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Production and perception aspects of weak forms in Czech-accented English

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Czech is mostly syllable-timed, while English is mostly stress-timed and partly constructs rhythm through connected speech processes (CSPs), which cause unstressed grammatical words to change into weak forms. Since these are particularly challenging for speakers with syllable-timed mother tongues, this study addresses the production and perception of weak forms in proficient Czech speakers. In the production part, we examined Czech-accented speakers producing material loaded with grammatical words and CSPs. Subsequent listening analysis confirmed that the more accented the speaker, the fewer weak forms and associated CSPs can be found in their production. In the perceptual part, we used two perception tests containing realisations where CSPs had been manipulated to create one more and one less native-like version of a sentence. Czech respondents were asked to assess comprehensibility and accentedness. The results suggest that comprehensibility is easier for them to assess than accentedness, regardless of whether they had received phonetics and phonology instruction prior to the experiment. Our results correspond with and expand upon previous findings, both for Czech speakers (e.g., Skarnitzl & Rumlová, 2019) and for non-native speakers in general (e.g., Barańska & Zając, 2014), showcasing non-native patterns in Czech speakers. Yet, despite their importance and frequency, CSPs have been given little space in research and teaching.

Keywords: connected speech processes, grammatical words, weak forms, Czech-accented English



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1 Introduction

Given the differences between Czech and English, it is likely that Czech speakers will transfer their native language (L1) habits into their L2 English. Among others, this will affect rhythmic patterning, which includes, particularly in English, the pronunciation of weak forms (WFs) of grammatical words. The aim of our study is to establish whether there are any patterns in production and perception of WFs and associated connected speech processes (CSPs) in Czech-accented proficient learners of English. The importance of weak forms as part of connected speech (CS) in English language acquisition is highlighted.

2 Previous research

2.1 Speech rhythm and connected speech

Speech rhythm is treated today not as a regular occurrence of a speech unit in time, but rather as a sequence of contrasting units, i.e., those with greater and smaller prominence (Nolan & Jeon, 2014; Turk & Shattuck-Hufnagel, 2013). In line with this approach, the traditional binary division of languages into strict categories is replaced by a rhythm continuum whose theoretical ends would correspond to the stress- and syllable-based languages (Nolan & Jeon, 2014). Crucially, however, (strict) timing regularities are no longer part of the definition of speech rhythm (see also Cauldwell, 2002), and no language corresponds to either theoretical end. Languages' rhythm profiles lie on this continuum, meaning that, when compared, two languages can be relatively closer to or further away from each other, the latter being the case of Czech and English.

The mostly stress-based rhythm of English is largely constituted by prominence contrasts at stress group level (Brown & Kondo-Brown, 2006, p. 2), with stressed syllables functioning as peaks of prominence, as compared to unstressed syllables. In contrast, all syllables are of roughly the same prominence in Czech (Skarnitzl & Eriksson, 2017), a language traditionally described as syllable-timed.

Out of the four levels of stress in a unit of speech as defined by Volín & Johaníková (2018, p. 181), unstressed syllables are of interest for us, since they can be further divided into full unstress (containing a full vowel) or weak unstress (containing a reduced one).

A language's rhythm profile is facilitated by the (partially) language-specific CSPs; otherwise, rhythm would be disrupted, inhibiting perception (e.g., Barańska & Zając, 2014). CS helps maintain speech rhythm through several processes, with modifications taking place in some words when they occur in CS (Shockey, 2003). As there is still a lack of extensive research on CSPs, and the terminology is far from unified, we find it fit to include an overview of the core CSPs as referred to in this article (but see, e.g., Alameen & Levis, 2015 for a slightly different categorisation).

First of all, vowel reduction contributes strongly to the rhythmic profile of English (e.g., in the phrase *There was a man* [ðə wəz_ə], the first three words will only have the mid central vowel schwa). Schwa is known to constitute approximately one quarter of all vowels occurring in natural English speech (e.g., Volín et al., 2013, pp. 32–33).

The second group of processes contains various types of assimilation: a) place of articulation (e.g., $/n/ \rightarrow /m/$ in *in Prague* [Im prace]); b) manner of articulation (e.g., $/d/ \rightarrow /n/$ in *good night* [gon nate]); and c) coalescence (e.g., $/d+j/ \rightarrow /d_3/$ in *could you* [kod3_u]). An instance of place assimilation is dentalisation, which occurs frequently in English (e.g., alveolar /t/ influenced by (inter)dental $/\delta/$ in *get this* [get δ Is]). In native-like speech production, stop consonants are often unreleased (e.g., /t/ in final position in *not* in the phrase *not to* [not tə]).

