

# Word onset Consonant+Vowel: Experiments on Finnish Syllable Structure

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To Bruce Derwing

The most widely accepted view of the syllable-internal architecture is the right-branching onset plus rime structure with the subsequent division of the rime into the vocalic nucleus and the coda. However, this view has not been uncontested in grammatical descriptions, as various other interpretations including flat structures and non-right-branching hierarchical descriptions have also been proposed. Moreover, a number of psycholinguistic studies have shown that the onset plus rime structure may not be a universal processing unit either. The present results from two experimental paradigms and spontaneous slips of the tongue strongly suggest that Finnish speakers prefer the CV plus the remaining segments over the onset plus rime segmentation, both in on-line and off-line conditions.\*

## 1. Introduction

The most widely accepted view of syllable-internal architecture is the onset plus rime structure with the subsequent division of the rime into the vocalic nucleus and the coda. However, this view has not remained uncontested, as alternative phonological theories including flat structures and non-right-branching hierarchical descriptions have also been proposed (for reviews, see Fudge 1987, Laubstein 1988 and Blevins 1995). Moreover, a number of psycholinguistic studies have shown that the onset plus rime structure may not be a universal processing architecture (see Laubstein 1958; Pierrehumbert & Nair 1995 and a subsequent rejoinder by Treiman & Kessler 1995, and Yoon & Derwing 2001). The mainline psycholinguistic view derived mostly from analyses of English spontaneous slips of the tongue and experiments, however, supports the onset plus rime view. For instance, English word-initial exchange slips are typically thought to be more like spoonerisms of the type *my dear old queen* > *my queer old dean*, where the word onsets exchange, rather than of the type *stre/ss and pi/tch* > *piss and stretch*, where the onsets and nuclei move (see e.g. Fudge 1987 for an analysis of the Fromkin 1973 data). Shattuck-Hufnagel presents a slot-and-filler

type of speech production model that highlights the separation of word onsets in English (e.g. Shattuck-Hufnagel 1987). One of her empirical sources is the extensive MIT slip corpus, in which 50 per cent of consonant exchanges deal with word onsets (viz., 91/181, for other error types, see Table 2.7 in Shattuck-Hufnagel). The slip evidence, together with experimentally elicited tongue twisters, makes it plausible for her to state that – at least for English – the high error rate on word-onsets “suggests that word onsets are represented and processed separately from other aspects of words, at some point during production planning” (Shattuck-Hufnagel 1987: 45).<sup>1</sup> Regarding Finnish slips of the tongue, Niemi & Laine (1997) arrived at a somewhat different conclusion, as they obtained empirical support for postulating a word-onset plus first vowel slot (CV) structure in that language. (We refer to this sequence as a CV not as the body, since in Finnish the nuclei may contain two autosegmental V slots, either in long monophthongs or in diphthongs, the first of which is included in the present CV.) In their quantitative analysis they used three independently collected slip data-bases, viz., those collected by Ahti-Virtanen (1992), Dufva (1992), and by the authors and their linguist colleagues. Of the 37 word-initial blends and exchanges of the three corpora, 13 slips involved unambiguous CV segmentation; e.g. exchanges like *\*vi/ik sä \*me/nttii* for *mEEK+k sä vintti+i* ‘go+CLITIC you attic+to’, i.e. ‘Will you go upstairs’, and blends like *\*no/sku < no/usu* ‘take-off’ and *la/sku* ‘landing’ (see Table 1, Niemi & Laine 1997). Note that the authors reported only one “English-type” slip affecting the onset (and that appeared in an English proper name!). Moreover, a group of 22 word-initial slips was ambiguous in regard to the units affected. These 22 ambiguous products were those manifesting the repeated phoneme effect, which means that the exchange rate of word-onset consonants increases if the consonants are followed by identical vowels (see e.g. Dell 1984, and note 1, above). Thus, *ceteris paribus*, in English a slip like *litty winguist* for *witty linguist* would be more probable than *lild(e) winguist* for *wild linguist*. Thus, applying less stringent criteria than those used by Niemi & Laine (op.cit.), the 22 repeated phoneme effect slips like *\*tusta \*muntuu* for *musta tuntuu* ‘I feel’ could have also been interpreted as CV errors. Note that, indirectly, the repeated phoneme effect shows that the initial CV is a unit of processing at some level also in English.<sup>2</sup>

