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On the perceptual accuracy of non-native phonemic contrasts: A case study of Native Arabic Speakers

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Abstract

Research on native Arabic speakers' perception of non-native English phonemic contrasts has manifested various conclusions. Some studies have revealed that native Arabic speakers experience difficulty in the perception of non-native English phonemic contrasts, where others have concluded that they largely do not experience such difficulty. Due to this discrepancy, the current study aimed to examine the overall perceptual accuracy of only the English labial categories /p, b, f, and v/ in onset positions performed by native Arabic speakers. The study also examined the potential effects of the phonetic contexts and the familiarity of the stimuli being tested on the participants' perceptual performance. Twenty-four Saudi male participants completed consonantal phoneme identification and discrimination tasks. The findings revealed that the participants experienced difficulty in the perception of the categories /p/ and /v/, confusing them with their counterparts /b/ and /f/. The findings also revealed that neither phonetic context nor familiarity had any effect on the participants' perceptual accuracy of all of the categories in question, except in the context in which the category /v/ was followed by back vowels. In this specific context, the participants' performance tended to be lower, which could be attributed to the influence of lip rounding, which results in coarticulation with the fricative noise associated with this category (/v/). Lastly, the results obtained in this study provide additional crucial insights into auditory phonetics and present additional explanation on how the human auditory system recognizes speech sounds.

Keywords: speech perception; second language acquisition; Arabic speakers; English labial sounds; Speech Learning Model

1. Introduction

Research in cross-language speech production and perception has claimed that early native language experience constrains the ability of second-language (L2) speakers to produce and perceive non-native

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speech sounds. More specifically, early L2 research indicated that adult L2 speakers faced difficulty when exposed to non-native phoneme contrasts and vice versa (i.e., they had no difficulty if the phoneme contrasts to which they were exposed also exist in their first language (L1)). Indeed, two of the most influential theoretical models proposed for L2 acquisition included such concepts. First, Flege (1995) developed the Speech Learning Model (SLM) as a model of L2 sound acquisition in adulthood. This model relies on immersion in English as opposed to age. Adult learners have the ability to create new phonetic categories for new L2 phonemes after many years of immersion in L2 speech. Therefore, L2 adult speakers with high exposure to L2 sounds are more likely to produce non-native sounds in a native-like way than those who have less exposure to L2 sounds. One of the predictions of the SLM concerns the feature hypothesis, which states that L2 speakers encounter difficulty in realizing a feature that does not exist in their L1 grammars. Brown (2000), for instance, examined this hypothesis and reported that both Chinese and Japanese speakers lack the sounds /l/ and /r/ in their phonological systems. In her study, she found that the Chinese speakers were able to acquire the English /l/ and /r/ distinction, while the Japanese speakers were not. Brown suggested that these liquids are distinguished through the "coronal" feature, and the reason behind this different performance is that the "coronal" feature is present in the Chinese phonological inventory but absent in Japanese. Thus, the Chinese speakers could properly form the representations needed for the /l/ and /r/ distinction, whereas Japanese speakers were unable to realize this distinction due to the lack of this feature in Japanese. In a similar study, Price (1981) found that Japanese speakers experienced difficulty in distinguishing the English categories /r/ and /l/ because their L1 lacks the phonemic contrast between these two categories. In addition, Lisker (1970) concluded that his participants, who were monolingual Russian speakers, were not able to discriminate the English bilabial categories /p/ and /b/ because the Russian language lacks the contrast between these two categories.

Second, Best (1995) developed the Perceptual Assimilation Model (PAM) as a model of how a listener perceives new segments of second languages successfully. This model focuses mainly on speakers with little experience in the second language. The PAM predicts that realizing the new segments will hinge on the perceived correspondence between phonetic elements in the systems of both the native and second languages of the speaker. Best et al. (2001) proposed that patterns of perceptual assimilation differ depending on the gestural differences and similarities of the non-native phonemes to the phonemes of L1. The new segment is perceived and categorized relative to the segment of the native category. Thus, the new segments are expected to assimilate to the native category, particularly if they are perceived as optimal patterns of the native correspondence. Accordingly, the new segments are expected to demonstrate one of the following perceptual assimilation patterns based on the degree of similarity and dissimilarity between L1 and L2 sounds:

A) They are perceived as sounds and assimilated to the L1 category.

B) They are perceived as sounds but not classified as any one native category.

C) They are not perceived as sounds. For example, "native English listeners, with no previous exposure to click languages, were nevertheless able to discriminate Zulu click contrasts because they were not perceived as speech" (Tyler & Fenwick, 2012, p 1).

The conclusions that have been reached on the production and perception of native speakers of many languages, such as English, Chinese, Japanese, and Russian, when they are exposed to non-native speech categories prompt us to explore the behavior of native Arabic speakers when they are exposed to non-native speech sounds, specifically the English speech sounds /p, v/. Native Arabic speakers' production of English speech sounds has received greater attention in the literature, but little research has been conducted on these speakers' perception of English speech sounds. To clarify, numerous studies (e.g., Ahmed, 2010; Albadawi, 2012; Barros, 2003; Binturki, 2008) have concluded that native Arabic

speakers encounter difficulties in the production of the English labials /p/ and /v/ but not with their counterparts /b/ and /f/. Such a conclusion also motivates us to examine native Arabic speakers' perception of these English labials /p, b, f, and v/. Phonologically speaking, Arabic differs from English in that it has the /b/ and /f/ categories in its phonemic inventory but lacks their counterparts /p/ and /v/. Therefore, the phonemic contrasts between these categories, which exist in English, are not available in Arabic. Table (1) demonstrates the stop and fricative sounds in both Arabic and English, with the sounds investigated in this study in bold. The table illustrates both the place and manner of articulation.

