

Issues in Learning Labial Consonants of English by Arabic Speaking Students in Saudi Arabia: A Test of Feature Model

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المخلص

تستخدم هذه الدراسة نموذج براون لاختبار فرضية أن تعلم مقاطع صوتية جديدة للغة الثانية أمر ممكن إذا كانت السمات الصوتية ذات الصلة التي تميز الصوت الجديد عن أقرب صوت مريبك له نشطة في خصائص اللغة الأم للمتعلمين. أجريت هذه الدراسة على متعلمي اللغة الإنجليزية الناطقين بالعربية، حيث يواجه متعلمو اللغة الإنجليزية العرب صعوبة في تعلم الصوامت الإنجليزية والتي منها /p/ و/v/. لذا، تم اختيار ستة عشر متعلمًا للغة الإنجليزية على المستوى الجامعي لعمل هذه الدراسة. تم اختبار إدراك المتعلمين لأزواج الصوامت التي تختلف في الهمس والجهر /v-f/ و /b-p/ في تحديد الهوية واختبار التمييز المعجمي لتأكيد ما إذا كان بإمكانهم التمييز بشكل إدراكي بين أزواج الحروف الساكنة /v-f/ و /b-p/. تدعم نتائج الدراسة توقع فرضية Feature Model بأن صوامت اللغة الثانية L2 الجديدة يمكن تمييزها بشكل إدراكي عن أقرب صوت مريبك إذا كانت الميزة ذات الصلة التي تميز الصوتين نشطة في اللغة الأم L1. أظهر المشاركون نتائج أفضل في إدراك /v/ ونتائج جيدة في إدراك /p/. إن نتائج هذه الدراسة لها أهمية تربوية لمتعلمي اللغة الإنجليزية العرب في المملكة العربية السعودية.



Abstract

This study tests the prediction of the Feature Model (FM) by Brown that learning new phonemes of an L2 is possible if the relevant phonological features that differentiate the new sound from its closest confusing sound are active in the Feature Geometry of the learners' L1. The study is conducted in the context of Arabic learners of English who face difficulty learning English /p/ and /v/ phonemes. Sixteen undergraduate level learners of English were selected for this study. Their perception of /v-f/ and /b-p/ consonant pairs was tested in an identification and a lexical discrimination test to confirm if they can perceptually differentiate between /v-f/ and /b-p/ consonant pairs. The findings of the study support the FM prediction that a new L2 sound can be perceptually differentiated from the closest confusing sound if the relevant feature differentiating the two sounds is active in the L1. The participants showed better results in the perception of /v/ and good results in the perception of /p/. The findings of this study have pedagogical significance for adult Arabic learners of English in Saudi Arabia.

Keywords: *Arabic, discrimination, English, feature model, identification, perception*

Introduction

Perceptual assimilation of voiceless labial plosive /p/ with /b/ is a classical and well-known difficulty that adult Arabic learners of English usually experience. They also assimilate the voiced labial fricative /v/ with its voiceless counterpart /f/. A huge amount of literature exists on this topic. However, the former pair has been studied and discussed more than the latter. The reason for this discrepancy is very simple to understand, that is, two of these consonants namely /p/¹ and /v/ do not exist in the phonemic inventories of most dialects of Arabic. It is natural for adult learners of an L2 to have trouble in the perception and production of a sound that does not exist in their L1. The current study discusses this issue with reference to the Feature Model of adult language acquisition (Brown, 1997). Although the previous research has studied and analyzed adult learners' difficulties with reference to these consonants of English, there is not much literature which has attempted to analyze the nature of difficulty of Arabic learners of English consonants using the Feature Model (also known as the FM).

In order to fill this gap in the literature, the primary goal of this study is to examine the amount and sources of major difficulties encountered by Arab English learners, as well as to identify the root causes of their difficulties in learning English sounds, which is similar to the endeavour of teachers and researchers working in the field of adult second or foreign language acquisition who are looking for strategies to alleviate students' difficulties. To this end, an experiment with a group of adult Arab undergraduate English students was conducted.

Literature Review

Learning a second or foreign language results in acquiring the ability to communicate in it. Normally, acquiring command over the four communication skills is considered the major target of adult language learning. Most of the literature on foreign and second language learning focuses on these four communication skills, namely reading, writing, speaking, and listening. There is a huge literature available on reading (Pae, 2018) and writing skills (Mohsen, 2022; Zare et al., 2023). But, in the few past decades researchers in the field of applied linguistics have been relatively more interested in speaking and listening skills. In the first half of the 20th century, when this domain of study came under discussion in the academic circles, theoreticians were more interested in speaking skills (e.g., Lado's Contrastive Analysis Hypothesis (Lado, 1957) focuses on speaking skills). A brief overview of research in this field is recapitulated in the following sub-section which indicates that in the second half of the previous century, the concentration of the researchers in the field of applied linguistics remained thoroughly centered on pronunciation (ibid). However, at the end of the 20th century, researchers started realizing that comprehension (listening) was as important as speaking (Best, 1994; Brown, 1998; Flege, 1995). The models of second language learning which emerged in the last decade of the previous century mainly focus on perception or listening skills (e.g., see models like Perceptual