Linking is a key characteristic of English sound patterns, with words beginning with a vowel typically linked to the previous word (e.g., *can I* [kən_aɪ], *see it* [si:_(j)It]). Finally, elision, or, the deletion of a sound, is also an integral part of English CS (e.g., /r/ in *from* in the phrase *from Paris* [fəm pærıs], /d/ in *and* in the phrase *you and me* [ju:_(w)ən mi:]). Naturally, in certain contexts, more CSPs may be combined, as is the case of an elision of word-initial [h] in *he* with linking to the preceding word (e.g., *does he* [dəz_i]).

2.2 Weak form words in English as L1 and L2

Grammatical words constitute a major component of the rhythmic pattern of English: bearing little prominence and semantic load, they participate strongly in CSPs, where they are frequently realised as what is called their weak form (e.g., *must* realised as [məst] or [məs], *them* as [ðəm] or [əm]). These weak forms of grammatical words (see the comprehensive overview by Cruttenden, 2014, or the discussion of CSP typology by Shockey, 2003) almost invariably contain the reduced vowel schwa [ə], and they make up the "filling" between the prominent peaks of lexical words.

The absence of WFs and CSPs in the speech of L2 speakers may impact not only their accentedness (i.e., the strength of foreign accent), but also their comprehensibility (i.e., the subjective ease of processing of their speech). From the contrastive perspective, this may be partly caused by the absence of (systematic) vocalic reduction in the native language of L2 speakers. Alameen and Levis (2015, p. 160) point out that the way L2 speakers produce CS may pose a challenge to native speaker listeners. At the same time, comprehensibility issues may arise even for other L2 speakers who speak a different variety. However, native-like production of WFs by L2 learners may also cause problems in the perception of other L2 speakers of English, especially beginners.

Given the high frequency and the essential role of connected speech phenomena in English, they should certainly be targeted in pronunciation teaching. However, several publications, including Brown and Kondo-Brown (2006) or Alameen and Levis (2015), point out that CSPs and WFs are marginalised in EFL curricula. A number of studies (e.g., Alameen & Levis, 2015; Brown & Kondo-Brown, 2006; Izumi, 2003) show that WF and CSP instruction is beneficial for learners' production of the target language, as well as the perception of native speech. Greater attention should also be given to vowel quality instruction (see Barańska & Zając, 2014 or Volín & Johaníková, 2018).

2.3 Research questions and hypotheses

In this study, we are interested in how relatively advanced Czech speakers of English produce weak forms of grammatical words and associated connected speech processes in specially designed sentences which are rich in these phenomena. Our second objective is to find whether speech manipulated to feature near-native-like patterns of WFs and CSPs will be regarded by Czech listeners as less accented and more comprehensible.

Specifically, our hypotheses are as follows:

- **H1A**: Czech-accented speakers of L2 English show deviations from native-like production of weak forms of grammatical words and the associated CSPs.
- **H1B**: The deviations from native-like production are modulated by the speakers' overall accentedness.
- **H2A**: Czech learners of English perceive WFs and CSPs in English through the qualities of accentedness and comprehensibility.

- **H2B**: Comprehensibility is more difficult to assess for Czech-accented learners of English than accentedness.
- **H2C**: The more advanced the student, the more their perceptual assessment of accentedness and comprehensibility will correspond to stimulus manipulations.

3 Experiment 1: Production

3.1 Research methodology

To map how advanced Czech learners of English produce weak forms, we recorded 34 volunteers reading out loud 24 sentences from paper. The sentences were designed to ensure the occurrence of all types of WFs. The expected default realisation of WFs and CSPs (see Appendix) was based on Standard Southern British English.

All speakers were L1 Czech female first-year BA students (aged 19–25) in English Studies and English Translation Studies at the Faculty of Arts in Prague, for which they had previously passed an entrance exam, ensuring proficiency at the B2/C1 CEFR level (Council of Europe, 2020). Although the speakers had not yet received any instruction concerning weak form words or CS at the time, to assure that the sentences are not perceived as unnatural, we used varied but simple lexical words to complement the large concentration of grammatical words. The recordings were obtained in a recording booth of the sound-treated studio at the Institute of Phonetics in Prague, using an AKG C4500 B-BC condenser microphone at a sampling rate of 32 kHz with 16-bit quantisation.