Table 1. Arabic and English stops and fricatives

	Bilabial	Labiodental	Dental	Alveolar (Emphatic)	Alveo-Palatal	Velar	Uvular	Pharyngeal	Glottal
Arabic Stops	**b**			d t tˤ		g k	q		ʔ
Arabic Fricatives		**f**	ð θ ðˤ	z s sˤ	ʃ		ʁ x	ʕ ħ	h
English Stops	**b p**			d t		g k			ʔ
English Fricatives		**v f**	ð θ	z s	ʒ ʃ				h

Studies on the perception of the native Arabic speakers of English speech sounds, though few, have manifested various conclusions. Moustafa (1979) carried out an experimental investigation of the phonemic perceptual difficulty among 50 educated and uneducated speakers of Egyptian Arabic learning English (aged 10-60 years old). He based this investigation on the Contrastive Analysis Hypothesis (CAH) to explore the non-clustered obstruent consonants in standard American English (i.e., /p, b, f, v, θ, ð, tʃ, dʒ/). His study employed acoustic instead of articulatory description of the English consonants, such as tense vs. lax, stop vs. friction etc. Moustafa empirically tested the target consonants in minimally paired words contrasting initially, medially, and finally. Thus, the participants were required to listen to the paired words and determine whether the target consonant in the minimal pairs were the same. The findings revealed that the educated and upper-class speakers were confused between the contrasts /p,b/ and /f,v/, identifying them as the same 92% and 40% of the time, respectively, although they perceived them at very low rates (i.e., they rarely perceived the target sounds). He claimed that the high frequency in realizing the contrasts between /f,v/ resulted from the frequent occurrence of /v/ in newspapers, neon signs, and commercial labels. Nevertheless, most of the uneducated participants perceived the phonemes /p/ and /v/ as /b/ and /f/, respectively. Lastly, his findings confirmed the prediction of CAH that the participants would encounter difficulties in perceiving the phonemes that do not occur in the speakers' native language.

Alzahrani (2015) also investigated the perceptions of Saudi Arabian postgraduate students regarding the English bilabial stops /p/ and /b/ compared with their perception of the alveolar stops /t/ and /d/. The participants in his study were seven Arabic speakers pursuing their degrees in Australia. They were asked to listen to the target sounds and then recognize them as positioned in different environments (i.e., initially, medially, and finally). The findings revealed the overall trend that all participants performed well and accurately in perceiving the phonemes that occur in both English and Arabic (i.e., /b/, /t/, and /d/). However, as expected, the participants had more difficulty in perceiving the English category /p/ than the other categories. The results of this study cannot be generalized regarding Saudi Arabic speakers' perception of English speech categories due to the lack of statistical analysis and the small

number of participants. Accordingly, we believe that an alternative study with a larger number of participants may provide more precise findings on Arabic speakers' perceptions of English speech categories.

In contrast, Salim and Albadawi (2017) found, in their study on the perception of English consonantal phonemes by Jordanian learners of English at the college level, that the participants performed well in differentiating between the categories /p/ and /b/ after four weeks of training and practice. Before training and practice were provided, their performance was very poor. The major finding of this study is that prior training and practice showed a significant improvement in the participants' performance, although they did not explicitly point out the exact results of their participants' perception of these two categories as well as the other English consonantal categories, such as /s/, /z/, /t/, and /d/, or the perceptual task that they used in the study.

Demonstrating different findings, Buali (2010) examined the perception of the Saudi Arabic speakers of the English speech sounds in non-actual English words. Strikingly, his findings indicated that most of the participants perceived the English category /p/ more frequently than the other categories. An apparent flaw in Buali's study is that he first had to test the Saudi Arabic speakers' perception of English speech sounds in actual English words for better and accurate results rather than testing their perception only through non-actual English words.

Similarly, Shafiro et al. (2012) carried out an experiment to assess the accuracy of the Arabic speakers' identification of American English speech sounds as well as the perceptual difficulties of certain vowel and consonant patterns. The participants were divided into two groups: early Arabic-English bilinguals and native speakers of English varieties spoken in the United Arab Emirates. Their results revealed that the participants, though they experienced some perceptual difficulties with certain sounds, generally perceived accurately the sounds of American English. One of their significant conclusions is that although Arabic lacks the American English category /p/, the participants did not experience difficulties in the perception of this particular category. Even though the effect of phonetic context is less discussed in the cross-language literature (Shafiro et al., 2012), their results also revealed that the vowel context influenced the identification of the categories /v/ and /ð/, as both groups displayed perceptual difficulty in the /uCu/ context compared to /iCi/ context due to the coarticulatory influence of lip protrusion on the fricative noise related with the categories /ð/ and /v/. This study, however, does not accurately represent the Arabic speakers' perception of the American English sounds since the participants were likely native speakers of English. Thus, they were, predictably, less likely to experience difficulty in the perception of the American English sounds.

Lastly, Evans and Alshangiti (2018) conducted a large study[2] on the perception of English consonants by Saudi Arabic learners of English residing and working in the UK. Using the *Oxford Placement Test 1*, they divided the participants into two groups based on their English proficiency: the high-proficiency (HP) group and low-proficiency (LP) group. All participants were asked to complete an identification task of English consonants positioned in the two vocalic contexts, /ɑCɑ/ and /iCi/. The findings showed that both groups performed well in the consonant identification task (HP: 86.5%, LP: 73.5%), although the LP listeners performed more poorly than the HP listeners. The findings also show that the vocalic contexts did not have any significant effect (High Proficiency: 86% for /ɑCɑ/ and 87% for /iCi/, Low Proficiency: 73% for /ɑCɑ/ and 74% for /iCi/). As regards the bilabial categories, the LP group performed well with the /p/ category (74%) even though this is not available in their first language, but less well with the /b/ category (68%). They often confused the latter with the former, which indicates that this group of learners struggled with the voicing contrast. However, the HP group performed very

[2] Their study was about the perception of English consonants and perception and production of English vowels. The only part that concerns us in this study is their perceptual study of English consonants.

accurately with both categories. With respect to the /f/ and /v/ categories, both groups performed very well in the identification of these categories, with higher accuracy (82%). Notably, all participants had been living in the UK from 3 months to 9 years. This range indicates that their exposure to the English language might play a significant role in their recognition tasks.

Given the discrepancy in the results of the previous studies on native Arabic speakers' perception of English speech sounds, and the conclusion that native speakers of many languages, such as Japanese and Russian, experience difficulty when encountering non-native speech categories due to the effect of their L1, we believe that a new alternative study is required to provide more precise results regarding native Arabic speakers' perception of English speech categories. Thus, the main purpose of the current study is to examine the overall perceptual accuracy of the English labial categories /p, b, f, and v/ in onset positions as realized by native Arabic speakers. Two specific, related factors will be also tested: (1) the potential effects of phonetic contexts and (2) the potential influence of the participants' familiarity with English words.

Three hypotheses underlie this study. It is strongly predicted that the participants, who are native Arabic speakers, will demonstrate high overall accuracy in the perception of the English categories /b/ and /f/ compared to their counterparts /p/ and /v/ due to the absence of the latter categories in their L1. They will tend to assimilate the non-native categories /p/ and /v/ to the closest native categories, specifically, the categories /b/ and /f/. It is also expected that the phonetic context (e.g., back and front vowels) may play a significant role in the perception of these English labials. Lastly, it is expected that the participants' familiarity with the presented English words may affect their perceptual performance of the categories in question. The following section illuminates the methodology used to test these three hypotheses.

