جامعة عمر المختار
كلية التربية ـ البيضاء
مجلة كلية التربية (مجلة علمية محكمة)
العدد الثالث لعام 2018

DOI: https://doi.org/10.54172/744cc583

The Acquirement of English Vowels by Arabic Learners: A study of Production and Perception.

Idris Abdulaziz Sultan
Department of English
Faculty of Education
Omar Al-Mokhtar University
Al-Bayda, Libya

Abstract

It is commonly agreed that adult foreign language (FL) speech learning is strongly influenced by the learners' first language (L1). This study examines the effect of the L1 vowel system on native Arabic speakers' production and perception of English vowels. Fifteen Libyan students from Omar Al-Mukhtar University (College of Education) who had been Learning English between 1 and 4 years participated as speakers and listeners, and the CD of English vowels as a comparison for the production test. The isolated English vowels [i ɪ eɪ ɛ æ u ʊ oʊ ɒ ʌ] produced in a carrier sentence to the group. The results showed that, in general, the Arabic speakers' productions of the vowels that have Arabic counterparts were as intelligible as the CD production and were significantly more intelligible than the vowels lacking obvious Arabic counterparts. In a perception task, the Arabic speakers identified the five front English vowels, [i ɪ eɪ ɛ æ], produced by the CD. The results of the perception test were not completely consistent with those of the production test, indicating that FL production may not always be related to perception in a straightforward way and that the relationship between perception and production is a complex issue. In addition, the spectral overlap in the vowel pairs [i]-[ɪ] and [ɛ]-[æ] apparently caused intelligibility problems. The results suggested that the dense distribution of FL vowels in the area of the vowel space where the L1 vowel system is less crowded may have caused some of the difficulties the FL learners experienced in producing and perceiving these vowels.

Keywords— speech learning, Arabic speakers, foreign language, English vowels.

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

جامعة عمر المختار
كلية التربية – البيضاء
مجلة كلية التربية (مجلة علمية محكمة)
العدد الثالث لعام 2018

الملخص

بشكل عام متفقون على أن المتعلمين للغة الأجنبية يتأثرون بلغتهم الأولى. هذه ألدراسة تختبر تأثير نظام الأصوات المتحركة للغة الأولى على المتحدثين العرب من حيث إنتاج الأصوات والقدرة على فهم وإدراك الأصوات المتحركة للغة ألانجليزية. خمسة عشر طالب من جامعة عمر المختار بكلية التربية كانوا يدرسون اللغة ألانجليزية في مدة تتراوح ما بين سنة وأربع سنوات شاركوا كمتكلمين ومستمعين, والقرص ألمدمج المحتوي على أصوات أللغة ألانجليزية كمقارنة لاختبار ألإنتاج. ألأصوات الانجليزية المنعزلة [i ɪ eɪ ɛ æ u ʊ oʊ ɒ ʌ] أبرزت في جملة متضمنة لهذه ألأصوات إلى المجموعة المستهدفة. النتائج بينت في العموم أن نتاج ألأصوات من قبل المتكلمين العرب للأصوات الانجليزية التي لها نظائر في اللغة ألعربية كانت كإنتاج القرص المدمج وكانت أكثر وضوحا من ألأصوات التي ليست لها نظائر في اللغة العربية. في جانب القدرة على الفهم ميز ألمتكلمين العرب ألأصوات الانجليزية ألأمامية ألخمسة [i ɪ eɪ ɛ æ] ألتي أنتجت بالقرص المدمج.نتائج اختبار ألفهم لم تكن متوافقة مع نتائج اختبار الإنتاج، وهذا يشير بأن نتاج المتعلمين الأجانب للأصوات لا يرتبط دائما بطريقة الفهم والإدراك بسهولة, وأن تلك العلاقة بين ألفهم والإنتاج هي قضية معقدة، بالإضافة إلى أن التوافق الطيفي في أزواج ألأصوات [ɪ]-[i] و [æ]-[ɛ] سبب مشاكل في ألفهم والإدراك على ما يبدو. ألمحت النتائج بأن التوزيع الكثيف للأصوات المتحركة في اللغة الأجنبية عنها في نظام الأصوات ألمتحركة في اللغة الأولى وكذلك قلت ونقص اكتظاظها سبب بعض من الصعوبات للمتعلمين للغة الأجنبية من حيث اكتساب الخبرة في إبراز ونتاج ألأصوات والقدرة على الفهم والإدراك لهذه ألأصوات.

Introduction

The students who learn a foreign language generally do not produce the phones of the foreign language (FL) in a perfectly native-like manner. This problem remains one of the most enduring and challenging research topic in the field of speech perception and production in foreign language learning. Researchers have examined this issue from various perspectives. Some of the important factors that influence foreign/second language speech learning, including the effect of age and first language interference will discuss. In addition, in this chapter will mention some information about Arabic vowels, and common theoretical approaches to foreign language speech learning will be discussed along with previous empirical studies .

Therefore, it important to compare the structures of the native language and the target language in order to predict the learners 'difficulties. The cross-linguistic differences in the Contrastive Analysis Hypothesis (CAH) approach cover all aspects of language as well as culture. This discussion will focus only on segments. According to the CAH, the areas of difficulty in L2 phonemes are mainly caused by the differences between the phonological systems of the L1 and L2. For

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

example, a segment is predicted to be difficult to learn if it exists in the L2 but not in the L1.

A learner will have trouble perceiving and producing the new segment. As a result, he will substitute some other phoneme from his native sound system, (Lado, 1957). This model accounts for some of the common problems with certain L2 learners. For example, the problem with Japanese speakers in learning the English segments /ɹ/ and /l/ is commonly believed to be caused by the lack of the /ɹ/ and /l/ contrast in the Japanese sound system .

