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A COMPARATIVE ANALYSIS OF CONSONANT CLUSTERS IN ENGLISH AND IN SLOVAK

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Abstract: *The paper presents the partial results of the research project verifying the proposed universal nature of the CVX theory of syllable. The character of the word-initial and the word-final clusters in English and in Slovak indicates that while in English all onset and coda clusters form a complex sound or can be explained by morphology, in Slovak the number of possible word-initial and word-final clusters is much higher, their structure is more heterogeneous and it seems that only a few of them can be accounted for by morphology.*

Keywords: *consonant clusters, onset, coda, tautosyllabic clusters, heterosyllabic clusters.*

The paper presents the partial results of the research project whose objective is to verify the universal nature of the so-called morphological theory of syllable as proposed by San Duanmu (Duanmu 2009). Duanmu's CVX theory claims that the maximal syllable size in all languages is CVX (CVC or CVV) and any extra consonants at word edges are predictable from morphology (Duanmu 2009: 70 – 71). This theory is based on the claim that '*there is a correlation between the morphology of a language and the maximal syllable size*' (ibid., p. 52). Since the maximal syllable size in a language depends on the maximum number of consonants in its onset and coda and on the nature of consonants included, the first step in applying the CVX theory to Slovak is to compare the consonant clusters in English as one of the languages on which Duanmu tested his theory and Slovak as a language which allows large consonant clusters and is typologically different. The results of this comparative analysis could be useful not only for the syllable theory and theoretical linguistics, but also for applied linguistics. The similar or different nature of consonant clusters in terms of their production and perception has a direct influence on the process of language acquisition by second language learners (cf. Altenberg 2005).

A consonant cluster as a group or sequence of consonants that appear together in a syllable without a vowel between them (cf. e.g. Jones 1976) can be studied in terms of graphemes, phones and phonemes. In languages, there is rarely one-to-one correspondence between letters and phonemic (sound) units. The concrete realization of the individual segments – vowels and consonants – in their linear sequences (words, phrases, sentences) is influenced by various pronunciation and phonological rules of the given language (e.g. assimilation) and not all combinations of graphemes have their reflection in speech. The critical unit of language for its production and perception is syllable (Gibson et. al 1976) and syllable is 'a phonological prime' (Jones 1976: 121).

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By implication, my survey of the possible[2] consonant clusters in English and in Slovak is based on the analysis of phonemes[3].

Since much has been done in this field in both languages, the analysis of the word-initial and word-final consonant clusters presented here is more quantitative than qualitative.

In some languages, the word-medial position accepts combinations which are not possible at the beginning and/or at the end of a word. It seems that the middle part of words is the least immune against the occurrence of consonant clusters (e.g. the number of the medial three-consonant clusters in Slovak is 252, cf. Sabol 1969a). But the medial consonant clusters are usually '*decomposable into legal initial or final clusters*' (Hammond 1999: 69). This finding is based on the idea that the beginning of the word is the beginning of the first syllable and the end of the word is at the same time the end of the last syllable (Kuryłowicz 1948). Medial clusters can be viewed as possible combinations of the initials and the finals that provide a model '*in terms of which medial clusters can be characterized*' (Jones 1976: 121). This means that all initial and final clusters are tautosyllabic, but the word-medial are not and that is why they were excluded from this analysis and will be treated separately.

2. Consonant clusters in English

So as to give a complete picture of initial (onset) and final (coda) clusters in English, the following sources have been compared: Heinz J. Giegerich (1992) who analyses consonant clusters in terms of generative phonology, Peter Roach (2002) whose analysis of possible phoneme combinations is based on more traditional structural approach, San Duanmu (2009) who supplements Giegerich's and Roach's descriptions of the phonotactic possibilities of English with the aspects of Optimality Theory and gives the reliable statistical data, and one internet source (http://www.btinternet.com/~ted.power/clustersindex.html) which offers the practical list of some consonant clusters in English.