¹ The [p] occurs in Arabic as an allophone and not a distinctive phoneme. For example, the word for Saturday السبت[sapt] and [nabt] show the contrast where the former has a [p], due to the spreading of the voicelessness feature of the [s] to the [p]. Thus, [p] occurs as an allophone in Arabic.

Assimilation Model (1995), Speech Learning Model (1995), Feature Model (2000), Native Language Magnet (Kuhl, 1991). In the following sub-section, we briefly summarize the relevant studies to recapitulate the development of research in the field of applied linguistics that occurred during the second half of the 20th century.

The study of adult second and foreign language acquisition has become a scientific discipline after Robert Lado published his world-famous study in 1957 elaborating his views which were later known as contrastive analysis hypothesis (also called CAH). According to Lado, an L2 consonant which does not exist in L1 of the learners is a source of difficulty for adult learners of the L2 (Kramersch, 2007; Lado, 1957). Although later literature challenged the spirit and process assumed in transfer involved in this hypothesis, for example see publications by researchers like Flege (Flege, 1993, 1995, 1997, 2003, 2009), Cynthia Brown (Brown, 1998, 2000), Best and her colleagues (Best, 1994, 1995; Best, McRoberts, & Goodell, 2001; Best, McRoberts, & Sithole, 1988), Kuhl (1991), and her colleagues (Kuhl et al., 2008), and many others on this topic; despite strong opposition from the experts, CAH has still been an idea studied with interest by teachers in the field of second and foreign language learning. Even those teachers and researchers who do not accept the CAH predictions, also see roots of most of the difficulties of L2 learners in L1 grammar and compare L1 and with L2 when identifying the basic reason for learners' difficulties in learning a new language in adult age; for example, see references and discussion in (Li et al., 2023; Westergaard, Mitrofanova, Rodina, & Slabakova, 2023).

As pointed out above, the study of difficulties of second and foreign language learners came in the limelight in the middle of the previous century with Lado's seminal publication. CAH also gave a concept of positive and negative transfer (Wong & Dras, 2009). According to Lado, if an adult learner shares phonemes of L1 and L2 grammar, learning of such phonemes of L2 will be facilitated by positive transfer from the L1; and if some sounds are new for learners, such sounds will pose difficulty for them, and they, instead of acquiring the target L2 sound, will produce the closest L1 sound. CAH calls this negative transfer from L1. Negative transfer has debilitating effect on L2 learning. But by the end of the previous century, there was a trend shift in the L2 research, and researchers started analyzing the role of perception and markedness (De Lacy, 2007) in learning, which has been found to have a significant role in language learning (Gnanadesikan, 2004).

Another important factor in this regard is the contribution of perception in L2 learning. By the end of the previous century, researchers in the field of L2 learning were convinced that perception precedes production in acquisition of L2 phonology (MacKay et al., 2001). That was the time when Feature Geometry (FG) was established as one of the main models of theoretical phonology. Various researchers had developed their models of features geometric representations; for example, see studies by Halle (1995), Clements and Hume (1995), Rice and Avery (1993), and McCarthy (1988), among others. It was in this scenario that Brown (1998) established her idea of FM in adult L2 acquisition. A brief introduction of the basics of FM is given in the following section.

Feature Model in L2 Phonology

An important question the researchers faced at the end of the previous century was to determine the basis of perception for an L2 sound. Browman and Goldstein (1990) thought that articulatory gestures provide a basis for perception of new L2 sounds. A listener gets image of articulation of a sound on hearing it; but Guion, Flege, Akahane-Yamada, and Pruitt (2000) along with Ladefoged (1990) thought that L2 perception was based on phonetic details. They suggest that acoustic signals hit the auditory system and develop a picture of the sounds in the mind of listeners. Thus, while the former researchers consider articulatory phonetics as the basis of perception, the latter consider acoustic phonetics responsible for perception of a sound. Brown, on the other hand, believed that it is phonological feature which provides a proper base for developing a particular perceptual category of an L2 sound. Thus, she claimed that acquisition of an L2 sound is basically acquisition of the relevant feature(s) required to identify and differentiate it from the closest sounds (Brown, 1998). Brown conducted a series of research to confirm her hypotheses. She arranged perception tests with subjects who were native speakers of Japanese, Korean and Chinese. In all these tests, she realized that only those new pairs of sounds were successfully comprehended by the participants which were differentiated based on active phonological features of their L1 FG. She developed the FM with an empirical support from these experiments.

