TRAINING AMERICAN-ENGLISH SPEAKERS IN THE PERCEPTION AND PRODUCTION OF ARABIC EMPHATIC CONSONANTS

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Abstract

The present study investigated the role played by communicative pronunciation instruction as opposed to the traditional form-based approach in the perception and production of Arabic emphatic-plain contrasts by beginning-level English-speaking learners of Arabic. The participants in this study were 19 English-speaking students enrolled in ARAB 110 for the Fall of 2017 in the Department of African and African-American Studies at the University of Kansas. Nine participants were randomly assigned to the experimental group and the other ten participants were assigned to the control group. The participants in the experimental group received instruction based on the communicative pronunciation unit designed for this study in addition to the in-class listen-and-repeat drills, whereas the participants in the control group received only in-class listen-and-repeat drills. The study consisted of perception and production tests (i.e. pre-tests) followed by a period of 90 minutes of instruction. The period of instruction was then followed by the same perception and production tests (i.e. post-tests). The instructional period focused mostly on presenting the target emphatic-plain consonant contrasts in minimal pairs through a variety of formats. The pre- and post-tests were (a) two perception tasks, i.e., a discrimination task and an identification task and (b) a production task. The results indicated a positive effect of both the communicative and traditional form-based approaches. Even though no statistically significant differences between the perception and production pre- and post-tests across the participants in the control and experimental groups were found, numerical differences do exist in favor of communicative pronunciation instruction.

Dedication

This dissertation is dedicated to the late Dr. Mahmoud Abou-Elfath. May Allah shower His unending mercy upon his soul.

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CHAPTER 1: INTRODUCTION

Adult English-speaking learners of Arabic confront several common pronunciation problems in their Arabic language acquisition process. Hayes-Harb and Durham (2016) pointed out that English-speaking learners of Arabic "are faced with a rich consonant inventory involving unfamiliar places of articulation for consonants (i.e., uvular and pharyngeal), in addition to a secondary articulation associated with the so-called emphatics" (p. 558). The emphatic consonants, as opposed to the plain ones, are produced with a primary constriction that usually occurs in the dental or alveolar region and a secondary constriction that occurs in the back of the vocal tract (Jongman, Herd, Al-Masri, Sereno, & Combest, 2011). The inventories of Arabic and English consonants are in tables 1.1 and 1.2 below.

Table 1.1: Consonant inventory of Modern Standard Arabic (adapted from Hayes-Harb & Durham, 2016)

	Bilabial	Labio-dental	Inter-dental	Alveo-dental	Palatal	Velar	Uvular	pharyngeal	glottal
Stop	b			d t dˤ tˤ		k	q		ʔ
Fricative		f	ð θ ðˤ	z s sˤ	ʃ		χ	ʕ ħ	h
Affricate					dʒ				
Nasal	m			n					
Liquid				l					
Tap/trill				r					
Glide	w				j				

Table 1.2: Consonant inventory of English (adapted from Saadah, 2011)

	Bilabial	Labio-dental	Inter-dental	Alveolar	Palatal	Velar	Uvular	pharyngeal	glottal
Stop	b p			d t		g k			
Fricative		v f	ð θ	z s	ʒ ʃ				h
Affricate					dʒ tʃ	ŋ			
Nasal	m			n					
Liquid				l					
Tap/trill				ɾ					
Glide	w				j				

This secondary articulation characteristic of the emphatic consonants is called pharyngealization (e.g. Jongman et al., 2011; Odisho, 1981; Saadah, 2011). Odisho (1981) reported that emphatic consonants are perceptually and articulatory problematic for English-speaking learners of Arabic. He argued that the emphatic consonants are articulatory difficult because of the secondary constriction, which he calls "the backing gesture", that occurs in their production simultaneously with the primary constriction (p. 277). In a more recent study, Shehata (2015) concurred in that Arabic emphatic consonants have been "found to be difficult to perceive and produce" by English-speaking learners of Arabic (p. 24).

The Arabic emphatic consonants consist of two fricatives and two stops; the emphatic fricatives are the voiced interdental /ðˤ/ and the voiceless denti-alveolar /sˤ/ and the emphatic stops are the voiced denti-alveolar /dˤ/ and the voiceless denti-alveolar /tˤ/. The Arabic plain consonants, i.e., / ð/, /s/, /d/, and /t/ are articulatory similar to their English counterparts and hence do not pose any articulatory problems for English-speaking learners of Arabic (Odisho, 1981). Odisho (2005) explained that “without a reasonable mastery of such consonant contrasts, the learner will not be able to distinguish the meaning of thousands of Arabic words” (p. 55). Hayes-Harb and Durham (2016) provide the minimal pair /dˤællæ/ “to wander” vs. /dællæ/ “to demonstrate” as an example to illustrate the emphatic-plain consonant contrast. Pharyngealization is effected by retracting the root of the tongue towards the back wall of the pharynx resulting “in a narrower pharyngeal passage and a raised larynx that lasts during the vowel articulation” (Saadah, 2011, p. 26). Following IPA practice, pharyngealization is represented by adding the diacritic ˤ above the emphatic consonant.

All the studies that described that acoustic correlates of emphasis provided evidence that the second formant frequency (F2) of vowels significantly lowers in the emphatic context. The inventory of Modern Standard Arabic vowels is in table 3 below.

Table 1.3: Vowel Inventory of Modern Standard Arabic (adapted from Hayes-Harb & Durham, 2016)

	Front	Back
High	i/i:	u/u:
Low	æ/æ:	

Card (1983) reported that lowering F2 was the only major acoustic cue for emphasis; the first formant frequency (F1) and the third formant frequency (F3) were not affected by emphasis. Similarly, Wahba (1993) reported no significant difference in F1 values in the emphatic and non-emphatic environments. However, F2 was significantly lowered in the emphatic environment. Al-Masri and Jongman (2004) reported that F2 of the vowel was significantly lowered in the emphatic context. However, they did not examine either F1 or F3. Khattab, Al-Tamimi, and

Heselwood (2006) reported significant lowering of F2 and significant raising of F1 in the emphatic environment. Al-Masri (2009) reported significant raising of F1 and F3 and significant lowering of F2 in the emphatic context. Jongman, Herd, Al-Masri, Sereno, and Combest (2011) reported significant raising of both F1 and F3 and significant lowering of F2 of vowels in the emphatic context. To sum, the consensus of all the acoustic studies that investigated the acoustic correlates of emphasis in Arabic is that F2 of vowels significantly lowers in the emphatic environment. Therefore, in this study only F2 of vowels in emphatic and plain contexts was measured.

In their 2011 study, even though Jongman and his collaborators found that emphatic stops, but not emphatic fricatives, exhibited substantial lowering of spectral means, native speakers of Arabic rely heavily on the acoustic cues on vowels, not consonants, to perceptually distinguish the emphatic and plain consonants. Similarly, Hayes-Harb and Durham (2016) showed that native English speakers who had never been exposed to either Arabic or any other language having emphatic consonants also rely heavily on the acoustic cues on vowels to perceptually distinguish the emphatic and plain consonants.

Addressing some practical procedures to teach the production of emphatic consonants, Odisho's (1981) argued that "the existence of the two vowel qualities /æ/ and /ɑ/ in English is of great help" (p. 278) in teaching the emphatic consonants to native speakers of English because allophonic variation of Arabic /æ/ in emphatic and plain contexts overlaps acoustically with the English phonemes /æ/ and /ɑ/. In addition, Odisho (2005) argued that the English vowel /ʌ/ that is close in quality to the English vowel /ɑ/ can also be used to generate sounds phonetically similar to the Arabic emphatic sounds; for example, the English words *suck, dumb, dull, sub,* and *sud* are phonetically similar to the Arabic words /sˤæk/ "closed", /dˤæm/ "embraced", /dˤæl/

“went astray”, /sˤæb/ “poured”, and /sˤæd/ “hindered”, respectively as opposed to their plain counterparts /sæk/ “monetized”, /dæm/ “blood”, /dæl/ “symbolized”, /sæb/ “swore”, and /sæd/ “closed”. However, Hayes-Harb and Durham’s (2016) study showed that “a strategy where learners rely on native English vowel contrasts to perceive Arabic emphatic-plain consonant contrasts should be less effective when the following vowel is /i/ or /u/, where the vowel allophones in emphatic and plain contrasts do not map differentially to the English vowel inventory” (p. 570).

