# The effect of non-conclusive melodic rises on Czech speech sounding French

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**ABSTRACT**

This paper is based on a study of first language attrition in Czechs living in France, which reveals that Czech expatriates in France use prominent rises in non-conclusive intonation patterns in their native language. We manipulated the speech of six expatriates by reducing the fundamental frequency ($f_o$) range of non-conclusive rises in a phrase, and the speech of six Czech control speakers by expanding the $f_o$ range to mimic the French-like prominent rises. The manipulations served, alongside filler items, as the basis for a perception test in which 37 native Czech listeners assessed how much the speakers' pronunciation manifested marks of a long-term stay in France. The results confirmed our hypothesis that expanding the control speakers' $f_o$ range would increase the perceived effect of French. However, reducing the $f_o$ range in the expatriate group did not yield lower French-effect ratings, most likely due to the presence of other pronunciation features in their speech.

## 1 INTRODUCTION

In today's world, bilingualism or multilingualism seem to be increasingly frequent, with many people living in a country where the ambient language is not their native language (L1). As a result, the number of speakers who use a second or foreign language (L2) on a daily basis is increasing. It is well known that when there are two or more languages spoken by one person, they affect each other in various ways, and several accounts have been proposed over the past century which attempt to explain and predict the resulting effects (Myles 2013). For a long time, the study of cross-linguistic influence (CLI) has involved the L1-to-L2 direction, i.e., the effect of the speaker's native language on the language that he or she was learning, typically referred to as *second language acquisition*. In the domain of speech and pronunciation, the almost inevitable result of such interactions between the sound patterns of the two languages is a foreign accent (Moyer 2013). Examining the opposite direction of CLI, where one's L2 exerts some kind of an influence on their native language, represents a comparatively more recent stream of research and is sometimes labeled *first language attrition* (although see section 1.1 for a more nuanced approach). L1 attrition concerns a non-pathological decline of L1 skills previously possessed by the speaker

(Köpke and Schmid 2004). More specifically, we can talk about adaptations of sound patterns, lexical representations or grammatical structures of a speaker's L1 due to the influence of an L2.

Although terms like "cross-linguistic influence" or "language attrition" may be unknown to most ordinary people, the concept of "losing one's mother tongue" is far from unfamiliar, as it appears in hundreds of hits on the Internet, including newspaper articles, blogs, and websites (cf. Sučková 2020: 2). In addition, many people have witnessed this phenomenon in their family members returning from a prolonged stay in a foreign country or in well-known persons living abroad. In the Czech context, the tennis players Ivan Lendl or Martina Navrátilová can serve as famous examples.

The present study is based on research into the attrition of Czech as the L1 in speakers living in L2 French environment (Hévrová, Bořil and Köpke 2020; Hévrová 2021). This research reveals that Czech speakers living in France manifest, among other things, specific forms of melodic behavior, particularly in the non-conclusive patterns, which tend to be marked by a prominent rise in their speech (see also below). The aim of our study is to verify the perceptual salience of this non-conclusive rising melody as a marker of CLI. We will use controlled manipulations of speech melody to help us assess the role of non-conclusive rises in evoking a perceived effect of L2 French in native speakers of Czech who have in fact never spent a significant amount of time in a French environment.

In the following two subsections of this paper, we will briefly introduce the study of language attrition and CLI in bilinguals, also summarizing the main findings concerning the pronunciation of Czech speakers living in France (section 1.1), and describe the differences in the melodic patterning of Czech and French which are relevant for our research (section 1.2). In section 1.3 we will address the research questions and hypotheses of the study. Section 2 will detail the experimental procedure and the compilation and administration of the listening task. In sections 3 and 4, we will present and discuss the results, respectively.

## 1.1 CROSS-LINGUISTIC INFLUENCE AND ATTRITION IN BILINGUALS

In most recent definitions, bilingualism relates to the use, and the necessity of use, of multiple languages by one speaker (Grosjean 2013; Kohnert, Ebert and Pham 2022); both conditions are likely to evolve over the speaker's lifespan and entail modifications in the balance between the different languages spoken by the speaker. Crucially, bilinguals may not have equal fluency in their languages and may speak with a foreign accent in one of them (Grosjean 2013). Given the huge variation in bilingual profiles, however, it is common to differentiate bilinguals along a multitude of dimensions; for example, early and late bilinguals are distinguished with respect to the age of acquisition (AoA), which is known to be responsible for differences in the brain structure involved in the processing of different languages (e.g. Berken, Chai, Chen, Gracco and Klein 2016; Birdsong 2018). However, it is now well established that the link between the age of onset of L2 learning and the ability to attain a native-like L2 proficiency is complex (see e.g. Birdsong 2018 or Hyltenstam and Abrahamsson 2003 for a review). Specifically, age effects have been shown to differ depending on the linguistic domain, with the sound patterns of the L2 particularly affected. Moreover,

other factors modulate ultimate attainment in the target language, such as the learner's motivation (Dörnyei 2010) and willingness to communicate (MacIntyre, Clément, Dörnyei and Noels 1998), the type of memory applied during L2 learning (Baddeley 2012; Morgan-Short, Faretta-Stutenberg, Brill-Schuetz, Carpenter and Wong 2014), or the quality and quantity of L2 input (Moyer 2009).