The main focus of the present experiments is to test the CV hypothesis in Finnish, a language with a phonology quite different from the phonologies of mainstream psycholinguistics. The following aspects of the Finnish sound structure are relevant to its syllabic and

intrasyllabic analyses: (a) The prototypical simplex word (or base and root) in this language is the disyllabic CV(C).CV. In fact, there are only a few hundred (if not less) simplex and about 85 monosyllabic non-proper name lexemes longer than two syllables in Finnish. Moreover, of the monosyllabic words, all tend to be grammatical words (see Karlsson 1983: 215-216). (b) As for the polysyllabic words, the general rule placing the syllable boundary before each word-internal CV sequence accounts for 90 per cent of all syllables (Häkkinen 1978). The exceptions are those intervocalic instances where lenition processes have either diachronically deleted or synchronically still delete, through morphophonological alteration, the consonant of the VCV chain (Karlsson 1983: 137-139; Sulkala & Karjalainen 1992: 375). For instance, *te.os* 'artefact' often more specifically 'tome, piece of art', from *teke-* 'do, make' plus *-os* 'product of X', *ha.en* 'I fetch', from *hake-* 'fetch', *kiu.as* 'sauna stove', cf. *kiukaa-* inflectional stem of *kiuas*.<sup>3</sup> (c) The language makes use of all the possible V-C-V quantity combinations (see e.g. Lehtonen 1970): VCV as in *taka* 'hind-, back-' VCVV as in *takaa* 'from behind', VCCV as in *takka* 'fireplace', VCCVV as in *takkaa* 'fireplace'+PART, VVCCV as in *taakka* 'burden', VVCCVV as in *taakkaa* 'burden'+PART, VVCV as in *raaka* 'raw', and VVCVV as in *raakaa* 'raw'+PART. The quantity opposition is also very intricately balanced phonetically between the vowel of the (primary/secondary) stressed syllable, the intermediate consonant(s) and the following syllable vowel (see Lehtonen 1970, and Wiik 1975). (d) However, disregarding the intersyllabic durational interplay studied e.g. by Wiik (1975), in similar positions the short-long opposition is about 1 to 2 in duration in vowels as well as in consonants (Lehtonen 1970). Moreover, in overall duration, true diphthongs and so-called vowel combinations (i.e. vowel strings originating from C deletion in VCV, see (c) above) behave like long monophthongs. Finally, the components of the diphthongs are equally prominent. It follows from these facts, e.g., that the vocalic nucleus of a CVV syllable is durationally stable and symmetric irrespective of the phonological content. (e) The language carries no phonologically reduced syllables/vowels (see the pervasiveness of quantity distinction, above). (f) The lexical stress is phonetically weak (compared, e.g., to English, Niemi 1984), and the primary lexical stress is fixed on the initial syllable. The rhythmically placed secondary stresses are positionally fine-tuned by the relative heaviness of the third and the fourth syllable (e.g. *sá.ta.mà.na.kin* vs. *sá.ta.ma.kin.ko*, morphologically: *satama-na-kin* 'harbor'-ESSIVE-CLITIC vs. *satama-kin-ko* 'harbor'-CLITIC-CLITIC). (g) The orthography of the language is a textbook

example of almost 100 per cent grapheme-phoneme correspondence. Thus writing will most probably enhance the segmental knowledge of the naive speaker more easily in this language than in French or English. This nearly complete mapping relation also facilitates the use of written material in experiments like the present ones. (h) Finally, an atheoretical and impressionistic observation: Finnish schoolchildren are taught to syllabify early, and syllabification errors are relatively scarce in these beginning writers.<sup>4</sup>

## 2. Word Segmentation Experiments 1 and 2

### 2.1. Method

#### 2.1.1. Data

As the grapheme to phoneme correspondence in Finnish is close to 100 per cent, two written, non-chronometric segment cohesion experiments of phonemes (graphemes) were administered to a group of Finnish speakers. In languages with less isomorphic writing systems and/or less literate speakers more complex methods have to be used (see e.g. Derwing, Yoon & Cho 1993). Two versions of a segmentation task containing identical sets of stimuli were used. Each subject was presented with a list containing, in random order, 56 isolated Finnish words of the following types:

- 16 monomorphemic disyllabic words where the initial syllable was (C)VV (like *hii.va* ‘yeast’) or (C)VVC (like *lais.ka* ‘lazy’).

