THE ROLE OF L2 FLUENCY IN THE PERCEPTION OF NON-NATIVE CLUSTERS BY TURKISH SPEAKERS

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ABSTRACT

The interplay between perception and the phonological constraints of a language plays a role in loanword adaptation; for example, native phonotactics may induce speakers to perceive 'illusory' epenthetic vowels in clusters that would be ill-formed in their language. Perceptual accuracy is also modulated by the degree of L2 verbal fluency; more fluent L2 learners tend to perceive L2 sounds more accurately than less fluent learners.

Word-initial consonant clusters are not attested in the native lexicon of Turkish. However, Turkish has borrowed many words containing such clusters in the donor languages. A learned pronunciation may preserve them, but a short epenthetic vowel between the two consonants is generally observed in a colloquial pronunciation. Two perceptual experiments showed that Turkish native speakers who are more fluent in an L2 are much more successful in discriminating word-initial CC tokens from VCV tokens than less fluent speakers are.

Keywords: Perceptual illusion, Turkish phonology, loanword adaptation, L2 fluency, vowel epenthesis.

1. INTRODUCTION

Many factors may influence the phonetic and phonological adaptation of loanwords (see [1] for an overview), but there is now strong and reliable evidence that one of them is the way segmental and phonotactic constraints of the native language shape the perception of foreign words (see e.g. [2, 3]). For instance, when speakers of Japanese – a language that does not allow clusters of obstruents – are presented with auditory stimuli such as the pseudoword [ebzo], they are often found to perceive an 'illusory' vowel between the two consonants [4]. This parallels Japanese speakers' production of loanwords, which display an epenthetic vowel in similar clusters (e.g. English *basket* > Japanese [basɯketto]). Similar 'illusory' vowels have been reported for other languages as well [3], suggesting that loanword adaptation often takes place in perception.

At the same time, since perception is supposedly affected by a speaker's native phonological system, it is plausible to expect that speakers will be able to faithfully perceive loanwords from a given L2 if they are proficient in that language, as they master its phonology as well as their L1's phonology.

Indeed, several studies suggest that perceptual accuracy of L2 sounds is modulated by the degree of L2 proficiency; for example, learners with an earlier age or acquisition and/or longer length of exposure tend to perceive L2 sounds more accurately than late learners or learners with a shorter exposure [5, 6]. L2 proficiency not only affects perception accuracy, but also the mode of adaptation: less fluent Korean listeners are more attentive to non-contrastive phonetic information, such as coda release, than more fluent listeners when perceiving English sounds [7], and in environments with degrees of bilingualism, highly bilingual speakers are more likely to refer to phonological representations over phonetic representations of the input language in loanword adaptation [8].

Turkish provides an excellent testing ground to understand both the role of perception in loanword adaptation and the impact of different levels of L2 proficiency on the adaptation process. As for the first aspect, word-initial consonant clusters are unattested in the native lexicon of Turkish. However, Turkish has extensively borrowed lexical items from other languages, including languages which have more complex syllable types. Turkish words such as *tren* (from French *train*) or *tramvay* (from English *tramway*) generally show at least two variants. A careful or learned pronunciation may preserve the cluster. However, in a more common colloquial pronunciation an epenthetic high vowel between the two consonants of the cluster is typically observed. It is often shorter than lexical vowels, but it may acquire the full duration of normal vowels, for example under contrastive emphasis [9] (although see [10] for an analysis in terms of vowel intrusion rather than epenthesis). In conformity with Turkish vowel harmony, the frontness/backness and roundness of this vowel appear to match that of the following vowel (however, the epenthetic vowel is always back after velar plosives [9]).

As for the impact of different levels of L2 proficiency on the adaptation process, knowledge of foreign languages is unevenly distributed across the population, providing ample room to compare the performance of proficient vs. less skilled L2 speakers.

