably considered pairs of stimuli like /mot/ and /mop/ more similar than /mot/ and /pot/, contrary to the tendency of English speakers (Yoon 1994). In fact, one and the same set of Korean CVC words was very differently judged by Koreans and English speaking subjects (Yoon & Derwing 1994).

What is particularly reassuring about these data is that the same techniques have been applied to different languages, yielding different results. The blending technique, for instance, yielded an On_1+Rh_2 preference with Taiwanese and English speaking subjects (Wiebe & Derwing 1994). Equally, the sound similarity judgements method produced very different results in the languages to which it was applied. For instance, it may be remarked that for Japanese speakers the most salient unit appeared to be the mora (Derwing & Wiebe 1994), a result consistent with Otake et al.'s (1993) finding in a monitoring task. However, the mora did not emerge as a relevant constituent in the case of English, Korean, Taiwanese or Arabic, where other elements emerged instead: the segment first and foremost in all cases, but also specific constituents of the syllable, according to a hierarchy differing from language to language. For Arabic speakers, in particular, one phonological constituent that emerged very clearly, obtaining in fact the same score as the segment, was the C-tier (Derwing & Nearey 1994).

The latter result might raise suspicion, in that (as Derwing et al. (1992) note) vowels are not normally represented in Arabic spelling. Thus, the preferences of subjects might be guided, at least in part, by writing conventions, rather than by the internalized phonological component alone. The same objection might in fact be voiced with respect to the Korean 'hangul' and the Japanese 'hiragana' and 'katakana' writing systems, which often give visual prominence to the *Bo* over and above other constituents (Yoon & Derwing 1994). As Derwing (1997) judiciously points out, the orthographic factor needs to be addressed directly in future experiments, in order to rule out its potentially disruptive effects. Nevertheless, the results obtained from sound similarity judgements are somewhat reassuring, at least in the sense that they seem to be by and large independent of the specific type of writing system employed in the various languages. Consider the following fact (Derwing & Nearey 1994). The Korean 'hangul' is said to be a 'syllabic' system, although (as noted above) it should best be characterized as a body-based system. Yet, in similarity judgements Korean subjects attribute prominence to the segment just as English speakers, who employ a so-called 'phonetic' alphabet. Thus, although the impact of orthography may not simply be dismissed, there are grounds for believing that it does not condition the behaviour of speakers beyond a reasonable limit.

In addition to this, it is fairly clear that these experimental findings are supported by a number of other findings, which lend them further credibility. In the case of Korean and Japanese, in particular, converging data are yielded by speech errors, natural (i.e. not experimentally induced) blends and language games. For instance, Kubozono (1989) notes that in Japanese speech errors, *Rh* errors do not prevail over *Bo* errors as they do in English, and the same occurs in Korean according to Cheon (1980). Kubozono also points out that Japanese word blends (both in word-formation and in spontaneous errors) tend to be of the type Bo_1+Co_2, rather than On_1+Rh_2, while English shows the opposite tendency (as an example of word-formation blend, consider *smog* < *smoke* + *fog*; cf. § 6 for further details). Finally,

there are Korean language games involving the insertion of elements after the *Bo* of CVC syllables (Gim 1987), a strategy that seems to be unknown to English.

It should also be mentioned that a blending preference study conducted by Kubozono (1995) with English monosyllabic words produced opposite results with English natives and Japanese subjects, with the latter again expressing a strong preference for the Bo_1+Co_2 combination. Thus, Korean is not the only language for which it has been experimentally shown that the syllable may have a left-branching structure.[2] But even if this were the only exception to the alleged 'Universal Rhyme Hypothesis', its very existence would compel us to check the situation in other languages. Needless to say, English, a typical right-branching language, is typologically very different from Korean at most levels, including the prosodic level which concerns us here.[3] It is therefore interesting to see what happens in Italian, which is typologically much closer to English than to Korean, and whose syllable structure might therefore be expected to be right-branching.[4]

5. *Experiments on the internal organization of the syllable in Italian.*

A series of five experiments were carried out with Italian subjects. A selection of the main findings is reported below (for a full-fledged description, cf. Bertinetto et al., in preparation). Each experiment consisted of a variable number of tasks (from 10 to 13). These were of two types: substitutions and blendings. Table 1 indicates the tasks performed in each experiment and the percent results obtained. The materials consisted of a series of nonsense words, carefully chosen in order to conform to the phonotactic constraints of Italian. In order to avoid unnecessary complications, all internal codas consisted of sonorants; no geminates appeared in the experimental list. The choice of nonsense materials was dictated by the need to avoid possible biases caused by the uncontrolled factor of lexical frequency, which is known to have a heavy impact on speakers' performance.[5]

Table 1
Tasks performed in a series of experiments on the geometry of the syllable in Italian with percent figures of correct responses (the integers refer to the position of the syllable in the word; e.g., Bo_2 = body of the second syllable).

2 Kubozono (1995) reports also the results of a pilot experiment with two Italian speakers and nine speakers of Mexican Spanish, producing blends out of the same English monosyllables. In both cases, left-branching structure prevailed. However, due to the small population of both tests, their significance is negligeable.

3 Interestingly, Korean and Japanese, two languages which (as noted above) seem to behave alike in a number of situations relevant to our problem, are structured in a way that is perfectly symmetrical with respect to the Indo-European languages even at the syntactic level, e.g. with complementizers at the end of the clause rather than at the beginning (Sells 1995). This is clearly another instance of left-branching. Thus, it is possible that the contrast to be observed at the prosodic level is but an aspect of a more basic property of these languages.