- 16 monomorphemic words of foreign origin, mostly either special vocabulary items (like *stig.ma*) or slang words (like *skit.so* short for ‘schizophrenic’), were used to ward off the effect of counting the number of letters from the onset word. Eight of these words had CCVC or CCVVC as the first syllable structure, eight had CCCVC or CCCVVC. Historically, Finnish only allows a maximum of one word-onset consonant, words with heavier onsets being latecomers and often incorrectly nativized by less-educated speakers. Thus the consonants preceding the initial-syllable CV are easily dropped by these speakers, who may, e.g., order [votkaa ja raittia] and not [votkaa ja spraittia] when placing an order for a vodka and Sprite.

- 8 monosyllabic interjection-type items with long monophthongs (CVVC, CVVCC, CCVVC, CCVVCC, 2 each), e.g. *kääks*.

- 16 bimorphemic words where the productive derivative suffixes cause resyllabification (e.g. *kori* ‘basket’ plus *-llinen* adjectival suffix > *koril.linen* ‘basketful’).

The interjections, morphologically complex items and loan items

with heavy onsets were used as distractors as well to avoid monotony and mechanistic segmentation of the words. In addition, the morphologically complex words with nonsyllabic morpheme boundaries were used to obtain preliminary data on the relative transparency of syllabic vs. morphemic boundaries for naive speakers (for more specific tasks bearing on phonological vs. morphological transparency in Finnish, see Niemi et al. 1997).

### 2.1.2. Procedures and Subjects

Two segmentation experiments were eventually administered. The subjects were to split each item into two parts with a slash. The only differences in the test sheets were the following: In Experiment 1 the written instructions had a morphological cut-off example (*leveähkö* > *leveä/hkö* 'wide-MODERATIVE', i.e., 'somewhat/rather wide'). Moreover, syllable boundaries were explicitly forbidden as segmentation points. The example with a morphological cut might have been a confound, as was pointed out by an anonymous referee. Accordingly, a modified version was subsequently administered to another group of students. Experiment 2 was identical to the first in all other respects but the following: (i) The example word of the revision carried a compound-internal, word-constituent and CC internal syllable cut (viz. *kirves/mies* lit. 'axe/man', i.e. 'carpenter'). (ii) The subjects were free to segment each item at any point. The versions were administered to 21 and 42 native Finnish students, respectively.

## 2.2. Results

The results were analyzed only on basis of the initial syllables, excluding higher-order, i.e. morphological and lexical<sup>5</sup> responses. The calculations below are based on those syllables where both onset and CV segmentations are possible, i.e. on the heavy, or CVX types (where X stands for a homosyllabic vowel or consonant).

### 2.2.1. Results of Word Segmentation Experiment 1

In the first segmentation task 351 segmentations fell within the first syllable, and 51 of them separated the CVX from the syllable-final segment (like *lai/s.ka*). The remaining first-syllable-internal segmentations were as follows: C/V 36.0 per cent (108/300), and the CV/X segmentations obtained the complementary 64.0 per cent. Thus these experimental data show that the CV division is preferred by Finnish speakers. Outside of these intrasyllabic responses it may be of interest to note that although the test instructions had a morpho-

logical cut example (viz., *leveä / hkö*, see above), only 57 per cent of the morphologically complex words received a morphological cut (91/160). Thus it may be the case that morphology is not extremely transparent to naive speakers when they are asked to split written words (see also Niemi et al. 1997).

### 2.2.1. Results of Word Segmentation Experiment 2

The segmentation data of Experiment 2, in which the subjects were free to partition the stimuli at any point, including the syllable boundaries, chiefly corroborate the relative transparency of the syllable in Finnish, since as many as 95.8 percent of the 1314 cuts (1260/1314) in the polysyllabic items fell on the first syllable boundary. Furthermore, when the 54 onset and CV responses of the initial syllables are analyzed separately, it is clear that the overall result of the first version of the experiment gains additional support, since the CV cuts account for 72.2 per cent (39/54) of these responses.