2. EXPERIMENTS AND RESULTS

We carried out two perceptual experiments, one ABX test and one identification test, to explore the relationship between L2 proficiency and perception of non-native clusters by Turkish speakers.

In both experiments the subjects heard pairs of pseudowords, the only difference between them being the presence or absence of a vowel between the first two consonants ($C_1V_1C_2V_2C_3V_3$ vs. $C_1C_2V_2C_3V_3$). Our goal was to investigate two related hypotheses: first, given the role played by L1 phonology on the faithful perception of clusters, and since the native Turkish lexicon does not allow initial CC clusters, Turkish speakers are expected to discriminate between #CCV and #CVC with difficulty. Second, subjects who are fluent in at least one L2 that allows #CC clusters are expected to perceive them more accurately than subjects who are monolingual or have a limited knowledge of such L2s.

2.1. Experiment 1

In this experiment we used an ABX paradigm: subjects first heard two stimuli, one with and one without a word-initial consonant cluster, and then had to decide whether the third stimulus they heard was identical to the first or to the second.

2.1.1. Participants

Thirty-eight native Turkish speakers participated in this experiment. One group (n=23, mean age 23.2 years, SD = 2.6 years) consisted of speakers proficient in at least one language allowing word-initial consonant clusters (English, French, German, and so on); they had started acquiring it between the age of 6 and 11, and have studied or been exposed to it continuously for at least the last 10 years. The second group (n=15, mean age 43.1 years, SD = 12.3 years) consisted of speakers with limited or no knowledge of any language allowing word-initial consonant clusters (the age difference reflects subject availability; subjects in the first group are mostly university students, while subjects in the second group reflect less widespread L2 acquisition among the older generations. We do not think that age is in itself a major factor in their different performance).

2.1.2. Materials

Ten triplets of the form (CiCeCV, CCeCV, CaCeCV) were created. All stimuli were pseudowords in Turkish and, except for the initial CC clusters, consisted of phonologically licit Turkish syllables. CCeCV pseudowords provided the cluster; The first vowel in CiCeCV is the most likely Turkish speakers would perceive in case of perceptual illusion (as said above, epenthetic vowels are usually high and conform to Turkish vowel harmony, thus a following [e] would imply an epenthetic front unrounded vowel); the correct identification of CaCeCV is used as a baseline.

When asked about identity, it may be possible that subjects base their decision more on acoustic similarity than on phonological representations; that is, they might judge the AB stimuli CiCeCV and CCeCV to be different not because they perceive a cluster in the latter, but because they conclude that it is a [CiCeCV] token with a very short [i], and hence not identical to the other stimulus. To reduce the role of phonetic similarity and induce subjects to rely on a more abstract representation, we used two different talkers; one of them produced the A and B stimuli, while the other produced the X stimuli.

Therefore, the stimuli were recorded twice, once by a female native Turkish speaker and once by a male native Turkish speaker. The recordings were made in a quiet room using a cardioid condenser microphone powered by a preamplifier connected to a PC laptop, where the signal was digitized at a 44.1 kHz sampling rate using the software *Audacity* [11].

Since both speakers were native Turkish speakers, they would be expected to insert an epenthetic vowel when asked to produce the CCeCV stimuli. However, both have training in phonetics and phonology, were informed about the goal of the experiments and the kind of stimuli needed, are fluent L2 speakers of languages (English and French) allowing word-initial clusters, and were explicitly instructed to produce clusters. Their production was immediately checked, and they were asked to repeat a CCVCV stimulus if the initial recording showed vowel-like characteristics between the first two consonants. This procedure was repeated until a satisfactory cluster was obtained. ABX trials were then created. Each experimental trial consisted of the stimuli A, B, and X, where A and B were from the female speaker, while X (repeating either A or B) was from the male speaker. Half of the AB pairs differed in the presence vs. absence of a cluster (CCeCV vs. CiCeCV). Each pair could appear in the two different possible orders, and either the first or the second item could be repeated, resulting in four (2x2) trial triplets for each CCeCV / CiCeCV pair.