Brown also believed that perception preceded production (Brown, 2000). According to her model which was later called Feature Model, new born babies have access to universal grammar (UG) which is operative in L1 acquisition. In adult age, access to UG remains active in the learners but ability to acquire a new feature terminates. As a result, an adult L2 learner can acquire a new sound but s/he cannot acquire a new feature. In other words, a new sound can be acquired in adult L2 when the required feature is already active in the L1. We shall explain it with an example from Arabic and Saraiki. Saraiki is a language which has voiceless stops and implosives on labial, coronal and dorsal places of articulation (Bashir & Connors, 2019).

On the other hand, Arabic has only voiced stop on labial place of articulation. Thus, in this context, if an Arabic learner of English tries to acquire Saraiki as L2, s/he will come across two new consonants on labial place of articulation, namely implosive labial /ɓ/ and voiceless labial stop /p/, whereas Arabic (L1) has only one plosive i.e., /b/ on this place of articulation. From the point of view of FM, these two new consonants of Saraiki (/ɓ/ and /p/) will pose a different level of difficulty for these learners. At initial stage of learning, the adult learners will equate both implosive /ɓ/ and voiceless labial stop /p/ with the closest L1 stop that is voiced labial stop /b/. However, with some exercise and practice, the learners may develop a different perceptual category of voiceless labial stop /p/, but it is extremely difficult for these learners to develop a separate perceptual category for implosive labial /ɓ/. This is because voiceless labial stop /p/ is differentiated from voiced labial stop /b/ by one feature which is [voice], but an implosive labial is differentiated from an explosive voiced labial plosive /b/ on the basis of feature /constrictive glottis/ (Clements & Hume, 1995).

Arabic learners of English are already familiar with a contrast which is based on the feature voicing. For example, they have consonant pairs like /s z/, /t̪ d̪/ or other such pairs which are differentiated because of voicing contrast. This is what Brown calls active phonological feature in L1. The feature [voice] is active in Arabic. On the other hand, Arabic does not have any single implosive consonant which means the feature /constricted glottis/ which is needed to differentiate an implosive from the corresponding explosive sounds that is not active in Arabic. In this context, the FM would predict that an Arabic learner can develop a separate conceptual category for voiceless labial stop without assimilating it with the corresponding voiced labial stop but they may not develop understanding of an implosive stop and will always confuse it with the corresponding explosive stop at the same place of articulation.

If we survey the difficulties that Arabic learners of English face in learning new English sounds, we discover that adult Arabic learners find it difficult to differentiate English /p/ from /b/ and /v/ from /f/. These pairs are differentiated by the feature [voice] and this feature is active in Arabic. Thus, we hypothesize based on the predictions of the FM that Arabic learners of English are expected to resolve this difficulty with some practice and understanding. The current study was designed to test this hypothesis. A detail of research methods adopted in this study are explained below.

As pointed out earlier, to our understanding and knowledge, there is no previous study on this topic in the context of Arabic learners of English which is conducted to test the FM predictions. Although a huge body of literature is available on difficulties of acquisition of [p-b] contrast with focus on English as L2, no previous study has addressed this issue with a view to testing the predictions of FM. The current study is conducted with a specific aim to fill this gap in the literature.

Parallel to the FM, Flege (1995) supported his Speech Learning Model (SLM), and Best (1995) forwarded her ideas in the Perceptual Assimilation Model (PAM). However, both these models, PAM and SLM, are based on the phonetic perception of learners. PAM is for naive learners and doesn't fit for adult learners of an undergraduate programme who have been learning English for a long time. Both models base their predictions and hypotheses on the perception of learners. This is quite a subjective approach to measuring the level of difficulties for adult learners. On the other hand, FM is based on a solid yardstick which is the activation of a phonological feature in the L1 of learners. That is why, Larson-Hall (2004) after comparing the SLM with FM, concludes that the latter is better than the former in its predictability of the learners' difficulties. Although all three models are still used in studies on second language acquisition (e.g., see Best et al., 2019; Chang, 2019; Syed & Saleem, 2019), this study prefers to test the predictions of the FM because of its clarity of predictions.

Methodology

Data Collection

The main aim of the study was to find out if a group of adult L2 learners can perceive and differentiate two confusing sounds, one of which does not exist in the L1, but the relevant

differentiating feature is active in the L1. This wider aim was obtained in determining whether Arabic learners of English can differentiate labial /v f/ and /p b/ consonants differentiated by the feature voicing which is active in Arabic.

Participants

A group of 16 students (8 from each gender) of English undergraduate program from a public university in the Kingdom of Saudi Arabia participated in this study. The age of male participants ranged between 19 and 26 years (M=21.13, St. Dev=2.30) and of female participants between 21 and 23 years (M=21.75, St. Dev=0.71).