In fact, several studies have shown that Japanese speakers have difficulty perceiving this distinction (Sheldon & Strange, 1982, Flege, Naoyuki & Mann, 1995, among others). In his study, (Cebrian,1996) found that the CAH was useful in isolating the potential possibility of transferring L1 phonological rules by Catalan speakers when learning English. However, the CAH has been criticized for not being able to account for the degree of difficulty corresponding to typological markedness in the prediction of problems that L2 learners face (Eckman, 1977, Odlin, 1989). It also fails to explain the individual differences among learners who have less difficulty with particular sound segments that are predicted to be a problem because of their absence in L1. For example, (Munro, Flege, Mackay,1996) found that there were important individual differences in native Italian speakers' English vowel productions. The present study involving Arabic speakers will further test the CAH by examining their success in Learning to produce sounds that are missing from their L1 phonological inventory.

1.1 Arabic Vowels

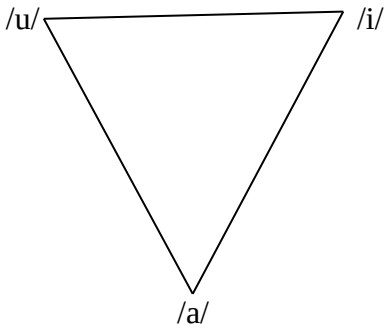
Previous studies have indicated that for both theoretical and empirical reasons, the relationship between the sounds of different languages cannot simply be evaluated by comparing the phoneme inventories (Bohn & Flege, 1992). Since the sounds in two languages often show different acoustic and articulatory characteristics, a phonetic description is necessary (Odlin, 1989). Talking about vowel descriptions within the framework of the Cardinal Vowels, the American researcher G. Oscar Russell stated that 'phoneticians are thinking in terms of acoustic fact, and using physiological fantasy to express the idea. This comment has since proved to be true for the largely impressionistic quadrilateral

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

representations of vowel systems of the world's languages. And Arabic is by no means an exception.

Any general description of Arabic vowels tends to start with the famous vowel 'triangle' of the 'fundamental' vowels, as they were first called by (W. Gairdner,1925), the pioneer of modern Arabic phonetics and the first to place the Arabic vowels within the Cardinal Vowel diagram**.**

Figure 1. Classical Arabic vowel triangle



Mitchell reported that 'the vowel system of Classical Arabic/Modern Standard Arabic is a simple one of three vowel units or phonemes – open, close front, close back – with a superposed short/long distinction applicable to all three' (1993 : 138), whereas he also clearly relates the vowels of the classical language to the Cardinal Vowels, i.e. Any investigation of the sounds of 'Arabic' throws up many tendentious issues related to the existence of a normative variety alongside local dialects (many of them mutually unintelligible), a phenomenon known as diglossia. The terminology used by early modern phoneticians for the normative speech variety confused the issue even more, with Gairdner using the terms Classical Arabic (CA) and Literary Arabic, whereas Cantineau referred to ancien arabe (whose vowels he lumped together with ancient sémitique). The most common term used to denote the modern descendant of Classical Arabic (the language of the Quran) – known in Arabic as /fusʕħɑ at-tura:θ/ ('pure <speech>') - is 'Modern Standard Arabic (MSA)'.

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

This may be associated with Ferguson's 'High style' (1959) or Sa'id al-Badawi's (1973) //fusʕħɑ at-tura: θ /, i.e. 'heritage / fusʕħɑ / (i.e. the most classically pure form)'. Belkaid (1984), for her part, preferred to call the highest formal register 'Classical Arabic as it is realized today', proposing a Modern Literary Arabic 'in opposition to Classical Literary Arabic and dialectal Arabic'. Far from referring to the existence of a 'received' acrolectal pronunciation, the above terms above all reflect a normative use of the grammar and lexis in very formal contexts, and are thus primarily rooted in a grammar- rather than a speech (or pronunciation)-based approach. In terms of pronunciation, it seems that within this context it is difficult to commit oneself to anything more than 'careful speech', implying the pronunciation of Classical Arabic phonemes, and the avoidance of dialectal variants (e.g. /q/→ /ʔ/, /g/; /dˤ/ /-/ /zˤ/; / θ / /s/, /t/; /ð/ →/z/, /d/) and 'unclassical' vowel phonemes like /e/ and /o/. The phonological and phonemic variations have on the whole received far less attention. 5 Matters are further complicated by the supraformal register of Quranic recitation (/tadʒwi:d/, /qirɑ:?a/), which is perceived by Western scholars and Arabic-speakers alike to reflect the Classical Arabic sounds most closely.

This pronunciation, within which any dialectal influence is eschewed, is wholly restricted to liturgical uses and is the subject of rigorous training as well as of a distinct theological discipline in accordance with historical precepts. It is this style which the most recent authority on Arabic phonetics, T. Mitchell (1990-3), referred to as 'High Classical Pronunciation' (HCP) or 'Classical Arabic Reading Style' (CARS), though it should be added that he, himself, blurred the issue by using 'the Classical language', 'High Classical Style', 'CARS', and CA/MSA interchangeably to denote this speech variety.

The first acoustic study of Arabic vowels, which was also the first and hitherto only full-blown phonetic study of Arabic sounds, was that by S. al-Ani (1970). Afterwards, Arabic vowels were the subject of acoustic research by Ghazeli (1979), Belkaid (1984), and Abou Haidar (1994), with F. Mitleb (1984) concentrating on vowel length only. An examination of these studies reveals the following. Firstly, nearly all profess to render the values of what is, irrespective of the labels used, essentially MSA, as spoken by respondents from various dialectal areas, with Iraqi by al- Ani (eight respondents, with additional data gathered from two Jordanian speakers), Tunisian for Belkaid, whereas Ghazeli included a number of informants (12) from six different Arab countries (Algeria, Tunisia, Libya,

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

Egypt, Jordan, and Iraq) with the inclusion of dialectal segments in the corpus (without however providing an indication as to the proportion of non-MSA entries, nor of the values of the individual speakers). Abou Haidar, too, produced a comparative study, involving 8 informants from as many different linguistic backgrounds (Qatar, Lebanon, Saudi Arabia, Tunisia, Syria, Sudan, United Arab Emirates, and Jordan). The second thing all these studies, bar one, have in common is that the data are based on spectrogram readings (though al- Ani did for some sounds also rely on X-rays). Abou Haidar was the only one who availed himself of modern DSP methods. Thirdly, one should comment on the discrepancies in the segments investigated. While al-Ani only gives exact values for /i, u, a/ and only ranges and deviations for allophones, Ghazeli focused exclusively on /i, i:, u, u:/, with Belkaid excluding vowels in pharyngealized contexts. Abou Haidar was the only one to provide values of the allophone of /a, aù/ next to pharyngealized consonants, /q/ and /r/ (/ɑ, ɑ:/). When it comes to the data corpus, one must remark on both the relatively small sample sizes and variation in approach by the researchers .

