PERCEPTUAL ASSIMILATION OF SSBE VOWELS BY TERTIARY-LEVEL BULGARIAN STUDENTS

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U radu se predstavljaju rezultati testa perceptualne asimilacije čiji je cilj bio da oceni i utvrdi perceptualnu sličnost vokalskih kategorija u standardnom južnobritanskom engleskom i u bugarskom jeziku onako kako ih čuju bugarski studenti na univerzitetskom nivou, kao i da ih uporedi sa onim koje bi artikulaciono-fonetske sličnosti i inače predvidele. Test je pokazao da su ispitanici bili u stanju da dodele sve engleske vokale bugarskim kategorijama pomoću kvantitativnih, kvalitativnih i drugih sličnosti. Rezultati su pokazali da model perceptualne asimilacije (eng. PAM) može da objasni obrasce asimilacije većine engleskih vokala, koji su mapirani na tipove asimilacije u PAM-u. Ova studija je osmišljena da olakša dalje istraživanje produkcije vokala standardnog južnobritanskog engleskog i bugarskog jezika kod istih učenika, kao i da utvrdi u kojoj meri obrasci perceptualne asimilacije mogu predvideti poteškoće sa kojima se L2 učenici susreću pri usvajanju vokala standardnog južnobritanskog engleskog.

Ključne reči: perceptualna asimilacija, kategorizacija, vokali, tip asimilacije, uspešnost predviđanja modela.

1. INTRODUCTION

In recent years, the problems that adult second language (L2) learners encounter in acquiring a new phonological system have been well documented and have increased the interest in studying the perception of non-native speech sounds. Cross-language identification and discrimination studies have demonstrated the influence of L1 phonology on L2 perception. That is, L2 learners' perception of L2 phonetic segments differs from that of native speakers because these segments have been processed

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through the system of L1 phonology, resulting in accented speech production. In his Speech Learning Model (SLM), Flege (1995) claims that continuing problems with accented production of L2 sounds can be attributed to a large extent to L2 learner's perception of the L2 sounds as equivalent to similar sounds in the native language (L1). That is, if the phones of the target language (L2) are sufficiently similar to the phones of the native language (L1), they will be perceptually assimilated to these native categories, with the result that both L1 and L2 segments are produced differently from native monolingual speakers' utterances. On the other hand, if L2 sounds are perceived as 'new', i.e. sufficiently dissimilar from any L1 category, the production of the L2 segments will become more native-like, because the L2 learner establishes distinct L1 and L2 phonetic categories.

Best's Perceptual Assimilation Model (PAM: Best 1995) was originally developed to predict perceptual assimilation of non-native sounds by naïve listeners. Like Flege, she invokes the concept of cross-language phonetic similarity to predict the relative difficulties that listeners will have in perceptual differentiation of non-native segmental contrasts. Although PAM relates specifically to cross-language speech perception, the relevance of PAM's predictions to L2 learners' speech perception has been outlined in Best and Tyler's (2007) version of PAM extended to L2 learners (PAM-L2). In this paper, the authors discuss some of the commonalities and complementarities with the Speech Learning Model (SLM). Best (1995: 195) describes several patterns of perceptual assimilation of L2 segments to L1 phonological categories, which are determined by the perceived phonetic similarity of L1 and L2 segments. In the Two-Category (TC) pattern two L2 segments are assimilated to two different L1 categories, which makes them easy to discriminate. Two L2 segments which are judged as equally good instances of a single L1 category establish a Single-Category pattern (SC). The sounds that fall into this pattern will be most difficult to differentiate. Moreover, if contrasting L2 segments differ in their judged goodness as instances of a single L1 category (Category-Goodness pattern), they will present intermediate levels of perceptual difficulty. Finally, when one member of an L2 contrast is Categorised and the other Uncategorised, the two phones will be relatively easy to discriminate.

According to both PAM and SLM the pattern of initial perceptual problems and persistent learning difficulties adult L2 learners have in mastering the L2 phonological system is determined to a large extent by the perceived similarity of segments of L1 and L2. Therefore, in order to predict L2 learning difficulties more accurately, it is essential that cross-language perceptual similarity be established, independent of identification or discrimination performance. Measuring perceptual similarity is not an easy task because there is no widely-accepted method and most studies rely on the more or less subjective judgement of the participants. Listeners are presented with utterances and are asked to make a judgement on similarity. Different studies use different methods, each of them with its advantages and disadvantages. In some of the studies listeners were presented with instances of a non-native speech sound and then asked to orthographically transcribe the sound in terms of the closest native speech sound. They might also be asked to judge the sound qualitatively by saying how similar or dissimilar it is to the native sound or they were sometimes