## 3. Word Beginning Exchange Experiment

### 3.1. Method

#### 3.1.1. Data

The basic rationale was to linguistically test the assignment of word-internal boundaries by naive subjects in two-word adjective plus noun sequences, where the task was to exchange the unspecified “beginnings” of the items. It was hypothesized that the major response patterns would reflect syllable- and word-internal cohesion.

The phonological structure of the initial syllables of the test items was controlled by systematically varying the initial syllable rime pairs, thus producing two-word strings with the following rimes: V-V, VV-V, V-VV, VC-V and V-VC (see Table 1). Moreover, three pseudoword V-VC and VC-V items, which would produce a two-word Finnish string after a syllable exchange, were included in the Group 2 list. For instance, *\*mo.ta \*nas.po* would yield *nasta mopo* ‘nice moped’ after a syllable exchange, while the onset and CV exchanges would bring about nonsense strings (here: *\*nota \*maspo* and *\*nata \*mospo*, respectively). These latter items will be referred to as items of the *lexical condition* in contrast to the *nonlexical condition* items. The lexical condition was included to test the movability of the syllable-

ble in this simple-to-syllabify language (the transparency of the syllable in metalinguistic tasks is shown by the high number of syllable-division responses – 96 per cent – in Word Segmentation Experiment 2, above). Since lexicality is a pervasive feature in language use (see e.g. lexical bias in phonological slips, Dell & Reich 1981), the lexical condition was expected to tease out any possible syllable movements. Due to problems in test item creation, in the potential onset-exchange products of the nonlexical condition the nonlexicality constraint was somewhat loosened by allowing a real word as one of the two items in the end-product in some of the potential onset exchange pairs. In the potential CV and syllable outcomes, the nonlexicality condition was, however, fully followed. In this respect, these specific test items were biased to produce onset (and not CV or syllable) exchanges in these items (see, e.g., *kuuma tapa* in Table 1, with *tuuma \*kapa*, *\*taama \*kupa* and *\*tama \*kuupa* as the potential onset, CV and syllable exchange productions, respectively).

**Table 1.** Test item types and examples in the Word Beginning Exchange Experiment with possible onset, CV and syllable exchange outputs.

Test Item Example	Expected Exchange Output After:		
	Onset Exchange	CV Exchange	Syllable Exchange
<i>A. Nonlexical Condition</i>			
V-V kiva napero	*niva *kapero	*nava *kipero	*nava *kipero
VV-V kuuma tapa	tuuma *kapa	*taama *kupa	*tama *kuupa
V-VV kärsivä Tyyne	*tärsivä kyyne	*tyrsivä *kääne	*tyysivä *kärne
VC-V kelpo kuti	*kulpo *keti	*kulpo *keti	*kupo *kelti
V-VC kavala tuska	*tavala *kuska	*tuvala *kaska	*tusvala *kaka
<i>B. Lexical Condition</i>			
V-VC/			
VC-V *mota *naspo	*nota *maspo	*nata *mospo	nasta mopo 'nice moped'

### 3.1.2. Subjects and Procedures

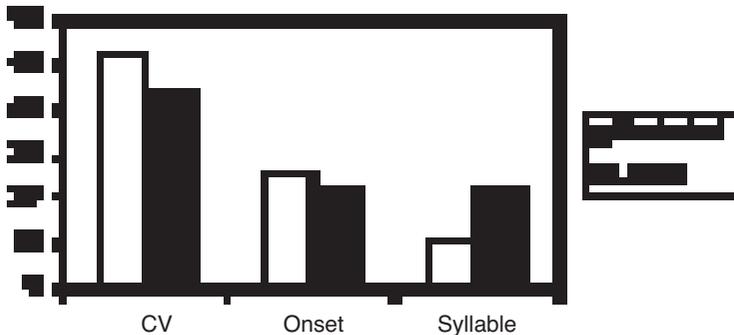
61 native Finnish subjects (university students, groups of 30 and 31) were each given a list of 25 two-word/pseudoword sequences and instructed to write down in the space provided the end-result of the exchange of the word “beginnings” of each adjective plus noun pair. In order to minimize sequentiality (perseveration) effects, each group was given two test forms with randomized orders of their own. The example given in the written instructions was neutral as to an onset, a CV or a syllable exchange (the example is furnished here with its

syllabic divisions): *ka.ma.la pa.ta* ‘terrible pot’ (dish) > *pa.ma.la ka.ta*.

