INTERFERENCE OF L1 SYLLABIFICATION PATTERNS IN L2 SPEECH OF CHINESE LEARNERS OF RUSSIAN AS FOREIGN LANGUAGE

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ABSTRACT

An experimental study of syllabification behaviours of speakers of syllable-timed and stressed-timed languages proves our hypothesis that differences in a language's rhythmical organisation comprise a significant source of foreign accents in L2 speech. The experimental material consisted of Russian words with various types of rhythmical structures and consonantal clusters as syllabified by Chinese learners of Russian. The syllabification patterns of Chinese learners were compared with the syllabification patterns of the same word list produced by native Russian speakers. The principal differences in syllabification behaviour occur in V and CV syllable types. The prevalence of CV-syllables was higher in the Chinese syllabification inventory than in Russian speakers' data, and vice versa for V-type syllables. Other differences in Chinese learners' syllabification results included variations in phoneme additions and deletions, as well as modifications of a Russian word's rhythmical structure. We consider the latter difference proof that the concept of 'phonetic word' (rhythmical structure) lacks in the Russian speech of Chinese learners.

Keywords: syllable, rhythmical structure, phonetic interference, Russian as foreign language, Chinese as L1.

1. INTRODUCTION

Today it is more or less assumed that learners' progress in foreign language acquisition is influenced by their native language as well as by the language being acquired. Publications on the cross-impact of L1 (the learner's native language) and L2 (the language to be learned) have, of late, become more numerous and more diversified in terms of the various combinations of L1 and L2 languages and types of linguistic units under investigation. Research focused on phonetics are particularly abundant (for a detailed review of the principal theoretical models for L1 transfer/interference on the L2 phonetic segmental level see Cheng, Zhang [6]). The practical results of L1–L2 reciprocal influence studies have proven valuable for many reasons, not least of all in language didactics, where interference between the respective languages' phonological and phonetic organisation have long been considered a principal source of foreign and dialectal accents. In applied linguistics, speech recognition in particular, there also is general agreement that accents cause multiple problems in inter-cultural communication.

While consensus exists that the peculiarities of L1 play a major role in learners' inability to produce native-quality speech in L2, the contribution of different linguistic sub-systems to this phenomenon still remains unclear. Initially, investigation of speech errors and pronunciation flaws focused on the fine-grained segmental level of speech. At this level the main cause of speaking difficulties in L2 was attributed to the absence (or difference in phonetic/phonological realisation) of L2 phonemes in the learner's L1 inventory. More recently researchers have shifted their focus to linguistic domains above the segmental level, a considerable part of modern phonetic/phonological research in the field having moved to the syllabic level (for an overview see Yang, Fox [24]). Significant experimental evidence now supports the hypothesis that a major cause of foreign accents in L2 speech derives from peculiarities in the internal organisation of syllables in various languages, consonantal clusters above all [6, 1, 20, and 5]. Multiple studies have shown that a speaker's errors pronouncing inter-vocalic consonants and consonantal clusters supply valuable information about the types and source of foreign accents in L2 speech [15, 9, and 3]. Moreover, it has been demonstrated [21] that syllabic constituents in L1 influenced adult learners' accuracy producing L2 consonantal clusters even in the speech of high intermediate learners. Thus, the production of consonantal clusters in L2 by speakers of languages with similar or different rhythmic organisation has come to be considered of particular interest for the study of language interference.

While the syllabic organisation of different languages has been of theoretical and practical interest for a long time, the linguistic concept of the syllable is still far from consistent. Long-term research in articulatory phonology, as well as multiple inter-disciplinary studies by psycholinguists, physiologists, phoneticians and