even expected to say that what they had heard didn't sound like speech (Best, et al. 2001: 782). Flege and his colleagues (Flege, et al. 1994: 3628) presented listeners with an example of a non-native and a native sound and then asked them to rate on a nine-point Likert scale whether the two sounds were 'very similar' or 'very dissimilar' to one another. In more recent studies, perceptual similarity has been assessed directly, using a perceptual assimilation task in which listeners are presented non-native segments with a choice of predetermined orthographic labels and asked to categorize the non-native sounds they hear with respect to which native category they are most similar and to rate their "category goodness" as exemplars of the chosen categories (e.g., Strange, et al. 2004; Strange, et al. 2005; Gilichinskaya and Strange 2010). PAM determines the assimilation patterns of L2 learners based on articulatory-phonetic similarities between the L1 and the target language L2 (Best, et al. 2001: 785). Following Best and her colleagues, in the study reported here, the perceptual similarity of SSBE (Standard Southern British English) and Bulgarian vowel categories as heard by experienced Bulgarian tertiary-level students was assessed and related to those predicted by the articulatory-phonetic similarities between the two languages.

The vocalic system of standard Bulgarian is relatively simple. It has no distinction based on phonological quantity, i.e. there are no long and short vowels. Stress plays an important role in the realization of Bulgarian vowels and it is generally accepted that the full inventory of six vowels /i, e, a, ɔ, u, ɜ/ can be found only in stressed syllables, while in unstressed syllables these are reduced to a subsystem of four (three in some dialects) /i, (ɛ), ɜ, u/. The six Bulgarian vocalic phonemes are evenly distributed in the vowel space and are classified traditionally in terms of:

- the degree of raising of the tongue
- the position of the lips during the articulation
- the part of the tongue which participates in the articulation
- tongue-root position

In terms of the degree of raising of the tongue, Bulgarian vowels are divided into three major categories: high, mid, and low. The high vowels are /i, u, ɜ/, the mid vowels are /ɛ, ɔ/ , and /a/ is the low vowel. Vowels are also classified as rounded /ɔ, u/ and unrounded /i, ɛ, a, ɜ/ according to the position of the lips during the articulation and as narrow /i, u, ɜ/ and wide /ɛ, ɔ, a/ regarding the tongue-root position. Bulgarian vowels are traditionally classified as front /i, ɛ/ and back /a, ɔ, u, ɜ/ depending on the part of the tongue that participates in their articulation (Tilkov 1982), but more recent research shows that /a, ɜ/ are rather central than back (Zhobov 2004) or that especially "/ɜ/ is located robustly midway between /ɛ/ and /ɔ/" (Andreeva, et al. 2013: 348) and is classified as mid-central.

Andreeva et al. (2013: 346) have found the following patterns of reduction of the vowels in unstressed syllables: front vowels /i, ɛ/ are not reduced; /i/ does not change while /ɛ/ shows significant raising but does not merge with either stressed or unstressed /i/. Unstressed /a/ is raised and merges with stressed /ɜ/, but unstressed /ɜ/ is also raised and remains distinct from unstressed /a/. The back vowels follow a similar pattern to

that of the mid-central vowels. Unstressed /ɔ/ is raised and is no longer distinct from stressed /u/. Further, /u/ in an unstressed syllable is raised but remains distinct from /ɔ/ in an unstressed syllable, though, as an already high vowel, it does not have the same scope for raising as unstressed /ɜ/. Thus it is not significantly different from /u/ in a stressed syllable. In addition there is a systematic correspondence between phonetics and orthography for stressed vowels in Bulgarian.

The present study addresses the following questions:

Q1: How do Bulgarian participants perceptually assimilate English pure vowels to the six vowel qualities of their L1 phonological inventory?

Q2: What are the predicted difficult contrasts within the PAM framework?

2. METHODS

Ten female and seven male Bulgarian first year university students, whose major is English philology, took part in the Perceptual Assimilation Task (PAT). In order to have a homogenous group of participants, they were chosen to have the same regional background and no exposure to English in an English speaking community. They speak standard urban variety typical for the northern part of Bulgaria and they reported that they had not studied or lived abroad. All subjects have had English formal education in their native country for an average of nine years. The students' age was between 18 and 31, the majority of them being between 18 and 20. All participants signed an informed consent form.