Al- Ani used vowels in isolation and an unspecified number of CV sequences, minimal pairs and short phrases (though he does put the total number of spectrograms at 2000, which also includes phrases and sentences used for the purposes of investigating syllable and stress patterns), whereas Belkaid relied on 70 words (50 of three syllables and 20 of three), with vowels in CV and CVC contexts, examining a total of 110 long vowels and 50 short vowels. Abou Haidar's findings were based on 232 monosyllabic words (CVC). Arabic vowels, and posited that the existence of more open varieties of the close vowels (ɪ, ʊ) is linked to syllable type. Belkaid aimed to test the results arrived at by al-Ani and Ghazeli, with additional attention to the effect or stress and syllable type on the quality of the vowels. Abou Haidar examined the Modern Standard Arabic vowel system in a broader perspective, postulating a cross dialectal structural stability in perception.

1.2.The Relationship Between Perception and Production

The effective learning of an L2 segment involves both perception and production. It is often assumed that production has a perceptual basis and that good perception generally precedes good production. In first language acquisition, young children all go through the stage of perceiving the sounds of their L1 before they learn to produce them. In a foreign language classroom, it is not uncommon

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

for teachers to practice the discrimination of certain L2 sounds before they actually let the students try to produce them. Furthermore, even such common terms as 'imitating' and 'mimicking' all imply a perceptual basis for production. Previous studies concerning L2 segmental perception have very seldom involved parallel production studies. In theory, Flege's Speech Learning Model (SLM) strongly implies that production has a perceptual basis.

According to the (SLM), an L2 speaker's success in perceiving at least some differences between the L1 and L2 sounds is considered to be the basis for the establishment of new phonetic categories for the L2 sounds. This success in perception will presumably lead to successful production of the L2 sounds but not vice versa. If a bilingual speaker is unable to discriminate an L2 vowel from either the neighboring L2 vowels, or from the L1 vowels that are different from the L2 vowel phonetically, the L2 vowel will be produced inaccurately (Flege, 1995). Therefore, L2 vowel production errors arise from the failure to discriminate certain L2 vowels. (Flege,1995) reported that native Korean subjects failed to discriminate the English front vowel pairs /i/ /ɪ/ and /ɛ/-/æ/ in a perception test. The Korean subjects also had problems in producing these vowel pairs. The results showed that their productions of the intended /i/ and /ɪ/ tokens were often misidentified as each other, as were their /ɛ/ and /æ/ tokens. Some counter-evidence to the proposa1 that perception precedes production was found in a study by (Sheldon & Strange,1982) who examined the production and perception of the English /ɹ/ and /l/ by native Japanese speakers. They found that Japanese learners were somewhat more successful in producing a contrast between /ɹ/ and /l/ than in perceiving the distinction between the two sounds. They concluded that perceptual mastery of an L2 contrast does not always precede the learners' ability to produce 'acceptable tokens' of contrasting phonemes. (Blankenship,1991) also reported in her study that although Spanish bilinguals were not always able to perceive differences in FL vowels, they were able to produce all the necessary FL vowel contrasts in both a reading task and in an interview. These findings were in contrast to the common belief that perception precedes production. The present study will test whether production has a perceptual basis using natural vowel tokens.

2. The problem statement:

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

The purpose of this study is to explore the problems that native Arabic speakers have with the perception and production of English vowels. The main focus is to discover which English vowels are perceived and produced well by native Arabic speakers and which ones are not. It will be considered whether success or failure in the production of English vowels is explicable in terms of sound correspondences between the native language (Arabic) and the FL (English). With regard to foreign language speech learning theory, this study will test the Contrastive Analysis Hypothesis which predicts specific problems in FL speech learning by comparing the inventories of the L1 and FL. A careful examination of previous studies also reveals complexities in the methodology of studying FL vowels. One problem is that vowels have often been identified or rated for accent in the context of the surrounding consonants, which could have an effect on the listeners' judgment of the vowels. However, the use of isolated vowels in an intelligibility test is not ideal either because in real communication, vowels are rarely produced or heard in isolation.

The aims of this paper:

1. The primary goal of this paper will discuss some of the important factors that influence foreign/second language speech learning, including the effect of period (age) and first language interference. It also focus on the differences and similarities between the Arabic and the English vowels.
2. This study examines the effect of the (L1)vowel system on native Arabic
3. speakers' production and perception of English vowels, and sheds light on the relationship between perception and production .
4. This paper also examines the usefulness teaching method through the two experimental which help the teachers in predicting problems faced by Arabic speakers learning the English vowel system.

Methods:

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

Participants

In Experiment 1 fifteen Arabic speakers were recruited as paid subjects (eight males and seven females). They all came from same area and spoke Standard Arabic all the participants had learned English in secondary school before they came to the university Age of learning English as a foreign language (age at which English instruction began in Libya) varied from 10 to 16 years with a mean of 11 years.

Recordings

Individual recordings were made in the English language LAP the experimenter then explained the reading tasks to clarify any possible problems concerning the reading lists to the subject.