The word, i.e. the syllable in English can begin with a vowel, with one, two or three consonants. No word in English begins with more than three consonants (Roach 2002: 71), thus the maximum number of segments in the word-initial consonant cluster is three.

At the beginning of English words (syllables), there are **55 two-consonant clusters**. In many cases the first element is /s/ and the second consonant is approximant /l, r, w, j/ (cf. Roach 2002: 73; Duanmu 2009: 160).

Initial CC clusters in English

starting with oral plosive: pr, pl, pj, pw, pf, ps, p□, br, bl, bj, tr, tw, tj, dr, dj, dw, kr, kl, kw, kj, km, kn, kv, gr, gl, gw (26)

starting with nasal plosive: nj, mj, mw (3)

starting with fricative: fl, fr, fj, vj, vw, θr, θw, θj, st, sp, sk, sl, sw, sn, sm, sf, sj, sr, sv, zl, □r, □m, □n, □p, □w, hj (26)

starting with approximant: -

starting with affricate: -

The number of **the initial three-consonant clusters** in English is quite limited, there are 9 of them, all starting with /s/: spl, spr, spj, str, stj, skl, skr, skw, skj.

In Duanmu's view the initial /s/ can be

excluded and all onset clusters either form a complex sound (they are produced with different articulator, cf. Duanmu 2009: 43 – 44) or they are predictable by morphology as real or potential affixes.[4]

The word (syllable) in English can end with a vowel, with one, two, three or four consonants (Roach 2002: 73). The maximum number of consonants in the **final consonant cluster** is four.

There are **55 final two-consonant clusters** in English. They usually end with /s, z, t, d, θ/ which represent separate morphemes (Roach 2002: 73); /s, z/ are the sound forms of ending -(e)s, and /t, d/ stand for ending -(e)d.

Final CC cluster in English

starting with oral plosive: pθ, pt, ps, bd, bz, tθ, ts, dz, kθ, kt, ks, gd, gz (13)
starting with nasal plosive: mp, mf, mt, md, mz, nθ, nt, nd, ns, nz, n□, n□, ŋθ, ŋt, ŋd, ŋz, ŋk, ŋg (18)
starting with fricative: fθ, ft, fs, vd, vz, θs, δd, δz, sp, st, sk, zd, □t, □d (14)
starting with approximant: lp, lf, lθ, lt, ld, ls, lz, lk (8)
starting with affricate: □t, □d (2)

(cf.http://www.btinternet.com/~ted.power/clustersindex.html)

The final three-consonant clusters are quite numerous too, there are **40** of them. They usually end with /s, z, t, d/ which, as already mentioned, can easily be accounted for by morphology since they represent separate morphemes.

Final CCC cluster in English

starting with oral plosive: pθs, pts, pst, tθs, tst, kθs, kts, kst (8)
starting with nasal plosive: mps, mft, mfs, mts, mst, nts, ndz, n□t, n□d, ŋts, ŋst (11)
starting with fricative: fθs, fθl, fts, sts (4)
starting with approximant: lmd, lmz, lpt, lps, lbd, lbz, lft, lvd, lθs, lnd, lnz, ldz, l□t, l□d, l□t, lks, lkt (17)
starting with affricate: -

(cf. http://www.btinternet.com/~ted.power/clustersindex.html)

The **final four-consonants clusters** in English (**7**) are usually formed by the three-consonant cluster not containing final /s, z, t, d/ as separate morphemes and the sound form of the suffixes -(e)s and -(e)d.

Final CCCC cluster in English

starting with oral plosive: ksθs, ksts (2)
starting with nasal plosive: mpts, ntst (2)
starting with fricative: -
starting with approximant: lfθs, ltst, lkts (3)
starting with affricate: -

(cf. http://www.btinternet.com/~ted.power/clustersindex.html; Roach 2002)

The survey of the possible onset and coda clusters in English shows that in the case of three-consonant clusters the phonotactic possibilities of the English phonemes are higher at the end of the syllable (word). Although the number of two-consonant clusters is identical in the word-initial (syllable onset) and word-final (syllable coda) position (55), three-consonant clusters are rare in onsets (9) and frequent in codas (40), and four-consonant clusters occur only in codas (7).