Stimuli were produced by a female native speaker of SSBE born and raised in the south-eastern part of England, who is a professor of phonetics at a university in the south-eastern part of England. A set of monosyllabic /CVC/ words were read from a numbered list. For each of the English vowels, with the exception of the centring diphthongs, five real English words were chosen, most of them given by Wells (1982) as examples of the vowels in the standard lexical sets, while others are similar to his examples (see Table 1 for the list of the words used for each vowel). The target words were put in the phrase "say.....again". The speaker produced five randomized repetitions of the 16 vowels from the list, from which the five tokens of the eleven pure vowels (/iː/, /ɪ/, /e/, /æ/, /ɑː/, /ʌ/, /ɒ/, /ɔː/, /ɜː/ /ʊ/, /uː/), were used for this experiment (11 vowels x 5 repetitions = 55 tokens). The list of responses was composed of nine possible alternatives written in standard Bulgarian orthography and included a full list of L1 vowel categories (/i/, /ɛ/, /a/, /ɔ/, /u/, /ɜ/). Bulgarian sequences of vowels and glides /ij/, /ɛj/, and /ɔj/, which are diphthong-like sounds, were also added to the list because some English diphthongs were predicted to map to them.

iː	Speak, beat, heed, sea, deep
ɪ	Ship, sick, pit, bid, him
e	Beg, set, bed, friend, step
æ	Tap, sat, bad, hat, can
ɑː	Ask, park, heart, farm, lark
ʌ	Cup, nut, gun, pub, fund
ɜː	Hurt, burn, purse, search, term
ʊ	Put, bush, look, cook, shook
uː	Soup, tomb, moon, move, tooth
ɔː	Saw, taught, bought, short, fought
ɒ	Sock, pot, dock, dot, shop

Table 1: List of English words representing English vowels
which were used as stimuli for the PAT

Testing was carried out in a quiet room. Stimuli were presented using a trial version of Paradigm 4.0 (Tagliaferri 2005). The participants were informed that they were going to listen to words containing SSBE vowels and that these words will be presented in the phrase 'say......again'. The participants were directed to listen to the target English word and select the Bulgarian/L1 vowel category to which each English vowel was most similar. After a Bulgarian vowel category was selected, the participants were asked to rate its category goodness of fit as a good example of the Bulgarian/ L1 vowel category on a 9-point scale. This scale reflected the perceived similarity between the English and Bulgarian sound: 1-3 were treated as different, 4-6 were different but shared some properties and 7-9 were similar. The participants were allowed to listen to the target English word as many times as they needed. Once they decided and gave the category goodness of fit rating for their choice, they moved to the next item.

3. RESULTS AND DATA ANALYSIS

The classifications and categorisations of each participant were pooled into a confusion matrix of all English and Bulgarian vowels, i.e. a table that includes all possible categorisations between Bulgarian and SSBE vowels. After that these categories were analysed using PAM categories (Best 1995).

The number of responses of the Bulgarian participants was calculated for each English vowel. Table 2 presents the confusion matrix of the vowels under investigation. It presents the percentages and average goodness of fit ratings for the categorisation of each English vowel. It also shows the total number of responses for each vowel.

As can be seen from the table, SSBE vowels /ɪ, ɜ:, ɒ, ɑ:, ʊ, u:/ were assimilated most consistently to corresponding Bulgarian vowels, whereas the other five vowels yielded less consistent modal responses. These patterns of group consistency are a reflection of the individual responses of the participants. Although all English vowels are categorised quite clearly as particular Bulgarian phonological vowel categories, median ratings of goodness of fit are not consistently high. Whereas we can say that for the vowels /ɪ/, /ʊ/, /e/, /ɒ/ and /æ/ they are high, around 6, for the rest they are low, around 4, which means that the participants do not find them very similar to their native language category.

SSBE vowels	/i/	/e/	/a/	/ɔ/	/u/	/ɜ/	/ejɜ/	/ijɜ/	/ɔja/	NUM of responses
iː	29 (4.4)							71 (4.7)		85
ɪ	100 (6.1)									85
E		91 (6.2)				9 (4.8)				85
Æ		2 (3.5)	98 (6.4)							85
ʌ			63 (4.2)		37 (4.7)					85
ɜː					100 (4.1)					85
ɑː			100 (3.8)							85
ɒ				100 (6.2)						85
ɔː				93 (3.9)					7 (4.3)	85
ʊ					100 (6.0)					85
uː					100 (3.8)					85

Table 2 Percentages of categorization, median goodness of fit ratings, total number of responses

According to PAM the assimilation patterns of L2 learners are based on the articulatory-phonetic similarities between L1 and the target language L2 (Best et al. 2001: 785). The differences and similarities between SSBE vowels and Bulgarian vowels can be determined based on their articulatory-phonetic characteristics. SSBE /i:/, a high, front, long vowel and /ɪ/, a mid-high, more central, but close to the front, short vowel are expected to be categorised as the Bulgarian vowel /i/, which has similar