In each case, the subject was told to prepare the reading list by reading silently once before recording to reduce the likelihood of reading errors or hesitations. During the recording phase, if a target word was mispronounced accidentally, the subject was asked to repeat the word with the entire sentence. The CDs contain English words list which consisted of 13 English vowels in /bvt/ or /bvk/ words, /bv/ combinations and isolated /v/ production They were words or syllables containing the 13 English vowels: /i/, /ɪ/, /eɪ/, /ɛ/, /æ/, /u/, /ʊ/, /oʊ/, /ɒ/, /Λ/,/ʒ/,/aɪ/,and /ɑu/. The words were written in standard orthography: beat, bit, baie, bet, bat, boot, buwt (same vowel as in 'book'), boat, bot, Bert, but, bite, and bout. In instances where the desired tokens were not real words, for example, ‘bot’, a “sounds-like” example ‘pot’ was given just beside the target “word”. The real English word ‘bought’ was avoided for the intended vowel/ɒ/because English learners are sometimes confused by the many possible pronunciations of “ough” in English (e.g., though, through, cough, rough).

The only word that ends with a /k/ instead of /t/, ‘book’, was given as a special precaution to elicit the correct vowel /ʊ/ just in case some speakers could not produce the 'word' buwt. In order to keep the target vowel in their productions, the speakers were instructed to read the /bvt/ word that contained the target vowel first followed by the /bv/ and then by the isolated /v/. Both the /bvt/ words and /bv/ combinations, as well as the isolated /v/ were read in the carrier sentence “How I Say ” . The speakers were told to read the list at normal speed.

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

4.3. Listeners(Judges)

The listeners were three foreign lecturers of English in English department (one male and two females).

4.4. Listening Test

A total of 750 vowel tokens (10 vowels x 15 speakers x 5 randomizations) were used for the intelligibility test. They were blocked in separate sets of front and back vowels of 150 each for each listening session. Individual listening sessions were held in English language LAP. Each listener completed 10 self-paced sessions in approximately eight minutes per session. In most cases, the front and back vowel stimuli (five sessions each) were identified in alternate sessions. The listeners performed the task on a computer using speech playback software (Munro, 1996). The stimuli were all presented at a comfortable listening level through a speaker connected to the computer in a English LAP. The listeners were permitted to hear the CD sound only once. During the front vowel sessions, seven phonetic symbols [i ɪ eɪ ɛ æ ɒ Λ**]** were attached to the relevant keys on the keyboard. The two back vowels **[**ɒ Λ**]** were also included among the labels for the front vowel task because they provided possible choices for some potentially ambiguous front vowel tokens.

During the back vowel sessions, eight phonetic symbols [u ʊ oʊ ɒ Λ æ ɛ ɪ**]** were used. The three front vowel symbols [æ ɛ ɪ] were included for the back vowel sessions for similar reasons. Each listener was instructed to press the key labeled with the symbol corresponding to the vowel heard. Different stimulus randomizations were used for each session and for each listener. Before the listening task, the experimenter explained the identification task to the listener carefully to make sure that he or she understood the task thoroughly. The identification data were collected automatically by the computer and saved for subsequent analysis.

Experiment In 2 the same 15 native Libyan students who participated in Experiment 1 as speakers all participated as listeners in this experiment. The listening task was carried out in a sound-treated room immediately after the Libyan speakers finished the production task reported before.

5. Procedures

The Experiments :

In first experiment, fifteen students their native language is Arabic production of 10 English vowels [i ɪ eɪ ɛ æ u ʊ oʊ ɒ Λ] be identified by three

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

lecturers of English department as a listeners. The purpose of this experiment is to evaluate the success of the native Arabic speakers in producing these vowels. The experiment is designed to address the following issues. First, it will indicate how intelligible the Arabic accented vowels are to the three lecturers of English listeners in comparison with the CD sound productions of the same 10 vowels.
Second, it will establish whether some vowels produced by the Arabic speakers are more intelligible than others, and if so, which ones. The results of Experiment **1** indicated that, in general, the 15 Libyan speakers' productions of English vowels that have Libyan analogs. It is not clear how this pattern in production is related to the speakers' perception. This study will examine the relationship between production and perception of FL vowels using natural vowel tokens. The same 15 Libyan students who participated in Experiment 1 will all participate as listeners in Experiment 2. They will identify five English front vowels [i ɪ eɪ ɛ æ] in CV combinations produced by the CD. If their success or failure in FL vowel production is tied to their ability to perceive L1 vowels, it is expected that their success or failure in identifying the five English front vowels should correspond to their production in Experiment 1.

It is often assumed that good perception precedes good production and that failure to produce an FL sound accurately tends to reflect the lack of a good perceptual representation for that sound. As discussed in chapter **,** Flege's Speech Learning Model posits that an accurate perceptual representation of a sound will eventually be realized in production (Flege, 1995). However, some possible counter-evidence to this proposal was reported in a study by (Sheldon & Strange**,**1982), who examined the production and perception of English **/ɹ/** and /l/ by native speakers of Japanese. They found that Japanese learners were somewhat more successful in producing the contrast between **/ɹ/** and /l/ than in perceiving the distinction between these two sounds. This outcome led them to the conclusion that perceptual mastery of an L2/FL contrast does not always precede the production of the contrasting phonemes. **A** parallel result for vowels was found in a study by (Blankenship,1991**).** The perception test in this study will further explore the relationship between FL vowel perception and production by Libyan learners.

Recordings collected in an earlier study (Munro & Derwing, 1996) were used as listening material. The CD productions of the words *beat, bit, bait, bet* and *bat* representing the five English front vowels [i ɪ eɪ *ɛ* æ] were all produced in a carrier sentence ("How **I** say ") in sentence final position.

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

The words for identification were printed on a multiple-choice response sheet with the final (t) in brackets in the order of *bea(t), bi(t), bai(t), be(t) and ba(t)* in a single line. There were two sections of 100 numbered lines each, with a space after every five lines. Listeners were instructed to circle the word among the five given words they thought they heard for each item. A voice announced the number of the next item the listener was going to hear on the tape to minimize errors in circling words.

The rate at which the listeners heard these words was fixed, and they were not permitted to stop the tape once they started listening.