However, on the basis on the CVX theory all coda clusters can be explained by morphology as real or potential affixes

or they form a complex sound (Duanmu 2009: 171 – 181).

3. Consonants clusters in Slovak

The picture of consonants cluster in Slovak was gained by the mutual comparing of the works of J. Sabol who dedicated the substantial part of his research work to the analysis of the permissible strings of phonemes and their frequency in Slovak (e.g. Sabol 1969a, 1969b). When characterizing two-consonant clusters, the MA thesis of J. Petriščáková (2006) was used. Her results were combined with my own observations of consonant sequences occurring in the words included in the *Short Dictionary of Slovak Language* (KSSJ).

A Slovak word can begin with two, three or four consonants. The maximal size of onset in Slovak is CCCC. Five-consonant clusters are very rare and cannot be treated as monosyllabic, as I will explain later in my analysis.

In the **initial** position of Slovak words (syllables), there can be **139 two-consonant clusters**, **85 three-consonant clusters** and **7 four-consonant clusters**.

Initial CC clusters in Slovak

starting with oral plosive: ps, pš, px, pn, pň, bď, bz, bl, bľ, br, tk, tx, tv, tm, tl, tľ, tr, dv, dm, dn, dň, dl, dľ, dr, kt, kv, km, kn, kň, gď, gň, gl, gľ, gr (34)

starting with nasal plosive: mn, mň, ml, mľ, mr (5)

starting with fricative: sp, st, sť, sk, sc, sč, sx, sf, sv, sm, sn, sň, sl, sľ, sr, zb, zd, zď, zg, zh, zž, zv, zm, zn, zň, zl, zľ, zr, zj, šp, št, šť, šk, šč, šm, šn, šl, šľ, šr, žv, žm, žň, žľ, žr, hn, hň, hl, hľ, hr, xť, xc, xv, xm, xň, xl, xľ, xr, fp, ft, fť, fc, fč, fs, fš, fx, fň, fl, fľ, fr, vb, vd, vď, vz, vž, vh, vm, vn, vň, vl, vľ, vr, vj, lk, lž, lp, ls (86)

starting with affricate: cť, cm, cn, cň, cl, cľ, čp, čv, čm, čn, čň, čl, čľ, čr (14)

(cf. Petriščàkovà 2006)

Initial CCC clusters in Slovak

starting with oral plosive: tkľ, tkn, tkv (3)

starting with nasal plosive: mdl, msť (2)

starting with fricative: vzd, vžd, vzň, vzb, vzď, vzr, vzl, vzn, vzm, vzľ, vhr, vzh, vžr, fst, fkr, fpr, fsk, fsť, fpl, fsp, fsx, fkl, fpľ, ftl, fkľ, fšť, ftr, str, spr, skr, skl, skľ, skv, stv, smr, spl, sxv, sxl, spľ, stl, stľ, stm, sxň, scv, skm, sxm, sxn, sxr, skň, svr, zdr, zvl, zdv, zbr, zbľ, zbl, zhr, zhl, zmr, zvr, zhľ, zhň, zml, zvľ, zdn, zvn, zgň, zhn, zmn, škr, štv, škv, štr, špľ, škľ, špr, hml, hmľ, ľst (79)

starting with affricate: ctn (1)

(cf. Sabol 1969a: 129 – 149)

Initial CCCC clusters in Slovak

starting with oral plosive: pstr, pštr (2)

starting with nasal plosive: -

starting with fricative: fspr, fspl, fskr, fskv, vzdm (5)

starting with affricate: -

(cf. Sabol 1969b: 32)

Although the occurrence of the initial four-consonant clusters in Slovak is connected with the prefix *vz-* or its sound form *fs-* and they can be solved by morphology, majority of the initial two- and three-consonant clusters cannot be explained in terms of the complex sound analysis[5] neither they are prefixes or prefix-like consonants (i.e. perceivable as

prefixes). For example, 68 out of 139 onset clusters cannot be reduced to a complex sound (they represent different value of the same articulator)[6].