All participants speak the Saudi northern dialect, which is native to Arar, northeast Saudi Arabia. They began learning English in public schools at the age of eleven, during their intermediate years. All participants were born and raised in Saudi Arabia, and none had any previous experience studying or living overseas. Throughout the experiment, students were enrolled in university levels 3–7.

The selection of the participants was based on availability and convenience sampling technique. This is most frequently used sampling technique for data collection in experimentation in the field of applied linguistics. After receiving permission from Northern Border University Institutional Review Board (IRB) the researcher started the recruitment process. Participants were informed of the risks and advantages of participating in the study and promised that their replies would be kept anonymous. They were made aware that they were not required to participate and could choose not to answer any of the questions or quit at any point without having to justify their decision. Before beginning the investigation, participants signed the informed consent form.

Instruments

There are two experiments in this study. For the first one (an identification test), a set of 20 words of English were selected, 17 of which had target words on different positions. The target words carrying the stimuli on different syllable positions are listed below.

/p-b/ sounds on onset and coda of a syllable

Beeb, beep

/p-b/ and /f-v/ sounds on syllable-coda

rope, robe, tab, tap, leave, leaf, safe

/p-b/ and /f-v/ on syllable-onset

bore, pore, pack, back, fat, vat,

/v-f/ on word-medial position

rifle, rival

Along with this, three control words were added to the list to confirm the reliability of the whole data collection process. The control words were 'car, coke, and bus'. The word 'car' was added twice in the list. Another purpose of adding these words was to conceal the real purpose of the text from participants. It was an identification test.

Another experiment in this study was a lexical discrimination test. In this test, pairs of words recorded in the voice of native speakers of British English were played. The participants were asked to determine whether they heard two different words, or the same word repeated. They noted their response on an answer sheet. (The answer sheet is given in Appendix A & B). The purpose of using two experiments was to double check the results obtained in one experiment. Normally, a discrimination test is considered easier, but an identification test may pose difficulty for participants. Therefore, the main aim to include two tasks in the experiment was to obtain data which is more reliable and valid.

Data Analysis

Two tests were used in this study. In the first test, a list of target and control words were played with a five millisecond inter-stimulus interval in a mixed order and the participant students were asked to identify the words of English that they were hearing. The stimuli for each participant were randomized computationally in notepad and the control words were placed in the beginning and end of the target stimuli. Normally participants are nervous in such experiments in the beginning, or sometimes they start feeling bored and/or tired by the end of the experiment. To avert the impact of nervousness and boredom, the control stimuli were placed in the beginning and at the end of the target list so that the natural and real responses of the participants are obtained about the target stimuli. The participants were provided with an answer sheet on which they wrote their answers. The words were played slowly so that the participants could hear and write their answers conveniently. The researcher collected the answer sheets after they had completed the test and evaluated them. One mark was awarded for each correct entry and zero mark was awarded for the incorrect ones.

In the second test, pairs of words which comprised of some words repeated twice and in some pairs two different words making minimal pairs of /v f/ and /p b/ contrast were played. The sequence of word-pairs carrying similar and different words was randomized so that the respondents were unable to guess the correct answer. The participants determined whether they heard one word repeated twice or two different words in the pair. The pair of words used as stimuli are listed in the first column of Table 5 below. One mark was awarded for each correct response. Some pairs were too simple and out of context in this test. The purpose of using these pairs in this test was to confirm the reliability of the methods of data collection used in this test.

The stimuli in this experiment were words with different vowels. In the previous literature, it is pointed out that vowels may influence comprehension of the listeners. Other than this, the target consonants were also tested on word-initial, -medial and -final positions. These are treated as repeated conditions in the quantitative data analysis section that follows. Besides, the participants were in two groups, male and female. Thus, gender is also being treated as an independent variable. Keeping in mind the nature of variables involved in the

analysis, a repeated measures analysis of variance (RMANOVA) is being applied on the results. Before that, reliability of the data is determined in the following sub-section.

Reliability of Data

In the list of stimuli four distractors consisting of common English words were added along with the target words. These words were used as control tokens for determining reliability of the tools. These words are those which almost every student of English at undergraduate level is expected to know. Table 1 shows results of identification of the control words.

Table 1

Results of Identification of Control Tokens

Token	N	Mean	Std. Deviation	Accuracy (%)
Bus	16	0.88	.35	88
Car	16	1.00	.00	100
Car2	16	1.00	.00	100
Coke	16	1.00	.00	100

As the data in Table 1 shows, students obtained 88 % accuracy in identification of one distractor word ‘bus’ and 100% accuracy in the other two i.e., ‘car’ and ‘coke’. These results are an indicator of excellent reliability of the experiment process. Another important thing is that exactly same statistics were obtained from female and male participants. (That is why results obtained from both groups are cumulated in Table 1). This also increases the level of reliability of data. Both groups performed the activity at different times and places.