Gradually, it has come to light that the L1, even in late bilinguals, is not as immutable as it was believed to be. Early studies in the 1980s started to show that the speakers' L2 may affect their L1. It was Sharwood Smith (1983) who introduced the term "cross-linguistic influence" (to replace the negatively perceived term "transfer") and used it also for the reversed, L2-to-L1 direction. It is interesting to note, however, that anecdotal observations about the loss of the speakers' L1 were offered decades earlier by Vilém Mathesius, who discussed the speech of Czechs living in Slovakia (Mathesius 1935: 102).

In the context of the influence of an L2 on an L1, Pavlenko (2000) distinguishes five types of CLI. When linguistic elements from the L2 are added into the speaker's L1, Pavlenko talks about **borrowing**; in our Czech speakers residing in France, one may observe a frequent occurrence of an epenthetic schwa at the ends of words (called "stuck schwa" by Hévrová 2021). Some features of the two linguistic systems may approximate each other, resulting in a unitary system distinct from both the L1 and the L2; this situation was termed **convergence** and appeared, for instance, in the sound shape of the rhotic sound in some of Hévrová's speakers. In a **shift**, L1-typical values or structures adjust to approximate those of the target L2; this may be exemplified by the short close-mid front /ɪ/ of Czech to be pronounced as a more close and peripheral [i] due to the effect of L2 French. **Restructuring** occurs when L2 elements are incorporated into one's L1, leading to a reanalysis of existing L1 elements (see Ulbrich and Ordin 2014 for an interesting example); as for Czech speakers residing in France, the application of French intonation patterns in Czech speech may be used as an example. It is only the last type that is, in Pavlenko's (2000) typology, called **L1 attrition**, and it involves the inability to produce an element of the L1 due to the effect of the L2 and due to decreased L1 use and/or input (De Leeuw 2019; Kříž and Chromý 2020).

In the domain of the effects of L2 sound patterns on those of the L1, or what is often referred to as **phonetic attrition**[1], most studies have focused on late bilinguals whose L1 or L2 was English (e.g. Bergmann, Nota, Sprenger and Schmid 2016; Chang 2012; Sancier and Fowler 1997; Ulbrich and Ordin 2014). There are only very few studies which address phonetic attrition in contexts where the Czech language acts as either the L1 or L2. In her doctoral dissertation, Sučková (2020) examined Anglophone expatriates living in the Czech Republic; she measured VOT values in the participants' fortis and lenis plosives, the degree of devoicing of word-final lenis plosives, and the speaker' realizations of English dental fricatives. The results were not always straightforward. On the one hand, VOT in fortis plosives was found to be shorter in some of the English words, supporting a shift towards L2 Czech values;

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[1]   Note that some researchers also talk about **phonetic drift** to describe effects of a shorter stay in an L2 environment or even a short exposure to an L2 on a speaker's pronunciation in his or her L1 (Tobin, Nam and Fowler 2017).

on the other hand, however, word-final lenis plosives were actually produced with more voicing and the dental /ð/ more canonically than what speakers in the native English control group produced. Sučková (2020: 128) attributes the latter finding to greater "enunciation effort". Note that Pavlenko's (2000) typology does not consider such a possibility, which may be termed *dissimilation* (see e.g. De Leeuw 2019 or Flege and Bohn 2021). Šreková's (2020) MA thesis focused on phonetic CLI in the L1 speech of Czech students majoring in English translation studies and reported only insignificant effects of English VOT values on those in Czech. Finally, as was mentioned above, Hévrová's (2021) doctoral dissertation examined L1 attrition in Czech speakers residing in France. Other studies of L1 attrition with Czech as an L1 or L2 concentrate on other linguistic domains such as the lexicon (Kříž 2020) or morphology (Zajícová 2010).

Returning to phonetic attrition, most studies have examined segmental aspects of speech, but the L2-on-L1 effect has also been addressed in prosody, and specifically in the melodic domain. For instance, Mennen (2004) examined L1 Dutch speakers of L2 Greek; although the two languages use a pre-nuclear rise in declarative intonation, the phonetic implementation of the rise differs. The study revealed a bi-directional CLI in most of the speakers who were examined, with the melodic peak alignment different from either of the native speaker control groups. De Leeuw, Mennen and Scobbie (2012) also investigated tonal alignment of pre-nuclear rises in the L1 of late German-English bilinguals. The authors predicted an assimilation effect concerning both the onset and offset of the rise; overall, however, their analyses confirmed an L2 effect only on the alignment of the onset, which occurred significantly earlier in the German of the bilingual speakers than in that of the monolingual control group. Intonation has also been mentioned by listeners as contributing to a non-native impression of speakers living in an L2 country (see for example Mayr, Sánchez and Mennen 2020).