2. Method

2.1. Participants

A total of twenty-four Saudi male students took part in the study. They were born and raised in the region of Qassim in Saudi Arabia[3]. Their native language is Arabic, specifically, Najdi Arabic (NA), which is a local dialect spoken in the central regions of Saudi Arabia. All the participants passed the English intensive course program[4] and joined the BA program in the Department of English and Translation at Qassim University. Arabic and English are the only two languages that each participant speaks. The participants reported that they had learned English via schools, private language centers, watching English movies, and electronic applications such as YouTube channels. None of them had experience living in any English language-speaking country. They also reported that their parents speak Arabic only. All participants were aged 19-21 years old (median 20 years), and none reported any speech or hearing impairments. They voluntarily took part in the study.

2.2. Stimuli & Procedure

Two perceptual tasks, identification and discrimination, were carried out to investigate the Arabic native speakers' perception of certain English categories. These two recognition tasks were thought to

[3] Each participant completed a linguistic background questionnaire before commencing the experiment to make sure that he had satisfied the selection criteria.

[4] The intensive course program (ICP) is an academic program that each student must pass to join the BA program in the Department of English and Translation at Qassim University. In this program, students study for three months the main skills of English language, including reading, writing, vocabulary, grammar, and listening and speaking. They must earn more than 300 points out of 500 to pass this program.

be the most appropriate and relevant methods to test the hypotheses of the present study. First, two monolingual American English speakers (one male and one female), born and raised in the state of Wisconsin in the US, were asked to record their pronunciations of a number of various English and non-English words for use in this experiment. All the stimuli were recorded in a quiet lab using a Marantz PMD661 Portable Digital Audio Recorder using a sampling rate of 44.1 kHz.

The experiment took place in a quiet listening lab in the Department of English and Translation at Qassim University to help the participants feel relaxed, comfortable, and focused. Prior to the presentation of the stimuli, the participants were given clear instructions and necessary information about the tasks and materials. Then, they were asked to put on and adjust their headsets. They were given an answer sheet for each task and told to write down their responses in front of the provided numbers or letters, arranged in a serial order. The subsequent subsections shed light on the two tasks used in the experiment.

2.2.1. Identification Task

The participants were asked to listen to 36 actual and non-actual CVC English words, as shown in Tables (21 & 22) below in the appendix, as an identification task. They were told to identify the category that they heard at the initial of every word and then write it down on the provided answer sheets. This task was carried out only one time, and the participants heard each stimulus only once, without any feedback given. The 36 stimuli were randomly presented to the participants, with an interval time between stimuli of approximately 3 seconds. Participants were given a break of five minutes after they had completed the identification task.

A total of 28 words of these 36 stimuli were actual CVC English words, and the remaining 8 words were non-actual CVC English words. Among the 28 actual CVC English words, 12 words contain the target categories /p/ and /b/, and 12 words contain the other target categories /f/ and /v/. The last 4 words include the categories /k/, /dʒ/, /ʃ/, and /tʃ/, which were unrelated to the aim of the present study. They were presented as distractors to keep the participants blind to the particular categories that we were examining, which might otherwise affect their responses.

Additionally, among the 8 non-actual CVC English words, 4 words contain the target categories /p/ and /b/, and 4 words contain the other target categories /f/ and /v/. All words, except the distractors, were arranged in minimal pairs of the initial category. Half of the words were positioned before front vowels, such as /i/, /I/ and /æ/, while the other half were positioned before back vowels, such as /u/ and /oʊ/.

2.2.2. Discrimination Task

The participants were also given an ABX discrimination task to examine whether they were able to discriminate the categories in question, particularly the target categories /p/ and /v/ from their counterparts /b/ and /f/ and from the control categories /s/, /z/, /t/, and /d/. In addition to the identification task, it is assumed that this task would provide more significant and robust evidence for the Arabic speakers' perception of English labials /p/ and /v/. In this task, each participant heard two words (A & B) that differ in the initial categories and then heard a third word (X), which is similar to either the first or the second word. The first (A) and second (B) words were pronounced by a female speaker, whereas the third word (X) was pronounced by a male speaker or vice versa (i.e., the first and second words were pronounced by a male speaker and the third word was pronounced by a female speaker). The participant's job was to match the third word to either the first or second word. To clarify, each participant was instructed to write 1 if X matches A or 2 if X matches B.

In this task, a total of 12 stimuli were presented to the participants only once, without any feedback given. Each stimulus comprises three words (A, B, and X), with an interval time between words of approximately 3 seconds. The first four stimuli examined the participants' discrimination of the /p/ and /b/ categories positioned word initially before front and back vowels. The other four stimuli tested the

participants' discrimination of the /f/ and /v/ categories positioned word initially before front and back vowels as well. The last four stimuli examined the participants' discrimination of the control categories /s/, /z/, /t/, and /d/ positioned word initially before front and back vowels. Control categories were included in this experiment to compare the participants' perception results for these categories, which all exist in their L1 phonological system, with the results of the target categories, specifically /p/ and /v/. The participants were given a break of five minutes after they had completed the discrimination task.

2.2.3. Statistical Procedure

A paired-sample *t*-test was performed to compare the participants' perception of the target consonant pairs. In addition, a one-way RM-ANOVA test was conducted to compare the perception of the target categories with the four control categories to examine the extent of differing performance in the target categories, specifically, to what extent the native Arabic speakers' performance in each target category (/p/, and /v/) differs from the performance in the control categories. All statistical analyses were performed using IBM SPSS Statistics for Mac, Version 26.0.

3. Results

As mentioned above, the present study investigates the perception of the English labials /p, b, f, and v/ in onset positions by native Arabic speakers. This section is organized as follows: section (3.1) displays the results of the overall perceptual accuracy of the categories /p, f/ and their voiced counterparts /b, v/ in the identification task in both actual and non-actual words, section (3.2) demonstrates the results of the overall perceptual accuracy of the categories /p, b/ and /f, v/ in the discrimination task, section (3.3) shows the overall results of the perception of the categories /p/ and /v/ with the comparison of the control speech categories /s/, /z/, /t/, and /d/, and section (3.4) lays out the results of the effect of the phonetic context (e.g., front vs. back) on the perception of the categories /p, b/ and /f, v/.

3.1. Identification Task

Table (2) below displays the mean scores as well as standard deviation and standard error mean values on the identification tasks for the perception of the English bilabials /p, b/ in actual words performed by the same Arabic-speaking participants.