Additionally, ABX pairs CiCeCV / CaCeCV were created to provide a baseline. In principle, inability to distinguish CCeCV from CiCeCV could be due to some other confounding variable rather than perceptual illusion. By measuring their ability to perceptually discriminate CiCeCV from CaCeCV, which should be a very simple task for native Turkish speakers, we have a point of reference against which the CiCeCV vs. CaCeCV discrimination rate can be compared. For each CiCeCV / CaCeCV pair we created four ABX trials as above, for a total of 80 trials (10x2x2x2).

2.1.3. Procedure

After describing the task to the subjects, the stimuli were presented with a laptop and a low-noise headphone to each participant through an ABX task scripted in *jsPsych* [12]. The participants were asked to listen to the ABX trials, determine whether the third sound was a repetition of the first or the second, and click on the corresponding box (*Birinci* 'The first' or *İkinci* 'The second') on the screen. All the instructions were in Turkish. The inter-stimulus interval was 500 ms and the inter-trial interval was 1500 ms. The experiment started with a brief practice session to familiarize the subjects with the task. This session had 10 trials with a set of pseudowords similar to the experiment proper's. All trials were randomized for each participant. The experiment took about 10-15 minutes per person.

2.1.4. Results and discussions

The ratio of 'incorrect' responses as a function of L2 proficiency is shown in Figure 1. Turkish native speakers with limited or no exposure to languages allowing word-initial CC clusters tend to confuse CiCeCV with CCeCV much more often than speakers who are fluent speakers of at least one such L2. This result is consistent with the hypothesis that proficiency in an L2 phonology may influence the way the sounds and structures of a previously unheard word are categorized.

Turkish native speakers with limited or no exposure to other languages also confused [a] and [i] more often than the other group (presumably because, being on average older and less educated that the latter, they were relatively less at ease with the use of a laptop and the kind of task they were asked to perform). However, this kind of mistake is substantially less pronounced than the CiC / CC confusability, suggesting that their difficulty in correctly distinguishing clusters from CiC sequences is not merely the effect of unfamiliarity with the task.

Since the accurate perception of the CiC / CC stimuli – the dependent variable – is binary, we modelled the data with a mixed-effects generalized linear model (*glmer* function in the *lme4* R package [13]), with subjects and items as random variables. We used each speaker's number of misidentifications between [a] and [i] as a proxy of their general ability to perform the task, as opposed to the language-specific ability to correctly perceive consonantal clusters. The results are shown in Table 1. L2 fluency highly increases the likelihood of a correct CiC / CC discrimination, while apparently the general ability to perform the test has a minor negative effect on it it. The influence of both factors is statistically significant, while their interaction is not.

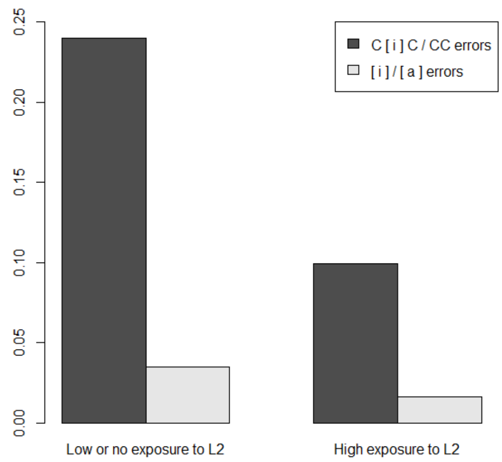

Figure 1: Proportions of misidentifications between C[i]C and CC in ABX test depending on speakers' level of exposure to L2s. Proportions of misidentifications between C[i]C and C[a]C added for comparison.