Since the study reported in this paper is motivated by Hévrová's (2021) findings, we will summarize her research in more detail. A perceptual experiment revealed that native Czech listeners, students of phonetics, do perceive a French accent in the Czech speech of speakers residing in France. The listeners pinpointed several phonetic features which, in their opinion, "flagged" the speakers as sounding "French". These features included vowel quality (typically /ɛ/ and /ɪ/), the replacement of /ɦ/ by /x/, the realization of /r/ and, crucially for the present study, intonation. Intonation of the Czech speakers affected by French was described as "very rising", having "a prominent rising pattern" or "rising ends of phrases" (Hévrová 2021: 149). In a subsequent acoustic study, the author identified the presence of CLI in the speakers' production of unrounded vowels ($F_1$ of [aː] and [ɛː], $F_2$ and $F_3$ of [ɪ] and $F_3$ of [iː]), as well as in phonetic properties of the Czech [r] and [x]. In addition, the acoustic study confirmed a higher proportion of rising melodic contours in the non-conclusive pattern than in the control group. Finally, the Czech speakers living in the French environment used the stuck schwa (see above) more frequently. It is the rising melody in non-conclusive patterns which provided an impetus for the present study. Hévrová's results lend support to the common assumption of models like the SLM-r (Flege and Bohn 2021) or PAM-L2 (Best and Tyler 2007) that L1 and L2 sounds of late bilinguals

exist in a common phonetic space; Flege and Bohn (2021: 22) refer to a "composite L1–L2 phonetic category". As such, the sounds can interact with one another, which results in perceptible and measurable changes even in the speakers' native language.

## 1.2 NON-CONCLUSIVE INTONATION PATTERNS IN CZECH AND FRENCH

It seems to be a linguistic universal that non-conclusive intonation patterns signal a syntactic or semantic boundary in speech and, at the same time, the speaker's intention to continue speaking. Such patterns alert the listener that the utterance is not yet complete and that continuation of the utterance should be expected (Di Cristo 2016); for that reason, non-conclusive patterns may also be called continuing intonation patterns (ibid.).

While it is beyond the scope of this paper to provide a systematic comparison of intonation in Czech and French, it is necessary to at least briefly compare the non-conclusive nuclear melodic patterns in the two languages. Before turning to this comparison, it should be pointed out that a contrastive analysis of Czech and French intonation (Duběda 2012: section 4.3) has identified significantly greater melodic variability in French than in Czech; this is achieved not only by a higher pitch range, but also by more frequent melodic movements.

As for a non-conclusive melody, the classic description of Czech intonation (Daneš 1957) distinguishes one unmarked and four marked phonetic realizations of the non-conclusive phonological pattern; the marked realizations also take into account whether the last pre-nuclear syllable is lower or higher than the onset of the nuclear tone (see also Palková 1994: 313ff). In the most recent systematic treatment of these patterns in Czech, Volín (2008) used k-means cluster analysis to examine non-conclusive intonation patterns produced by 252 speakers in a reading of continuous text. Focusing on the nuclear tone along with two preceding syllables, the author identified six realizations of this functional pattern; these are illustrated in Figure 1. Volín has shown that realizations with a slightly rising intonation (appearing in the upper row of the figure) were most frequent. The other phonetic realizations, in the lower row of Fig. 1, involve a flat or falling melodic contour. Crucially, therefore, it is obvious that Czech does not regularly use a *high rising* melodic realization of non-conclusive tones.
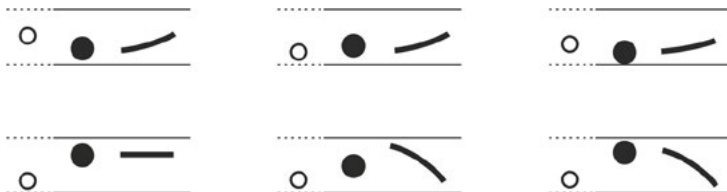


**FIGURE 1.** A schematic illustration of Czech non-conclusive patterns (adapted from Volín 2008: 177); note that only one pre-nuclear syllable is shown for the sake of comparison with French. The empty circle corresponds to the pre-nuclear syllable, the filled circle to the nuclear syllable, and the solid line to the melodic movement in the tail of the prosodic phrase.

