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Research Article

Experimental evidence on the syllabification of two-consonant clusters in Czech

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ABSTRACT

This study examines syllabification preferences of 30 speakers of Czech in two behavioural experiments using real disyllabic words with 61 intervocalic CC clusters as stimuli. The aim was to evaluate competing theoretical predictions about syllable boundaries in Czech. Participants synchronized individual syllables with metronome pulses in Experiment 1 (induced pause insertion) and produced syllables in reversed order in Experiment 2 (syllable reversal). Logistic regression analyses revealed significant effects of cluster sonority type, phonological length of the preceding vowel and word-edge phonotactics (also in relation to frequency of occurrence). Morphological structure of the items significantly influenced syllable boundary placement as well. The results of both experiments converge towards the effects found in previous studies on English and some other languages. However, ambisyllabic responses were virtually non-existent in pause insertion and relatively low (8%) in syllable reversal, which differs from the results on Germanic languages. Finally, the findings do not support strict onset maximization but rather indicate an onset-filling strategy.

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1. Introduction

Syllabification has been investigated, both in metalinguistic judgments and in behavioural experiments, quite thoroughly over the years. We now possess data not only on English, which is arguably the best-researched language in this respect, but also on Dutch (Schiller, Meyer, & Levelt, 1997), German and Finnish (Berg & Niemi, 2000), Icelandic (Berg, 2001), French (Content, Kearns, & Frauenfelder, 2001; Goslin & Frauenfelder, 2001), Italian (Bertinetto, Caboara, Gaeta, & Agonigi, 1994), Russian (Côté & Kharlamov, 2011), Polish (Bertinetto, Scheuer, Dziubalska-Kończyk, & Agonigi, 2006), Irish (Ní Chiosáin, Welby, & Espesser, 2012), Hindi (Ohala, 1999) and even L2 English of Japanese speakers (Ishikawa, 2002). Derwing (1992) investigated English and four other languages: Arabic, Blackfoot, Korean and Swiss German. This is promising because we can survey the specific findings and generalize across a wide range of languages. However, even with such a representative sample of languages generalization might be less straightforward, since the studies are not directly comparable in terms of material

and tasks (this will be attended to in more detail throughout the paper and in the General discussion).

The current study examines Czech, where the syllable has so far been examined in phonological and phonotactic descriptions only (e.g. Bičan, 2013; Kučera, 1961; Ludvíková, 1972). New results from Czech would contribute significantly to broadening and deepening the focus of the field, as the experiments present a good testing ground for various issues. For instance, one finding of the English studies is that syllables with a short, lax vowel (such as /ɛ ɐ ɪ¹) tend to attract consonants to the coda position (Eddington, Treiman, & Elzinga, 2013a, 2013b; Fallows, 1981; Treiman & Danis, 1988; Treiman & Zukowski, 1990). However, given that English lexical words do not end with such vowels, this might just reflect the English phonotactics. As there is no phonotactic constraint against short vowels word-finally in Czech, any tendency to avoid syllables ending with short vowels cannot reflect phonotactics, but may rather be related to universal characteristics, such as syllable weight.

Moreover, the current study can be of interest for the following reasons. First, a wide range of two-consonant clusters is

E-mail address: Pavel.Sturm@ff.cuni.cz¹ The vowel /ɐ/ as in "cut" (traditionally transcribed as /ʌ/). The transcription employed here follows the conventions of the IPA.

examined here, including morphologically complex forms, which are usually omitted from experiments. Second, the present analysis can draw on the availability of corpus frequency data provided by Šturm and Lukeš (2017), which will be useful because cluster word-edge frequency of occurrence might play an important role in syllabification behaviour. Third, two different methods are employed on the same material to see whether the results from one task (pause insertion) can be replicated in another (syllable reversal). If the two tasks converge, the conclusions drawn from this study might be more convincing.

1.1. Syllables and syllabification

The articulatory basis of the syllable is related to the cyclic motion of the jaw and the alternation of open vocal tract shapes, associated with vowels, and strictures in the oral cavity, associated with consonants (Hála, 1956; MacNeilage, Davis, Kinney, & Matyear, 2000). Syllable nuclei are linked to peaks in acoustic sonority (i.e., relative intensity, see Parker, 2008), which facilitates speech perception and segmentation of the signal. Sonority relations between segment classes have been captured in phonology by the *sonority hierarchy* (Blevins, 1996; Clements, 1990; Goldsmith, 2011; Zec, 2007) and, by extension, by rules governing preferential segment ordering, such as the Syllable Contact Law or the Sonority Sequencing Generalization (see Blevins, 1996; Clements, 1990). These principles make specific predictions about syllable boundaries: since sonority is expected to rise towards the nucleus, an obstruent-sonorant intervocalic cluster (/p/) would be assigned to the onset of the second syllable, whereas a sonorant-obstruent cluster (/lp/) would be divided between the two syllables (or assigned to the coda of the first syllable; however, in that case the second syllable would be onsetless, which is generally strongly disfavoured; Gordon, 2016, chap. 4; Prince & Smolensky, 2004).