### 3.2. Results

In the items of the nonlexical condition, about half (viz., 52.2%) of the exchanges were of the CV type, about one-fourth (26.7%) were onset exchanges and one-tenth (11.3%) were syllabic (Figure 1). The corresponding absolute values are 350/671, 253/947, and 97/856, respectively. The totals are not identical since the same transformation could sometimes be ambiguous as regards two or more exchanges, as in *kamala pata* > *pamala kata*.

It is worth noting that although the syllabic segmentations are higher in the lexical condition, the CV preponderance can be found in these items as well (CV 43.5%, onset 22.6%, and syllable 21.8%; absolute values: 54/124, 21/93, and 27/124, respectively; see also Figure 1). The higher proportion of syllable exchanges in the lexical (21.8%) vs. nonlexical (11.3%) condition indicates that the nonsense item strings were at least in some instances analyzed as ill-formed Finnish lexical entries. Syllables can thus be made to move in these types of tasks, especially when recovering real words from nonsense strings. However, even in the lexical condition Finnish syllables move less than CV's.



**Figure 1.** CV, onset and syllable exchanges (in per cent) in the nonlexical and lexical condition of the Word Beginning Exchange Experiment.

In passing, it is of interest to observe that in addition to highlighting the CV, the present Word Beginning Exchange Experiment as well as the language games studied by Anttila (1989) and Niemi &

Laine (1997) and the slip analysis in Niemi & Laine (op. cit.) all point towards an autosegmental component in these word-initial exchanges; a sequence of the type *kärsivä Tyyne* ‘suffering Tyyne (woman’s name)’, an item in the present experiment (see Table 1), most probably comes out as *\*tyrsivä \*kääne* in these three data-sources after the CV exchange, and not *\*tyrsivä \*käyne*. In fact, 30 of the present 61 responses to this specific item were of the former, and only 3 of the latter type, where the phonologically specified segments, and not the abstract CV slots, have been exchanged.

#### 4. Discussion

The present results from two metalinguistic experimental paradigms, together with a previous analysis of spontaneous, on-line data (slips), suggest that in intrasyllabic divisions Finnish speakers use the CV structure to an extent that could not have been predicted on the basis of the mainstream psycholinguistic literature (cf. the importance of the body in Korean, Yoon & Derwing 2001). Thus, although the rime is a well-established unit in a number of phonological descriptions of the syllable, it need not be the sole unit of speech production. Actually, even in English, we can detect CV effects, since this language exhibits the repeated phoneme effect, according to which onsets followed by identical vowels (in essence CV’s) are susceptible to word-initial segment exchanges.

Why is the CV, which splits the rime of the heavy syllables, like CVV and CVVC, highlighted in the psycholinguistic data of Finnish, although the rime is a relevant domain in the phonology and phonetic events of this quantity and/or mora counting language? In order to formulate a possible scenario and an initial hypothesis we have to admit that at some level(s), both language production and perception are implemented in spreading activation networks where the syllable nodes are needed to account for observables like the repeated phoneme effect (cf. the present CV cohesion in Finnish; for simulations using the syllable tier in Finnish, see Tikkala, Eikmeyer, Niemi & Laine 1997). Moreover, it is a fundamental finding in psycholinguistics that frequency of use has both short-term and long-term effects in language processing tasks (for the former, see, e.g., primed lexical decision tasks; for the latter, see, e.g., overall, socially shared lemma and lexical surface frequency effects in the language). In Finnish, nearly half of the syllables (viz., 44%) in the running text are CV (Häkkinen 1978). On the basis of these frequency considera-

tions, and in all its theoretical banality, it is here claimed that the frequency of use of the CV as a syllable also boosts the role of the CV chain as a subsyllabic unit.