4 Analysing a small corpus of Finnish spontaneous errors, Niemi & Laine (1997) claim that in this language there is evidence for a major division point after the first CV sequence of the word. This may at first sight appear to be a variant of the *Bo+Co* hypothesis, but in fact it differs from it because the initial sequence CV does not always correspond to a *Bo*, nor does it necessarily include a whole nucleus, since V may here represent the first half of a long vowel. The authors thus claim that Finnish provides evidence for a different prosodic type, mora-based (in some sense of this word) rather than syllable-based. Alternatively, to adopt Beckman's (1995) hypothesis concerning Japanese, Finnish provides evidence of a language where the 'optimal' syllable type CV plays the role of a cognitive point of reference for the speakers.

This is undoubtedly an appealing hypothesis. Nevertheless, on closer examination these data turn out to be best interpretable in terms of the *Bo+Co* hypothesis. Consider the following examples:

(i) luistelu-tyyli tuli > luistelu-tuuli tyli
(ii) romantiikka ja realismi > remantiikka ja roalismi
(iii) lypsää lehmiä > lepsää lyhmiä

Leaving aside for the moment case (i), the crucial fact appears to be the interpretation of the vowel sequence /ea/ in (ii). If this is interpreted as a true diphthong, then one is forced to admit that the relevant unit is the first CV sequence, rather than a specific syllable constituent, for the sequence CV would correspond to the *On* in the second word of (ii), but to the *Bo* in the remaining words of both (ii) and (iii). However, Finnish vowel sequences appear to be much more like hiatuses than like true diphthongs, for none of the two vowels undergoes a proper glidification, not even in terms of duration values. If this is so, then the only relevant unit is the *Bo* in both (ii) and (iii). The same applies to (i), with the difference that in this case there is reassignment of quantity. But this may easily be explained by the prosodic structure of *tyyli tuli*:

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C V V C V     C V C V
| \ /  | |     | | |  |
t  y  l i     t u l  i
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The elements that move are the first two segments, i.e. the *Bo*. As soon as they reach their new site, they are immediately assigned the appropriate quantity values, specified on the CV tier. Note that if the movable elements were the first CV sequence of the skeleton tier, dragging the corresponding segmental units, one would obtain the impossible word *tuyli*. To remedy this, one might of course posit a low-level harmony readjustment, but the solution advocated here seems to be more consistent with the facts, since the segmental units appear to be the ultimate elements involved in the interference.

5 It is reassuring to observe that, according to Treiman (1986), there is no statistical difference between real and nonsense words in this type of experimentation. So, whatever the cognitive operation activated by these tasks, it does not seem to differ for linguistic and non-linguistic materials.

number	*structural description*	*scheme*	*experiments and results* I	II	III	IV	V
	Substitution tasks						
1	*On* in monosyllable	CVC	86.66	83.33		74.05	
2	*Co* in monosyllable	CVC	97.91	95.18		77.64	
3	On_1	'CV-CVC	67.08	83.77		72.78	76.98
4	Co_2	'CV-CVC	97.08	93.86		90.35	
5	*Bo* in monosyllable	CVC	90.83	91.67		75.88	
6	*Rh* in monosyllable	CVC	98.75	96.93		89.91	
7	Bo_1	'CVC-CV		76.76		65.77	
8	Bo_2	'CV-CVC	74.16	68.42		53.06	
9	Rh_1	'CVC-CV	82.91	69.74		72.81	
10	Rh_2	'CV-CVC	91.25	86.84		76.32	
11	$syllable_1$	'CV-CVC		84.26			
12	$syllable_2$	'CVC-CV		96.30			
13	'free' On_2	'CV-CVC			68.65	58.33	63.33
14	'bound' On_2	'CVC-CV			88.09	81.57	79.36
15	Co_1	'CVC-CV	88.75		79.36	82.90	72.62
16	Bo_2 (stress on $syllable_2$)	CV-'CVC-CV			68.65		
17	Rh_2 (stress on $syllable_2$)	CV-'CVC-CV			63.49		
18	Bo_2 (stress on $syllable_3$)	CV-CVC-'CV			57.14		
19	Rh_2 (stress on $syllable_3$)	CV-CVC-'CV			71.03		
20	'bound' Bo_2 (stress on $syllable_3$)	CVC-CVC-'CV			53.57		
21	Rh_1 (stress on $syllable_3$)	CVC-CV-'CV			76.98		
22	On_2 in open syllables disyllable	'CV-CV					90.07
23	On_2 in open syllables trisyllable	CV-'CV-CV					69.44
24	On_1 in open syllables disyllable	'CV-CV					78.57
25	On_1 (closed syllable)	'CVC-CV					84.12
	Blend learning						
26	*Bo* + *Co*	CVC+CVC > CV+C		68.16	69.04		
27	*On* + *Rh*	CVC+CVC > C+VC		73.04	64.68		
	Blend preference						
28	*input* :	CVC+CVC					
	output :	C+VC (vs. CV+C)				75.72	
29	*input* :	'CVCCV+'CVCCV					
	output :	'C+VCCV (vs. 'CV+CCV)					55.14