In French, it appears to be precisely the non-conclusive (continuation) intonation patterns which are responsible for the overwhelmingly rising impression (Delattre 1953). Non-conclusive intonation patterns in French were examined in a number of studies. As summarized in Delais-Roussarie, Post, Avanzi et al. (2015), tonal movements associated with non-final intonational phrases are most typically rising (cf. also Duběda 2012), with the rise manifested usually on the last syllable (Santiago 2019). However, Di Cristo (2016: 218) listed another five possible realizations of non-conclusive patterns which, similarly to those observed in Czech, also include falling movements and a flat melody (see Figure 2).
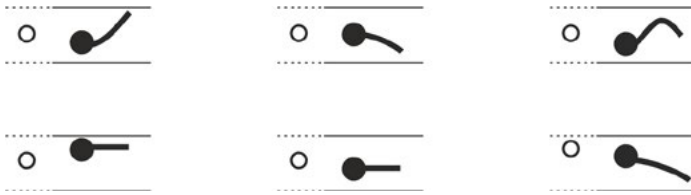


**FIGURE 2.** A schematic illustration of French non-conclusive patterns (adapted from Di Cristo 2016: 218). The empty circle corresponds to the pre-nuclear syllable, the filled circle and the solid line mark the nuclear syllable and its melodic movement.

To summarize, non-conclusive intonation patterns are more frequently rising in French than in Czech, with the rise typically occurring on the last syllable and being more prominent. As described in section 1.1, Hévrová (2021) documented assimilation effects in non-conclusive melodic patterns in Czech speakers residing in France in what may be regarded as restructuring (Pavlenko 2000), and her Czech listeners mentioned rising intonation as the "revealing" feature. From the perspective of L2 acquisition, we may expect this feature to be acquired early by Czech speakers living in France due to its semantic weight and perceptual prominence (Pešková 2020). This study aims to provide another perspective on the perceptual salience of rising melody as a marker of French influence in the speech of Czech speakers.

### 1.3 RESEARCH QUESTIONS AND HYPOTHESES

In the reported experiment, we will manipulate fundamental frequency ($f_o$; roughly, the acoustic correlate of perceived pitch) in the speech of two groups of Czech speakers. In those living in the Czech Republic, $f_o$ will be changed to mimic the prominent rises, whereas in those who have been living in France for a period of time, the rises will be reduced. We hypothesize that both changes will modify the listeners' perception. Specifically, we predict that 1) introducing more prominent rises into the speech of Czech speakers will evoke an influence of French in the ears of our respondents, and that 2) flattening the rises in the speech of those residing in France will render the impact of the French language less distinct.

## 2 METHOD

### 2.1 SPEAKERS

We used recordings of 32 native speakers of Czech who talked freely for several minutes on a general topic (usually answering questions like *How was your day? What is your typical day?*). Half of the speakers had never spent a significant time (over a month) in a French-speaking country, which should preclude any CLI from the French environment, whereas the other half did, ranging from two months to 28 years (see Table 1). In these speakers, it is reasonable to expect substantial CLI on their Czech pronunciation. The two groups of speakers will be referred to as the **Control group** ($n$ = 16) and the **Expat group** ($n$ = 16) for convenience, which is not meant to imply that they necessarily consider themselves as expatriates. Age summaries are provided in Table 1. The recordings of the Control group were obtained in a quiet room at the Czech Technical University using a head-mounted Beyerdynamic Opus 55 microphone connected to a high-quality portable recorder Zoom H1. The recordings of the Expat group were acquired in a recording studio at University Toulouse Jean-Jaurès using a Neumann TLM 49 microphone and the MOTU ULmk3 sound card.

| Variable | Group | Min | Max | Mean | SD |
|---|---|---|---|---|---|
| Age | Control | 21 | 49 | 32.9 | 9.7 |
|  | Expat | 20 | 49 | 31.6 | 10.2 |
| Length of residence | Control | — | — | — | — |
|  | Expat | 0.17 | 28.25 | 8.1 | 9.2 |

**TABLE 1.** Age (in years) and Length of residence (in years) for the Expat and Control groups of speakers.

### 2.2 MATERIAL

The material included target and filler stimuli. One target stimulus was selected from each of six Control and six Expat speakers, amounting to 12 stimuli; note that the demographic characteristics of the selected speakers do not substantially differ from those reported in Table 1. The selected portions were meaningful stretches of speech extracted from the larger spontaneous recordings, with the nuclear tone spanning at least two syllables. Their key characteristic was the presence of two rising nuclear non-conclusive contours. The length of the extracts varied from 2.60 to 6.85 seconds due to tempo, but in terms of prosodic structure it was kept approximately the same across speakers, ranging between 6 and 8 stress groups. Filler stimuli were extracted from the recordings of the remaining speakers (9 Control and 9 Expat), and differed from the target stimuli in the structure of the phrases. Specifically, two rising contours were not allowed in a single phrase, and a variety of contours differing in shape and level were used. The length of the phrases also varied more as compared to the target stimuli.