Odisho (1981; 2005) and Hayes-Harb and Durham’s (2016) studies provided important pedagogical insights into teaching emphatic-plain consonant contrasts by emphasizing the importance of the acoustic cues contained in vowels, not consonants, in emphatic and plain contexts. However, only Odisho (2005) provided activities that could be used to teach the perception and production of emphatic-plain consonant contrasts; these activities are essentially listen-and-repeat drills that employ minimal pairs featuring emphatic-plain consonant contrasts. Therefore, this study has taken precedence over all other studies in innovatively applying these pedagogical implications by providing learners of Arabic with multiple opportunities to use Arabic in a more communicative and spontaneous way.

Problem Statement

Amayreh and Dyson’s (1998) study showed that the emphatic consonants are not fully acquired until the age of 6 by Arabic-speaking children. This could explain why learners of Arabic as a second/foreign language who have acquired sufficient grammar or vocabulary skills, after years of studying Arabic, may still have major difficulties in perceiving and/or producing the emphatic consonants appropriately. English-speaking learners of Arabic as a foreign language usually have limited opportunities to use the language outside the classroom.

Furthermore, “although some ESL/EFL instructors can successfully assist their students, many others are reluctant” (Derwing & Munro, 2005, p. 379). In addition, some instructors, mistakenly, may not realize the necessity or value of teaching the pronunciation of emphatic consonants. Finally, although few studies (e.g. Odisho, 2005) have provided some procedures to teach the perception and production of emphatic consonants, researchers have not provided empirical evidence that learners can successfully benefit from formal instruction to perceive and produce emphatic-plain consonant contrasts. In fact, only one perception study has relied on subjective naïve listeners’ judgment (e.g. Hayes-Harb & Durham, 2016) and none has provided objective analysis of acoustic information.

Purpose of Study

The main purpose of this study was to determine whether perception and production training is successful in improving the perception and production of emphatic-plain consonant contrasts. The perception and production training in this study incorporated the use of a communicative intervention along with the traditional form-based pronunciation teaching. This study aimed to determine whether learners of Arabic as a foreign language will improve their ability to perceive and produce emphatic-plain consonant contrasts and to use them successfully for different communicative purposes after communicative perception and production training. Even though perception of emphatic-plain consonant contrasts might not be problematic because of its saliency as suggested by Hayes-Harb and Durham (2016), incorporating perception into this study rendered it more comprehensive.

Research Questions and Hypotheses

The research questions were the following:

1. Does targeted communicative instruction on Arabic emphatic-plain consonant contrasts result in significant gains in the accuracy of perceiving and producing emphatic consonants?
2. Does vowel quality affect the ability to produce Arabic emphatic-plain consonant contrasts?

The research hypotheses were the following:

1. Learners who receive communicative instruction about the perception and production of Arabic emphatic-plain consonant contrasts will demonstrate significant gains in more accurate perception and production of Arabic emphatic-plain consonant contrasts.
2. There will be a difference in the ability to produce Arabic emphatic-plain consonant contrasts depending on vowel quality. More specifically, learners will be able to more accurately produce emphatic-plain consonant contrasts in the context of Arabic /æ/ than in the context of /i/ and /u/ as Hayes-Harb and Durham's (2016) predict.

Significance of Study

The value of this study was twofold. First, this study will help teachers of Arabic as a second/foreign language improve their students' ability to perceive and produce emphatic-plain consonant contrasts for more effective communicative use. Language learners need to develop their ability to perceive and produce the target language to accurately convey their messages in communication. Different from traditional practice, this study did not treat the learning of emphasis production as an automatic process; rather, learners learned explicitly through meaningful contexts. Learners who wish to develop better communicative abilities should greatly benefit from this intervention. Second, this study helped learners increase their awareness of the importance of accurate emphatic-plain productions in communication. Learners will develop their confidence to communicate by producing more accurate emphatic-plain consonant contrasts that would have long-term benefits for their overall oral proficiency development.

This study was also important to the field of Arabic pronunciation instruction. First, this study confirmed the effectiveness of perception and production communicative instruction of emphatic-plain consonant contrasts. Being trained for a relatively short period, learners developed their abilities to perceive and produce emphatic-plain consonant contrasts appropriately for communicative purposes. Evidence of the effectiveness of this intervention could be of great value in the field of Arabic pronunciation teaching; in other words, if there is limited time in the curriculum to teach the pronunciation of emphatic-plain consonant contrasts, instructors could focus on short interventions only, and students might still improve their ability to perceive and produce more accurate emphatic-plain consonant contrasts. Second, examination of the acoustic features of emphatic-plain productions should help instructors and researchers better understand to what extent explicit instruction affects learners' outcomes. Language instructors may help their students improve their pronunciation and speaking skills using communicative interventions. The teaching materials developed for this study could be a good starting point for Arabic language instructors.

CHAPTER 2: LITERATURE REVIEW

Why can we differentiate sounds in our native language but find sounds in foreign languages much harder to perceive and produce? And why are some sounds much easier to perceive and produce than others? These are some of the questions that have inspired extensive research and have led researchers to develop theoretical frameworks, such as the Native Language Magnet Model, the Speech Learning Model, and the Perception Assimilation Model to account for the especially complex process of how native and non-native sound systems are perceived and produced. It is worthwhile to note that all three models have been developed within segmental frameworks, and they are the "most commonly cited general models of cross-language speech perception" (Tyler, Best, Faber, & Levitt, 2014, p. 5).

The Native Language Magnet Model

The Native Language Magnet Model (NLM) (e.g. Iverson & Kuhl, 1995) and the Native Language Magnet Model, expanded (NLM-e) (e.g. Kuhl, 2000; Kuhl et al., 2008) have been developed to study native and non-native phonetic development in infants. Both versions of the model hold that infants categorize sound patterns into phonetic categories. As babies gain experience in their L1, they create, within the phonetic categories, perfect as well as poor examples of each native sound with a target area around it. These perfect and poor examples are called excellent exemplars (or prototypes) and poor exemplars (or nonprototypes), respectively. Prototypes (and nonprototypes) tune the child's brain to his or her native language. Once these phonetic categories are established, speech perception will not be equivalent within them due to a mechanism called the "perceptual magnet effect". In other words, "the best instances of the category are associated with reduced discrimination and perceptual clustering" (Iverson & Kuhl, 1995, p. 560). Interestingly, NLM-e makes predictions for speech production. Kuhl et al. (2008) argue that:

> Infants forge a link between speech perception and production based on perceptual experience and a learned mapping between perception and production (Kuhl & Meltzoff 1982, 1996). On this formulation, sensory learning occurs first, based on experience with language, and this guides the development of motor patterns. Infants' vocal play allows them to relate the auditory results of their own vocalizations to the articulatory movements that caused them, and this creates a learned mapping between the two. Infants strive to imitate the sounds they hear and are guided by the degree of 'match' between the sounds they produce and those stored in memory. (pp. 984-985)

Moreover, NLM makes predictions for adults learning a second language. Iverson and Kuhl (1995, p. 561) argue that adult L2 learners "would find it difficult to perceive a phonetic contrast from a new language when the sounds are proximate to a native-language prototype". This shift (from a language-general) to a language-specific pattern of speech perception makes learning an L2 more difficult. Once a phonetic category exists in the L1 learner's memory, "it functions like a magnet for other sounds" (Kuhl, 2000, p. 11853). In other words, the prototype attracts an L2 sound that is similar to an L1 sound so that it sounds like the prototype itself. This neural commitment to a previously learned structure interferes with the processing of new L2 information. Therefore, "initial learning can alter future learning" (Kuhl, 2000, p. 11855). Kuhl et al. (2008, p. 993) suggest that "that *experience*, not simply time, is a critical factor driving phonetic learning and perception of a second language" due to neural commitment that "causes a decline in neural flexibility". This fossilization of the perceptual system places the system in a state that is unconducive for learning a new language and prevents learners from a straightforward modification of the phonetic categories that were developed in the early stages of acquiring the native language.