The 34 speakers were divided into two groups based on their overall accentedness, as determined by the authors. Subsequently, 12 speakers per group, representing the most and the least accented productions, were chosen for analysis by the authors. It should be noted that assessing the speakers' overall accentedness involves subconsciously taking into account WFs and associated CSPs, as these are likely to participate in the perception of accentedness. While it could therefore be argued that the group division is to a certain extent circular, this did not interfere with our research purpose.

Each realisation of a phenomenon of interest was analysed in Praat (Boersma & Weenink, 2021) and labelled, and all entries were extracted using a script. Processed in R (R Core Team, 2021), the refined data was visualised using the ggplot2 package (Wickham, 2016).

3.2 Data analysis and results

3.2.1 Linking and glottalisation

In Figure 1, the proportion of linked vs. glottalised (i.e., not linked) items is shown separately for linking towards lexical and towards grammatical words (for example, *who arrive* and *arrive at*, respectively). As expected, the less accented speaker group did link slightly more than the more accented one (51.4% for the former compared to 38.0% for the latter). Almost without exception, linking (marked in blue in the figure) was more frequent in grammatical words (in lighter shades, on the left for each speaker) than in lexical words. However, the results point to considerable between-speaker variability, even within the two groups. This is especially evident in the lexical words, with the less accented group having speakers who glottalised (as opposed to linking) in all instances, as well as some who linked most of the items.

Figure 1



Linking and Glottalisation in Less and More Accented Speakers (Separately for Grammatical and Lexical words)



3.2.2 **Vowel reduction**

The difference in the degree of accentedness is more salient in vowel reduction: as shown in Figure 2, the more accented group of speakers reduced the quality of canonical schwa vowels markedly less frequently, and the difference amounts to approximately 20 percentage points. An 'intermediate' realisation category was introduced, since 4.4% of all vowel realisations were neither full, nor reduced, but elsewhere on the spectrum. For instance, the first vowel in to you was realised as not only [u:] or [ə], but also [u], [u⁻], or [v], thus lying on the continuum from full to reduced. Finally, in contrast with linking, within-group variability is much lower here.

Figure 2



Reduction of Canonical Schwa Vowels in Less and More Accented Speakers

3.2.3 Assimilation

As for assimilation, the task yielded seven possible contexts of coalescence; of these, pronunciation with coalescence (e.g., $/z+j/ \rightarrow /3/$ in *as your* [æ30:] or $/d+j/ \rightarrow /d3/$ in *did you* [dtd39]) appeared in 55% of the items of the less accented group, and in 37% of the items of the more accented group – a result in line with our expectations. A more interesting tendency is revealed in the context of [n] before the dental [ð]; this occurred four times in the text. As shown in Figure 3, there were three possible realisations: a) with no assimilation (e.g., [m ðə] or, more frequently, [m də]; b) with partial assimilation, which involved the change in articulation place [m ðə]; and c) complete assimilation, which involved regressive place and progressive manner assimilation [m np]. Items where no assimilation was realised were much more frequent in the less accented speakers; the same applies, however, for the complete assimilation where there is, phonetically speaking, a long dental nasal sound. On the other hand, intermediate realisations were dominant in the more accented speaker group.

Figure 3



Assimilation of Place and Manner of [n] and [ð]

3.2.4 Consonant elision

The results for elision show that speakers from both groups deleted the word-final [d] in *and* [t] in *must* before another consonant in approximately one half of the instances, and almost always pronounced stops as unreleased before another stop (e.g., *some men*; *what does*).

3.2.5 Elision (h-dropping) followed by linking

The results for the combined phenomenon of [h] elision and subsequent linking, as in *does he* (see the end of §2.1) can be observed in Figure 4 which shows that linked pronunciation without [h] was quite rare, occurring in only 10% of the items. However, there is a difference between the less and more accented speaker groups, with productions like *should have* [fod_əv] or *for his* [fər_IZ] appearing more often in the former group.

Figure 4



Elision of [h] Accompanied by Linking

4 Experiment 2: Perception

4.1 Research methodology

We used two perception tests to examine whether and, if so, then how advanced Czech speakers of English perceive accentedness and comprehensibility of the recordings described in the previous section. A total of 24 sentences were read by 10 of the 34 speakers. Recordings from these 10 speakers were selected based on the accentedness level, so as to facilitate the subsequent manipulations. Each sentence was manipulated towards a more native-like version of the original sentence (containing uses of WFs and CSPs more natural for spoken English), and towards a less native-like version (where WFs and CSPs were suppressed).