Table 2. Descriptive statistics for scores on the identification tasks of the categories /p, b/ in actual words

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Identification score for /p/	3.58	24	1.412	.288
	Identification score for /b/	4.67	24	1.049	.214

As illustrated in Table (2), the same participants' mean scores on the identification of the categories /p/ and /b/ in actual words were 3.58 (SD = 1.412, N = 24) and 4.64 (SD = 1.049, N = 24), respectively. A BCa bootstrapped paired sample *t*-test, as shown in Table (3), demonstrates a statistically significant difference between same-participant mean scores on the /p, b/ identification tasks. The 95% CI was [-1.792, -.458], in favor of the /b/ identification, suggesting that the Arabic-speaking participants experienced less difficulty in perceiving the category /b/, which already exists in their native language, than they did in perceiving the non-native category /p/.

Table 3. Bootstrapped paired sample *t*-test of mean scores on the identification tasks of the categories /p, b/ in actual words

		Bootstrap[5]					
						BCa 95% Confidence Interval	
		Mean	Bias	Std. Error	Sig.(2-tailed)	Lower	Upper
Pair 1	Identification score for /p/- Identification score for /b/	-1.083	-.003	.334	.005	-1.792	-.458

[5] Henceforth, the bootstrap results in this study are based on 10000 bootstrap samples.

In addition, the participants were tested on their perception of the English category /p/ in actual and non-actual words to examine whether familiarity with the presented words influenced their perception. We expected that the non-actual words would correlate greatly with a low rate of perception in this category. Table (4) below shows the percentages for the identification tasks for the perception of the English bilabial /p/ in actual and non-actual words.

Table 4. Descriptive statistics for the percentages of the identification tasks of the category /p/ in actual and non-actual words

The Phoneme	Actual Words	Non-Actual Words
/p/	59%	56%
Total Stimuli	144	48

As illustrated in the above table, the participants achieved an identification rate of 59% for the non-native category /p/ in actual words, compared to 56% for the same category in the non-actual words. The test revealed that the difference is not statistically significant at $p<.05$. It can be concluded that these results did not support our hypothesis stating that familiarity with English words may play a role in the participants' perception of the investigated categories.

As for the perception of the categories /f, v/, Table (5) demonstrates the descriptive statistics on the identification of the fricative labials /f/ and its voiced equivalent /v/ in actual words.

Table 5. Descriptive statistics for scores on the identification tasks of the categories /f, v/ in actual words

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Identification score for /f/	5.58	24	.654	.133
	Identification score for /v/	4.08	24	1.412	.288

The data present that the participants accurately identified the fricative labial /f/ with a higher rate of perception, at 88% (170), followed by 67% (128) for the non-native phoneme /v/. Table (5) indicates the mean score on the identification tasks of the categories /f/ and /v/ in actual words. As shown in Table (5), with the phoneme /f/, the mean was 5.58 (SD =.654, N = 24), whereas the mean of the phoneme /v/

was 4.08 (SD = 1.412, N = 24). The BCa bootstrapped paired sample *t*-test, as in Table (6), demonstrates a significant difference in the mean scores for the /f, v/ identification tasks. The BCa 95% CI was [.833, 2.167], in favor of the /f/ identification tasks. This result suggests that the participants had trouble perceiving the non-native phoneme /v/ where it is substituted for /f/, which is the only labiodental fricative in Arabic.

Table 6: Bootstrapped paired sample *t*-test of mean scores on the identification tasks of the categories /f, v/ in actual words

		Bootstrap					
						BCa 95% Confidence Interval	
		Mean	Bias	Std. Error	Sig.(2-tailed)	Lower	Upper
Pair 1	Identification score for /f/- Identification score for /v/	1.500	-.006	.323	.000	.833	2.167

The participants were also examined on their perception of the English fricative labial /v/ in actual and non-actual words. Table (7) illustrates the percentages of the identification task performance for the perception of the category /v/ in actual and non-actual words.

Table 7. Descriptive statistics for the percentages of the identification tasks of the category /v/ in actual and non-actual words

The Phoneme	Actual Words	Non-Actual Words
/v/	68%	62%
Total Stimuli	144	48

The overall performance pattern in Table (7) is similar to the previous pattern shown in Table (4), in which the participants achieved largely similar accuracy in the category /v/ in the actual and non-actual words. The accuracy rates for the category /v/ in actual and non-actual performance were 68% and 62%, respectively. The test revealed no statistically significant at $p<.05$, suggesting that this pattern again did not validate our hypothesis on the influence of familiarity on the participants' perception of the investigated categories.

3.2. Discrimination Task

Table (8) shows the category discrimination scores for the English bilabial target categories /p, b/.

Table 8. Descriptive statistics for scores on the discrimination tasks of the categories /p, b/ in actual words

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Discrimination score for /p/ in actual words	1.29	24	.751	.153
	Discrimination score for /b/ in actual words	1.58	24	.584	.119

As shown in Table (8), the participants misperceived the phonemic contrasts between /p/ and /b/. Similar to the results obtained in the identification tasks, these contrasts were accurately discriminated at 62% and 79% of the stimuli, respectively. With the category /p/, the mean was 1.29 (SD =.751, N = 24), whereas the mean of the category /b/ was 1.58 (SD = .584, N = 24). Based on the descriptive statistics in Table (8) and the values in Table (9), the paired sample *t*-test shows that the mean score of the category /p/ is lower than the mean score of the category /b/; the BCa 95% CI was [-.542, -.042], as shown in the table below.

Table 9. Bootstrapped paired sample *t*-test of mean scores on the discrimination tasks of the categories /p, b/ in actual words

		Bootstrap					
						BCa 95% Confidence Interval	
		Mean	Bias	Std. Error	Sig.(2-tailed)	Lower	Upper
Pair 1	Discrimination score for /p/- discrimination score for /b/ in actual words	-.292	.000	.149	.069	-.542	-.042

With respect to statistical differences between the two means, the BCa bootstrapped paired sample *t*-test shows statistically significant differences in the mean scores of /p, b/ discrimination tasks, indicating that the /b/ discrimination was achieved more frequently than for /p/. As in the identification tasks, the participants' performance in both tasks of identification and discrimination showed lower accuracy rates for the non-native phoneme /p/ and higher accuracy for the native phoneme /b/.

As for the discrimination tasks for the categories /f, v/, Table (10) below demonstrates the descriptive statistics on the discrimination tasks of the fricative labial category /f/ and its voiced counterpart /v/.