The Speech Learning Model

The Speech Learning Model (SLM) has been developed by Flege and his colleagues as a model of L2 speech learning that attempts to model the level of success highly-experienced L2 learners will achieve in the perception and production of L2 sounds (Flege, 1995). SLM makes predictions on second language learners' ability to perceive and produce sounds in their second language based on the perceived phonetic distance that exists between sounds in their first and second language. A well-known phenomenon in second language acquisition is that L2 learners often have difficulties with perception and production of L2 phonological segments that either do not occur or are realized differently in their L1. Flege (1995) maintains that:

> During L1 acquisition, speech perception becomes attuned to the contrastive phonetic elements of the L1. Learners of an L2 may fail to discern the phonetic differences between pairs of sounds in the L2, or between L2 and L1 sounds, either because phonetically distinct sounds in the L2 are assimilated to a single category, … because the L1 phonology filters out features (or properties) of L2 sounds that are important phonetically but not phonologically, or both. (p. 238)

Flege and his colleagues adopt the term of "perceived phonetic differences" between the L1 and L2 sounds or between L2 sounds. This seems to put more emphasis on the role played by the perceiver (depending on how much the L2 learner hears the phonetic differences between the target contrasts) than on the nature of the phonetic/acoustic differences between the sounds. The emphasis on the perceivers in terms of the "perceived phonetic" distance would also explain the differences among the L2 learners having the same L1 who are learning the same L2 contrasts.

In other words, certain phonetic differences between an L1 and L2 sound may be perceived by some but not by other learners having the same L1. Another important point is that SLM emphasizes the relationship between perception and production by assuming accurate perception of the phonetic differences between L2 sounds or between L2 and L1 sounds will eventually lead to the correct production of these differences. The main problem with the notion of "perceived phonetic distance" is that it has not been made clear how to measure the degree of similarity or dissimilarity. Therefore, it is sometimes impossible to predict which sounds will be perceived as similar and which as dissimilar.

The predictions made by SLM regarding the degree of accuracy with which highly experienced learners will perceive and produce L2 sounds can be tested empirically. The SLM posits that the speech learning mechanisms (e.g., the ability to form phonetic categories) that are employed in the acquisition of L1 can also be exploited in L2 acquisition. The SLM also makes the hypothesis that L2 learners can form new phonetic categories depending on whether they detect adequate phonetic dissimilarities existing between L1 and L2 sounds. Therefore, SLM agrees with the Sensitive Period Hypothesis. In other words, the ability to learn a language does not decline dramatically after reaching a certain age. Rather this decline happens more gradually (Gass & Selinker, 2008). As discussed above, discernibility of phonetic differences between L2 and L1 sounds depends on the perceived phonetic distance existing among them. In terms of SLM, establishing new phonetic categories will enable L2 learners to perceive and produce L2 sounds in a native-like fashion with significantly less interference from the L1. Flege (1995) maintains that:

> An assumption we make is that the phonetic systems used in the production and perception of vowels and consonants *remain adaptive over the life span,* and the

> phonetic systems recognize in response to sounds encountered in an L2 through the addition of new phonetic categories, or through the modification of old ones. (p. 233, emphasis in original)

Interestingly, SLM predicts that the production of an L2 (or L1) sound may also change regardless of whether a new phonetic category is established. This happens when the phonetic category that is used in processing an L2 sound that is perceptually connected to an L1 sound is modified because of a two-language source of input. In other words, the model predicts that L2 learners will produce more native-like productions of L2 sounds regardless of whether a phonetic category is established or not as they gain more experience in their L2.

In sum, in order for L2 learners to attain native-like pronunciation, they must be able to discern subtle phonetic differences between L2 sounds and similar sounds in their L1 as they occur in a variety of phonological contexts. Consequently, they will be able to create new categories for L2 sounds, and eventually they may become able to produce the L2 sounds in a target-like fashion. Even though SLM is a model that accounts for both L2 production and perception and explicitly draws a link between them, its focus is mainly on learners who acquired the L2 in a naturalistic context and have reached their ultimate attainment. However, it is still the model that is frequently used in research on L2 speech acquisition within formal instructional settings (Fullana, 2006).

The Perceptual Assimilation Model

Best (1995) introduced the Perceptual Assimilation Model (PAM) to account for "language-specific influences on perception of non-native segments and contrasts" (p. 172). Best states that PAM originated from an epistemological position called *Direct Realism*. The fundamental principle of *Direct Realism* is that we directly perceive the reality of our environment rather than mapping our perceptions into mental/representational constructs. When the principles of *Direct Realism* are applied to speech sounds, the position held by direct realists is that articulatory movements in the vocal tract can be perceived through the sound signal. In other words, when someone hears the speech of another person, he or she can directly perceive the distal articulatory movements of their tongue, lips, jaw, velum, etc. This contrasts with the Motor Theory (e.g. Liberman & Mattingly, 1985) of speech which posits a neural module that is equipped with innate knowledge of the vocal tract. *Direct realism* does not require a module that is wired into our brains because we can pick up the distal articulatory gestures through the sound signal.

In terms of PAM, children start out perceiving all the little perturbations between the vocal folds and the lips that are transmitted in the speech signal. However, children gradually attune their perceptions to become more and more efficient at detecting the higher-order invariants in their L1-specific gestural constellations and thereby becoming increasingly worse at detecting what is not contrastive in the L1 (i.e., the lower-order gestures). Perceiving these groupings of related gestures allows them to process their first language faster and more efficiently. Best maintains that "as perceivers become attuned to this language-specific information, they become increasingly adept and efficient at detecting the critically distinguishing properties of those constellations; that is, of the linguistically relevant contrasts among them" (p. 185).

However, this efficiency always comes at a cost. Once these finely attuned perceptions of gesture combinations have been developed, one will have difficulty perceiving speech sounds that do not use these gestural constellations. This echoes Eimas's (1985) proposition that infants possess an innate module dedicated to speech perception. This innate module provides infants with the capacity to discriminate sound contrasts from all the human languages. As infants gain experience in their native language, only distinctions that are heard are maintained. For example, English speakers expect to hear a puff of air after a /p/ sound at the beginning of a word, and when they do not hear that little puff in a French /p/, it throws them off, i.e., the less aspirated French /p/ might be mistakenly classified as an English /b/.

The Perceptual Assimilation Model makes the prediction that non-native sounds will be perceived with better or worse accuracy depending on how closely the sounds map onto existing categories in a speaker's L1 sound system. Sounds that share the same gestural combinations are quite common across languages. Therefore, an American listener can hear an Arabic /m/ sound just as well as Arabic native speakers can. There are also those sounds that are totally foreign, i.e., they share almost no gestures at all with L1 speech sounds. English speakers are relatively good at perceiving the difference between a /t/ sound and a click sound such as those present in the Xhosa language of South Africa. A non-native sound is either assimilated to an existing native category, assimilated as a non-native speech sound, or assimilated as a non-speech sound (e.g. choking, tapping, or snapping fingers). Combinations of these categories determine how easy or difficult it would be for a non-native listener to perceive the difference between any two sounds in a foreign language:

- Two-Category Assimilation (TC Type): both sounds are assimilated to two different L1 sounds. The listener is expected to discriminate the contrast with great accuracy. For example, the Hindi retroflex stop /ɖ/ is likely to be assimilated to the English alveolar stop /d/, whereas the Hindi breathy-voiced dental stop /dʱ/ maybe assimilated to the English interdental fricative /ð/.