In the substitution tasks, subjects had to produce a verbal response in reaction to a verbal input. The underlined C and V units in the substitutions section of Table 1 indicate the elements that had to be replaced in each task; the appropriate interpretation in terms of syllable structure is indicated on the left-hand side of each row. The phoneme (or sequence of phonemes) to be inserted was shown on the screen of the computer, positioned in front of the subject, just before the auditory presentation of the target stimulus. For instance, if in task 1 subjects saw the character <t> on the screen shortly before hearing *fin*, they were expected to utter *tin*. The dependent measure was the percentage of correct responses in the performance of each task; pairwise comparisons between the results of two tasks, or two sets of comparable tasks, yielded the measure of statistical significance. Up to experiment III, subjects had 3 seconds to produce their response, a sufficiently comfortable interval. In the last two experiments this was cut down to 1.5 seconds, in order to put a time pressure, thus enhancing the possible contrast between 'easy' and 'difficult' tasks. Indeed, in the first three experiments it was found that Italian subjects (a different group in each of the five experiments) were generally able to perform most of the tasks quite successfully, although in some cases one could observe sharp differences between the various constituent of the syllable involved (see below).

The blending experiments were performed according to two slightly different procedures. In experiments II and III, besides allowing the comfortable time of 3 seconds, the task was one of 'blend-learning'. In two successive tasks (tasks 26-27), subjects had to apply first one and then the other of two possible blending strategies (On_1+Rh_2 or Bo_1+Co_2, with the integers referring to $Word_1$ and $Word_2$). The input was acoustic and the output oral. The comparison of the results of the two tasks yielded the statistical measure. In experiments IV and V, on the

other hand, the response time was shortened to 1.5 seconds, and the method employed was that of 'blend preference', in which, by pressing the appropriate key, the subjects had to choose between the two visually suggested blending strategies relating to two auditorily presented words (tasks 28-29). In this case the statistical measure was obtained by comparing the respective percentages yielded by the two types of blending strategy.[6]

On the assumption (based on coarse-grained typological considerations) that Italian should behave more like English than like Korean, the segment(s) substitution tasks were expected to yield the following results:

a) *On* should be easier to replace than *Co*;
b) *Rh* should be easier to replace than *Bo*;

Expectations (a-b) may be condensed in the following formula:

$$On = Rh > Co = Bo$$

where = stands for "behaves like", and > should be read as "has a behavioural advantage over". As to blending tasks, the prediction consistent with the above expectations was the following:

$$On_1+Rh_2 > Bo_1+Co_2$$

If we also take into consideration the 'marginality' factor, as defined in § 3 according to suggestions by Davis (1989), we may add the following predictions (actually, prediction (d) was not directly put forward by Davis, but looks like a reasonable extension of his assumption (c)):

c) initial segments should be easier to replace than final ones;
d) marginal (i.e. initial or final segments) should be easier to replace than medial ones.

To sum up, the general expectation was that both the substitution and the blending tasks would provide evidence that Italian is oriented towards an *On+Rh* structure. The actual results were quite different from the expected ones, indeed in some sense even surprising, with the sole exception of assumption (d), which received strong confirmation. There follows a summary of the most important results concerning assumptions (a-c).

The data relating to the contrast between initial and final segments turned out to be consistently at odds with assumption (c). In Italian there appears to be a very strong advantage for final elements over initial ones. This may be gathered in the significantly better performance on tasks 2, 4, 6 and 10 over tasks 1, 3, 5 and 7 (both in the overall comparison and in pairwise comparisons between related tasks; cf. Table 1). Italian apparently differs dramatically in this respect from English. Interestingly, the evidence of speech errors supports this conclusion. According to data collected by Magno Caldognetto et al. (to appear), Italian errors localized on the first syllable are only a third of the total (33%), a figure that remains below statistical significance even when the different number of initial vs. non-initial syllables is taken into account.[7] It is interesting to observe that Italian behaves in this respect very much like Spanish, and contrasts with all the Germanic languages listed in Berg (1991). Furthermore, it is interesting to note that this outcome seems to relate to the fact that, in both Italian and Spanish, stressed syllables do not attract significantly more errors than unstressed ones, again in contrast to Germanic languages (Berg 1991). The figure for Italian is 38%

6 Needless to say, the order of presentation of the two types of output was balanced. More generally, in all five experiments the relevant factors were balanced as carefully as possible in order to minimize experimental biases. Care was taken, for instance, to compose experimental sublists to be presented to different subsets of the subjects' population, in which the sequence of the tasks, and the succession of the stimuli within each task, was duly inverted. These and several other experimental details are reported in Bertinetto et al. (in preparation). Here I only concentrate on the main results.

7 Since the paper from which these data are taken is not yet available, I have to rely here on personal communication from the first author. In a previously published study, based on a smaller corpus (Magno Caldognetto et al. 1987), a higher percentage (48%) was reported.
In order to have a term of comparison, it is useful to cite the data reported in Berg (1991: 284, 290-291) for Spanish and German. It should be noted that 'word-initial errors' is not the same as errors localized on the first syllable; thus, these figures are not strictly comparable with those relating to Italian. Nevertheless, they may suffice as a first approximation.

	Spanish		*German*	
word-initial errors	27.3 %	(significant)	80.9 %	(significant)
errors on stressed syllables	40 %	(not significant)	55 %	(significant)

Interestingly, the percentage of first syllable errors raises decidedly in disfluences produced by Italian subjects. Magno Caldognetto & Zmarich (1995) report that 74 % of Italian disfluences hit the first syllable, a figure corresponding to 22.5 % of all initial syllables (against 4.9 % of non-initial syllables).