Table 10. Descriptive statistics for scores on the discrimination tasks of the categories /f, v/ in actual words

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Discrimination score for /f/ in actual words	1.67	24	.482	.098
	Discrimination score for /v/ in actual words	1.42	24	.717	.146

As seen in Table (10), the participants misperceived the contrasts between the non-native phoneme /v/ and the native /f/, identifying these contrasts with accuracy rates of 68% and 83%, respectively. With the phoneme /f/, the mean was 1.67 (SD =.482, N = 24), whereas the mean of the phoneme /v/ was 1.42 (SD = .717, N = 24). Consider Table (11) below for statistical differences between the two means.

Table 11. Bootstrapped paired sample *t*-test of mean scores on the discrimination tasks of the categories /f, v/ in actual words

		Bootstrap					
		Mean	Bias	Std. Error	Sig.(2-tailed)	BCa 95% Confidence Interval	
						Lower	Upper
Pair 1	Discrimination score for /f/- discrimination score for /v/ in actual words	.250	.000	.134	.084	.042	.458

Based on Table (11), the BCa bootstrapped paired sample *t*-test shows a statistically significant difference in the mean scores of the /f, v/ discrimination tasks. The BCa 95% CI was [.042, .458], though, it was statistically significant, further investigation is needed because the result of the T-tailed test is not significant, CI is closer to zero, and the effect size is small. Overall performance revealed that discrimination was achieved more frequently for /f/ than /v/, which was highly expected due to the existence of the former category in the participants' L1 phonological system.

3.3. Perception of Control Categories

Table (12) below displays the mean scores, standard error, and 95% confidence interval (CI) values for the overall perception of the English category /p/ in comparison to the control speech categories /s/, /z/, /t/, and /d/ as performed by the same native Arabic-speaking participants. As expected, the native Arabic speakers scored lower on the perception task for the English category /p/ (*M* = 1.292) than they did on the control categories /t/, /z/, /s/, and /d/ (*Ms* = 2.000, 1.917, 1.875, and 1.750, respectively).

Table 12. Estimates for mean scores on the perception of the category /p/ and the control categories /t, d, s, z/

Phoneme	Mean	Std Error	95% Confidence Interval	
			Lower Bound	Upper Bound
/p/	1.292	.153	.975	1.609
/t/	2.000	.000	2.000	2.000
/d/	1.750	.090	1.563	1.937

/s/	1.875	.092	1.686	2.064
/z/	1.917	.083	1.744	2.089

A one-way RM-ANOVA with a Greenhouse-Geisser correction, as shown in Table (13), confirmed that there was a statistically significant difference in the overall perception of the English category /p/ and the control categories /s/, /z/ /t/, and /d/ ($F_{8.837}$ = 92, p = .000, $^{2}_{P}$ = .278).

Table 13. One-way RM-ANOVA of /p/, /s/, /z/, /t/, and /t/

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent Parameter	Observed Power
Phoneme Perception	Greenhouse–Geisser	7.550	2.833	2.665	8.837	.000	.278	25.037	.991

Henceforth, computed using alpha in this study = .05

Post hoc pairwise comparisons of ANOVA with Bonferroni adjustment revealed an overall significant difference between the mean score for the perception of the category /p/ and the mean scores of the control categories /t/, /s/, and /z/, as summarized in Table (14). The performance of the participants did not reach the significance level comparing the English category /p/ and the native category /d/. Nonetheless, the participants demonstrated the same superior trend in the perception of the native category /d/ compared to the non-native category /p/, identifying the category /p/ at a lower mean value (M = 1.292) than the category /d/ (M = 1.750), thereby reflecting the influence of their L1.

Table 14. Significance for pairwise comparisons for the perception of the categories /p/, /t/, /d/, /s/, and /z/

Phoneme 1	Phoneme 2	Mean Difference (1-2)	Std Error	Sig	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
/p/	/t/	-.708*	.153	.001	-1.184	-.233
	/d/	-.458	.170	.129	-.986	.069
	/s/	-.583*	.158	.012	-1.075	-.092
	/z/	-.625*	.168	.011	-1.147	-.103

Henceforth, adjustment for multiple comparisons in this study: Bonferroni.
Henceforth, the mean difference is significant at the .05 level in this study.

As for the overall perception of the English category /v/, Table (15) below demonstrates the mean scores, standard error, and 95% confidence interval values for the overall perception of the English category /v/ in comparison to the control speech categories /s/, /z/, /t/, and /d/ as performed by the same native Arabic-speaking participants. As expected, the native Arabic speakers scored lower on the perception task for the English category /v/ (M = 1.417) than they did on the control categories /t/, /z/, /s/, and /d/ (Ms = 2.000, 1.917, 1.875, and 1.750, respectively).

Table 15. Estimates for mean scores on the perception of the category /v/ and control categories /t, d, s, z/

Phoneme	Mean	Std Error	95% Confidence Interval	
			Lower Bound	Upper Bound
/v/	1.417	.146	1.114	1.720
/t/	2.000	.000	2.000	2.000
/d/	1.750	.090	1.563	1.937
/s/	1.875	.092	1.686	2.064
/z/	1.917	.083	1.744	2.089

To confirm the difference between the overall perception of the English category /v/ and the control categories /s/, /z/, /t/, and /d/, the RM-ANOVA with a Greenhouse-Geisser correction, as shown in Table (16), revealed a significant difference of mean score of the category /v/ with control categories ($F_{6.053} = 92$, $p = .001$, $^{2}_{P} = .208$).

Table 16. One-way RM-ANOVA of /v/, /s/, /z/, /t/, and /d/

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent Parameter	Observed Power
Phoneme Perception	Greenhouse–Geisser	5.000	2.921	1.711	6.053	.001	.208	17.683	.946

As shown in Table (17), pairwise comparisons of the ANOVA with Bonferroni correction revealed a significant difference of mean score for the perception of the category /v/ only from the mean scores of the control categories /t/ and /z/. Table (17) displays the perception of the English category /v/ as compared to the control categories. Unexpectedly, the native Arabic speakers perceived the English category /v/ more frequently than /p/, which will be discussed in section (4). The mean scores were 1.417 for /v/, 1.750 for /d/, 1.875 for /s/, 1.917 for /z/, and 2.000 for /t/. The only statistical differences appeared with the categories /t/ and /z/, and the differences were not significant with the categories /d/ and /s/. These results align with the general expectation that the native Arabic participants would demonstrate the same trend in more accurate perception of the native categories /d/ and /s/ compared to the non-native category /v/, suggesting the influence of their L1.