- Category-Goodness Difference (CG Type): both L2 sounds assimilate to the same L1 sound, but one is associated more strongly than the other. The listener should be moderately good at distinguishing these two sounds because they are clearly different even though they may sound like a single sound in the L1. For example, both Zulu voiceless aspirated velars /k/ and /k'/ are likely to be assimilated to the English velar /k/; the former should be perceived as identical to English /k/, whereas the latter should be perceived as quite discrepant from it. Similarly, an Arabic emphatic consonant and its plain counterpart would fall into this category. For example, both Arabic voiceless denti-alveolar emphatic /sˤ/ and its plain counterpart /s/ would assimilate to English /s/; the former should be perceived as quite discrepant from English /s/, whereas the latter should be perceived as similar to it.

- Single-Category Assimilation (SC Type): both L2 sounds are assimilated equally well or equally poorly to the same L1 phone. The predicted discrimination of the contrast is poor to moderate. For instance, both Thompson Salish ejective velar /k'/ and uvular /q'/ are likely to be assimilated to the English velar /k/.

- Both Uncategorizable (UU Type): the two sounds are very clearly foreign and do not belong to an L1 category. Sound distinctions in this category can range from poor to very good depending on the actual sounds in question. The well-known difficulty Japanese speakers have in distinguishing the English /l/-/r/ contrast is a good example of this type where neither liquid is assimilated to an equivalent Japanese category.

- Uncategorized vs. categorized (UC Type): one L2 sound is assimilated to one L1 sound; the other L2 sound falls in L1 phonetic space, outside L1 categories. The predicted discrimination of the contrast is very good. The English /r/-/w/ distinction for Japanese speakers is a good example of this type; English /w/ is assimilated to Japanese /w/, but English /r/ does not assimilate to any category in Japanese.

- Nonassimilable (NA Type): both sounds are perceived as non-speech sounds. The listener would probably be good to very good at discriminating them; the Zulu clicks, for English speakers, are a good example of this type of assimilation.

PAM-L2

Best and Tyler (2007) state that PAM has been developed to account for non-native speech perception by naïve learners and SLM has been developed to explain the perception and production of L2 speech by experienced listeners. However, neither PAM nor SLM was intended for both situations. Therefore, they probed "commonalities and complementarities of these two models" (p. 14) to find out if SLM could be applied to extend PAM's framework to include L2 sound perception by inexperienced L2 learners. The following discussion, however, provides an overview of only the predictions that PAM-L2 makes for L2 sound perception.

PAM-L2 predicts four possible cases of L2 minimal contrasts. In the first case, both L2 sounds are either assimilated to two L1 categories *TC Type* (e.g. the Hindi retroflex stop /ɖ/ is assimilated to the English alveolar stop /d/, whereas the Hindi breathy-voiced dental stop /dʱ/ is assimilated to the English interdental fricative /ð/) or only one L2 sound is assimilated to the L1 category and the other is not *UC Type* (e.g. the English /w/ is assimilated to Japanese /w/, but English /r/ does not assimilate to any category in Japanese). In this case, the learner should not have great difficulty "discriminating minimally contrasting words for those distinctions" (Best and Tyler, 2007, p. 28). However, when an L2 sound in either category (TC Type or UC Type) is perceived as a poor exemplar of the L1 phonetic category, a new phonetic category will eventually be established “under the common phonological category” (Best and Tyler, 2007, p. 29).

Regarding the second case, both L2 sounds are associated with an L1 phonological category; however, one of them is more phonetically “deviant” than the other. The Arabic emphatic consonants and their plain counterparts fits this situation; for example, both Arabic voiceless denti-alveolar emphatic /sˤ/ and its plain counterpart /s/ would assimilate to English /s/; the former should be perceived as quite discrepant from English /s/, whereas the latter should be perceived as similar to it. In this case, learners are expected to establish a new phonological category for the more deviant segment by recognizing “the lexical-functional contrasts between the L2 phones” (Best and Tyler, 2007, p. 29).

As for the third case, “both L2 phonological categories are perceived as equivalent to the same L1 phonological category, but as equally good or poor instances of that category [i.e., SC Type]” (Best & Tyler, 2007, p.29). For instance, both Thompson Salish ejective velar /k’/ and uvular /q’/ are likely to be assimilated to the English velar /k/. In this situation, the learners will find it difficult to discriminate between the L2 sounds at the phonetic and phonological levels. In this case, “the minimally contrasting words would be perceived as homophones” (p. 29). If learners could attune to such an L2 contrast, they need to create a phonetic category (or phonetic categories) before establishing a phonological category (or phonological categories) for one or both L2 sounds.

The fourth situation would be if there is “no L1-L2 phonological assimilation [i.e., UU Type]” (Best & Tyler, 2007, p. 30). None of the L2 phones are perceived as L1 correspondents and both members of the contrast should be learned by the subjects without any difficulty; distinguishing the English /l/-/r/ contrast is a good example of this type where neither liquid is assimilated to an equivalent Japanese category. In SLM's terms, such a situation could be an example of new phones, however as Best and Tyler argue, in the PAM framework it is not similarity or dissimilarity that underlies the L2 perception but the relationship with the interlanguage phonological system. In such a situation, if both non-native phones have similarities to different sets of L1 categories, then perceivers should easily detect the L2 lexical-functional differences in the minimal contrast and both categories should be learned to be perceived appropriately. However, if both L2 categories have similarities to the same L1 phone, then it will be difficult for a learner to recognize sound differences in the lexical-minimal pair of that contrast. Therefore, they would remain homophonous. As the authors explain, a new single phonological category could be learned for both L2 phones. However, over the course of L2 acquisition the language learners could establish separate categories for those L2 sounds. The following section briefly discusses some of the pedagogical implications of the models discussed above. It is worth mentioning here that the focus is on the segmental level of L2 speech perception and production since all the discussed above models make predictions for perceiving and/or producing L2 speech at the segmental level.

The Models' Predictions for the Perception and Production of Arabic Emphatic-Plain Contrasts

In terms of NLM, the Arabic plain vowels, i.e., /iː/, /i/, /uː/, and /u / and their emphatic counterparts will be mapped onto the English prototypes /i/, /ɪ/, /u/, and /ʊ/, respectively. This mapping will be due to the *neural commitment* (or the perceptual magnet effect) mechanism to a previously learned structure that interferes with the processing of new L2 information. However, the plain Arabic vowels will sound as excellent exemplars of their English counterpart prototypes whereas the emphatic Arabic vowels will sound as poor exemplars. Similarly, SLM predicts that the Arabic plain vowels, i.e., /i:/, /i/, /u:/, and /u / and their emphatic counterparts will be assimilated into the English categories /i/, /ɪ/, /u/, and /ʊ/, respectively. This is expected because English-language speakers will fail to discern the emphatic-plain phonetic (and phonological) contrasts. In terms of PAM, the Arabic plain vowels and their emphatic counterparts will be assimilated into their counterpart English categories /i/, /ɪ/, /u/, and /ʊ/, where the Arabic plain vowels will be perceived as good exemplars and the emphatic vowels as phonetically deviant (CG Type).