neuroscientists have provided abundant, albeit not unequivocal or indisputable, evidence supporting the syllable as a universal language unit for organizing temporal patterns of speech production and perception. L. Chistovich and V. Kozhevnikov laid the foundation for this view in their seminal work [17], where they elaborated the general concept of the articulatory syllable. Later, in a series of experimental investigations into the role of the syllable in speech planning and execution, Y. Xu demonstrated that the syllable is "a temporal coordination mechanism whose main function is to synchronize multiple articulatory movements so as to make speaking possible" [23]. The syllable thus is assumed to influence the organisation of other supra-segmental tiers of language. However, while the syllable as the universal articulatory unit embodying basic segmental and supra-segmental components of speech production has been investigated in numerous publications, the interrelation between the syllable and other higher supra-segmental linguistic levels such as the phonetic word is considerably less studied. We hypothesize that better understanding of the syllabification behaviour of speakers of various languages could facilitate greater knowledge of segmental and supra-segmental coordination and thus inform an effective methodology to overcome one of the major factors of L1–L2 interference. Syllabification discrepancies as a source of accents in L2 have been investigated principally using speech data obtained from English as a Second Language learners. A major share of the research in this field concerns the English language as L2 in the pronunciation practice of native speakers of German [18], French [8], and Spanish [20]; valuable data have also been presented in the literature for Japanese [13], Korean [11], and Mandarin Chinese ESL learners [19]. Considerably less experimental data are available in the literature on contrastive investigation of L1 influence on L2 in the field of syllabic organisation and syllabification models for other languages. A literature search revealed that while research on segment errors in Russian as a Second Language (RSL) is abundant (e.g., [7, 16, 22, and 10]), there is an absence of studies on the transformation of Russian rhythmical and syllabic patterns in speech produced by foreign learners. Recently, new original research has begun to appear in RSL on L1 segmental interference in the context of syllabic or phonetic word structure [2, 14, and 4].

While the concept of the "syllable" is basic in both Chinese and Russian educational practice, and the two languages are generally considered to be in opposition in terms of their rhythmic organisation (as representative of syllable-timed vs stress-timed groups of languages, respectively), we surmised that investigation of the syllabification behaviour of speakers of the two languages would provide valuable information for understanding core sources of L1–L2 interference. The present study therefore undertook experimental investigation of the interplay of syllabic and word phonotactic regulations of L1 in the L2 speech of Chinese Russian language learners in order to discern core factors responsible for multiple pronunciation errors documented in the literature on RSL didactics.

In our experiment we tested three hypotheses: 1) the syllabification behaviours of Chinese and Russian subjects for the same word set would differ, depending on syllabic organisation in L1; 2) Chinese syllabic consonantal constraints would influence the Chinese learners' production of consonantal clusters in their Russian speech; 3) rhythmical organisation of the Chinese language as a syllable-timed language contravenes the rhythmic patterns of the Russian language (a stressed-timed language), noticeably affecting speech accentedness.

2. MATERIAL AND METHOD

Principal investigative procedures for the current study involved surveying the syllabification behaviour of Chinese learners with Russian words with and without consonantal clusters of varying complexity and structure. Chinese syllabification results were compared with the syllabification practices of Russian native speakers for the same word set. It bears mentioning that while syllabification behaviour has been commonly acknowledged as a valuable representation of rhythmical language organisation, how speakers of different languages actually divide words into syllables is still unclear. As demonstrated in multiple experiments, novice speakers of various languages coincide in counting numbers of syllables in target words, but differ when required to place syllabic boundaries within a lexical item [8]. We note that while the objective reality of the syllable as an executive language unit is permanently under discussion, recent brain studies provide evidence of its validity [12].

2.1. Material

A randomized list of 100 Russian words (high-frequency lexical items) with and without consonantal clusters was assigned as an oral syllabification task. Test stimuli varied in the number of syllables from 2 to 5. The composition of potential consonantal clusters (i.e., Cyrillic characters representing consonants) varied from 2 to 5 letters. The consonantal clusters repertoire was as follows (IPA transcription of the N-gram standard