Table 17. Significance for pairwise comparisons for the perception of the categories /v/, /t/, /d/, /s/, and /z/

Phoneme 1	Phoneme 2	Mean Difference (1-2)	Std Error	Sig[d]	95% Confidence Interval for Difference[d]	
					Lower Bound	Upper Bound
/v/	/t/	-.583*	.146	.006	-1.038	-.129
	/d/	-.333	.167	.574	-.851	.184
	/s/	-.458	.159	.084	-.952	.035
	/z/	-.500*	.159	.046	-.994	-.006

3.4. Effect of Phonetic Context

As pointed out by Strange et al. (2007), vowel contexts have effects on the perception of non-native phonemes for L2 learners. The current study examined the influence of the phonetic context (front vs. back vowels) on the perception of the English labial categories. Table (18) demonstrates the mean scores of the perception of the phoneme /p/ with front and back vowels.

Table 18. Descriptive statistics for scores on the identification tasks of the category /p/ with front and back vowels

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Identification score for /p/ followed by front vowels	1.83	24	.917	.187
	Identification score for /p/ followed by back vowels	1.71	24	.999	.204

Based on Table (18), the participants' mean scores on the identification tasks for the category /p/ in front and back vowel contexts were 1.83 (SD =.917, N = 24) and 1.71 (SD =.999, N = 24), respectively. The means are similar for the front and back vowels. As shown in Table (19), the bootstrapped paired sample *t*-test demonstrates that the 95% CI was [-.375, .625], suggesting that there was no statistically significant difference between the mean scores of the participants on the perception of the category /p/ in different vowel contexts.

Table 19. Bootstrapped paired sample *t*-test of mean scores on the identification tasks of the category /p/ in actual words with front and back vowels

		Bootstrap					
						BCa 95% Confidence Interval	
		Mean	Bias	Std. Error	Sig.(2-tailed)	Lower	Upper
Pair 1	Identification score for /p/ followed by front vowel-score for /p/ followed by back vowel	.125	.003	.246	.628	-.375	.625

These results did not support our hypothesis, which states that accurate performance may relate to the target sounds through vowel quality. Thus, the results confirmed that the vowel quality does not affect the perception of the English bilabial category.

Contrary to the results for the accuracy of perception for the category /p/ with front and back vowels, the participants performed differently in the perception of the category /v/ in front and back vowel contexts. The descriptive statistics indicated that the participants perceived the non-native category /v/

with back vowels at low rates compared to the category /v/ with front vowels. The mean score for the category /v/ with front vowels was 2.71 (SD =1.122, N = 24), whereas the mean score of the category /v/ with back vowels was 1.38 (SD = .824, N = 24). Consider Table (20) below for statistical differences between the two means.

Table 20. Bootstrapped paired sample *t*-test of mean scores on the identification tasks of the category /v/ in actual words with front and back vowels

		Bootstrap					
						BCa 95% Confidence Interval	
		Mean	Bias	Std. Error	Sig.(2-tailed)	Lower	Upper
Pair 1	Identification score for /v/ followed by front vowel- score for /v/ followed by back vowel	1.333	.000	.278	.000	.833	1.792

As shown in Table (20), the 95% CI was [.833, 1.792]. The results of the bootstrapped paired sample *t*-test demonstrated a statistically significant difference between participants' mean scores in the perception of the category /v / with front and back vowels.

4. Discussion

As presented in section (1), earlier research in cross-language speech perception has drawn various conclusions: some studies have revealed that L2 speakers encounter difficulty in the perception of non-native phonemic contrasts (e.g., Alzahrani, 2015; Brown, 2000; Flege, 1995; Lisker, 1970; Moustafa, 1979; Price, 1981), while others concluded that they largely did not experience such difficulty (e.g., Buali, 2010; Evans & Alshangiti, 2018; Salim & Albadawi, 2017; Shafiro et al., 2012). Therefore, we conducted this study, which principally aimed to examine the overall perceptual accuracy of the English labial categories /p, b, f, and v/ in onset positions performed by native Arabic speakers, aged 19-21 years old. It was predicted that the participants would demonstrate high overall accuracy in the perception of the English categories /b/ and /f/ compared to their counterparts /p/ and /v/ due to the absence of the latter categories in their L1. The study also investigated the potential effects of phonetic context and familiarity with the stimuli being tested on the participants' performance. It was expected that the phonetic context (e.g., front and back vowels) might play a significant role in the perception of the English labials. Lastly, it was expected that the participants' familiarity with the stimuli being tested might affect their perceptual performance of the categories in question.

The results for the overall perceptual performance of the English labial categories in actual words suggested that in tasks of both identification and discrimination, the Arabic-speaking participants performed well in the perception of the English categories /b and f/, which are available in the phonological system of their L1. However, they performed poorly in the perception of the English categories /p and v/, which are absent in the phonological system of their L1. In line with the PAM of Best et al. (2017), these results support the pattern of perceptual assimilation, as the native Arabic-speaking participants primarily perceived the non-native categories (e.g., /p/ and /v/) as sounds and assimilated them to their L1 categories, specifically to /b/ and /f/. They also provided supporting evidence for the CAH of Lado (1957), as the participants' performance in the control categories /s, z, t,

and d/, when compared to the results of the target categories /p and v/, contributed to the same conclusion, that the Arabic-speaking participants had substantial trouble in perceiving these non-native categories. Moreover, these findings are also consistent with the conclusions of Alzahrani (2015) and Moustafa (1979), who reported that their Arabic participants generally experienced difficulty in the perception of non-native English speech categories. However, they are incompatible with the conclusions reported in the studies of Bauli (2010), Evans and Alshangiti (2018), Salim and Albadawi (2017), and Shafiro et al. (2012), whose Arabic participants were generally able to perceive non-native English speech categories. As mentioned in section (1), the Arabic participants in these studies performed well because they had already obtained substantial exposure to the English language, they were early bilinguals, or they had received ample prior training and practice. This explanation is supported by the SLM of Flege (1995), which suggests that the adult learners are expected to have the ability to create new phonetic categories for new L2 phonemes after many years of immersion in L2 speech; thus, L2 adult speakers with high exposure to L2 sounds are more likely to realize non-native sounds in a native-like way than those who have less exposure to L2 sounds. Several researchers (e.g., Bradlow and Pisoni, 1997; Perlmutter, 1989; Rochet, 1995) have also indicated that the perception of foreign language speech sounds will improve significantly when learners are given more language training or instruction. These reasons explain clearly why the participants in the studies of Bauli (2010), Evans and Alshangiti (2018), Salim and Albadawi (2017), and Shafiro et al. (2012) were able to perceive the non-native categories, whereas our participants were not. The participants in the current study had not experienced substantial exposure to the English language and did not receive any kind of training or practice.