(Magno Caldognetto et al., to appear); cf. fn. 7 for the Spanish and German data. While the interpretation of the latter datum is not easy, it is clear that the effect of higher-order prosodic factors, evidently at work in all languages, may produce very different results.

One remarkable consequence of this is to be observed in a type of datum that emerges in substitution tasks. As it happens, the length of the stimulus had a strong effect on the results. On the one hand, there was altogether a clear advantage, in strictly comparable tasks, of monosyllables over disyllables, and of the latter over trisyllables; on the other hand, and most importantly, monosyllables and disyllables yielded diverging results in *On* vs. *Bo* comparisons (tasks 1 and 3 vs. 5 and 7) as contrasted to *Co* vs. *Rh* comparisons (tasks 2 and 4 vs. 6 and 10). In other words, collapsing together the data of experiments I, II and IV, there was an advantage of longer constituents (*Bo* and *Rh*) in monosyllables and of shorter constituents (*On* and *Co*) in disyllables. The results were thus markedly dependent on the length of the stimuli, and this was confirmed (minor details aside) in more than one experimental session. While the reason for this is not at all clear, it must be admitted that higher-order prosodic factors (to be understood in the broad sense) enter into play, strongly interacting with the syllabic tier. Indeed, other effects of such higher-order factors were to be observed in our data, as will become clear in the following description of results.

Let us now consider the diverging behaviour of *On* vs. *Co*, and *Rh* vs. *Bo* (cf. assumptions (a-b) above). Since the comparison of these constituents in external positions (cf. tasks 1 to 7 and 10) is obscured by the striking word-offset advantage which is clearly at work in Italian, we have to look for evidence relating to internal positions. As to the comparison between *On* and *Co* (cf. tasks 13,14,15), the situation appears to be rather confusing. The *Co* constituent significantly prevails in tasks 15 vs. 13 in all three experiments in which this test was made, whereas the *On* prevails (but not significantly) in tasks 14 vs. 15. Thus, no definite direction seems to emerge. To add to the confusion, it turns out that task 14 significantly prevails over task 13, although in task 14 the *On* of the second syllable is (so to say) 'bound' within a consonant cluster, because of the presence of the *Co* of the previous syllable. The prediction was rather that the 'free' *On* of task 13 would be favoured. Evidently, words exhibiting the structure /'CVCCV/ enjoy an advantage for Italian speakers over words of the type /'CVCVC/, possibly a reflex of the higher frequency of words of the former type. I shall return to this below.

As to the comparison between *Rh* and *Bo* (cf. tasks 8,9,16,17,18), *Rh* can indeed be seen to prevail over *Bo* in tasks 8 vs. 9, a contrast that was significant in two out of the three experimental sessions in which this test was run. However, since this comparison again involves a contrast between the two word types indicated above (/'CVCCV/ vs. /'CVCVC/), it is possible that this outcome reflects higher-order factors concerning the preferred structure of Italian words, rather than the different syllabic targets involved. In trisyllabic words, the situation again looks fairly confusing because of the interaction with stress, another higher-order prosodic factor. In fact, while *Rh* significantly prevails over *Bo* in tasks 19 vs. 18, the reverse happens (although the result is not statistically significant) in tasks 16 vs. 17. Thus, once again no robust conclusion may be drawn.

In order to check the influence of the word structure factor, a number of tasks were performed on the same syllabic constituent (the *On*) embedded in different word types. Two series of comparisons were performed: (a) word-internally (cf. tasks 13,14,22,23); (b) word-initially (cf. tasks 3,24,25). In the first control series, unsurprisingly, task 22 yielded a significantly better result with respect to both tasks 13 and 14, for the last two involve longer words. There was also an advantage of task 14 over 23, while task 23 yielded an advantage over task 13, despite the fact that words of the type /CV'CVCV/ are one phoneme (and one syllable) longer than words of the type /'CVCVC/. However, the last two comparisons were statistically non-significant. In the second control series, concerning the *On* in word-initial position, task 24 performed better than 3, and the same happened for 25 over 3 and even 25 over 24, despite the possible disadvantage of a longer word type; but altogether no statistically significant result emerged. To sum up, although most of the comparisons did not reach significance, there is some initial indication concerning: (a) the relative disadvantage for Italian speakers of the word type /'CVCVC/ (tasks 3 and 13); (b) the relative prominence of the word type /'CVCCV/ (tasks 14 and 25), except for the predictable superiority of the type /'CVCV/ (tasks 22 and 24), but only when the substitution was performed on the second syllable (tasks 14 vs. 22). Further control on a larger population of subjects should be performed to provide confirmation for the tendencies observed.

The data just reported suggest that when Italian subjects perform substitution tasks of the sort considered here, syllabic structure is not the only factor involved, nor even the most important one. Among the relevant factors, we should consider at least the following, in decreasing order of importance: (i) word-offset advantage, (ii) word structure, (iii) stress. Given the results obtained in experimental tasks of this sort, syllable structure seems to be slightly more effective than stress, but less effective than factors (i-ii), in influencing subjects' behaviour. This puts severe limits on the actual relevance of the internal hierarchy of the syllable in Italian phonology, as opposed to what we observe in comparable experiments in

English or Korean. Yet, this should come as no surprise, given the experimental results described in Pierrehumbert & Nair (1995) and Finney et al. (1996) concerning the behaviour of English subjects, or the discussion in Beckman (1995) relating to Japanese. As it happens, even in languages (like English) where it has already been experimentally proven that the internal organization of the syllable has a strong impact on the outcome of psycholinguistic experimentation, the responses of the subjects are at least to some extent influenced by the general prosodic structure of the language. In particular, according to Finney and co-workers, stress is a powerful predictor of subjects' behaviour; and according to Beckman, the foot seems to play a dominant role in English, just as the mora does in Japanese (also according to the testimony of Kubozono 1989, 1995 and Otake et al. 1993).