The task, which lasted 20 minutes, was performed in a sound-treated room through headphones with one listener participating at a time. Five sample items were given to familiarize the subjects with the procedure before the actual task began. A preliminary screening of tokens was carried out by two trained phoneticians (one male and one female) who lecturers of English department. The error rates for the two listeners were 2% and 5.5% respectively.

RESULTS

Figure (1) shows the mean percentage of correct identifications (pooled over three listeners) of the 10 vowel productions by The CD and 15 native Arab speakers. Overall, it can be readily seen that the Arab speakers vowels were lack by comparison with the CDs' vowels. On average, the Arabic speakers' English vowels had a correct identification rate of 69% as compared to those the vowels of the CD. Tests of simple main effects revealed that the Arabic speakers' productions of **[** ɪ ɛ æ ʊ ɒ] were significantly less well identified than the corresponding vowel productions by the CDs sound. However, the Arab speakers' productions of [i eɪ u oʊ Λ **]** were about as intelligible as those of the CDs' vowels. Figure 2-1 depicts an interesting pattern in the vowels that were produced with high intelligibility to listeners (lecturers). In general, the Arab speakers' productions of English vowels that have Arab counterparts were significantly more intelligible than those that had no counterparts. However, the vowel **[Λ]** was found to be inconsistent with this pattern. The correct identification rate for this vowel was 76% for the native Arab speakers**.** No obvious explanation could be found for this exception at this stage.

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

To explore further the misidentified Arab speakers 'vowels, a confusion matrix was created (averaged over the three listeners) and is presented in Table 1. The data indicated that the majority of misidentified **[ɪ]s** were heard as [i]s (37%). A considerable number of [ɪ]s were also heard as [eɪ]s (11%). For the poorly identified [u], which had a correct rate of identification of only 15%**,** the most common misidentification was [u] (47%). A considerable number of [u]s were also heard as [oʊ]s **(**34%**).** The confusion patterns for these two vowels suggested that the nearest tense vowels of the L1 were substituted by the native Arab speakers for the FL categories that they had not yet learned to produce successfully. The same pattern also applied to [ɒ], whose misidentified tokens were heard as [oʊ]s most of the time (28%). However, this substitution of the nearest vowel with L1 counterparts could not explain the Arab speakers' performance on the other poorly identified vowels. For example, for the misidentified [ɛ]s, more [æ]s were heard (19%) than [eɪ]s (13%). Furthermore, the incorrectly identified [æ]s were almost all heard as [ɛ]S (38%). Only 1% of [æ]s were heard as [eɪ]s. The confusion data for [ɛ] and [æ] indicated, the Arab speakers' [ɛ] and [æ] were mostly confused with each other rather with than [eɪ], the single category that exists in that area of vowel space in their L1 system. The majority of misidentified [ʌ]S were heard as [ɒ]s. The overall percentage of correct identifications of the vowels by each of the 15 Libyan listeners is given in Figure 2**.** Across listeners, on average, a total as the CD productions of *beat*, *bit*, *bait***,** *bet*, and bat. However, there was considerable variation among listeners in the correct rate of identifications. The best listener had a correct identification rate of 87%**,** while the worst had a much lower rate of 60%.

The correct percentage of identification for all five vowels by each individual listener is given in Table 3. Obvious differences in the listeners' performance on the vowels can be seen here.

To explore the between-vowel differences, a one-way repeated measures with five levels of vowel as a within-group factor was carried out. To investigate whether there were any consistent patterns in the perceptual errors, a confusion matrix giving correct percentages of identification for each vowel was created and is given in Table 4. The majority of misidentified [i]s were heard as [i]s (14%)' [ɪ]s as **[ɛ]s** (22%), [eɪ]s as [i]s (23%), [ɛ]s as [æ]s (21%), and [æ]s as **[ɛ]s** (18%). In general, the confusions indicated a consistent pattern of misidentification of the tokens as "adjacent" vowels. The confusion patterns observed here will be compared with those of the same participants' productions in the next section.

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

Between-vowel differences were also reflected in each individual listener's best or worst performances on the five vowels. As expected, on average, the best identified vowel was **[i].** However, one listener's identification of [eɪ] was 100% correct. The average correct identification for [æ] was 79%, which ranked it as the second best.

Even though the Libyan speakers did not identify significantly better or worse than any of the other four vowels, their production of [ɪ] was the least intelligible among the five front vowels in Experiment 1. Two listeners had their lowest identification scores on **[**i**] ,** while one listener performed the best on [ɪ]. Four listeners performed the best and two the worst on **[**ɛ**].** The individual listener's best and worst performances on each vowel are highlighted in Table 3. Considerable listener variation was also observed in the overall perception scores. For example, no single listener appeared to have performed the best on all five vowels. The listener whose average correct identification score was the highest among the 15 subjects heard [i] and [æ] correctly 100% of the time.

TABLE 1, this data collected from the result of experiment (1)
Confusion Matrix (%) for Libyan students' productions of English [i, ɪ, eɪ, ɛ, æ, u, ʊ, oʊ, ɒ, ʌ,] (The percentage of correct identification for each vowel is in bold face.)

Heard	i	ɪ	eɪ	ɛ	æ	u	ʊ	oʊ	ɒ	ʌ
i	96	37	1.5							
ɪ		46	0.25	4						
eɪ	4	11	96	13	1					
ɛ		6	2	63	38					
æ			0.25	19	53				0.25	2
u						97	47	15		
ʊ						2	15	0.5	2.75	5
oʊ						1	34	95	28	
ɒ					5		4	3	49	17
ʌ				1	3				20	76

TABLE 2, this data collected from the result of experiment (1)
Correct % of identifications of 15 Libyan students' productions of 10 English vowels

	i	ɪ	eɪ	ɛ	æ	u	ʊ	oʊ	ɒ	ʌ
AR.1	100	0	100	90	80	95	0	100	25	65
AR.2	100	0	100	15	90	100	0	100	95	65
AR.3	45	25	80	25	55	95	0	95	5	85