On the whole, the findings revealed different performances in the perception of the categories /p/ and /v/. Unexpectedly, it appeared that the native Arabic speakers perceived the English category /v/ more frequently than the English category /p/. We argue that the category /v/ is perceptible and consists of internal perceptual cues including frication noise and high amplitude, compared to the category /p/ with weak and low amplitude. The /p/ category also does not have internal cues during the closure (Hartmann et al., 2008).

As noted in the L2 literature (Strange et al., 2007), the phonetic contexts of the target phonemes affect the perception of non-native phonemes in L2 learners. The results of the overall perceptual performance of the English labial categories in specific vowel context (e.g., front vs. back vowels), as shown in Table (19), showed no statistically significant difference between participants' mean scores in the perception of the category /p/ in both vowel contexts. This finding suggests that the vocalic contexts did not have any significant effect: (M =1.83) for /p/ with front vowels and (M = 1.71) for /p/ with back vowels. Consequently, this finding contradicts the finding of Shafiro et al. (2012) but aligns with the finding of Evans and Alshangiti (2018), in that vowel quality does not appear to affect the perception of non-native phonemes.

Contrary to the results of the perception of the category /p /, the results showed a statistically significant difference between participants' mean scores in the perception of the category /v/ in both vowel contexts. The participants' performance in the /v/ category tended to be higher with front vowels (M= 2.71) compared to back vowels (M= 1.38). These findings were in line with those of Shafiro et al. (2012). One possible explanation for this tendency (i.e., the high rate of perception with front vowels but not with back vowels) could be that the coarticulatory influence of lip protrusion on the fricative noise occurs more strongly with the category /v/.

Lastly, one of the objectives of this study was to examine the potential influence of the participants' familiarity with English words on the perceptual accuracy of English labials /p and v/. Kazanina et al. (2006) argued that the knowledge of word meaning might influence the perception of a sound contrast. Our results, however, indicated that there was no statistically significant difference between

participants' mean scores in the perception of the target categories with actual and non-actual words. The participants identified the category /p/ with 59% accuracy for actual words compared to 56% for the same category with non-actual words. They also identified the category /v/ with 68% accuracy for actual words compared to 62% for the same category with non-actual words. Thus, these findings did not provide substantive supporting evidence for any relationship between the perception of the non-native English labials /p and v/ and familiarity, at least in the current study. Further investigation is needed with more non-actual words to confirm this conclusion. Generally speaking, these obtained findings are incompatible with the findings of Buali (2010), which indicated that his Saudi Arabic-speaking participants performed well in the perception of the English category /p/ in non-actual English words. As mentioned in section (1), these findings were limited because Buali first had to test his participants' perception of the English category /p/ with actual English words.

5. Conclusions

The current study examined native Arabic speakers' overall perception of English labials /p, b, f, and v/ in initial positions and investigated the possibility that phonetic contexts and familiarity might influence the perception of non-native phonemes. Based on performance by 24 Saudi male participants, the results demonstrated that these native Arabic-speaking participants experienced difficulty in perceiving the bilabial stop /p/ and labio-dental fricative /v/, often confusing them with their counterparts /b/ and /f/. In particular, participants sometimes identified /p/ as /b/ and /v/ as /f/ or vice versa. The results also showed that neither phonetic contexts nor familiarity with the English words played any active role in the participants' perceptual accuracy of all of the investigated categories, except in the context in which the category /v/ was followed by back vowels. There was a significant difference of mean scores between the perception of /v/ with front and back vowels, with low rates of perceiving /v/ with back vowels.

This study provides crucial insights into the second-language field. We hope that the findings obtained in this study will considerably help second-language instructors recognize some of the perceptual difficulties that native Arabic speakers of English usually encounter with English speech categories. Moreover, we hope that this study provides additional insights into auditory phonetics and presents further explanation on how human ears recognize speech sounds, since perception is strongly correlated with both the fields of phonetics and cognitive psychology.

Finally, there are three limitations of the present study. First, there is a need for a single study that can combine both the native Arabic speakers' production and perception of the English labial categories or of all English speech categories that Arabic lacks. This type of study may provide important insights regarding the correlation between production and perception. The second limitation is the requirement for a study that can include more Arabic participants whose English proficiency varies considerably. This type of study may provide more precise results on the native Arabic speakers' perception of the English labials. The third limitation lies in having little data that represent the non-actual words. It will be useful to test more non-actual words to confirm the conclusion regarding the possible effect of the familiarity of English words on the perception of non-native categories.

6. Ethics Committee Approval

The author(s) confirm(s) that the study does not need ethics committee approval according to the research integrity rules in their country (Date of Confirmation: December 11, 2020).

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References

Ahmad, J. (2011). Pronunciation problems among Saudi learners: A case study at the preparatory year program, Najran University Saudi Arabia. *Language in India, 11*, 22-36.

Albadawi, K. (2012). An analysis of phonetic, morphological and syntactic errors in English: A case study of Saudi BA students at King Khalid University. *International Journal of Social Science and Humantiy*, *2*(6), 536-538.

Alzahrani, M. (2015). Saudi speakers' perception of the English bilabial stops /b/ and /p/. *Sino-US English Teaching, 12*(6), 435-447.

Barros, A. (2003). Pronunciation difficulties in the consonant system experienced by Arabic speakers when learning English after the age of puberty (Unpublished master thesis). West Virginia University, Morgantown.

Best, C. (1995). A direct realist view of cross-language speech perception. In W. Strange (Ed.), *Speech perception and linguistic experience*: *Issues in cross-language research* (pp. 171-204). Baltimore: York Press.

Best, C., McRoberts, G., & Goodell, E. (2001). Discrimination of non-native consonant contrasts varying in perceptual assimilation to the listener's native phonological system. *Journal of the Acoustical Society of America, 109*, 775-794.

Binturki, A. (2008). Analysis of pronunciation errors of Saudi ESL learners. (Unpublished master thesis). Southern Illinois University at Carbondale, Carbondale.

Bradlow, A., Pisoni, D., Yamada, R., & Tohkura, Y. (1997). Training Japanese listeners to identify English /r/ and /l/: Some effects of perceptual learning on speech production. *Journal of the Acoustical Society of America, 101*(4), 2299-2310.

Brown, C. (2000). The interrelation between speech perception and phonological acquisition from infant to adult. *Second Language Acquisition and Linguistic Theory, 1*, 4-64.