Table 2

Reliability in Lexical Discrimination Test Based on Control Pairs

Pairs	N	Mean	Std. Deviation	Accuracy (%)
Bus-Car	16	0.94	0.25	94
Rice-Rice	16	1.00	0.00	100
Saver-Safe	16	0.94	0.25	94
Coke-Coke	16	1.00	0.00	100
Cole-Bus	16	1.00	0.00	100

These were simple pairs of words easy to understand for any learner of English at an undergraduate level. The participants obtained minimum 94% and maximum 100% scores in discrimination of these pairs. This shows extraordinarily excellent accuracy of data and reliability of the test methods. Detailed results of the target stimuli are presented in the following section.

Results

Two tests were used in this study namely, identification test and lexical discrimination test. The results of both tests are presented in the below sub-sections, one by one. First, we present the results of the identification test.

Results of Identification Test

Table 3 shows mean scores of male and female participants. Standard deviations are given in parentheses. These are mean marks awarded out of one mark. It means those who have scored one mark identified all tokens of that stimulus accurately, and those who scored zero mark means they did not identify a single token of the target stimulus. There are two contrasts in this set of stimuli namely, /v-f/ and /b-p/. These consonants occur in different word positions in these tokens. A description of the results of both pairs are given in Table 3.

Table 3

Gender-based Results of Identification Test

Tokens	Female	Male
Beeb	0.13 (0.35)	0.63 (0.52)
Rope	1.00 (0.00)	0.65 (0.46)
Beep	1.00 (0.00)	0.00 (0.00)
Bore	1.00 (0.00)	0.50 (0.53)
Robe	0.75 (0.46)	0.75 (0.46)
Pore	0.88 (0.35)	0.50 (0.53)
Pack	1.00 (0.00)	0.37 (0.52)
Back	1.00 (0.00)	1.00 (0.00)
Tab	0.13 (0.35)	0.63 (0.52)
Tap	0.88 (0.35)	0.25 (0.46)
Leave	1.00 (0.00)	0.75 (0.46)
Leaf	1.00 (0.00)	0.75 (0.46)
Fat	1.00 (0.00)	1.00 (0.00)
Vat	1.00 (0.00)	0.63 (0.52)
Rival	1.00 (0.00)	0.63 (0.52)
Rifle	1.00 (0.00)	1.00 (0.00)
Safe	0.00 (0.00)	0.50 (0.53)

Excellent results are seen in the identification of /v f/ phonemes by the participants. Except for 'safe', female candidates scored 100% marks in identification of all other words carrying /v/ and /f/ consonants. Male students have shown 63% and above accuracy in identification of these words which is not bad. It is a rather very good result. In /v f/ contrast, the difference in position of the consonant (initial, medial, and final) in the words is only marginally non-significant ($F=4.20$, $df=2$, $p=0.08$, effect size=.069). In the Muchley's test, sphericity was assumed because the test result was non-significant ($p=.874$).

In identification of the words carrying labial stops, the participants have scored relatively poor marks. Their results range between 25% and 50% for identification of /p/ in different words. Even their identification of words carrying /b/ is also not so good although this consonant is common in Arabic and English. The effect of vowels on perception was determined by analyzing words ‘beeb, beep, robe, rope, tab, tap as repeated conditions. The results of RMANOVA show a significant effect of Gender ($F=8.223$, $df=1$, $p=0.012$, Effect size=.739) and vowel ($F=8.66$, $df=2$, $p=0.015$, effect size=.195) on identification. Vowel and gender also interact significantly ($F=49.54$, $df=3$, $p=0.0001$, effect size=.450) in identification of these sounds. The test was conducted with an assumption of sphericity because Muchley’s test yielded non-significant result ($p=.319$).

To show the effect of gender on perception of two groups of learners, we separately list the words in identification of which, male and female students differed significantly. Table 4 shows results of comparison of means obtained by applying a t-test on these results. Only in the tokens listed in Table 4, the performance of male and female was significantly different from each other.