pronunciation within a word is provided in square brackets and Cyrillic graphemes in *italics*): [bl] *бл*, [br] *бр*, [bʲj] *бъ*[й], [vl] *вл*, [vn] *вн*, [fts] *вц*, [gl] *гл*, [gr] *гр*, [kʧ] *гч*, [dv] *дв*, [dl] *дл*, [dn] *дн*, [dr] *др*, [tʃ] *дш*, [ʒn] *жн*, [zv] *зв*, [zd] *зд*, [ʒ:] *зж*, [zm] *зм*, [jts] *йц*, [kl] *кл*, [kr] *кр*, [kt] *кт*, [lb] *лб*, [lʲj] *ль*[й], [lʲts] *льц*, [ml] *мл*, [nk] *нк*, [nʲk] *ньк*, [pl] *пл*, [pr] *пр*, [pt] *пт*, [rb] *рб*, [rn] *рн*, [rt] *рт*, [sv] *св*, [sk] *ск*, [sm] *см*, [sn] *сн*, [ss] *сс*, [st] *ст*, [ʃʲʃʲ]/[ʃʲʧ] *сч*, [ʃʃ] *сш*, [ʃʲʃʲ] *сщ*, [tv] *тв*, [tn] *тн*, [tr] *тр*, [ʧʃʲ] *тщ*, [tʲj] *ть*[й], [tsts] *тьс*, [fr] *фр*, [ʧk] *чк*, [ʧn] *чн*, [ʧr] *чр*, [ʧt] *чт*, [ʧj] *чь*[й], [ʃn] *шн*, [ʃʲn] *щн*; [tsk] *дск*, [tsm] *дсм*, [zn]/[zdn] *здн*, [zʲnʲj] *знь*[й], [ksp] *ксп*, [nts]/[lnts] *лнц*, [lst] *лст*, [ndr] *ндр*, [rdv] *рдв*, [rsn] *рсн*, [rst] *рст*, [skl] *скл*, [ssk] *сск*, [stv] *ств*, [stl] *стл*, [st]/[stn] *стн*, [str] *стр*, [sʲtʲj] *сть*[й], [stsv] *сцв*, [trʲʃʲ] *трщ*; [fstv] *вств*, [rstv] *рств*, [rstk] *рстк*, [ssk]/[stsk] *стск*; [drstv] *дрств*.

2.2. Experiment design

The experimental word list was presented to 15 Chinese subjects and 15 Russian subjects for syllabification on a computer screen. All the Chinese subjects had studied Russian as their bachelor-degree major in China and had achieved at least B1 proficiency (intermediate-high according to the Russian national testing system). We used Microsoft PowerPoint to display on separate slides each item from the experimental word set. Experimental sessions comprised: a setup phase (a short training phase to accustom subjects to pronouncing two- and three-syllable Russian words syllabically) and a data collection phase (approximately 1 hour). Participants were allowed to view each slide as long as they needed to correctly execute the syllabification task, before advancing to the next slide. All subjects were encouraged to repeat mispronounced syllabic stimuli for correction as many times as they wished.

Segmentation of the data recorded in the silent booth and its annotation were based on trained experts' auditory and acoustic analysis (spectrogram with intensity and f0 trajectories). Acoustic analysis of all speech data was performed using PRAAT software. Recordings were also annotated in PRAAT, each speech block corresponding to a syllable, that is, delimited by pauses (we defined pauses as either silent periods or by dramatic significant intensity and pitch changes identified on a spectrogram via visual inspection), further segmented into vowel (V) and consonant (C) segments. All segmentation procedures were carried out manually using a pre-written transcription protocol for recorded speech. We identified the metrical phonotactic structure of each syllable in terms of consonant and vowel constituents.

3. RESULTS

The total number of syllables in the pronunciation of Chinese subjects (errors excluded, repetitions if any included) was 4497 syllables; the total number of syllables in the pronunciation of Russian subjects (errors excluded, repetitions if any included) was 4198 syllables. The syllable type inventory was similar for the Chinese and Russian subjects with one exception: the VCCC syllable type occurs only in the Chinese subjects' syllabification data. Syllables common to both groups of subjects were: V, VC, VCC, CV, CCV, CCVC, CCCVC, CCVCC, CCCV, CVC, CVCC, CVCCC. The frequency of various types of syllables in the Chinese subjects' dataset is presented in Fig. 1. The frequency of various types of syllables in the Russian subjects' dataset is presented in Fig. 2.