Buali, I. (2010). The perception and production of /p/ in Saudi Gulf Arabic English: a variationist perspective. (Unpublished master thesis). Concordia University, Montreal.

Evans, B., & Alshangiti, W. (2018). The perception and producation of British English vowels and consonants by Arabic learners of English. *Journal of Phonetics, 68*, 15-31.

Flege, J. (1995). Second language speech learning: Theory, findings, and problems. *Speech Perception and Linguistic Experience: Issues in Cross-Language Research, 92*, 233–277.

Hartmann, J., Hegedűs, V., & Van Riemsdijk, H. (2008). *Sounds of silence: Empty elements in syntax and phonology*. Amsterdam: Brill.

Kazanina, N., Phillips, C., & Idsardi, W. (2006). The influence of meaning on the perception of speech sounds. *Proceedings of the National Academy of Sciences*, *103*(30), 11381-11386.

Lado, R. (1957). *Linguistics across culture*: *Applied linguistics for language teaching*. Michigan: University of Michigan Press.

Lisker, L. (1970). On learning a new contrast. *Haskins Laboratories Status Report on Speech Research, 24*, 1-15.

Moustafa, M. (1979). Perception analysis. *The Modern Language Journal, 63*(8), 435-441.

Permuttler, M. (1989). Intelligibility rating of L2 speech pre- and postintervention. *Perceptual and Motor Skills, 68* (2), 515-521.

Price, P. (1981). A corss-linguistic comparison of flaps in Japanese and American English. (Doctoral dissertation). University of Pennsylvania, Morgantown.

Rochet, B. (1995). Perception and production of L2 speech sounds by adults. In W. Strange (Ed.), *Speech perception and linguistic experience*: *Theoretical and methodological issues* (pp. 379-410). Timonium: York Press.

Salim, J., & Albadawi, A. (2017). The perception of English consonants by Arab ELF learners: A case study of University students at ZU. *Advances in Socail Sciences Research Journal, 4*(17), 26-33.

Sharfiro, V., Levy, E., Dakwar, R., & Kharkhurin, A. (2012). Perceptual confusions of American English vowels and consonants by native Arabic bilinguals. *Language and Speech, 56*(2), 145-161.

Strange, W., Weber, A., Levy, E., Shafiro, V., Hisagi, M., & Nishi, K. (2007). Accoustic variability within and across German, French, and American English vowels: Phonetic context effects. *The Jouranl of the Accoustical Society of America, 122*(2), 1111-1129.

Tyler, M. D., & Fenwick, S. (2012). Perceptual assimilation of Arabic voiceless fricatives by English monolinguals. *In Thirteenth Annual Conference of the International Speech Communication Association.*

Appendix A.

A.1. Actual monosyllabic English words

Table 21. Actual monosyllabic English words

Actual CVC English words						
peak	vine	van	ban	juice	pull	foal
veal	Vaughan	fine	veil	cat	beak	pour
vole	bore	fawn	feel	shoes	fan	choose
fail	pan	big	pig	bowl	bull	pole

A.2. Non-actual monosyllabic English words

Table 22. Non-actual monosyllabic English words

Non-actual CVC English words with their phonetic transcriptions			
Non-actual word	***IPA Transcription***	**Non-actual word**	***IPA Transcription***
pove	*[poʊv]*	**bove**	*[boʊv]*
vooth	*[vuθ]*	**footh**	*[fuθ]*
beege	*[bidʒ]*	**peege**	*[pidʒ]*
feem	*[fim]*	**veem**	*[vim]*

A.3. Abbreviations appearing in the paper

Table 23. Abbreviations appearing in the paper

	Abbreviation	**Description**
1	**NA**	Najdi Arabic
2	**HP**	High proficiency
3	**LP**	Low proficiency
4	**ICP**	Intensive course program
5	**BA**	Bachelor of Arts
6	**CAH**	Contrastive Analysis Hypothesis
7	**SLM**	Speech Learning Model
8	**PAM**	Perceptual Assimilation Model
9	**L2**	Second Language
10	**L1**	First Language

Yerel olmayan fonemik kontrastların algısal doğruluğu hakkında: Anadili Arapça Konuşanlar hakkında bir vaka çalışması

Öz

Anadili Arapça olanların ana dili İngilizce olmayan fonemik karşıtlık algısı üzerine yapılan araştırmalar çeşitli sonuçlar ortaya koymuştur. Bazı araştırmalar, ana dili Arapça olanların ana dili İngilizce olmayan fonemik zıtlıkların algılanmasında zorluk yaşadıklarını ortaya koyarken, diğerleri büyük ölçüde bu tür zorluklarla karşılaşmadıkları sonucuna varmıştır. Bu tutarsızlık nedeniyle, mevcut çalışma, ana dili Arapça konuşanlar tarafından gerçekleştirilen başlangıç pozisyonlarında yalnızca İngilizce labial kategorilerinin / p, b, f ve v / genel algısal doğruluğunu incelemeyi amaçlamıştır. Çalışma ayrıca fonetik bağlamların potansiyel etkilerini ve test edilen uyaranların katılımcıların algısal performansı üzerindeki aşinalığını da inceledi. Yirmi dört Suudi erkek katılımcı ünsüz fonem tanımlama ve ayrımcılık görevlerini tamamladı. Bulgular, katılımcıların / p / ve / v / kategorilerini algılamada güçlük yaşadıklarını ve onları meslektaşları / b / ve / f / ile karıştırdıklarını ortaya koymuştur. Bulgular ayrıca, / v / kategorisinin ardından arka ünlülerin geldiği bağlam dışında, ne fonetik bağlamın ne de aşinalığın katılımcıların söz konusu tüm kategorilerin algısal doğruluğu üzerinde herhangi bir etkisi olmadığını ortaya koydu. Bu spesifik bağlamda, katılımcıların performansı daha düşük olma eğilimindeydi, bu da dudak yuvarlamanın etkisine atfedilebilir, bu da bu kategori (/ v /) ile ilişkili sürtünmeli gürültü ile birlikte eklemlenme ile sonuçlanır. Son olarak, bu çalışmada elde edilen sonuçlar, işitsel fonetik hakkında önemli ek bilgiler sağlar ve insan işitme sisteminin konuşma seslerini nasıl tanıdığına dair ek açıklamalar sunar.

Anahtar Sözcükler: konuşma algısı; ikinci dil edinimi; Arapça konuşanlar; İngiliz dudak sesleri; Konuşma Öğrenme Model

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