In the **final** position of Slovak words, there can be two- or three-consonant clusters, but their number is lower than in the word-initial position, i.e. in syllable onsets. There are **44 final two-consonant clusters** and **4 final three-consonant clusters**. The maximal size of coda in Slovak is CCC.

Final CC clusters in Slovak

starting in oral plosive: ps, bl, kt, ks (4)
starting with nasal plosive: mp, mf, nt, nk, nc, nč, ns, nš (8)
starting with fricative: st, sť, sk, št, šť, ft, vk, xt, lp, lt, lk, lc, ls, lz, lf, lm, rp, rt, rk, rc, rč, rs, rš, rf, rv, rm, rn, rň, jt, jk, jf, jn (32)

(cf. Petriščàková 2006)

Final CCC clusters in Slovak

starting with oral plosive: tkv (1)
starting with nasal plosive: nkt (1)
starting with fricative: jsť, jzď (2)

(cf. Sabol 1969a: 139 – 140)

Only a few Slovak consonant clusters in the word-final position (syllable coda) can be explained by morphology as real or potential affixes (cf. Sokolová et. al 1999) as proposed by Duanmu.

Having been presented the survey of the word-initial and word-final consonant clusters in both analysed languages and indicating the possibilities of clusters reduction, I shall now return to the above mentioned problem of five-consonant clusters which may occur in the Slovak language. Let's take e.g. words *zmrzlina* (ice-cream), *štvrť* (quarter), *žblnknúť* (plop), *nervstvo* (nervous system). They all contain combinations of five consonantal segments. But these sequences of consonants are legal clusters only on the graphematic level. Sounds *r* and *l* – which are consonants phonetically – have a very high degree of sonority and can form the centre of syllable, i.e. they function as vowels, when surrounded by consonants. Simply, they are vowels phonemically, as in the words *zmrzlina, štvrť, žblnknúť*. In the word *nervstvo* the five-consonant 'cluster' occurs in the word-medial position and is heterosyllabic.

Inasmuch as the different conception of consonant clusters on the graphematic and phonematic (and also phonetic) level requires phonological reconstruction of consonantal neutralizations this issue remains open for the further analysis.

syllabification of words with the combinations of five consonantal graphemes:

***zmr-zli**-na*: zm – onset, r- centre, zl-onset of the 2nd syllable
***štvrť**:* monosyllabic word, štv – onset, r-centre, ť - coda
*ne**rv-stv**o:* rv – coda of the 1st syllable, stv – onset of the 2nd syllable

4. Conclusion

The comparative analysis of the word-initial and word-final consonant clusters shows that frequency, combinatory and distribution possibilities of the Slovak phonemes are higher than those of the English phonemes. The analysis also indicates that Slovak is rich in various consonant clusters which can usually not be accounted for by morphology: they cannot be treated as complex sounds and they do not represent separate morphemes. This observation cast doubts on the universal nature of Duanmu's CVX theory of syllable. Of course, the detailed analysis of all consonants clusters in Slovak in terms of distinctive features and possible

complex sounds is necessary.

The follow-up research will also have to concentrate on the relationship between graphematic, phonetic and phonemic consonant clusters in both languages.

[1] In order to test the CVX theory Duanmu analyses Standard Chinese, Shanghai Chinese, Jiarong English, and German. The last 'two are chosen for their large consonant clusters' (Duanmu 2009: 70).

[2] The contribution does not report all possible combinations of consonants, only those that are mentioned in the sources used.

[3] Transcription symbols valid in the given language are used for the graphic representation of phonemes in this paper.

[4] For detail explanation of the affix and affix-like sounds see Duanmu 2009, Giegerich 1992.

[5] Of course, this is only preliminary conclusion. The final answer requires detailed analysis of all clusters in terms of the feature analysis and the complex sound analysis.

[6] The classification of consonant clusters according to the manner of articulation of the initial element is crucial for the future feature analysis.

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