3. DISCUSSION

ANOVA statistical analysis shows that the frequency of choices for the most used types of syllables differs for Russians and Chinese ($F>F_{cr}$ for the majority of syllable types). The most prominent difference occurs in syllables CV and V. The medium frequency of CV-type syllables was significantly higher in the Chinese syllabification inventory than in the Russian speakers' data (AVG=39,13; STD=2,36 for Chinese; AVG=33,92; STD=1,18 for Russian subjects), and vice versa for the V-type syllables (AVG=2,92; STD=1,09 for Chinese; AVG=5,19; STD=1,03 for Russian subjects). More detailed analysis of the segmental composition of syllabified speech revealed that the prevalence of open (CV) syllables in the Chinese subjects' syllabification data was realized through abundant vowel insertions into the consonantal clusters. A syllabified word with a consonantal cluster was thus pronounced with an additional syllable, e.g.: [ʃe-sət-va-vatʲ] – CV-CVC-CV-CVC (cf. CVC-CCV-CVC/CV-CCCV-CVC by Russian speakers for *шествовать*); [dʲe-rʲe-və-nʲa] – CV-CV-CV-CV (cf. CV-CVC-CV/CV-CV-CCV by Russian speakers for *деревня*), [prʲi-sə-ma] – CCV-CV-CV (cf. CV-CCV/CCVC-CV by Russian speakers for *призма*). Shwa/vowel insertion also occurred in the syllabified pronunciation of Russian native speakers, but far less frequently: 12.4% in the Chinese data, 5% in Russian pronunciation. Another valuable finding showed that shwa insertion may occur in the syllabified pronunciation of all of the Chinese subjects, while vowel-like segment insertion in Russian subjects' data seems to be an individually preferred pronunciation strategy.

Figure 1: Syllable type frequencies (Chinese subjects).

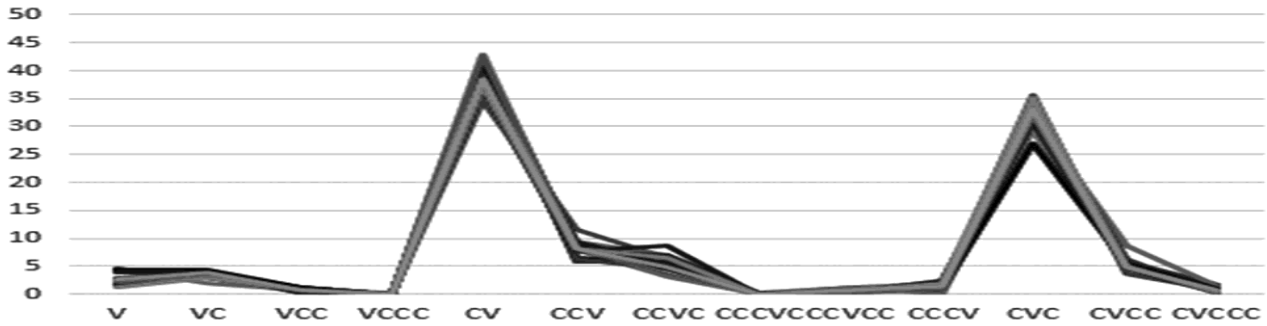
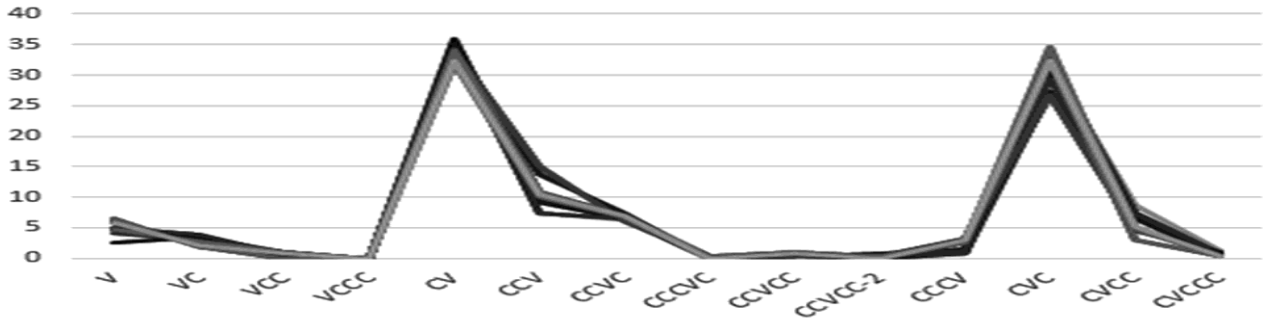


Figure 2: Syllable type frequencies (Russian subjects).