Pedagogical Implications

In terms of NLM, the notion of native language *neural commitment,* proposed to explain the influence of language experience on the learners' brain, affects their ability "to learn the phonetic scheme of a new language" (Kuhl et al., 2008, p. 983). However, neurolinguistics studies (e.g., Iverson, Hazan, & Bannister, 2005; Vallabha& McClelland, 2007) show that adult learners benefit from training on L2 sound contrasts and that exaggeration of phonetic cues enhances the learners' ability to perceive these contrasts as well. Even though the original PAM focuses on naïve listeners' perception of non-native contrasts, Best and Tyler (2007) maintain that "nonnative speech perception can also account for the relative difficulties that late learners have with specific L2 segments and contrasts" (p. 13). They also argue that L2 sounds that are identified as a realization of an L1 sound require the learner to "discover a different set of invariants to encompass the new shared phonological category" (p. 26).

In terms of SLM, the problem in L2 speech perception is that adult learners exhibit a tendency to use categorical processing in the L2 even though their phonological knowledge of the L2 is not perfect. Adults tend to use the same categories they have developed over years of exposure to their native language(s). SLM implies that learners must be able to detect subtle phonetic differences between L2 sounds and similar L1 sounds. In other words, the process of acquiring an L2 sound system begins first by discerning differences between native and nonnative sound contrasts (as they occur in a variety of phonological environments). Flege (2003) argues that "L2 phonetic segments can be produced only as accurately as they are perceived" (p. 344). Mora (2008) points out that "an obvious implication of this approach (i.e., SLM) for foreign language (FL) pronunciation instruction is that perceptual training should constitute an essential component in the design of pronunciation tasks" (p.1). Archila-Suerte, Zevin, Bunta, and Hernandez (2011) state that "introducing L2 learners to natural linguistic environments that emphasize the acoustic distance between L1 and L2 can help in the formation of new L2 speech categories" (p. 191).

The conclusion that can be drawn from the above arguments is that explicit phonetic instruction, including appropriate types of exposure, practice, and feedback (Kissling, 2013), should improve the L2 learners' perception and production of the target sounds. In other words, language teachers should help L2 learners to attune precisely their perceptive skills, and this attunement would facilitate later development in production, i.e., adding or modifying *sensorimotor programs* for producing sounds in L2.

Pronunciation Teaching Approaches

Proponents of the audio-lingual approach in the 1970's viewed pronunciation teaching as an integral element in the curriculum and they emphasized native-like pronunciation. To achieve this end, minimal pair drills and imitation of appropriate models (e.g. the teacher) were used. Later, however, L2 speech researchers (e.g. Flege, 2003; Flege, Munro, & MacKay, 1995) provided empirical evidence showing that accented L2 speech is inevitable depending on the learners' age of acquisition and first language. In fact, a few studies showed that very few learners achieve native-like pronunciation after puberty (e.g. Ioup, Boustagui, El Tigi, & Moselle, 1994; Moyer, 1999). Derwing and Munro (2005) pointed out that:

> We know of no study documenting a link between pronunciation instruction and the elimination of a foreign accent. Rather, most learners who strive for nativeness are likely to become disheartened … it may do more harm than good for teachers to lead learners to believe that they will eventually achieve native pronunciation or to encourage them to expend time and energy working toward a goal that they are unlikely to achieve. (p. 384)

Consequently, pronunciation was considered unteachable and instructors often left out pronunciation teaching from their syllabi (Celce-Murcia, Brinton, & Goodwin, 1996; Levis, 2005; Setter & Jenkins, 2005). Even though some instructors do incorporate pronunciation teaching into their syllabi, their teaching of pronunciation is usually limited to teaching articulatory phonetics or sometimes influenced by their intuition rather than research (Derwing, 2008; Derwing & Munro, 2005; Levis, 2005; Munro, 2008; Setter & Jenkins, 2005).

The emergence of the communicative approaches to language teaching has influenced the language pedagogy including pronunciation teaching; interaction, authenticity, meaningfulness, context, and focus on the learner are now of great significance. This shift has brought about a new perspective on pronunciation teaching; pronunciation features are now taught in context that involves the presentation of natural discourse or real-life communicative situations that engage the learner in meaningful manipulation of phonological items (Richards & Renendya, 2002). The involvement of learners and the role of teachers are also significant features of communicative pronunciation teaching. In a communicative lesson, "pronunciation/speech study is most profitable (and most pleasant) when students are actively involved in their own learning, not passively detached repeaters of drills" (Morley, 1991, p. 503). The teacher's duty is not simply teaching and correcting mistakes. The teacher should always support and encourage his or her students and provide them with “a wide variety of practice opportunities” (p. 507). Unlike the audio-lingual approach, the communicative approach stresses intelligibility and comprehensibility which are at the very heart of successful and effective L2 communication (e.g. Derwing, 2008; Derwing & Munro, 2005; Levis, 2005; Munro, 2008; Setter & Jenkins, 2005). Instructors should set realistic goals for their learners based on empirical research findings; intelligibility and comprehensibility should be targeted rather than native-like pronunciation (Derwing & Munro, 1997, 2005; Levis, 2005; Venkatagiri & Levis, 2007).

A more recent approach to L2 pronunciation instruction is Gonzalez-Bueno and Quintana-Lara’s (2011) Pronunciation Processing Instruction (PPI). PPI consists of a series of “strategically controlled listening drills” (Gonzalez-Bueno & Quintana-Lara, 2011, p. 54). PPI stresses the importance of processing input for meaning before processing it for form. In this approach, production is delayed until learners master the system of rules and are able to apply them in the target language. Gonzalez-Bueno and Quintana-Lara’s PPI is an adaptation of VanPatten’s (1996) Processing Instruction Approach (PI) to L2 pronunciation teaching. Gonzalez-Bueno and Quintana-Lara explained that:

> *Processing Instruction* essentially consists of exposing learners to strategically controlled drills [1] that require their active attention to the form of the input in order to attach meaning to it. The model assumes, by intentionally delaying production of the target language, the learner will have already processed its grammatical system (one of the formal components of the language) and will be capable of accurately producing grammatically correct language. (p. 53, emphasis in original)

Dalton and Seidlhofer (1994) presented the approach to teaching pronunciation in terms of selection and presentation; items are first selected and then the procedure of teaching the selected items will follow. In selection, there are two variables to be taken into consideration, namely, size and attention. Size refers to "the unit which is given precedence" (p. 69). Selection of size is determined by the approach that is adopted by the teacher: bottom-up or top-down. The bottom-up approach prioritizes the segmental units whereas the top-down approach prioritizes the suprasegment units. The bottom-up approach assumes that "if you teach the segments, the suprasegmental features will take care of themselves" while the top-down approach presupposes "once prosodic features of pronunciation are in place, the necessary segmental discriminations will follow of their own accord" (p. 70). However, none of these two approaches is recommended by the authors. The second aspect of selection is attention. What that means is selection should be based 'primarily on where the students are coming from or where they are going to' (p. 70). This requires considering the students' linguistic background (L1-L2 distinction) as well as concentrating "on those aspects of speech which are more functionally significant in actual language use". (p. 71). In short, selection of pronunciation items should be made considering their communicative functions.

As for presentation, this phase includes 'exposure, exercise and explanation' as possible classroom procedures (Dalton and Seidlhofer, 1994, p. 71). These three different procedures address different functions in presenting the teaching materials. The exposure procedure follows an implicit way of teaching, i.e., "no explicit attention is paid to the specific features of pronunciation" (p. 72). This is based on the idea that "the use of language is motivated by some communicative purpose, sounds will be heard as significant and will be learnt as such" (p. 72). The exercise procedure, however, refers to "the traditional procedure of identifying specific sound features and providing practice in perception and production" (p. 72). It focuses on the explicit forms practice of the pronunciation features, i.e., it encourages imitation. In the explanation procedure, the idea is "to make students consciously aware of phonetic and phonological facts" (p. 72) because imitation (or inference) will not be effective without conscious awareness of the pronunciation features. The authors suggest that these procedures can be combined depending on the situation.