Approaching the CV from the ontogenetic perspective, we know that CV is the “universal”, prototypical phonetic syllable type in early language production (e.g. Lleó & Prinz 1996). Thus a strong acquisitional bias towards the CV structure as the core syllable in any language would also exist. We might also conjecture that beginning speakers of a language with more elaborate syllabification patterns would have to unlearn/suppress the CV when enriching their syllable stock. However, young speakers of Finnish cannot suppress their CV's too much, as CV accounts for nearly one half of the syllables that a speaker of this language will ever encounter. This conjecture, which rests on the theoretically somewhat uninteresting notion of frequency of use, should be tested, for instance, by administering these types of experiments to speakers of a language typologically similar to Finnish with one major exception: its CV syllable frequency would have to be either markedly lower or higher than the CV syllable frequency of Finnish.

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*Notes*

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A keen observer might note that for its background assumptions the present study owes very much to the pioneering work of Bruce Derwing, who has frequently submitted linguistic issues to psycholinguistic testing by indirectly “asking the native(s)” theoretically relevant questions in controlled experimental settings. The present modest peek into the Finnish syllable is warmly dedicated to him. May I also take the opportunity here to say that his 1973 book *Transformational Grammar as a Theory of Language Acquisition* (CUP) was an eye-opener for me when I was trying to decide in the 1970s heyday of Chomskyan linguistics how to pursue my studies in that discipline. As can be seen – for better or worse – I did not choose the formalist path, mostly thanks to Bruce and like-minded people.

<sup>1</sup> Like the repeated phoneme effect (Dell 1984), the initialness effect could rise

from the dynamics of speech production, and not from any special status of the phonological units themselves. In fact, Eikmeyer and Schade (1993) have proposed that at the selection of the initial segment, the activation from the lexical node is still on the rise, and the relatively weak activation together with network noise would increase the chances for the misselection of the initial segment of a competing lexical item. In non-initial segments, chances for misselection would be lower, since when they are selected the target word produces stronger activation and the activation of the competing lexical items is weakened through inhibition at the lexical level (for a simulation study supporting the Eikmeyer-Schade view, see Niemi et al. 1996 and Tikkala et al. 1997).

<sup>2</sup> The most widely used language game of the Finns can also be taken as a piece of evidence, albeit weak, to support the major finding derived from the off-line tasks and spontaneous slips (see e.g. Anttila 1989 and Niemi & Laine 1987 for more about Finnish word games). This game, usually resorted to in order to bring about double entendre expressions, cf. the English *stress and pitch - piss and stretch*, involves the first mora slots (or CV's) of the words affected. These words are usually consecutive, but can be intervened by connectors like 'and' or verbs like 'be'. Finnish speakers observe these expressions relatively often (depending on the type of one's interfaces with the external world). Examples could be created *ad nauseam*, e.g. [edmonton eilers] for *Edmonton Oilers*, typically pronounced by speakers of Finnish as [edmonton oilers].

<sup>3</sup> The intervocalic syllable points appear so seldom at the right margin that the reader rarely comes across illegal syllabifications. The few errors strongly indicate the syllabification programs used e.g. by publishing houses and personal computer word-processors are based on the crude CV rule. Moreover, impressionistically, the few illegal syllabifications tend to be misapplications of the CV rule across the compound-internal lexical constituent boundary. Not unexpectedly, in Finnish the compound-internal boundaries should override the CV syllabification rule in words like *nais+asia* 'female issue' (*nais-* a bound form of *nainen* 'woman') and *ruumis+arkku* lit. 'corpse chest', i.e. 'coffin', with the syllable and morphological cuts coinciding after *nais-* and *ruumis*, respectively. The misapplication of the CV syllabification rule would produce syllable cuts at *nai.sasia* and *ruumi.sarkku*, respectively.

<sup>4</sup> Another strong everyday reflection of the transparency of the syllable in Finnish is that crossword puzzles are constructed either on grapheme or on syllable cells.

<sup>5</sup> The excluded morphological and lexical instances include cases like *l/oiva*, where *oiva* would be 'excellent'. These were excluded in order to ensure the phonologicality of the segmentations.

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