The most important difference between the Chinese and Russian subjects' syllabification behavior in relation to the insertion of vowel segments is that vowel insertion in Russian syllabified pronunciation never changed a word's rhythmical structure, while the total number of syllables in a word was identical either with or without shwa insertion, e.g.: [sʲe-rʲebə-ro] and [sʲe-rʲe-bro] (*серебро*), [pozəd-na] and [pozd-na] (*поздно*). The only exception here was the word *цилиндр* (*cylinder*), often syllabified by both Russian and Chinese subjects as a word with three syllables: CV-CVC-CəC (Russian), CV-CVC-CCV/CV-CVC-CəC (Chinese).

Phonetic analysis of vowel insertions also attests to different functions of inserted vowels in Russian and Chinese syllabification. Russian subjects insert shwas after syllable coda consonants, if the phoneme is voiced, to mark the differential feature 'voiced': CV-CVC[ə]-CV [sʲe-godə-nʲa] (*сегодня*), whereas Chinese subjects' vowel insertions occur mainly within consonant clusters, or often after the final consonant in a word if the consonant is palatalized.

The low number of V-syllables in Chinese syllabification data could be considered a function of a hiatus avoidance tendency active in the Chinese syllable inventory. Chinese speakers obviously avoid V-syllables in their Russian syllabifications, therefore they often either omit a vowel in hiatus: [pa-gratʲ] CV-CCVC (cf. CV-VC-CVC/CV-V-CCVC by Russians for *поиграть*) or add a new vocalic segment to produce a diphthong: CV-C^{V}V-CCVC (cf. CV-CV-V-CCVC/CV-CV-VC-CCVC by Russians for *напуасский*).

4. CONCLUSION

Data obtained from syllabification experiments with Chinese learners of Russian as L2 demonstrate that word and syllable phonotactic patterns of L1 play a considerable role in the planning and realisation of L2 speech both on the segmental level and on the level of word structure. We have demonstrated that L1 influences L2 speech not only on the segmental level, but on the level of word structure as well. The fundamental concept of rhythmical structure [25] seems to be unfamiliar to Chinese learners, therefore teachers of RSL should give special attention to the realisation of Russian rhythmical structures. Russian consonantal clusters are also of special difficulty for Chinese speakers, because the Chinese language has different phonotactic regulations. Our experiments thus support all three of our initial hypotheses and attest that structural discrepancies in the syllabic systems of languages may be one of the most fundamental causes of inter-language phonetic interference.

5. REFERENCES

[1] Alario, F. X., Goslin, J., Michel, V., Laganaro, M. 2010. The functional origin of the foreign accent: evidence from the syllable-frequency effect in bilingual speakers. *Psychological Science* 21(1), 15–20.

[2] Aleksandrova A.Y. 2008. Syllable structure in Arabic as a factor of phonetic interference in the Russian speech of Arabs. *RUDN Journal of Language Education and Translingual Practices* 3, 16–23. (In Russian.)

[3] Altenberg, E. P. 2005. The judgment, perception, and production of consonant clusters in a second language. *IRAL-International Review of Applied Linguistics in Language Teaching* 43(1), 53–80.

[4] Barkhudarova, E. L. 2014. Zakonomernosti stroeniia sloga v rodnom iazyke kak faktor poiavleniia inostrannogo aktsenta. *Moscow State University Bulletin. Series 9. Philology* 9(4), 57–74. (In Russian.)

[5] Broselow, E., Xu, Z. 2004. Differential difficulty in the acquisition of second language phonology. *International Journal of English Studies* 4(2), 135–163.

[6] Cheng, B., Zhang, Y. 2015. Syllable structure universals and native language interference in second language perception and production: Positional asymmetry and perceptual links to accentedness. *Frontiers in Psychology* 6, 1801.