articulatory-phonetic characteristics. The predicted equivalent of SSBE /e/ vowel from the mid, front area is the Bulgarian /ɛ/ sound and that of SSBE /ɜː/ sound belonging to the mid, central area is Bulgarian /ɜ/. SSBE vowels /æ, ʌ/ which occupy the area between mid-low and low, /æ/ being more front and /ʌ/ more central together with the open, back /ɑː/ vowel will be categorised as Bulgarian /a/ sound. The low, back SSBE vowel /ɒ/ and the long mid back /ɔː/ vowel and the mid-high back short /ʊ/ and high back long /uː/ will have respectively Bulgarian /ɔ/ and /u/ sounds as their equivalents. The group model responses obtained in the perceptual assimilation task, with the exception of SSBE /iː/ sound, correspond with these predictions. The majority of the students have mapped this sound to a combination of Bulgarian /i/ sound and a glide beginning with /j/ with a comparatively high goodness of fit rating (4.7). This might be interpreted in two ways: (1) as a way to account for the length of the vowel or (2) a sign for their perception of the diphthongal quality of this sound in SSBE. This sound is also mapped, though by a much smaller number of students, to Bulgarian /i/ sound with a slightly lower rating of 4.4. English /ɪ/ is categorised by all the participants as the Bulgarian /i/ sound with a high goodness of fit rate. These two vowels match the description of PAM CG (Category Goodness) assimilation type because both are categorised as Bulgarian /i/ with SSBE /ɪ/ being closer to Bulgarian /i/ in terms of number of responses 100% and the goodness of fit rating (6.1).

The back mid-high and high vowels /ʊ/ and /uː/ are categorised as Bulgarian /u/ sound by 100% of the participants in the experiment but with different goodness of fit rate. The short vowel has a high rate of 6.0 and the long one a low rate of 3.8. Thus they belong to PAM's CG (Category Goodness) assimilation type.

English /æ/ and /ɑː/ sounds are both categorised into a single L1 category, though their ratings are different. The participants in the experiment gave a high rating for /æ/, 6.4 and a low one for /ɑː/, 3.8. In PAM terms, this would constitute a CG assimilation contrast.

On the other hand, the SSBE vowel /ʌ/ is categorised mostly as Bulgarian /a/ and has relatively high goodness of fit rate. However, a great number of the stimuli containing this vowel were categorised as Bulgarian /ɜ/ with the same goodness of fit rating, which shows that English /ʌ/ sound shares some properties with Bulgarian /ɜ/ sound though it is categorized mostly as Bulgarian /a/. In this case English /ʌ/ and /ɜː/ match PAM's description CG assimilation type because both are categorised as Bulgarian /ɜ/ with English /ɜː/ being closer to Bulgarian /ɜ/ in terms of mostly number of responses 100%.

Both vowels /ɒ/ and /ɔː/ are categorised as Bulgarian /ɔ/, the former with a high goodness of fit rating (6.2) and the latter with a low one (3.9). This puts them into CG type of assimilation.

4. CONCLUSION

The purpose of this study was to establish perceived similarity patterns of SSBE vowels to native categories by Bulgarian first year university students who were experienced listeners with a view to predicting the difficulties they might encounter in the production of the sounds. As can be seen from the analysis of the results, all English

vowel contrasts can be considered as PAM CG assimilation type. The PAM prediction for this type of contrast is that learners will discriminate the L2 contrast but not as well as a TC (Two Category) assimilation type. It also predicts that a new phonetic and phonological category will be formed for the deviant L2 vowels /iː, uː, ɑː, ʌ, ɔː/ whereas vowels which were perceived as good examples of L1 categories /ɪ, e, ɜː, ʊ, ɒ, æ/ will be phonetically and phonologically perceived similar to L1 categories and no new category is likely to be formed.

The PAT showed that the participants were able to fit all English vowels into Bulgarian categories, using any detected quantitative, qualitative or feature similarities. The results showed that PAM accounts for the assimilation patterns of most English vowels, which were mapped to PAM assimilation types.

Research is underway that examines the production patterns of SSBE and Bulgarian vowels by these same students to determine to what extent the perceptual assimilation patterns can predict difficulties L2 learners encounter in the acquisition of the vowel sounds of Standard Southern British English.

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SUMMARY

PERCEPTUAL ASSIMILATION OF SSBE VOWELS BY TERTIARY-LEVEL BULGARIAN STUDENTS

The paper presents the results of a Perceptual Assimilation Task whose aim was to assess and establish the perceptual similarity of SSBE and Bulgarian vowel categories as heard by experienced Bulgarian tertiary-level students and to relate them to those predicted by the articulatory-phonetic similarities between the vowel systems of the two languages. The PAT showed that the participants were able to fit all English vowels into Bulgarian categories, using any detected quantitative, qualitative or feature similarities. The results showed that PAM accounts for the assimilation patterns of most English vowels, which were mapped to PAM assimilation types. The study is designed to help further research that examines the production patterns of SSBE and Bulgarian vowels by these same students to determine to what extent the perceptual assimilation patterns can predict difficulties L2 learners encounter in the acquisition of the vowel sounds of Standard Southern British English.

KEYWORDS: perceptual assimilation, categorisation, vowels, assimilation type, goodness of fit.