Table 4

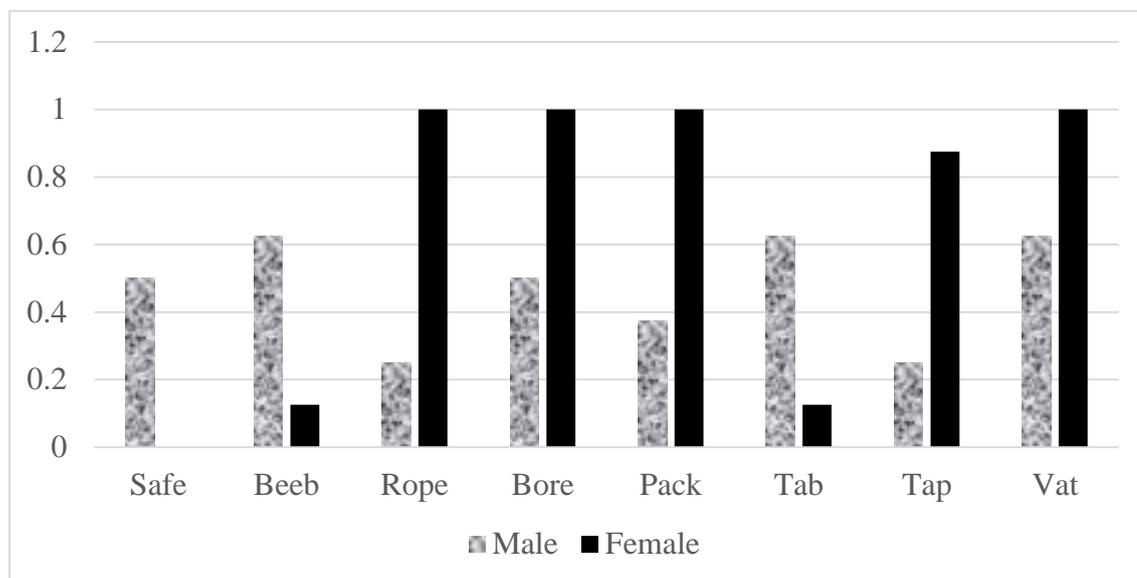
Gender-based Differences in Perception

Tokens	t	p
Rival	2.049	.060
Safe	-2.646	.019
Beeb	-2.256	.041
Rope	4.583	.003
Bore	2.646	.019
Pack	3.416	.004
Tab	-2.256	.041
Tap	3.035	.009
Vat	2.049	.060

The results of these words are reflected in a gender-wise graph below to depict a real picture of performance of both groups.

Figure 1

Gender-wise Performance of Participants



In this figure, it is clearly visible that female participants performed better than male participants in identifying the words ‘vat, tap, pack, bore, rope’ whereas male participants performed better than female participants in identifying the words ‘safe, beeb, tab.’

Lexical Discrimination Test

In Table 5, results of lexical discrimination test are given. A test was applied on these results to determine the effect of gender on perception. The results show that overall gender does not have any effect on comprehension of participants. In other words, both male and female students performed equally well on this test. Another series of t-test was applied on words to determine if any single pair of words has any effect on perception of participants. Among the five available pairs only robe-robe pair had significance of difference ($t= 2.236$, $p=0.041$,) of gender. Other pairs having /v-f/ ($F=14.00$, $p=0.005$) and /p-b/ ($F=11.118$, $p=0.005$) contrasts have only significance in positions but in gender both did not have any significance of difference ($p> 0.05$). The effect of word position was thus non-significant for both pairs. The following chart reflects accuracy percentage in comprehension of participants of the target word-pairs with the labial consonants on onset and coda position in different words.