The syllable as a distributional unit is associated especially with the domain of phonotactics. There are co-occurrence restrictions among segments so that, for instance, specific combinations of consonants cannot arise syllable-initially in one language (e.g., /t/ in English), whereas a different language might allow it (/t/ in Czech /tlɛskat/, “to clap hands”). Therefore, the absence of specific combinations is not always due to articulatory or perceptual reasons. Word-edge phonotactics is usually taken into account when substantiating assumptions about syllable boundaries (e.g. Fallows, 1981; Kahn, 1976; Ludvíková, 1972; Pulgram, 1970; Steriade, 1999). There is general agreement that words should be syllabified in such a way that phonotactic constraints of the given language are not violated (but authors may not agree on specifying which constraints are relevant).

Furthermore, language use seems to have significant effects at various levels of the linguistic structure, from morphology and syntax to phonological structures (Bybee, 2001). It has been demonstrated that intuitions of native speakers about the well-formedness of presented sound sequences are affected not only by the presence vs. absence of the given sequence in the language, but also by its frequency of occurrence (Hay, Pierrehumbert, & Beckman, 2004; Munson, 2001; Treiman, Kessler, Knewasser, Tincoff, & Bowman,

2000; Vitevitch, Luce, Charles-Luce, & Kemmerer, 1997). For instance, Vitevitch et al. (1997) used disyllabic nonsense words composed of English syllables differing in phonotactic probability. Of the four logical combinations (LL, HH, LH, HL, where L and H stands for low- and high-probability patterns, respectively), highest scores were assigned by the listeners to the HH nonwords, in contrast to LL items, which received lowest scores on the well-formedness evaluation scale. The other experimenters arrived at similar conclusions implying a strong correlation between well-formedness judgments and frequency of occurrence. Finally, the effect of phonotactics is reported in language development and psycholinguistic experiments as well (Bernard, 2015; McQueen, 1998; Skoruppa, Nevins, Gillard, & Rosen, 2015; Storkel, 2001).

However, phonotactics is not the only factor in locating syllable boundaries. In addition to the sonority sequencing mentioned above, morphological composition can play a significant role (Derwing, 1992), and phonological variables such as stress placement or segment type have also been shown to influence syllabification judgments (see Section 1.2 below). Focusing on Czech, it will be instructive to summarize the approach of Ludvíková (1972), who carried out a quantitative analysis of syllable types in Czech. In the description of her method she presents several criteria for syllable division of the Czech language:

1. syllable boundaries align with word boundaries;
2. if a word has a syllabic prefix, the syllable boundary aligns with the morpheme boundary;
3. single intervocalic consonants are aligned to the right, i.e. CV.CV;
4. intervocalic clusters are divided in agreement with the morphological structure; if there is no morpheme boundary, then a statistically more frequent solution – based on an inventory of word-initial onsets and word-final codas – is preferred.

In her view, morphological aspects prevail over phonotactics. However, it needs to be ascertained whether such a claim, reflecting Ludvíková’s intuition and theoretical stance, will be evidenced by experimental data (compare contrary results on English in Smith and Pitt, 1999).

By far the most widely invoked syllabification principle is the Maximum Onset Principle (Fallows, 1981; Hall, 2006; Kahn, 1976; Pulgram, 1970). Onset maximization becomes relevant with word-medial consonant clusters, as a single consonant is usually supposed to form an onset automatically (the Onset Principle or Onset Filling, see Hooper, 1972; Berg & Niemi, 2000; the ONSET constraint in Optimality Theory, see Prince & Smolensky, 2004). Thus onsetless syllables are not predicted to arise word-medially. The Maximum Onset Principle postulates that whenever possible, the onset should be preferred, i.e., maximized, by assigning the largest number of intervocalic consonants to the following vowel as an onset, rather than to the preceding vowel as a coda. Phonotactics acts as the restraining force here (or in some cases sonority relations, which are often indistinguishable). The English word “poster” would thus be syllabified as /pouə̯.stə/, but “pester” would result as /pɛs.tz/ since /ɛ/ does not occur word-finally. Although arguments in support of this principle can be provided from the domain of typology or speech acquisition (syllable onsets are preferred over syllable codas in general; Blevins, 1996;

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