The target stimuli furthermore underwent **acoustic manipulation of $f_o$**. First, $f_o$ tracks extracted in Praat (Boersma and Weenink 2021) using the default settings

were manually corrected for octave jump errors and saved as PitchTiers. Second, the portions of the recording with the relevant melodic movements were identified and annotated in a TextGrid. For each target contour, we identified in the speech signal and marked in the TextGrid (i) what would be the melodically stable part of the nuclear tone and (ii) the rising part of the tone, corresponding to the last syllable of the tail. Third, the manipulation involved replacing the original $f_o$ values with new $f_o$ values in the rPraat package (Bořil and Skarnitzl 2016). For (i), the median $f_o$ of this stretch of speech was computed ($f_0^*$), and all values within the interval were replaced by this median value. For (ii), the values were determined according to the following formula:

$$f_0 = f_0^* \left[ 1 + \left( 2^{\frac{d}{12}} - 1 \right) x^2 \right]$$

where $x$ is a sequence from 0 to 1 in 100 discrete equidistant steps and $d$ is a target $f_0$ step in semitones (ST).

The target values were based on the results of Hévrová (2021), where the effect typically included an interval of one octave (12 ST) for the rising portion in the Expat speakers, and an interval of half an octave (6 ST) in the Control speakers. However, since having two subsequent nuclear rising contours of exactly the same span would be rather unusual and might sound unnatural, we created two types of jump size: **a full span** ($d$ = 12 ST for manipulating Controls to sound like Expats, and $d$ = 6 ST for manipulating Expats to sound like Controls) and **a limited span** ($d$ = 9 ST for the former and $d$ = 4 ST for the latter manipulation type). The stimuli were balanced as to whether the full span was present in the first or second nuclear tone. In the manipulated version, the values from the original PitchTier were simply replaced by these new values.

The manipulation itself was done in *Praat* using the PSOLA (Pitch-Synchronous Overlap-And-Add) resynthesis method. The audio file was converted to a Manipulation object, the correct PitchTier loaded, and the resynthesized sound saved as a new audio file. This procedure was applied to both manipulated and unmanipulated target stimuli and to fillers as well. In other words, even stimuli that were not changed by the manipulation process were resynthesized anew, ensuring that all audio files maintain the same sound quality. Moreover, all resulting stimuli were examined auditorily by the authors as a check for potential artefacts resulting from the manipulation. An example of an unmanipulated and manipulated version is presented in Figure 3.

In total, 24 targets were created (2 × 6 speakers, two versions of a single phrase from each) and 36 fillers (2 × 9 speakers, two different phrases from each). The perceptual test (see section 2.4) thus included 60 stimuli in total. The prevalence of fillers was meant to ensure that the melodic rises of the target stimuli were not too conspicuous.
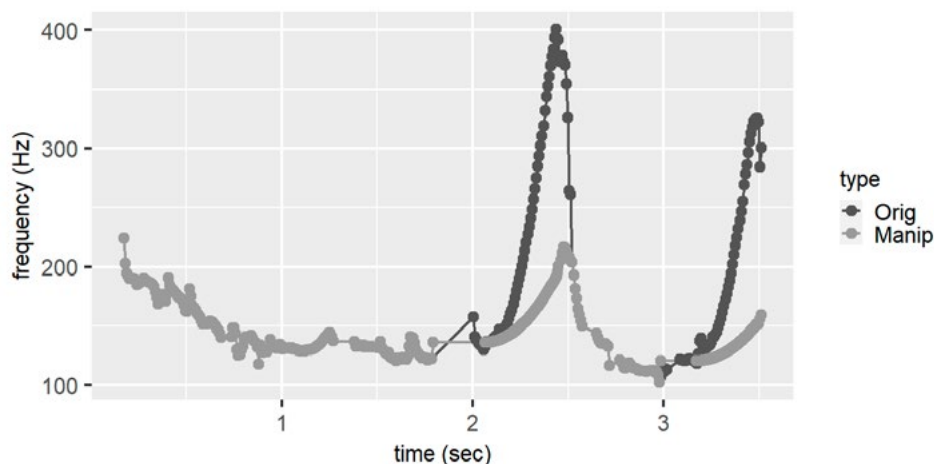
**FIGURE 3.** An example of $f_o$ contours of an Expat speaker before and after manipulation, in the sentence *V poledne jdu vyzvednout mého syna, obědvá doma* 'at noon I pick up my son, he has lunch at home'; the underlined words correspond to the manipulated intervals. The unmanipulated version has two steep-rising nuclear tones that are reduced to 6 ST and 4 ST in the manipulated version.

## 2.3 LISTENERS

In total, 54 listeners participated in the perceptual testing. However, eight were disqualified because they had left the experiment before finishing it, four were non-native speakers of Czech, three more did not indicate what their mother tongue was, and two people were excluded because all their answers were identical (they did not detect any influence of French at all in any of the speakers). The results presented in section 3 will thus be based on the 37 listeners who provided valid data.