Adobe Audition and Praat were used to perform the manipulations. We simulated full and reduced vowels by changing their duration (deleting or adding pitch periods) and amplitude. To eliminate linking, we spliced in a short period of silence; it was sometimes necessary to make the release of the word-final consonant more robust. To simulate lack of assimilation, release, and absence of elision in consonants, we have extended the duration of plosive closure or the noise component of fricatives and plosives; vice versa to achieve native-like consonant segments. Another method, used for both vowels and consonants, was splicing the target segment taken from the same speaker's data into the word being manipulated. Finally, fundamental frequency (f_0) was altered, transitions smoothed out, and amplitude adjusted where necessary.

Because of the social distancing measures associated with the COVID-19 epidemic, two perception tests were created using the MFCExperiment tool in Praat and sent to potential respondents via email. One test targeted accentedness, the other comprehensibility, and the respondents' task was to choose the recording (one more and one less native-like, as described above) which they regarded as less accented and as easier to understand, respectively. The order of the stimuli was randomised for each listener. The test set was accompanied by detailed instructions, which included saving the results into a binary file and sending it back to the

experimenter by email. Based on the Praat reaction time statistics, the whole test took 15 minutes, on average.

Another aim was to explore whether proficiency plays a role; for that reason, we had two groups of respondents, all between 19 and 25 years old. Group 1 consisted of 15 first-year students (F = 10, M = 5) with little formal knowledge of the sound patterns of English. Group 2 were eight third-year students (F = 7, M = 1), who had already completed a year-long course in English phonetics, including an overview of WFs and CSPs. None were familiar with the topic or the specifics of the study.

4.2 Data analysis and results

To assess the statistical significance of the perceptual comparisons, we employed the bootstrap method; this method is suitable for estimating the confidence interval of the mean value of a relatively small number of binary responses which are not normally distributed. Instances where our respondents were able to correctly assess accentedness (i.e., pick the more accented sentence realisation from a pair) were coded as 1, the opposite (i.e., they were not able to recognise the more accented version) as -1.

Figure 5 shows that, at the alpha level of 0.05, listeners in both groups were mostly able to correctly recognise the more accented sentence realisation. Interestingly, two listeners in the third-year group were slightly more ambivalent, with their responses approaching the significance boundary (the confidence interval nearly including zero).

Figure 5

Estimation of the Listeners' Ability to Assess Accentedness



Note. First-year respondents in red, third-year respondents in blue.

The results are much less unambiguous for comprehensibility, as shown in Figure 6. Most listeners' intervals intersect the zero value, which means that they were mostly unable to assess comprehensibility levels correctly. In total, only three listeners displayed significantly higher

awareness of the phenomenon (F04, F06, F09), while one listener's responses may be considered as marginally significant in the opposite direction (M04).

Figure 6

Estimation of the Listeners' Ability to Assess Comprehensibility



Note. First-year respondents in red, third-year respondents in blue.

5 Discussion

In line with hypothesis H1A, Czech-accented EFL speakers showed deviations from the native-like production of WFs and associated CSPs. No single CSP was produced in a native-like way in all contexts by a single speaker. As is characteristic of non-native speech, the percentage of native-like CSP use ranged widely, from 10% (elision of [h] with linking) to 90% (unreleased consonants). Intermediate realisations on the CSP continuum (Alameen & Levis, 2015) are also typical of L2 speakers, represented in our results by various "degrees" of vowel reduction, consonant elision lacking subsequent linking, and dentalisation instead of assimilation. Similarly to Barańska and Zając (2014, pp. 281–282), vowel reduction was found to be problematic, a characteristic which Slavic speakers of English seem to share. In all, this shows that there are, indeed, more problematic aspects of CS that deserve attention in EFL teaching.

Our results also supported H1B, according to which more accented speakers will employ fewer WFs and CSPs, with the less accented group typically producing by 15-20 percentage points more CSPs. However, the overall difference between the groups was not substantial, which is in line with the findings by Barańska and Zając (2014).

The results of the perception test show that Czech listeners are at least somewhat aware of WFs and CSPs in English speech (H2A). The hypothesis claiming that comprehensibility is more difficult for Czech speakers of English to assess than accentedness (H2B) was also confirmed, with accentedness assessed correctly in 80-85% of cases, and comprehensibility in 60%.

Kukačka (2018) found that having taken phonetics and phonology classes had no effect on the results in WF production (p. 51). We reached the same conclusion, failing to support H2C (the more experienced the respondent, the more successful they are in assessing accentedness and comprehensibility), as the two groups' results were quite similar.