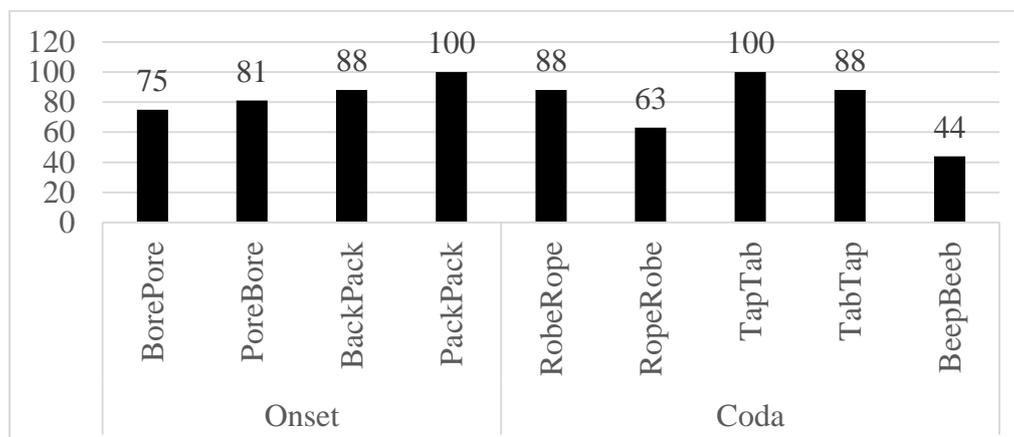
Table 5*Discrimination Test Result*

Word-pairs	N	Mean	Std. Deviation
Rival-Rifle	16	0.94	0.25
Rifle-Rival	16	0.94	0.25
Beeb-Beeb	16	1.00	0.00
Beep-Beep	16	0.44	0.51
Rope-Rope	16	0.88	0.34
Robe-Rope	16	0.88	0.34
Rope-Robe	16	0.62	0.50
Bore-Pore	16	0.75	0.45
Pore-Bore	16	0.81	0.40
Bore-Bore	16	1.00	0.00
Pore-Pore	16	0.94	0.25
Back-Pack	16	0.88	0.34
Pack-Pack	16	1.00	0.00
Pack-Back	16	0.94	0.25
Back-Back	16	1.00	0.00
Tap-Tab	16	1.00	0.00
Tab-Tap	16	0.88	0.34
Leave-Leave	16	1.00	0.00
Leave-Leaf	16	0.94	0.25
Leaf-Leaf	16	0.81	0.40
Vat-Fat	16	1.00	0.00
Fat-Vat	16	0.94	0.25

The following figure better reflects the performance of participants on target pairs when words are on onset and coda positions.

Figure 2

Participants' Accuracy (%) in Discrimination



This figure shows that the participants performed excellent (with 100% accuracy) in the discrimination of ‘tap-tab’ and ‘pack-pack’ pairs. They also performed better (with 88% accuracy) in the discrimination of ‘tab-tap, robe-robe, back-pack, pore-bore’ pairs. Their performance in discrimination of ‘rope-rope’ (with 63% accuracy) and ‘bore-pore’ (with 75% accuracy) pairs was not bad. Seen in this perspective, Arabic learners of English are overall very good in discrimination of /v/ from /f/ and /p/ from /b/. However, these data do not allow to determine whether the perception of the participants was better on onset or coda position because in some pairs they performed better on coda and relatively poor on onset but in others they performed the other way round. A discussion and brief analysis of these results are given in the following section.

Discussion

This study was conducted with an objective to test the prediction of the FM (Brown, 1998, 2000) that a new L2 sound can be discriminated from the closest L1 sound if the feature required to differentiate between the two is active in the L1 FG. The main research question tested in this study is whether Arab learners of English can perceptually discriminate between /p/ and /b/ and /v/ and /f/ in English. These pairs of sounds pose difficulty to adult Arab learners of English. The above results clearly indicate that Arab learners can perceive /v/ and /p/ consonants of English in different contexts accurately. They can also identify these consonants in different contexts. It means they can quite successfully learn to produce these consonants of English with correct pronunciation if proper teaching methodology is adopted in the classrooms.

The findings of this study are in accordance with those of Brown. Brown conducted her experiments with adult native speakers of Japanese, Korean and Chinese who were learning English in universities. The participants of these experiments successfully perceived those pairs of sounds which were different from each other in respect of the active phonological features of their L1. Thus, the results of this study further confirm the predictions of the FM. The FM is already tested on the speakers of languages like Japanese, Chinese and Korean. It was not

tested on Arab learners of English before. The current study widens the scope of the FM extending its predictions to the learners of English in Saudi Arabia.

Two tests were conducted with two groups of participants in this study. Equal number of male and female participants were included in this experiment. In the discrimination test, participants of both genders did very well. A discrimination test is normally used to test sensitivity of listeners for pairs used as stimuli (Nagle & Baese-Berk, 2022). However, in the identification test, female students performed slightly better than male students. The reason for this is that male students who participated in this study had completed three semesters, but female students were in 7th semester at the time when this experiment was conducted. The study of the role of gender in second language learning is a popular field of study these days (Noor & Bepari, 2023). Gender has been found to have a significant role in L2 learning (Van Der et al., 2015).

Depending on the nature of the test, identification is considered relatively more difficult than discrimination because in identification test listeners must identify a word and state it accurately. A minor misperception may lead to a wrong answer. But in a discrimination test, listeners' decision is based on the existing differences between tokens. Thus, there is not that much workload on the human mind in a discrimination test that participants normally have in an identification test. Therefore, the participants of this study performed better in the lexical discrimination test. The following table reflects the errors made by male (M) and female (F) participants. The table gives us an idea of which sound was replaced with which ones by the participants cumulatively.