The listener group under analysis consisted of 24 females, ten males and three people who did not state their sex. The mean age was 26.8 years (SD = 8.8, 75% range = 20–28, max = 67). Eight of the 37 listeners spoke French at the B2 level or better. Only two listeners spent more than a month in a French-speaking country. Due to online data collection and the snowballing technique employed (see the following section), further background is not known about the participants. However, most of the listeners are expected to be students of English and American Studies at Charles University and their friends or family.

## 2.4 PERCEPTUAL TESTING

A perceptual experiment was constructed from the materials described in Section 2.2. The 60 stimuli were allocated to six blocks of ten items of a fixed structure. The first and last item always contained a filler sentence, balanced as to whether an Expat or Control speaker started (terminated) the block. The remaining eight items — four targets and four fillers — appeared in a randomized order for each listener. The four targets included (i) an unmanipulated Expat speaker, (ii) an unmanipulated Control speaker, (iii) a manipulated Expat speaker, and (iv) a manipulated Control speaker.

As none of the 10 items in a block originated from the same speaker, the manipulated and unmanipulated versions of a phrase appeared in different blocks.

In an attempt to prevent order effects within the experiment (i.e., late items might be rated differently from early items), we constructed four block orders that were assigned randomly to participants: ABCDEF, reversed FEDCBA, CDAFEB, and reversed BEFADC. These orders were chosen so that no two consecutive blocks included two items from a single speaker, and blocks that were medial in two orders were peripheral in the other two. The resulting larger distance between identical voices aimed to reduce the likelihood that a listener would discover that there were repetitions from the same speaker.

For online data collection, we used the software *PsyToolkit* (Stoet 2010, 2017; https://www.psytoolkit.org/). A link to the experiment was sent to a pool of prospective participants, who might have distributed the link further to their friends or family members. Participants were required to wear headphones. After introducing the experiment, a questionnaire inquired about their sex, age, mother tongue, knowledge of French and any extended stays (> 1 month) in French-speaking countries.

The questionnaire was followed by instructions, in which the topic of CLI was described in more detail and the task was specified. Participants were informed that they would be *detecting cues of French influence in recordings of native speakers of Czech*. After playing a sound file once, they were asked to rate the speaker on a continuous scale with a moving slider in terms of the degree of detected French influence. Specifically, the question asked: *How much does the speaker's pronunciation manifest marks of a long-term stay in France?* [In Czech: *Nakolik vykazuje výslovnost mluvčího známky dlouhodobého pobytu ve Francii?*] The scale ranged from "Not at all" to "Very much". The position of the slider was converted into a score between 0 (not at all affected by French) to 100 (very much affected).

Four training items were used (all fillers: two Expat, two Control speakers). This allowed the participants to familiarize themselves with the procedure, evaluate the expected range of melodic deviance in the recordings, or adjust the loudness level. The training voices were different from the experimental voices. Then the proper session followed, consisting of three blocks of 20 items separated by a short break. Each 20-item block included two of the 10-item blocks described above, but this was not known to the participants. The experiment was concluded with a text box; here we asked respondents to specify which features most obviously suggested to them that the speaker had stayed in France, or to provide any other optional comments.

## 2.5 STATISTICAL ANALYSIS

Given the opposite effect of melodic manipulation in the two groups, Control and Expat speakers were analyzed in two separate linear mixed-effects (LME) regression models. Analyses were conducted in R (R Core Team 2020) using the lme4 package (Bates, Mächler, Bolker and Walker 2015). The type of manipulation (original vs. manipulated) was specified as a fixed effect, and participants and items were treated as random effects (intercept-only models; random slopes could not be specified due to the combination of effects resulting in a single data point). The statistical evaluation was based on likelihood ratio tests, where a full model with the type of manipulation
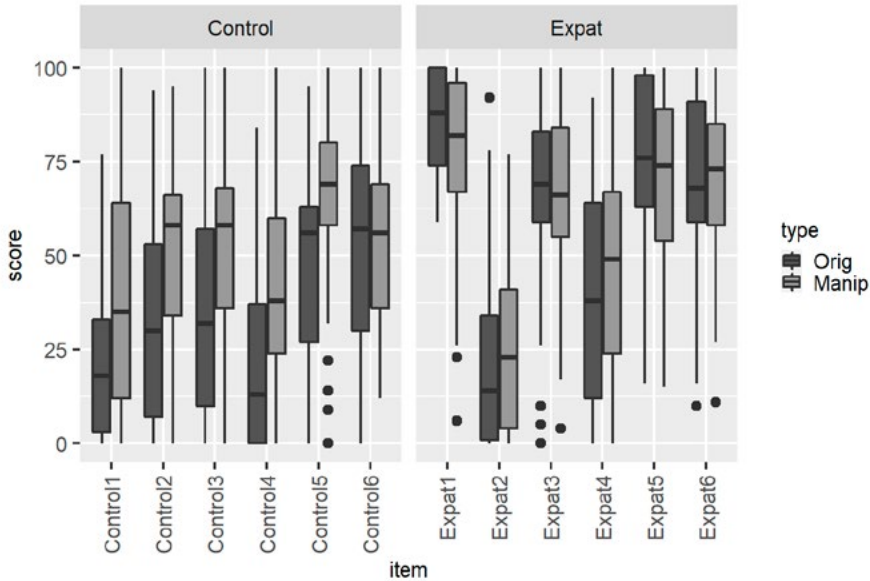
**FIGURE 4.** Rating scores for target items according to the type of stimulus (original vs. manipulated) and group of speakers (Control vs. Expat).