[7] Davidson, L., Roon, K. 2008. Durational correlates for differentiating consonant sequences in Russian. *Journal of the International Phonetic Association* 38 (2), 137–165.

[8] Goslin, J., Frauenfelder, U. H. 2001. A comparison of theoretical and human syllabification. *Language and Speech* 44(4), 409–436.

[9] Gut, U. 2007. First language influence and final consonant clusters in the new Englishes of Singapore and Nigeria. *World Englishes* 26 (3), 346–359.

[10] Hacking, J. F., Smith, B. L., Nissen, S. L., Allen, H. 2016. Russian palatalized and unpalatalized coda consonants: An electropalatographic and acoustic analysis of native speaker and L2 learner productions. *Journal of Phonetics* 54, 98–108.

[11] Hong, H., Kim, S., Chung, M. 2014. A corpus-based analysis of English segments produced by Korean learners. *Journal of Phonetics* 46, 52–67.

[12] Ignatyev G.A., Vlasova R.M., Akinina Y.S., Zavyalova V.V., Ushakov V.L., Ivanova M.V., Dragoy O.V. 2015. An fMRI Study of Sentence Reading: The Effect of Control Condition. *Proc. Conf. Cognitive Science in Moscow*, https://we.hse.ru/data/2015/07/14/1085789567/Ignatyev_et_al_CogSci_2015.pdf. (In Russian.)

[13] Ishikawa, K. 2002. Syllabification of intervocalic consonants by English and Japanese speakers. *Language and speech* 45(4), 355–385.

[14] Jie, D. 2010. Slogovaia "prisma" rodnogo iazyka kak faktor foneticheskoi interferentsii v russkoi rechi. *Moscow State University Bulletin. Series 9. Philology* 9(4), 101–108. (In Russian.)

[15] Kabak, B., Idsardi, W. J. 2007. Perceptual distortions in the adaptation of English consonant clusters: Syllable structure or consonantal contact constraints? *Language and Speech* 50(1), 23–52.

[16] Kochetov, A. 2006. Syllable position effects and gestural organization: Evidence from Russian. In L. Goldstein, D. Whalen, Best, C. (ed.), *Papers in Laboratory Phonology VIII.* Vol. 4–2. Berlin, New York: Mouton de Gruyter.

[17] Kozhevnikov, V. A. Chistovich, L. A. 1965. *Rech'. artikuljacia i vospriiatie*. Moscow: Nauka.

[18] Li, A., Post, B. 2014. L2 acquisition of prosodic properties of speech rhythm: Evidence from L1 Mandarin and German learners of English. *Studies in Second Language Acquisition* 36(2), 223–255.

[19] Li, N. H., Juffs, A. 2015. The influence of Moraic structure on L2 English syllable-final consonants. *Proceedings of the 2014 Annual Meeting on Phonology*, MIT, Cambridge, MA, 1–12.

[20] Martinez, S. G. 2011. The syllable structure: Understanding Spanish speakers' pronunciation of English as a L2. *RaeL: Revista Electronica de Linguistica Aplicada* (10), 1–7.

[21] Tessier, A. M., Duncan, T. S., Paradis, J. 2013. Developmental trends and L1 effects in early L2 learners' onset cluster production. *Bilingualism: Language and Cognition* 16(3), 663–681.

[22] Wilson, C., Davidson, L., Martin, S. 2014. Effects of acoustic-phonetic detail on cross-language speech production. *Journal of Memory and Language* 77(C).

[23] Xu, Y. (2017). Syllable as a synchronization mechanism that makes human speech possible. Manuscript, University College London. http://www.homepages.ucl.ac.uk/~uclyyix/Syllable_manuscript.pdf.

[24] Yang, J., Fox, R. A. 2017. L1–L2 interactions of vowel systems in young bilingual Mandarin-English children. *Journal of Phonetics* 65, 60–76.

[25] Zlatoustova, L. V. 1979. O ritmicheskikh strukturakh v poeticheskikh i prozaicheskikh tekstakh. *Zvukovoi stroi iazyka*. Moscow: Nauka, 109–114. (In Russian.)