Celce–Murcia, Brinton, and Goodwin (1996) characterized phonetic instruction as generally having two pedagogical foci. The first is intuitive–imitative in nature and it is focused on making the learners' pronunciation more target-like. This approach is best suited for beginning learners. The second approach is more analytic and explicit in nature and it is focused on analyzing linguistic features of the target language. This approach is best suited for advanced learners.

Previous Intervention Studies

In fact, many research studies have found that non-native segmental contrasts can be learned through training (e.g. Gonzalez-Bueno, 1997; McClaskey, Pisoni, & Carrell, 1983; Pisoni, Aslin, Perey, & Hennessy, 1982). Other research studies have found that training can also have positive effects on learning contrasts at the suprasegmental level (e.g. Wang, Spence, Jongman, & Sereno, 1999; Wayland & Guion, 2004; Wayland & Li, 2008).

Akahane-Yamada, Tohkura, Bradlow, and Pisoni (1996) examined the relationship between speech perception and production in second language acquisition. To investigate whether training in perception can be transferable to production, they trained native speakers of Japanese to identify English /r/-/l/ minimal pairs. The participants' productions of minimal pairs before and after identification training were recorded. Then Akahane-Yamada et al. had

American-English listeners perceptually evaluate these productions. The participants exhibited significant improvements from pretest to post-test in perception as well as in production. The study's findings demonstrate that training in perception results in modifications in both perception and production, implying a close link between L2 speech perception and production.

Gonzalez-Bueno (1997) investigated the effects of formal pronunciation instruction on the production of the Spanish stop consonants /b, d, g, p, t, k/ by English-speaking learners of Spanish. Even though the Spanish stop consonants are represented phonetically with the same symbols as their English stop consonant counterparts, they differ vastly in two subsegmental features, i.e., aspiration and duration. The goal of the intervention was to reduce the aspiration of the Spanish consonants, or the Voice Onset Time (VOT), in the speech of the experimental group through ten minutes of instruction at the beginning of each class during one semester. During these ten minutes, the learners received information about articulation and perception of the Spanish stop consonants and then practiced producing them. The findings of the study showed promising results for all stop consonants, and statistically significant improvement on two of them, i.e., /p/ and /g/.

Wang, Spence, Jongman, and Sereno (1999) demonstrated that adult learners can distinguish non-native tones after a short period of laboratory training. They trained eight English-speaking learners of Mandarin in eight sessions for two weeks to identify four Mandarin tones (i.e., Tones 1, 2, 3, and 4) in natural words produced by native Mandarin speakers. The findings showed that the learners identification accuracy revealed an average 21% increase from the pretest to the post-test, and the improvement transferred to new stimuli and to new speakers. Moreover, Wang et al. tested the learners 6 months later, and the results showed that the 21% of improvement from the pretest obtained in the posttest remained intact. Thus, Wang et al. (1999)

demonstrated that auditory training at the suprasegmental level proved effective. More importantly, Wang et al. provided evidence that "learners are more likely to perceive or produce new, rather than similar, L2 sounds authentically" (p. 3656) and that the pattern of L2 suprasegmental acquisition might be comparable to that of segmental acquisition, regarding L1 interference.

Wang and Munro (2004) investigated whether computer-based training can improve native Mandarin and Cantonese speakers' perceptions and productions of three English vowel contrasts, i.e., /i/-/ ɪ/, /u/-/ʊ/, and /e/-/æ/. The results showed that perceptual performance of the participants in the experimental group had improved. Moreover, the improvement in perceptual performance was transferred to novel contexts and was maintained for three months after training.

Wayland and Guion (2004) investigated the ability of native English and native Chinese to discriminate the mid and the low Thai tone contrast in before and after one-week long auditory training. The findings showed that the native Chinese participants outperformed the native English ones during both the pretest and the posttests. More specifically, significant improvement in discrimination from the pretest to the posttest was observed in the native Chinese participants, but not in the native English participants. These findings suggested that prior experience with the tone system in one tone language may be transferable to the perception of tone in another language. Wayland and Guion concluded that training listeners from a non-tone language background to achieve the same level of performance as that of native speakers of a tone language requires more extensive training.

Gonzalez-Bueno and Quintana-Lara (2011) pilot tested the effect of the Pronunciation Processing Instruction (PPI) on both L2 perception and production of Spanish tap /ɾ/ and trill /r/.

Three groups (two experimental groups and a control group) of high-school English-speaking learners of Spanish were compared. The first experimental group received PPI where leaners are aurally exposed to the given phonological form(s) in the target before production is attempted, the second experimental group received the traditional listen-and-repeat instruction, and the control group did not receive any instruction. The PPI group received explicit perception instruction for seven weeks through minimal pairs presented in activities followed by two weeks of production instruction. Each instruction session lasted for ten minutes. The traditional instruction group received ten minutes of instruction per day for nine weeks with no focus on production; they did listen-and-repeat exercises throughout the whole period. The production results showed that the PPI group exhibited slight improvement in the production task. However, the perception results revealed that subjects who received PPI and the traditional listen-repeat treatment improved from pre- to post-test. Learners who did not receive pronunciation instruction did not exhibit any improvement.

CHAPTER 3: METHODOLOGY

This study investigated whether learners of Arabic as a foreign language improve their ability to perceive and produce emphatic-plain contrasts and use them successfully for different communicative purposes after formal perception and production training. This study answered two major research questions: (1) Does targeted communicative instruction on Arabic emphatic-plain consonant contrasts result in significant gains in the accuracy of perceiving and producing emphatic consonants? And (2) Does vowel quality affect the ability to produce Arabic emphatic-plain consonant contrasts? Different from traditional practice, this study did not treat the learning of emphasis production as an automatic process; rather, learners learned explicitly through meaningful contexts. Moreover, this study helped learners increase their awareness of the importance of accurate emphatic-plain productions in communication. Learners developed their confidence to communicate by producing more accurate emphatic-plain contrasts that would have long-term benefits for their overall oral proficiency development.

Participants

The participants in this study were 19 English-speaking students enrolled in ARAB 110 for the Fall of 2017 in the Department of African and African American Studies at the University of Kansas. Nine participants were randomly assigned to the experimental group and the other 10 participants were assigned to the control group. All the participants were 18-33 years old. All of the participants were beginning learners of Arabic as a foreign language. All participants reported normal speech and hearing.

Procedure

The perception and production pretests were administered simultaneously for the experimental and control groups during the eighth week of the Fall of 2017 semester. The pretests were followed by the instructional period for the experimental group, i.e., in the ninth week of the semester. The perception and production posttests were administered (after the conclusion of the experimental groups' period of instruction) to both groups during the tenth week of the semester.

Instructional Materials and Pedagogical Procedures

The intervention (see Appendix I) for the experimental group was conducted by the researcher and lasted for 90 minutes. The intervention consisted of presenting the target sounds in minimal pairs (see Appendix II) through a variety of formats. The activities focused on both perception and production of emphatic-plain contrasts.

The experimental group was first provided with visual articulatory description of the emphatic and plain sounds followed by a contrastive analysis of the differences between English and Arabic. This was followed by perception and production activities. The perception activities consisted of two tasks, i.e., discrimination and identification. Ten minimal pairs and 10 pairs of the same word were used to present the target sounds in the discrimination activity. The participants listened to a recording that was made by the researcher saying pairs of words. The participants were forced to decide whether they perceived the words as the same or different (see Appendix III).

The participants then practiced performing one identification activity and one perception and production activity. In the identification activity, they listened to a recording made by the researcher saying 10 words containing the target sounds. Participants were forced to choose the correct word based on meaning (see Appendix IV). In the perception-production task, 10 minimal pairs were used (see Appendix V). One student read out one word from each minimal pair and the other ticked the words he or she heard. In the case that the student ticked a sound that the speaker did not intend because of inaccurate pronunciation, the speaker was forced to refocus his or her attention on the pronunciation of the emphatic sound.