This is not to say, however, that syllable structure plays no role at all in Italian. When higher-order prosodic factors are neutralized, the effect of syllable structure does emerge. This may be seen in the results concerning blendings. In these tasks, the interfering effect of word-structure is possibly neutralized, for both input and output stimuli have the same structure. As to the factor 'marginality', however, given the strong word-offset advantage to be observed in Italian, the two constituents which should prevail in the blending of monosyllables (cf. tasks 26,27,28) are *Co* and *Rh*; and among these two, we might expect that the *Rh* should be favoured, according to what happens in substitution tasks (cf. the comparison of tasks 2 vs. 6). Nevertheless, it turns out that when Italian subjects are allowed enough time to give their responses, as in tasks 26-27, the two blending types On_1+Rh_2 and Bo_1+Co_2 yield essentially the same results. On the other hand, when the response time is cut down to no more than 1.5 sec., as in task 28, the advantage of the On_1+Rh_2 solution emerges in a striking way.[8] Thus, despite its weak role in the overall design of the phonological component, syllable structure does have an effect in Italian. Yet, its role is indeed non pervasive, as is proven by the results of task 29, a blend preference task performed on disyllabic stimuli. In this case, although the type On_1+Rh_2 numerically prevails over the type Bo_1+Co_2, the difference is not significant, suggesting that either the short-term memory burden was too heavy, or the presence of a more complex word structure obscured the role of the syllabic component.

6. The structure of Italian and English natural blends.

It may be useful, at this point, to reflect on the validity of the experimental results obtained through artificial manipulations of the language. There is an important question that we should ask ourselves, namely: Do we know the exact cognitive significance of these results? The honest answer is, regrettably, "No".

Note that the tasks employed in this sort of experimentation bear some resemblance to 'natural' (i.e. historically developed) language-games, developed by virtually any linguistic community with ludic or cryptic purposes. However, although these games are also artificial constructs, they at least have the support of a living community of speakers. In addition, they have (supposedly) acclimatized themselves to the prosodic system of the host language, so that they may yield legitimate information regarding the structure of this component. By contrast, the experimental techniques described above are often expressly devised in defiance of the inherent prosodic tendencies of the language under scrutiny. Thus, one should always be aware that these findings may only be interpreted indirectly. Indeed, we do not know which particular cognitive capacity has been solicited, and what relation may exist between this capacity and the ones active in the normal process of speech production and comprehension. Thus, the ultimate relevance of these results needs confirmation by other types of data.

Nevertheless, the situation is not as confusing as it may appear. First, the very fact that the same experimental techniques yield different results in different languages seems to suggest that some crucial target has been hit, which authorizes interesting speculations concerning the prosodic component of those languages. In fact, the data obtained are strictly behavioural, inasmuch as they exhibit the competence of the speakers in actual linguistic performance (albeit of a somewhat unusual sort), rather than as elicited through metalinguistic judgements. In addition, one should keep in mind that although the blending tasks themselves are performed within an artificial (i.e. experimental) situation, they do bear resemblance with events which occur naturally in speech errors and even in word-formation processes widely exploited by natural languages. Thus, at least with the blending tasks, the observable contrasts between the various languages investigated may be considered to reflect some kind of spontaneous linguistic behaviour.

8 This outcome may also have been enhanced by the possible superiority of the blend preference technique over the blend learning one. However, since no direct comparison between the two methods, using the same response time, was performed, the answer to this question should be deferred.

In support of this observation, we may have a look at Italian natural blends, with an eye at the syllabic interpretation of the switching point between $Word_1$ and $Word_2$. There are actually two main classes of blends in Italian.[9] The formations of the first class resemble the usual blends combining the initial part of $Word_1$ with the final part of $Word_2$ (possibly including the whole of it). The second class includes a variety of acronyms, build by putting together fragments of the initial portions of successive words. The following blends provide an example of each class:

Coldiretti < col(tivatori) + diretti (class I)
Minculpop < Min(istero (della) Cul)tura Pop(olare (class II)

Since class I includes the type which resembles most the sort of blending exploited in the experiments reported on in § 5, in what follows I shall disregard class II (cf. Bertinetto (in preparation, a) for a full-fledged description of lexical blends in Italian and other languages with respect to syllable structure).

The analysis of a corpus of 79 Italian formations yields the situation depicted in Table 2 (where *Sy* stands for 'syllable', while the other abbreviations are as above). In the examples, underlined characters indicate the relevant fragments of words entering into the blend, while bold characters indicate the portion of the blend that exhibits the relevant type of switching, viewed in terms of syllable structure. Note finally that in the cases marked '*On*+*Rh*(=*Sy*)', the second fragment corresponds to a 'naked syllable'; thus, the rhyme here coincides with the entire syllable.