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

AR.4	100	45	100	100	15	75	30	95	40	90
AR.5	100	60	100	15	15	100	10	65	60	40
AR.6	100	40	100	75	100	100	90	100	35	90
AR.7	100	5	100	30	30	100	5	100	80	100
AR.8	100	60	100	70	95	100	15	100	10	90
AR.9	100	75	95	75	100	100	0	100	75	40
AR.10	100	90	100	45	90	100	0	100	90	75
AR.11	100	85	100	95	100	100	25	95	85	90
AR.12	100	75	100	100	10	100	10	95	40	95
AR.13	100	0	85	20	15	100	0	100	45	75
AR.14	100	55	100	95	0	95	10	100	40	95
AR.15	100	80	75	100	5	90	25	85	15	50

Figure 1 The mean % of correct identifications of each English vowel by three listeners (lecturers)

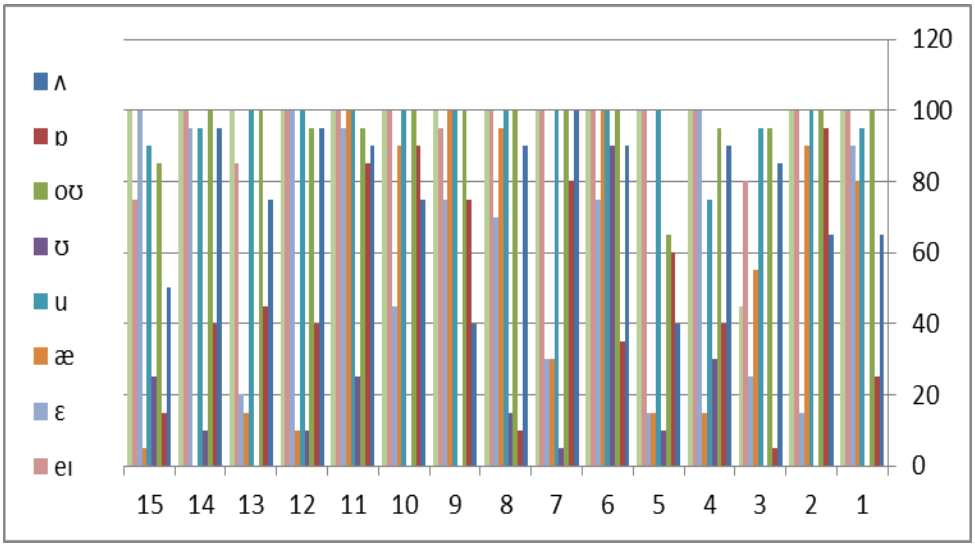


Table 3, this data below according the result of experiment (2), .
Correct identifications of English (i, ɪ, eɪ, ɛ,æ) by 15 Libyan listeners.

	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
i	90	73	55	63	83	100	78	95	98	80	95	90	83	75	95

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

ɪ	63	85	55	93	68	78	58	70	53	80	90	78	78	60	85
eɪ	64	100	69	92	58	78	50	64	33	22	50	69	61	69	61
ɛ	72	69	53	78	25	81	41	81	84	91	81	59	84	59	81
æ	78	64	81	83	67	100	94	89	100	67	94	56	72	61	81

Figure 2: Individual Libyan listeners perception scores (%) for English (i, ɪ, eɪ, ɛ,æ) produced by the CD.

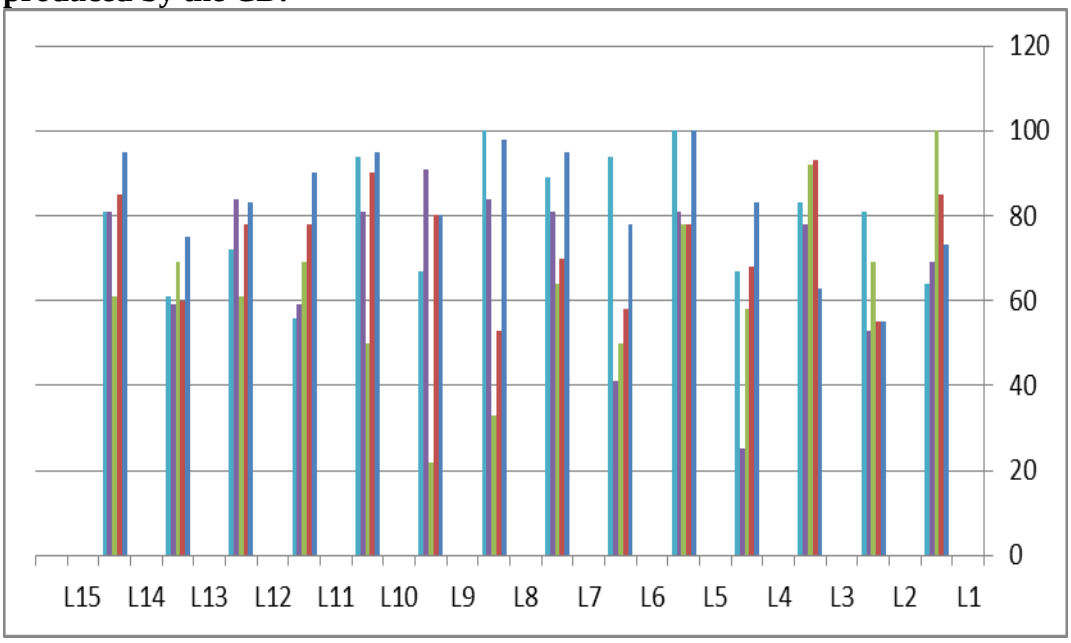


Table 4, this data below according the results of experiment(2)
Confusion Matrix (%) for students listeners' perceptions of English (i, ɪ, eɪ, ɛ,æ)

Target / heard	**i**	**ɪ**	**eɪ**	**ɛ**	**æ**
i	83	2	23	0	1

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

ɪ	14	73	12	6	1
eɪ	1	2	63	3	1
ɛ	2	22	1	69	18
æ	0	2	1	21	79

DISCUSSION

In general, the Arabic speakers' productions of English [i eɪ u oʊ Λ] were as intelligible as those of the CD. The success may be in part due to the fact that most of these vowels have Arabic analogs (with the exception of [Λ]) and that the speakers may have, to some extent, made use of L1 vowel categories in their productions of FL vowels. Conversely, the native Arabic speakers' [ɪ ɛ æ ʊ ɒ] were found to be significantly less well identified than their productions of [i eɪ u oʊ] and than the native English speakers' [ɪ ɛ æ ʊ ɒ] indicating that at least some of them had not learned to produce the vowels without L1 counterparts (except [ɒ]) successfully.