6 Conclusion and implications

Connected speech phenomena and weak-form realisation of grammatical words constitute an important component of the sound patterns of English, and specifically of its rhythm. This study has shown that even advanced, university-level students of English do not pronounce these in a native-like way, which may impact their comprehensibility (Anderson-Hsieh, 1990; Brown & Kondo-Brown, 2006; Ito, 2006). Our research has also presented evidence for the claim that none of the phenomena analysed here should be regarded as binary categories; rather, the realisation of WFs and CSPs typically occurs along a continuum. Similarly, in perception the awareness of these phenomena also ranges widely on a spectrum with the (theoretical) ends of 'no awareness whatsoever' and 'native-like perception'.

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Appendix

The predicted distribution of weak word forms and connected speech processes in the 24 sentences used as stimuli in the production experiment.

Schwa	Assimilation
	- Assimilation of place or manner
	- Coalescence (= coalescent/fusional assimilation)
Consonant elision	Unreleased consonants
Linking	Elision (h-dropping) + linking
-	(where the linking can only occur together with elision)

1. I w<mark>ou</mark>ld have tol<mark>d y</mark>ou abou<mark>t i</mark>t.

[aɪ w<mark>əd_ə</mark>v ˈtəʊl<mark>dʒ_u_(w)ə</mark>baʊ<mark>t_ı</mark>t]

- 2. Can I talk to you about something? [kən_ai 'təːk tə ju_(w)əbaʊt sʌmθıŋ]
- 3. When did you want to meet and discuss it?
- ['wen dɪ<mark>dʒ_ə</mark> wɒn<mark>t tə</mark> 'miː<mark>t_ən</mark> dɪ'skʌ<mark>s_ı</mark>t]
- 4. There was a young man there. [ðə wəzə jʌŋ 'mæn ðɛ:]

5. We must look in the locker and in the drawer. [wi mas 'lok_un na' 'lokar_l an un na' 'lokar]

6. What have you been doing? ['wɒt_əv jə bın 'duːɪŋ]

7. The people who arrive at five PM are too late. [$\partial_{\hat{\sigma}}$ 'pi:pl hu(w) $\hat{\sigma}$ 'rav = $\hat{\sigma}$ tav pi:(j) 'em = $\hat{\sigma}$ tu: 'lett]

8. When does he arrive from Paris? ['wen does he arrive from 'pæris]

9. She should have asked for his permission. [ʃi ʃədəvə'a:skt fər ız pəˈmɪʃŋ]

10. You shall be on the list. [ju jal 'bi:(j)pn ha 'list]

11. He can't have gone behind your back! [hi 'kɑːnt_əv 'gɒn | bə'hamdʒə 'bæk]

12. He got me her numbe<mark>r and e</mark>mail. [hi 'gɒ? mi_(j)ə 'nʌmbə<mark>r_ən _ 'i:</mark>meɪl]

13. Th<mark>ere is a</mark> lack of answers. [ð<mark>ər_ɪz_ə</mark> 'læk_əv_'a:nsəz]

14. Could you have been there? [$k \frac{1}{2} \frac{$

15. There were some men who knew them. [ðə wə səm men u 'nju: ðəm]

16. Hi<mark>s u</mark>niversity w<mark>as a</mark>s goo<mark>d as you</mark>r college. [hɪ<mark>ʒ uːnɪˈvɜːsətɪ | wəz ə</mark>z ˈɡʊ<mark>d əʒ ə</mark> ˈkɒlɪdʒ]

17. No, bu<mark>t</mark> there is an umbrella. ['nəʊ | bʌ<mark>t] d̪ər_ɪz_ən_ʌ</mark>m'brelə]

18. Do you like her more than Jane? [dʒə 'laık ێ : mɔ: ðən 'dʒeɪn]

19. It's a gift from us for him and his wife. [ts_{a} 'gift from ' Λ s | for him on z' waif]

20. The parents were nice to them. [ðə 'pε:rənts wə 'naıs tə ðəm]

21. To be, or not to be? [tə ˈbiː(j) ə ˈnɒt tə bi]

22. Out of everyone here, I am the best. [$aot_{v}'e^{vriwAn 'hisr_{v}'ai_{ij}am} da 'best]$

23. What does it mean to us? ['wpt doz r? 'mi:n to(w) ['wpt doz r? 'mi:n to(w)]

24. He sai<mark>d tha</mark>t his brother w<mark>as an a</mark>rtist. [hi 'se<mark>d] | də</mark>t_ız 'brʌðə w<mark>əz_ən_'a:</mark>tıst]

About the authors

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