As may be gathered from Table 2, the preferred switching point of Italian blends is localized at the boundary of two whole syllables. This type alone accounts for half of the data. As a matter of fact, a whole syllable is also involved, as the second part of the blend, in the other two main types. The other major switching point occurs after the *On* of $Word_1$. However, this does not constitute a proof of an *On*+*Rh* structure for, apart from the cases in which it coincides with a whole syllable, the *Rh* as such intervenes in not more than 3 blends (e.g. *zebrallo* < zebra + cavallo, which is by the way the only such example with univocal interpretation). This is notable, because the *Rh* constituent might obviously have appeared in many more cases, considering the frequency of closed syllables in the corpus. Ultimately, the type *On*+*Sy* appears to be exploited simply in order to give rise to closed syllables out of open ones (namely, the last *On* of the relevant portion of $Word_1$ is turned into a *Co* in the blend; see the example in Table 2). This enhances the conclusion that the preferred switching point in Italian blends is the syllable boundary; when this is not the original situation, it may nevertheless turn out to be the final product of the blending process.[10]

The picture emerging from the analysis of this Italian corpus is fairly consistent with the experimental results reported above. Italian blends do not seem to indicate a neat preference for either the *On*+*Rh* or the *Bo*+*Co* structure. This datum stands in striking contrast to the situation described by Kubozono (1989) for English and Japanese, where *On*+*Rh* and *Bo*+*Co*, respectively, clearly prevail.

Table 2
Most frequent types of Italian blends with respect to syllable structure

Type of splitting		*percent distribution*
Sy + Sy		40 (50.6 %)
	example:	*Corsera*
		corriere + **se**ra
On + Sy		16 (20.2 %)
	example:	*polstrada*
		pol(izia + **stra**da
On + Rh(=Sy)		15 (18.9 %)
	example:	*Farmitalia*
		far**m**aci + **I**talia
minor types		8 (10.1 %)

In order to verify Kubozono's assertion concerning English blends, I also made an inquiry into a corpus of 44 such formations taken from Lehrer (1996). This yields an interesting

9 Cf. Thornton (1993) and Lehrer (1996) for a detailed classification of the possible types of blend.

10 I did not consider examples involving intervocalic /sC/ clusters, whose syllabic interpretation in Italian is unclear (Bertinetto, in preparation b). However, this cluster occurred in only one case.

comparison with the Italian data. Indeed, the situation in English appears to be not only significantly different from, but also not even directly comparable to Italian. The main difference is that a remarkable proportion of English blends exhibit overlap between $Word_1$ and $Word_2$. Consider for instance: *boatel* > **boat** + ho**tel**, which may be either *Sy*+*Rh* or *Bo*+*Sy* due to the consonant that the two words have in common. In fact, in the corpus of English blends considered, 18 examples (namely 41%) exhibit overlapping, while the corresponding proportion in the Italian corpus is much smaller (only 4 examples, i.e. 3.5%). Table 3 presents an overview of the data, neglecting the 3 overlapping examples which do not lend themselves to any clear-cut interpretation. The percentages are provided for the 'univocal' and 'total' columns; the latter encompasses the 26 univocal divisions and the 28 ambiguous ones, corresponding to 15 examples with double interpretation (two of which present one division with uncertain interpretation; cf. Bertinetto (in preparation a) for more details).[11]

Table 3
Most frequent types of English blends with respect to syllable structure.

Type of splitting		*Univocal*	*Ambiguous*	*Total*
Sy + Sy		11 (42.3 %)	6	17 (31.4 %)
	example:	*busnapper* **bus** + kid**na**pper	*guestimate* (also *Bo*+*Co*) **guess** + **es**timate	
On + Rh		12 (46.1 %)	5	17 (31.4 %)
	example:	*brunch* **br**eakfast + l**unch**	*Bisquick* (also *Sy*+*Sy*) **bisc**uit + **quick**	
Sy + Rh		2 (7.6 %)	5	7 (12.9 %)
	example:	*shortalls* **short** + over**alls**	*sloburb* (also *Bo*+*Sy*) **slob** + su**burb**	
Bo + Sy		1 (3.8 %)	6	7 (12.9 %)
	example:	*infomercial* in**fo**rmation + com**mer**cial	*chatire* (also *Sy*+*Rh*) **chat** + sa**tire**	
Minor types		0	6	6 (11.1 %)

As may be seen in Table 3, the proportion of the *On*+*Rh* type is considerably higher than in the Italian corpus, which includes only 3 such cases (two of which with ambiguous interpretation). In addition, the *Bo* constituent emerges as such in only one example (which is furthermore devoid of significance given the independent existence of the clipping *info*), whereas in the remaining cases the *Bo* emerges in only one of the two possible divisions of the blend. Now, since it turns out that there is a high degree of intersection between the types *Bo*+*Sy* and *Sy*+*Rh*, and since the *Rh* enjoys a much stronger status as an independently existing constituent, I believe we can justifiably claim that these English data provide strong additional support for the right-branching structure of the syllable in this language, while at the same time endorsing the conclusion that the internal organization of the syllable in Italian may indeed be significantly different.