However, two important discoveries of exceptions need to be further explored. First, among vowel categories that do not have obvious Arabic counterparts, [Λ] was not significantly less well identified than the vowels that have apparent L1 analogs.

On the other hand, [Λ] was not found to be significantly better identified than [ɒ æ ɛ], suggesting that there were still some differences in degrees of intelligibility between [Λ] and all the other well identified vowels. A second important finding was that the Arabic speakers' productions of [ʊ] were significantly less well identified than not only the vowels that have L1 counterparts but also the ones that do not have L1 counterparts. Why did the Arabic speakers have particular difficulty with this vowel ? Some possible answers may be revealed upon detailed examination of the confusion data. The confusion pattern for [ʊ] showed that an overwhelming number of [ʊ]s were heard as [u]s and [oʊ]s, the two adjacent vowels that have Arabic analogs. parallel confusion pattern was found for the second least well identified vowel [ɪ]. The majority of misidentified [ɪ]s were heard as [i]s and **[**eɪ]s**,** the two nearest vowels that have Arabic analogs as well.

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

The confusion patterns for these two vowels were similar, although their absolute correct identification scores were different.

Although the Arabic speakers' problems in producing these two vowels were similar as the confusion data suggests, more speakers had trouble with their production of [ʊ] than [ɪ]. The results of Experiment 1 showed that there were apparently more speakers who produced totally unintelligible [ʊ]s than [ɪ]s. One possible reason for this difference may be due to the varying orthography representing the lax back vowel as compared to the relatively simple orthography which represents the front lax vowel. However, as special consideration was given to [ʊ] in the English reading list used in this study. The orthography problem should not be a factor for the poor intelligibility of **[ʊ]** observed. Another factor might be Arabic speakers' trouble in keeping the lax vowels in isolation in the reading task, assuming that [ʊ] could be more intelligible in the word 'book' than in isolation produced in a carrier sentence. The vowel [ʊ] is relatively more restricted in distribution than [ɪ] in English. For example, 'it'/ɪt/, and 'is' /ɪs/ are real words but no words may begin with [u] in English. It may be relatively easier to produce an isolated [ɪ] than an isolated [ʊ]. Further studies are needed before any firm conclusions can be made about this discrepancy in identification scores. For the other poorly identified Arabic speakers' back vowel [ɒ], the confusion pattern showed that the majority of the misidentified [ɒ]s were heard as [oʊ]s (28%), an adjacent vowel in the Arabic system. A considerable number of [ɒ]s were also heard as [ʌ]s, an adjacent vowel in English. The confusion pattern suggested that some of the native Arabic speakers had avoided simply substituting [oʊ] for [ɒ]. There is also an [ɑ] or [ʌ]. It is possible that some Arabic speakers produced a more [ʌ]-like English [ɒ] that was misidentified as the English **[ʌ].** Obviously, the perception data failed to support the prediction that both [il and [eɪ] would be better identified than **[**ɪ ɛ æ] Even though [i] was the best identified vowel on average, the picture was complicated by the fact that [eɪ]was significantly less well identified than [i] and [æ], and was the least well identified vowel among the five. Given that the Libyan speakers' productions of [i] and [eɪ] were both highly intelligible to the English lecturers listeners in Experiment 1, and both have obvious counterparts in Libyan, it was surprising to see this dramatic discrepancy in the Libyan listeners' perception scores. One possible explanation for such a discrepancy might have to do with the differences in the L1 and FL vowel inventories. While English distinguishes five categories [i ɪ eɪ **ɛ** æ] in the whole front area, Libyan contrasts only two [i eɪ]. The squeezing of three additional

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

categories [ɪ ɛ æ] into this area of the vowel space may have a distracting effect on the native Libyan listeners' identification of [eɪ]. It would probably be much easier for the Libyan listeners to discriminate only [i] and [eɪ] in the perception test. Such distraction seemed to have relatively less influence on the Libyan listeners' identifications of [i]. This is probably because [i] is a peripheral vowel. It is interesting to note that [æ], the second best vowel identified by the Libyan listeners, is the other peripheral vowel in this front area. The perception data also failed to support the prediction that the Libyan listeners would have more problems in identifying [ɪ ɛ æ] because these vowels were less successfully produced in Experiment 1 and because they do not have obvious Libyan counterparts. As the results of the statistical tests indicated, although [i] was the best identified vowel of the five by the Libyan listeners, it was not significantly different from [ɪ ɛ æ] in terms of correct rate of identification. Moreover, in contrast to the results of the production test in Experiment 1, the Libyan listeners' perception of [æ] was significantly better than that of [eɪ] . To conclude, data from this identification test failed to support the prediction that native Libyan listeners would perform better in their identification of the English [i eɪ] than [ɪ ɛ æ].