After that, the participants started practicing the emphatic-plain contrasts at the sentence level. The first activity focused on perception and production where one student read the sentences containing words with the target sounds and the other student placed a checkmark in the box under the correct picture. Students exchanged roles and checked their pronunciations (see Appendix VI). The second activity helped participants practice emphatic-plain contrasts in meaningful contexts where one participant described a picture using relevant words containing the target sounds and the other student reacted to that description (see Appendix VII). Finally, participants practiced pronunciation of emphatic-plain contrasts through a tongue twister (see Appendix VIII). This type of activity is known as a sequence of words that are difficult to say quickly and correctly. In the literature, there are different ideas about their applicability and usability in the language classroom; Celce-Murcia (1987) stated that although the transfer from practice to natural communication is little, they can be used whenever they are needed.

Perception Pre- and Posttests

The perception tests included a discrimination task and an identification task (see Appendices IX and X). The discrimination task was designed from 10 minimal pairs along with 10 additional word pairs. There was a total of 40 items on the test, i.e., 20 were minimal pairs and the remaining 20 were pairs of the same word. Participants listened to a recording made by the researcher saying each pair of words. Afterwards, students marked the corresponding column indicating whether the words were the same or different. For the identification task, 10 minimal pairs were used. Participants listened to one word at a time and identified it by marking it on the answer sheet. Prior to each task, participants received a training session consisting of five test items in order to familiarize them with the nature of the tasks.

Production Pre- and Posttests

In the production tests, the students were recorded in a sound-proof booth in the language laboratory in Wescoe Hall at the University of Kansas with a Marantz PMD-671 solid state recorder and an Electro Voice 767 microphone. The minimal pairs were contrasted in terms of whether the initial consonant was emphatic or plain. Each target word was recorded in the carrier phrase [ʔiħki___ kæmæ:n mærr:æh] ("Say____once"). The participants were instructed to read the sentences aloud at a normal pace. The words were presented to participants in the Arabic language orthography supplemented with diacritic markings.

Acoustic Measurements

Praat (Boersma & Weenik, 2007) was used to perform the acoustic measurements in this study. These measurements consisted of F2 of the vowels following the target plain and emphatic consonants and were taken from LPC spectra calculated at vowel midpoint.

CHAPTER 4: RESULTS

The data presented in this chapter are the participants' perception and production scores in both the experimental and control groups. The scores include the pre- and the post-tests. The analysis of the data attempt to find out whether there is a significant improvement in the participants' perception and production scores in the experimental group, on the one hand, and if there is a significant difference between the experimental and control groups on the other. The statistical analyses were guided by the study's research questions: (1) Does targeted communicative instruction on Arabic emphatic-plain consonant contrasts result in significant gains in the accuracy of perceiving and producing emphatic consonants? And (2) Does vowel quality affect the ability to produce Arabic emphatic-plain consonant contrasts? Parametric statistical tests were used based on the theoretical assumption that the dependent variables, i.e., perception and production scores, are normally distributed in the whole population.

Perception

The statistical analyses were performed using IBM SPSS version 24.0. The below tables and relevant figures were retrieved from the SPSS output file. Table 4.1 below shows the descriptive statistics of the data included in the analysis of the perception data. For the pre-test, the perception $M=26$ and $SD=2.625$ for the control group and $M=27.11$ and $SD=2.028$ for the experimental group. In the post-test, the perception $M=27.5$ and $SD=1.650$ for the control group and $M=27.56$ and $SD=3.206$ for the experimental group. Figure 4.1 shows the Means for pre- and post-tests among the control and experimental groups.

Table 4.1: Descriptive Statistics

	Group	Mean	Std. Deviation	N
PrePerception	Control	26.00	2.625	10
	Experimental	27.11	2.028	9
	Total	26.53	2.366	19
PostPerception	Control	27.50	1.650	10
	Experimental	27.56	3.206	9
	Total	27.53	2.435	19

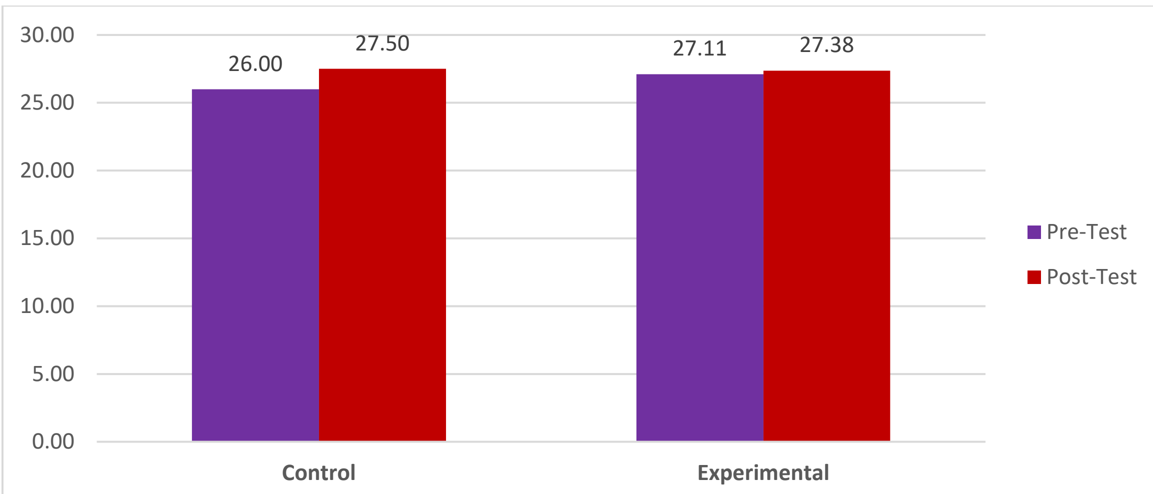

Figure 4.1: Means for perception pre- and post-tests among the control and experimental groups.

To answer the perception part of the first research question, the perception data was analyzed using a mixed analysis of variance (ANOVA) with the within-subject factor Test (two levels; pre-test, post-test), and the between-subjects factor Group (two levels: Control, Experimental). The Greenhouse-Geisser correction was used for tests of effects with one degree of freedom in the numerator. The ANOVA revealed no statistically significant main effects of the within-subjects factor Test, $F(1, 17) = 2.522$, $p > .05$ (Table 4.2).

Table 4.2: Tests of Within-Subjects Effects

Measure: Perception

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Pre_Post	Sphericity Assumed	8.955	1	8.955	2.522	.131	.129
	Greenhouse-Geisser	8.955	1.000	8.955	2.522	.131	.129
	Huynh-Feldt	8.955	1.000	8.955	2.522	.131	.129
	Lower-bound	8.955	1.000	8.955	2.522	.131	.129
Pre_Post * Group	Sphericity Assumed	2.639	1	2.639	.743	.401	.042
	Greenhouse-Geisser	2.639	1.000	2.639	.743	.401	.042
	Huynh-Feldt	2.639	1.000	2.639	.743	.401	.042
	Lower-bound	2.639	1.000	2.639	.743	.401	.042
Error(Pre_Post)	Sphericity Assumed	60.361	17	3.551			
	Greenhouse-Geisser	60.361	17.000	3.551			
	Huynh-Feldt	60.361	17.000	3.551			
	Lower-bound	60.361	17.000	3.551			

Additionally, the ANOVA revealed no statistically significant main effects of the between-subjects factor Group, F (1,17) = .388, p >.05 (Table 4.3).