Coefficients	Estimate	Std. Error	z value	Pr(>|z|)
Intercept	1.4219	0.1917	7.42	***
FluentL2	1.1603	0.2241	5.18	***
GeneralAbility	-0.123	0.0646	-2.01	*
FluentL2: GeneralAbility	-0.185	-1.51	-1.31	0.131

Table 1: Mixed-effects generalized linear model of the interaction between 'correct' identification of the CiC / CC and L2 fluency.

2.2. Experiment 2

In this experiment we used an identification paradigm: the subjects heard a stimulus, and then had to decide whether it contained the vowel [i] or not. Compared to the ABX test, the judgement required in this type of test entails a higher degree of metalinguistic awareness from the subject. At the same time, it avoids the problem of what participants really consider to be a repetition of the ‘same’ word; therefore, we decided to use both experimental paradigms.

In this case as well, we expected that subjects with higher L2 proficiency would perform better in correctly identifying the absence of an [i] in pseudowords starting with a consonantal cluster.

2.2.1. Participants

Twenty-eight native Turkish speakers participated in the experiment. Their demographics is similar to that of the first experiment. One group (n=14, mean age 22.4 years, SD = 2.1 years) consisted of proficient L2 speakers, while the other (n=14, mean age 38.1 years, SD = 7.3 years) consisted of less skilled L2 speakers or monolingual speakers.

2.2.2. Materials

In this experiment the same stimuli used in the first experiment were used (either CCeCV or CiCeCV or CaCeCV). As in the first experiment, CaCeCV stimuli were included to provide a baseline.

2.2.3. Procedure

After describing the task to the subjects, the stimuli were presented with a laptop and a low-noise headphone to each participant through an identification task scripted in *jsPsych* [12]. The participants were asked to listen to each stimulus and say whether it included an [i] clicking on the corresponding box (*Hayır* ‘No’ or *Evet* ‘Yes’) on the screen. All the instructions were in Turkish. Each pseudoword was heard four times (uttered twice by the female voice and twice by the male voice). The inter-stimulus interval was 750 ms. As with the first experiment, this experiment too started with a brief practice session to familiarize the subjects with the task. All stimuli were randomized for each participant. The experiment took about 8-10 minutes.

2.2.4. Results and discussion

Picture 2 shows that also the identification test reveals a pattern comparable to the one provided by the ABX test: Turkish speakers who have had little or no exposure to languages that admit word-initial consonant clusters perceive a vowel in such clusters significantly more often than proficient L2 speakers.

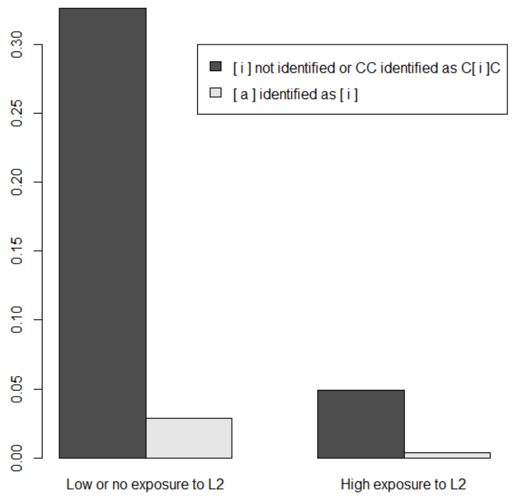

Figure 1: Proportions of misidentified [i]’s in identification test.

We modelled these data as well with a mixed-effects generalized linear model in which subjects and items are random variables and the correct/incorrect identification of [i] in a token is the dependent variable. The analysis showed a highly significant positive correlation (estimate 2.858, std. error 0.1704) between being a proficient bilingual speaker and the ability to accurately identify the presence or absence of [i] in CiCeCV / CCeVCV stimuli.

3. CONCLUSIONS

The results of both experiments indicate that proficiency in an L2 phonology may interact with and complement the role of native phonology in phonological perception, facilitating the correct perception of phonotactic configurations unattested in a speaker’s L1 if these configurations are part of L2.

4. ACKNOWLEDGMENTS

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