7. On the role of the syllable.

In the preceding sections I have discussed evidence bearing on the following facts:

(a) The internal organization of the syllable may clearly emerge in psycholinguistic experimentation.
(b) Different languages may yield conflicting results in comparable experimental tasks. Indeed, while English has repeatedly been proven to be an *On*+*Rh* language (§ 3), there

11 To clarify:
a) examples with univocal interpretation: 26 e.g. cf. the examples in Table 3
b) examples with ambiguous interpretation: 15 e.g. *Spanglish* < *Spanish* + *English*.
c) examples with unclear interpretation: 3 e.g. *swingle* < *single* + *week*
The examples with overlapping are 18 (b + c). In set (b), there are two examples presenting one division not amenable to clear interpretation in terms of syllable structure, (e.g. *sportianity* < *sport* + *Christianity*, corresponding to the type *Sy* + *Rh*, but possibly also to an undefinable type if /t/ is taken from $Word_2$). This yields a total of 28 interpretable divisions in set (b), instead of the theoretically conceivable 30 divisions.
Note that in my classification I have been conservative, for the velar /n/ in *Spanglish* would suggest a *Sy* + *Co* division, rather than *On* + *Sy*. However, velarization may also be regarded as an automatic restoration process.

are strong indications that Korean might be an example of the *Bo+Co* type (§ 4), whereas Italian seems at best to be weakly oriented towards the *On+Rh* type (§ 5). Apparently, there is not just one type of syllabic hierarchy; and it is even possible that in some languages the syllable presents no internal hierarchy, as predicted by the flat structure model shown in (1a) in § 3.

(c) Encouraging data emerge from the comparison of experimental results with results stemming from naturally occurring forms of linguistic behaviour, such as speech errors and blends generated for word formation purposes (§ 5-6). There seems to be a convergence of structural tendencies in these diverse domains.

(d) Higher-order prosodic factors, such as marginality, stress, word structure, syllable structure, prosodic domains larger than the syllable (e.g. the foot) or smaller (e.g. the mora), undoubtedly have a strong influence on the overall behaviour of the speakers. The different modulation of these factors in different languages, shapes the prosodic component in the way attested by speakers in both their spontaneous and experimentally elicited behaviour.

Further questions that deserve special attention, in the light of the above discussion, are the following:

(A) What are the reasons for the varying importance of the internal organization of the syllable in different languages? Specifically, why do some languages appear to present a very low syllabic profile?

(B) What is the role of the syllable in natural languages, especially with respect to the contrast 'high' vs. 'low profile' in syllable organization?

In the remainder of this paper, I shall attempt to examine these two points, although, at the present stage, the answer can only be rather speculative.

As to point (A), one might suggest that isolating languages provide a fairly obvious candidate for a language type where the internal hierarchy of the syllable does not seem to play a major role, for words tend to coincide with syllables exhibiting a rather simple structure. In such languages, the speaker does not need to develop sophisticated procedures for the segmentation of the speech chain, other than what is necessary to recognize the individual words. However, the experimental investigations carried out so far by Wang & Derwing (1993) do not appear to confirm this hypothesis, at least not in its stronger version. Clearly, further inquiry is needed.

As to the evidence pointing towards a low profile of the internal hierarchy of the syllable in Italian, one might suggest that this is related to the rather simple syllabic structure of Italian in comparison with, say, English. The argument might go as follows. Due to its rather elementary syllabic structure, Italian does not need to develop an elaborate processing strategy to help the speaker assemble the speech chain into chunks of segments conforming to the phonotactics of the language, ultimately guiding her/him in the process of lexical recognition. By contrast, a language like English, which exhibits a much more complicated syllable structure, might be in need of establishing precisely this sort of mechanism, based on a rigid internal hierarchy of syllabic constituents. On this view, the prominent hierarchy of the English syllable would then be a consequence of the more complicated phonotactics of the language. In other words, since English, as opposed to Italian, allows fairly complex sequences of segments, it should only be natural that these should develop a subtler scale of intersegmental cohesion, with the result that the reciprocal attractions would be more finely graded, giving rise to the observed behaviour in terms of separability of syllabic constituents. Thus, a rigid syllabic hierarchy would ultimately be the consequence of the general phonotactic properties of the language, rather than the underlying principle around which phonotactics should be organized. It is easy to see that the solution sketched here may easily be reconciled with the theoretical views of the now growing body of scholars contending that the syllable should be regarded as an epiphenomenon of more fundamental properties (cf. Vennemann (1988a and b, 1994), Clements (1990), Dziubalska-Kołaczyk (1995), Dziubalska-Kołaczyk & Dressler (1995), Ohala & Kawasaki-Fukumori (1997)).

There is however an important caveat to consider. If this hypothesis is correct, why should a language like Korean, with a syllabic structure not significantly more complex than that of Italian, present a strong hierarchical arrangement, whereas Italian apparently does not? We are of course not attracted by the highly unlikely hypothesis that languages with a simple syllabic structure correlate either with left-branching or with flat structure, while languages with a complex syllabic structure would require right-branching geometry. Although the reason for the structural contrast between Korean and English is not obvious, one would wish

to correlate this feature with other formal properties of the grammar of these languages (cf. fn. 3), rather than with gratuitous reasons such as the one given above.[12]

In any case, languages like Italian seem to exhibit a sort of 'variable geometry' structure at the syllabic level. Depending on the particular effect of the various forces acting upon it, the syllable may assume alternative structural profiles, i.e. different syllabic constituents may in turn be singled out. Consider for instance the different effects of word-final position in mono- and disyllables, of stress in trisyllables, of different word structures, and so on (cf. § 5). To put it somewhat bluntly, the geometry of the Italian syllable might turn out to be flat, left- or right-branching, depending on the pressures acting upon it, although with a preference for the latter solution when no disturbing effects are at play. If this variable geometry model proved to be a valid one, Italian would provide a very good example of Vennemann's (1988a) view of the syllable, conceived of as a dynamic structure rather than a static template, as is the case in most theories. Indeed, diachronic linguistics shows abundant evidence that languages may reshape their syllable structure in the course of time, suggesting that alternative arrangements are always (latently) available.