Table 6

Nature of Errors in Identification of Labial Consonants

Replacement Target	→	V	F	p	b	th	Mis
Rival			M= 3				
Bus				M=2, F=1			
Safe		M=4				F=8	
Rifle		M=1					
Beeb				M=1, F=7			M=2
Rope					M=5		M=2
Beep				M=5	M=1		M=2
Bore				M=2			M=2
Robe				M=1, F=2			M=1
Pore					M=4, F=1		
Pack					M=5		
Tab				M=1			M=2, F=6
Tap			M=1		M=3		M=2, F=1
Leave			M=2				
Leaf		M=2					
Vat			M=3				

Seen in a comparative perspective, the participants of this study performed better on fricative /v/ than on plosive /p/. This is in accordance with the previous research. A large body of existing research has already pointed out this difficulty (e.g., see Iverson et al., 2008) for /v/ and Syed and Bibi (2024) for /p/. Voiceless labial stop is a constant source of difficulty for adult Arabic learners of English. The reason for this level of difficulty lies in the phonetic nature of these consonants. /v/ is a fricative which is produced with a hissing noise but /p/ is a stop which does not have as strong noisy acoustic correlates. As a result, listeners can perceive /v/ more easily than /p/ because of the former's strong acoustic signals. This finding also supports the general principle that perception precedes production (Flege, 1995). Perhaps it is because of this factor that vowel effect on perception of /p/ is significant but that on perception of /v/ is non-significant in this study. A negatively influencing factor may have significant effect on only difficult area of learning and /p/ is the most difficult consonant for adult Arab learner of English.

To sum up the findings of this study, it is verified that Arab learners of English can develop ability to discriminate /v/ from /f/ and /p/ from /b/ during the developmental stage of ESL/EFL while learning English as a second or foreign language. If they can perceive the difference between /v/ and /f/, and /p/ and /b/, they will also be able to produce these consonants properly, because accurate perception leads to accurate production. The study also provides empirical support to the FM. It is the first study of its nature which confirms the predictions of the FM, thus extending it to Saudi Arabic learners of English.

Finally, it is also necessary to point out the limitation of this study. The sample of the study comprises of only 16 participants, 8 male and 8 female student learners of English in a public university of Saudi Arabia at undergraduate level. For further evidence to support this study, another large-scale experiment may be designed comprising of a large number of participants of different levels of learners speaking different dialects of Arabic. The findings of such a study may be generalized over the learners of the whole Arab world. Production test along with comprehension may also be included in such a study.

Conclusion

The study aimed to test the predictions of the FM that adult learners of L2 may learn to comprehend and produce new sounds if the relevant features which differentiate between the new sounds and the corresponding L1 sounds are active in the FG of the L1. To test this hypothesis, a perception experiment comprising of discrimination and identification tasks was designed for 16 adult learners of English whose mother tongue was Arabic and who were studying in a university of Saudi Arabia at undergraduate level. /p/ and /v/ of English were taken as new sounds which are normally confused with /b/ and /f/ of Arabic respectively, by Arab learners of English. Both these L2 sounds are differentiated from the corresponding L1 sounds on the basis of the feature voicing which is active in Arabic. Almost all dialects of Arabic differentiate between voiced and voiceless consonants. The results of this experiment confirm that learners from Saudi Arabia can differentiate between /p/-/b/ and /v/-/f/ pairs of sounds in English in production and comprehension with some effort.

Based on the findings, the study concludes that the FM prediction is correct that adult learners of an L2 can differentiate a new phoneme from its closest neighbouring sound if the relevant feature required to differentiate the two sounds is already active in the FG of their L1. The results support this view.

Pedagogical Implications

These findings have significant implications for learners of English in Saudi Arabia. Teachers of English may prepare a list of difficult areas of adult learners and see if the required grammatical feature is already active in the L1 of the learners. In this way, all difficult areas of learning may be divided into more difficult and less difficult. More concentration is required on more difficult areas, but less difficult areas may also be addressed in this way. Thus, depending on the existing models of second language, we can plan a large-scale study program for learners of English in the Arab world to address their difficulties even in the field of L2 syntax because FM is also extendable to syntax (Herschensohn & Arteaga, 2015). This could be a potential project for the researchers in Saudi Arabia.

The implications of use of the FM become promising for Arabic learners of English in the perspective that the FM also believes in readjustment of already acquired features in L2 learning (Kwon & Starr, 2023). Since Arabic has a very rich FG with its special set of emphatic consonants, it may provide an interesting ground to the researchers working on the theory of SLA with reference to the FM to see if a rich L1 FG can also contribute to adult L2 learning positively. An empirical study of contribution of emphatic sounds of Arabic in acquisition of English consonants is a future project for the author.

Bio

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Appendix A

Answer Sheet No. 1 Lexical Identification Test

Participant No.

Age:

Gender:

Class:

S. No.	Words
1	
2	
3	
4	
5	
6	
7	
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9	
10	
11	
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16	
17	
18	
19	
20	
21	

Please listen the file and write in the relevant cell the word that you have heard.

Appendix B

Answer Sheet No. 2 Discrimination Test

Participant No. Age: Gender: Class:

S. No.	Same repeated twice	Different words
1		
2		
3		
4		
5		
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7		
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10		
11		
12		
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14		
15		
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17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		

Please hear the pair of words and decide by ticking in the relevant box if the two words or different or one word repeated twice.