is compared to a reduced model without that effect. Residual plots did not show any issues with the analysis.

## 3 RESULTS

The perceptual ratings for the target items are presented in Figure 4, which represents the data as independent points. As can be seen, the perception of the Control group was affected by the melodic manipulations, since higher scores mean a stronger perceived French influence. However, the expected effect of manipulations in the Expat group (i.e., a lowering of the scores) does not seem to occur; the evaluations were generally the same or even slightly higher for some speakers in the manipulated version.

The situation is captured more precisely by the boxplots in Figure 5, showing the same data but in paired comparisons. Specifically, the score of an original item is subtracted from the score of the corresponding manipulated item (provided by the same listener), which reduces variability. We would expect higher values in the left panel (manipulation of a Control item towards "French" melody would increase the perceived effect of French), while lower values would be expected in the right panel (manipulation should reduce the effect of French). Again, the hypothesis seems to be supported only for the Control group, and statistical testing by LME models confirms these assumptions. The type of stimulus was statistically significant for the Control group ($\chi^2(1) = 36.9$, $p < 0.001$), where the manipulation caused an increase in the score
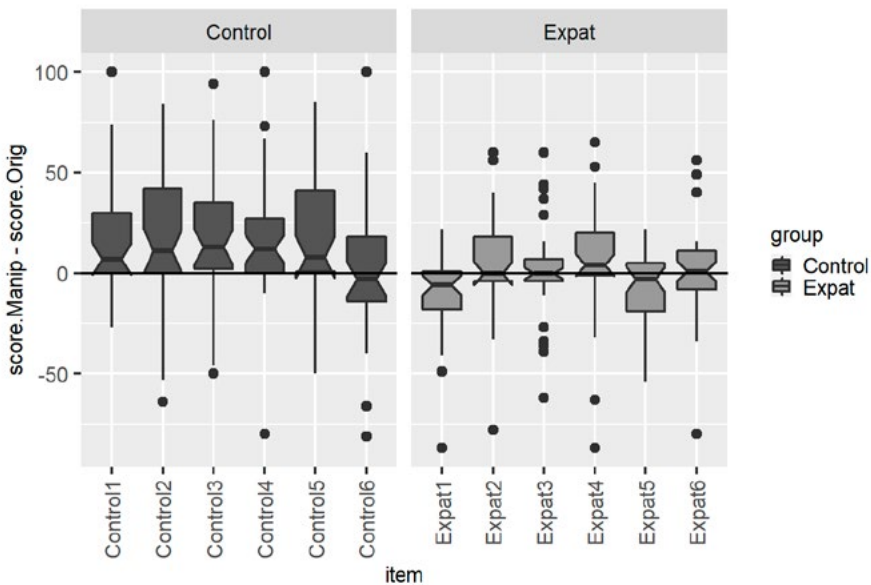
**FIGURE 5.** Rating scores for target items according to the type of stimulus (original vs. manipulated) and group of speakers (Control vs. Expat) in paired comparisons.

by 14.3 on average (Std.E. = 2.3). In contrast, stimulus type failed to reach significance in the Expat group ($\chi^2(1)$ = 0.3, $p$ = 0.613), since the average difference was only 1.1 (Std.E. = 2.1).

Finally, to provide a fuller picture, Figure 6 shows the scores for the filler items included as distractors and sources of variability; note, however, that these results have no direct bearing on our hypothesis due to the absence of the non-conclusive rises. Given the heterogenous structure of the utterances, it is not surprising that the scores span a large range, especially in the Control group. Some of the Control speakers, who have not been in France, were thus perceived as having some French characteristics. Still, somewhat higher scores were given to most of the Expat speakers.