Let us now consider point (B). The most extreme interpretation of the epiphenomenal view of the syllable recalled above would be one in which the syllable is not considered a basic phonological unit, but the mere reflex of other, more fundamental phonotactic properties. Let us call this the 'radical' view. At first sight, this interpretation, which has recently been put forth by Dziubalska-Kołaczyk (1995), looks easy to reconcile with the findings discussed above, both in the case of languages with a low syllabic profile, and in the case of languages with a clear orientation at the syllabic level. This position would certainly be preferable to an alternative one, where the syllable is considered to be a deep component only in languages presenting a definite hierarchical organization. According to the latter view, speakers of a language like English would supposedly gain an advantage by adhering to a right-branching structure, in the sense that this would give more efficiency to the segmentation strategy in the process of word recognition. However, this is at odds with the findings of Mehler et al. (1981), according to which the syllable does not seem to play a role in the segmentation of English words, as opposed to what happens in a language like French (Cutler et al. 1986).[13] Thus, the real advantage of a right-branching syllable structure for an English speaker, whatever it is, does not seem to be connected with strategies of word recognition.

Nevertheless, the complete dismissal of the syllable as a basic phonological component, as argued by the 'radical' interpretation sketched above, involves serious problems. We know from a number of studies that speakers are often sensitive to the presence of syllabic units. This has been proven, for instance, in tasks of 'sound similarity judgements' performed with Korean subjects (Yoon & Derwing 1995), in tasks of masked priming of word and picture naming performed with English speaking subjects (Ferrand & Segui 1996), or in tasks of short-term recalling of word lists performed again with English speaking subjects (Treiman et al. 1994). As the latter authors suggest, although the syllable may not be relevant as an on-line segmentation unit, it may become important at other stages of processing, supposedly playing a decisive role in remembering speech and in lexical access.

This invites a less radical interpretation of the epiphenomenal view of the syllable. The new position would consist in saying that although fine segmentation into syllables is not a primary ingredient in speech processing, the syllable as such remains a basic unit of the phonological component. The apparently contradictory character of this statement dissolves once we realize that, of the two fundamental aspects of the syllable (i.e. the definition of the boundaries and the individuation of the nucleus), only the second is of core relevance. In other words, the syllable is indeed a basic unit of phonology, but one with no assigned internal structure. The latter should be viewed as the real epiphenomenon, emerging under the pressure of both low-level factors (i.e. phonotactics) and higher-order ones (i.e. stress and prosodic domains other than the syllable). This implies that the level at which we observe subsyllabic clustering is shallower than that at which syllabic nuclei exert their action. Syllable constituents evolve as preferential aggregations, or force fields, whose stability differs from language to language. They do not exist as primitives of phonological organization, but are instead the result of the complex interplay of the overall structure of the language. Yet, once they come into existence, they may acquire prominence and become part of the speakers' competence, to the extent that they: (a) may be exploited at some (presumably

12 One possible way out of this dilemma, compatible with the findings discussed in the present paper, is the following. The type of experimentation in which Korean subjects revealed a sharp preference for left-branching geometry is of the same type (namely, blending preference with monosyllables) as that in which Italian speakers also exhibited a clear preference for a hierarchical organization, although in the opposite direction (cf. task 28 of Table 1). This leaves intact the possibility that Korean speakers, if confronted with substitution tasks, would exhibit the same kind of behaviour as Italians, i.e. a form of behaviour pointing towards a low syllable profile. Further research is obviously needed.

13 It is not clear, given the not entirely converging evidence stemming from other recent studies, whether this difference is related to the fact that French, as opposed to English, is supposed to be syllable-timed. In any case, the solution of this problem would go far beyond the scope of this paper.

later) stages of speech processing, and (b) may guide, to some extent, certain forms of linguistic behaviour (such as speech errors, language games, natural and elicited blendings etc.).

The emerging of a certain type of syllable geometry in a given language, however, should not be regarded as equivalent to the fixation of a rigid template, with the radical exclusion of any other conceivable aggregation. The phonology of natural languages is a complex organism, allowing many sorts of recombinations. Rather, what we expect to find is a prevailing orientation of syllable-sensitive phonetic regularities and phonological processes along the **predominant direction** indicated by the internal geometry to be observed in the given language. On this view, the stronger role played by the subsyllabic organization in English with respect to Italian is likely to be matched by a larger number of syllable-sensitive processes in the former language. Although this statement needs further validation, the relative wealth of phenomena of English phonology to be analysed in relation to syllable structure lends initial support to this hypothesis (cf. the flapping of intervocalic dental stops in certain varieties (Kahn 1976), /n/ velarization and /h/ deletion (Borowsky 1986), /l/ velarization etc.). This is likely to be concrete evidence of syllabic structuring for speakers of English, and apparently helps shape their phonological competence.

Obviously, further research is needed to strengthen and refine the hypotheses sketched here. As said at the outset, this kind of enterprise requires strict co-operation between theoretical and experimental investigation; the convergence of these two lines of research will help reject mistaken assumptions. In any case, the evidence gathered so far seems strong enough to cast doubt on some assumptions, despite the support they have traditionally enjoyed. In particular, the following two statements should now be taken as a robust starting point:

(i) Syllables DO NOT present the same basic geometry in all natural languages;
(ii) Syllable organization is NOT a self-contained structure, independent of higher-order prosodic factors.

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