Conclusion

The results of this experiment showed that, in general, the 15 Arabic speakers' productions of English vowels that have Arabic analogs were significantly more intelligible to the listeners (lecturers) than the vowels that do not have Arabic analogs. The Arabic speakers' success in their productions of vowels with L1 counterparts was remarkable because their percentage of correct identifications was comparable by the listeners (lecturers) with the CD sound of these vowels. The results suggested that there were strong effects of L1 on the production of FL vowels for the Arabic speakers. It is possible that some Arabic speakers simply substituted their L1 vowels in their productions of English vowels. It is also possible that some of them made a little adjustment in an effort to approximate the FL vowels in their productions. (Munro,1993) concluded from his study of native Arabic speakers' productions of 10 English vowels that there were 'pervasive' effects of L1 experience on the production FL vowels. The results of the intelligibility test seemed to partially support the Contrastive Analysis Hypothesis (CAH) which predicts that sounds that do not exist in the L1 will be

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

more difficult to learn, as the Arabic speakers did have problems with **[ɪ ɛ** æ ʊ]. However important points involving the CAH need to be discussed. First, CAH cannot explain the differences in level of difficulty the Arabic speakers had in their production of vowels that do not have L1 counterparts. For example, the Contrastive Analysis Hypothesis does not predict that **[ʊ]** would be more difficult than **[ɪ ɛ** æ **ʌ]** for the Arabic speakers to learn as the results of this study have shown. Secondly, the CAH cannot account for the individual speaker variation in the production of FL sounds. For example, for the poorly identified Arabic accented vowels [ʊ] and [ɪ], each vowel had one speaker whose production was 90% correctly identified.

Similarly, three speakers produced a perfect [æ] while another speaker produced a completely unidentifiable [æ] (0%). Therefore, it is important to point out that while some vowels without L1 counterparts are more difficult for some or even a majority of FL speakers to produce, they are not necessarily difficult for every FL speaker.

Individual speaker differences in FL speech learning are an important factor that cannot be ignored in future studies. As discussed before, in a study by Munro, (Flege, and Mackay,1996) which involved the study of native Italian speakers' 11 English vowel productions, the results showed that individual differences in speakers' success were found for most of the 11 vowels. They concluded that because of these individual variations, the between-vowel differences in native-like achievement were 'somewhat overshadowed' (Munro, 1996). The present vowel production test with native Arabic speakers demonstrated again that individual speaker variation is an important factor to take into consideration in future studies. The results of the two experiments showed that there was considerable inconsistency in success between Libyan students' perception and production of the five English front vowels. The expectation that accurate production of FL sounds has a clear perceptual basis was not fully supported by this study. The statistical analysis indicated a marginal correlation between perception and production of the five front vowels. For the English front vowels that lack Arabic counterparts, [ɪ, ɛ, æ], there was a tendency toward better perception than production. For the two front vowels that have Arabic counterparts,
[i, eɪ], the opposite tendency, better production than perception, was observed.

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

References:

1- Abou Haidar, L. (1994): 'Norme linguistique et variabilité dialectale: analyse formantique du système vocalique de la langue arabe', Revue de Phonétique Appliquée, 110, pp. 1-15.

2- Al-Ani, Salman (1970): Arabic Phonology, Janua Linguarum Series Practica, 61, The Hague/Paris: Mouton.

3- Belkaid, Yamina (1984): 'Les voyelles de l'arabe littéraire modern. Analyse spectrographique', Travaux de l'Institut de Phonétique de Strasbourg, 16, pp. 217-240.

4- Ghazeli, Salem (1979): "Du statut des voyelles en arabe", Analyses-Théories, Etudes Arabes, Nos. 2-3, pp. 199-219.

5- Mitleb, Faris (1984): 'Vowel length contrast in Arabic and English: a spectrographic test', Journal of Phonetics, 12, pp. 229-235.

6- Mitchell, T. F. (1990-1993): Pronouncing Arabic, 2 vols., Oxford University Press.

7-Blankenship, B. **(199**1). Vowel perception in second language. *UCLA Working Papers in Phonetics, 80,* 38-64

8-Bohn,O.-S., Flege, J. (1992). The production of new and similar vowels by adult German learners of English. *Studies in Second Language Acquisition*, 14, 13 1-1 58.

9-Cebrian, J. (1996). *Voicing in final obstruents and the transfer of phonological rules in Catalan-English inter-language.* Unpublished master's thesis, University of Toronto.

10-Flege, J. (1995). Second language speech learning: theory, findings, and problems. In W. Strange (Ed.), *Speech perception and linguistic experience: Issues in cross-language research* (pp. 233-277). Baltimore: York Press.

11-Flege, J. Naoyuki, T. & Mann, V. (1995). Japanese ad ilts cm learn to produce English /ɹ/ and /l/ accurately. Language and Speech,38, 25-55.

12-Sheldon, A., & Strange, W. (1982). The acquisition of Ir/ and N by

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©

Japanese learners of English: Evidence that speech production can precede speech perception. *Applied Psycholinguistics,* 3,243-261.

13- Munro, M., & Derwing, T. (1996). The effects of speaking rate on the cornprehensibility of native and foreign-accented speech. ***Canadian Acoustics, 24(3), 2*** 1.

14-Munro, M., Flege, J., & MacKay, 1. (1996). The effects of age of second language learning on the production of English vowels. ***Applied Psycholinguistics,*** 17, **3 13-334.**

15-Munro, M. (1993). Productions of English vowels by native speakers of Arabic: Acoustic measurements and accentedness rating. ***Language and Speech, 36,*** 39-66.

16-Odlin, T. (1989). ***Language transfer: Cross-linguistic influence in language learning.*** Cambridge: Cambridge University Press.

17-Eckman, F. (1977). Markedness and the contrastive analysis hypothesis. *Language Learning, 2 7,* 3 15-3 **3** 0.

18-Lado, R. (1957). ***Linguistics across cultures: Applied linguistics for*** 2***language teachers.*** Ann Arbor, ***MI:*** University of Michigan Press.

19-Al-Badawi, al-Said (1973): Mustwayat al-`Arabiya al- mu`asira fi Misr, (Levels of contemporary Arabic in Egypt), Cairo: Dar al-Ma`arif.

20-Gairdner, W. H. T. (1925): The phonetics of Arabic. A phonetic inquiry and practical manual for the pronunciation of Classical Arabic and of one colloquial (Egyptian), London: Humphrey Milford, Oxford University Press.

21-Ferguson, Charles A. (1959): Diglossia', Word, 15 pp. 325-340.

.The Author(s). This open access article is distributed under a CC BY-NC 4.0 license ©