## 4 DISCUSSION

This study constitutes a follow-up to the research on L1 attrition in Czech speakers living in France, which identified prominent rises in non-conclusive contexts as one of these speakers' typical features (Hévrová 2021). We investigated the perceptual salience of such prominent melodic rises as markers of French influence on the speech of Czech speakers. Expatriates' phrases with two non-conclusive rising contours were manipulated so that the melodic rise was less prominent, whereas Czech control speakers' phrases were manipulated to imitate the melodic contours found in the speech of the expatriates.
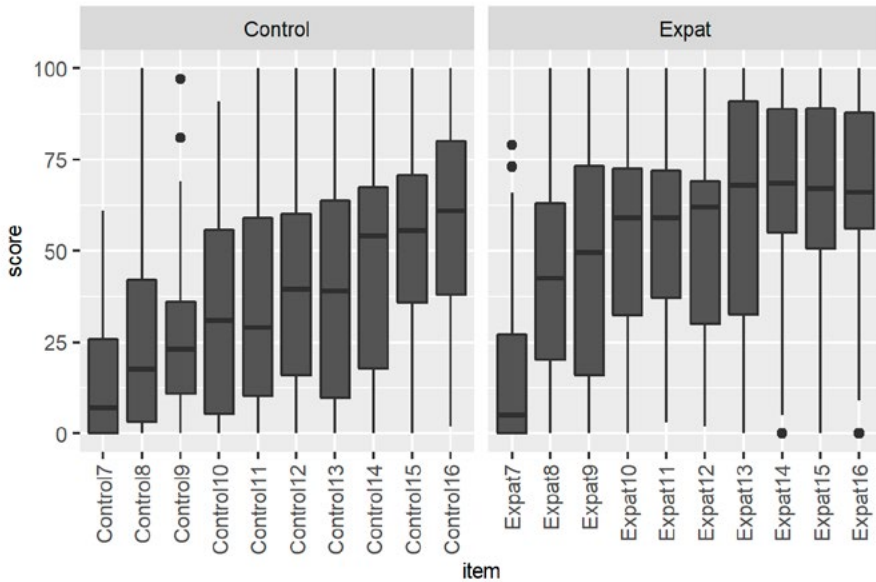
**FIGURE 6.** Rating scores for filler items according to the group of speakers (Control vs. Expat).

Our results support only the first hypothesis (see section 1.3). As shown in Figures 4 and 5, the introduction of prominent rises into the speech of the Control group speakers yielded significantly higher scores; in other words, the manipulated items were perceived as being affected by French more than the original ones. However, the second hypothesis, predicting that flatter melodic rises in the Expat speakers would result in a lower perceived effect of French, was not borne out by our data.

On the one hand, these results lend additional support to the salience of prominent non-conclusive rises signaling French influence on the sound of Czech, a language which is characterized by a very small habitual $f_o$ range (Volín, Poesová and Weingartová 2015). On the other hand, eliminating such prominent rises from the authentic speech of Czechs residing in France does not seem to be sufficient to reduce the perceived effect of French on their speech. This is, after all, not surprising, given that CLI is not limited to a single phonetic feature. Rather, the sound patterns of the respective languages interact in different ways, with individual segmental and prosodic features creating specific constellations which, in turn, reveal the effect of another language. As reported by Hévrová (2021; see a brief summary at the end of section 1.1), in the case of our Expat speakers, this constellation may have included vowel quality (particularly the front vowels /ɛ/ and /ɪ/) or the realization of /ɦ/ as [x], besides rising intonation in non-conclusive contexts; note that velar or uvular pronunciation of /r/ did not appear in our test items. In other words, the manipulation of $f_o$ in non-conclusive contours towards native Czech values seems to have been a distinct but insufficient step to undo the effect of French in the ears of our respondents. Indeed, some of the listeners' comments, obtained after the main experiment

had been concluded (see section 2.4), do mention some of these pronunciation features as revealing the effect of French.

From a methodological perspective, our study points to the importance of examining both directions of a presumed effect: it is clear that changing the melody only in recordings of non-expatriate native Czech speakers (corresponding to our Control group) would not have revealed the entire story behind the effect of non-conclusive rises on listeners' perception. One of the factors which may have introduced some uncertainty into our results is the usage of the rating scale: the listeners were asked to assess the degree to which the speakers' pronunciation revealed a long-term stay in France. In general, one cannot rule out the possibility that some listeners may have been reacting to any traces of foreign accent, rather than specifically traces of French. This is exactly the reason why we only manipulated one target feature — continuation rises which were found to be prominent in Czech expatriates in France (Hévrová 2021); that allows us to conclude that our findings really are related to the effect of French. Finally, although it would be worthwhile to increase the number of manipulated items/speakers to more than six per group, which might reveal more robust effects (possibly even in the expatriate group), the downside of this would be (i) an increase in the (psychological) duration of the listening test and (ii) an increased danger of discovering the true aim of the experiment, that is, the target manipulations. A proper balance must always be negotiated between the competing demands of the experimenter and the listener.

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