Table 4.3: Tests of Between-Subjects Effects

Measure: Perception

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	27710.592	1	27710.592	3335.080	.000	.995
Group	3.224	1	3.224	.388	.542	.022
Error	141.250	17	8.309			

Further analyses showed no statistically significant Test*Group interaction (Table 4.4).

Table 4.4: Tests of Within-Subjects Contrasts

Measure: Perception

Source	Pre_Post	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Pre_Post	Linear	8.955	1	8.955	2.522	.131	.129
Pre_Post * Group	Linear	2.639	1	2.639	.743	.401	.042
Error(Pre_Post)	Linear	60.361	17	3.551			

Production

Table 4.5 below shows the descriptive statistics of the data included in the analysis of the production data. For the pre-test in the context of plain consonants, the production M=1542.57 and SD=173.804 for the control group and M=1528.67 and SD=133.778 for the experimental group. In the context of emphatic consonants, M=1428.80 and SD=78.523 for the control group and M=1460.67 and SD=80.139 for the experimental group. For the post-test in the context of plain consonants, the production M=1560.37 and SD=111.867 for the control group and M=1563.66 and SD=127.201 for the experimental group. In the context of emphatic consonants, M=1472.80 and SD=94.654 for the control group and M=1449.08 and SD=54.538 for the experimental group (figure 4.2).

Table 4.5: Descriptive Statistics

	Group	Mean	Std. Deviation	N
PreProductionPlain	Control	1542.57	173.804	10
	Experimental	1528.67	133.778	9
	Total	1535.99	152.016	19
PreProductionEmphatic	Control	1428.80	78.523	10
	Experimental	1460.67	80.139	9
	Total	1443.90	78.770	19
PostProductionPlain	Control	1560.37	111.867	10
	Experimental	1563.66	127.201	9
	Total	1561.93	115.979	19
PostProductionEmphatic	Control	1472.80	94.654	10
	Experimental	1449.08	54.538	9
	Total	1461.56	77.134	19

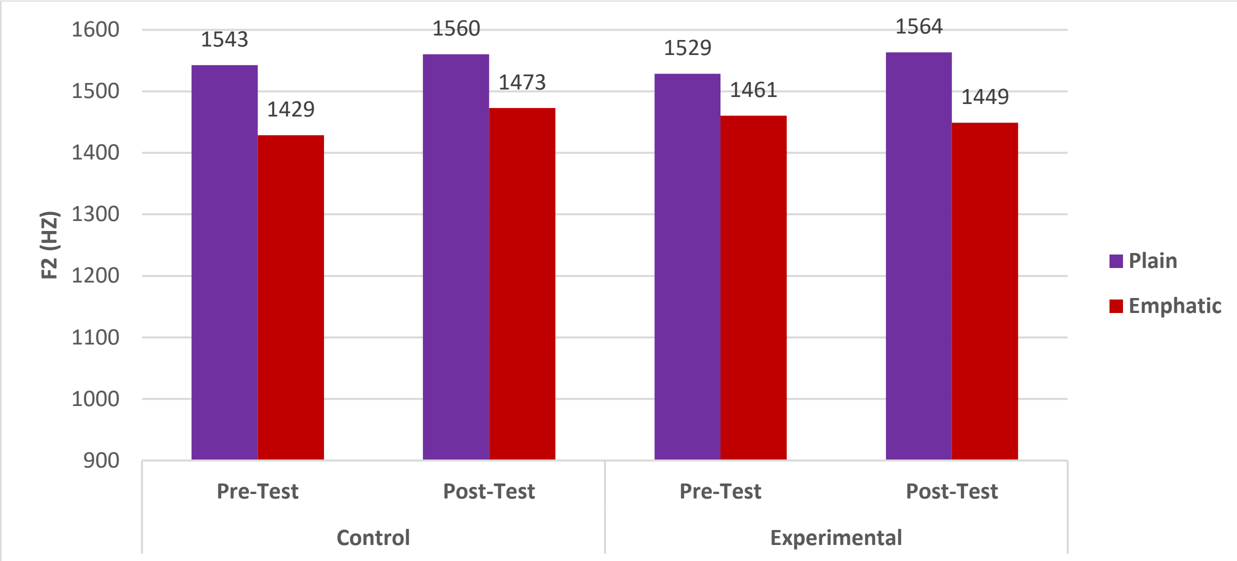

Figure 4.2: Differences in plain and emphatic F2 in pre- and post-tests across groups.

To answer the production part of the first research question, the production data was analyzed using a mixed analysis of variance (ANOVA) with the within-subjects factors Test (two levels: pre-test, post-test) and Consonant Type (two levels: plain, emphatic), and the between-subjects factor Group (two levels: Control, Experimental). The Greenhouse-Geisser correction was used for tests of effects with one degree of freedom in the numerator. The ANOVA revealed no statistically significant main effects of the within-subjects factor Test, $F(1, 17) = 1.379$, $p > .05$ (Table 4.6). On the other hand, the ANOVA revealed significant main effects for the within-subjects factor Consonant Type, $F(1, 17) = 17.111$, $p < .05$. In the same context, further analyses showed no statistically significant Test*Group, Consonant Type*Group or Test*Consonant Type interactions (Table 4.6).

Table 4.6: Tests of Within-Subjects Effects

Measure: Production

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Test	Sphericity Assumed	8595.061	1	8595.061	1.379	.256
	Greenhouse-Geisser	8595.061	1.000	8595.061	1.379	.256
	Huynh-Feldt	8595.061	1.000	8595.061	1.379	.256
	Lower-bound	8595.061	1.000	8595.061	1.379	.256
Test * Group	Sphericity Assumed	1745.101	1	1745.101	.280	.604
	Greenhouse-Geisser	1745.101	1.000	1745.101	.280	.604
	Huynh-Feldt	1745.101	1.000	1745.101	.280	.604
	Lower-bound	1745.101	1.000	1745.101	.280	.604
Error(Test)	Sphericity Assumed	105976.248	17	6233.897		
	Greenhouse-Geisser	105976.248	17.000	6233.897		
	Huynh-Feldt	105976.248	17.000	6233.897		
	Lower-bound	105976.248	17.000	6233.897		
Consonant_Type	Sphericity Assumed	174540.921	1	174540.921	17.111	.001
	Greenhouse-Geisser	174540.921	1.000	174540.921	17.111	.001
	Huynh-Feldt	174540.921	1.000	174540.921	17.111	.001
	Lower-bound	174540.921	1.000	174540.921	17.111	.001
Consonant_Type * Group	Sphericity Assumed	417.421	1	417.421	.041	.842
	Greenhouse-Geisser	417.421	1.000	417.421	.041	.842
	Huynh-Feldt	417.421	1.000	417.421	.041	.842
	Lower-bound	417.421	1.000	417.421	.041	.842
Error (Consonant_Type)	Sphericity Assumed	173403.599	17	10200.212		
	Greenhouse-Geisser	173403.599	17.000	10200.212		
	Huynh-Feldt	173403.599	17.000	10200.212		
	Lower-bound	173403.599	17.000	10200.212		
Test * Consonant_Type	Sphericity Assumed	491.474	1	491.474	.051	.823
	Greenhouse-Geisser	491.474	1.000	491.474	.051	.823
	Huynh-Feldt	491.474	1.000	491.474	.051	.823
	Lower-bound	491.474	1.000	491.474	.051	.823
Test * Consonant_Type * Group	Sphericity Assumed	6274.764	1	6274.764	.656	.429
	Greenhouse-Geisser	6274.764	1.000	6274.764	.656	.429
	Huynh-Feldt	6274.764	1.000	6274.764	.656	.429
	Lower-bound	6274.764	1.000	6274.764	.656	.429
Error (Test*Consonant_Type)	Sphericity Assumed	162528.025	17	9560.472		
	Greenhouse-Geisser	162528.025	17.000	9560.472		
	Huynh-Feldt	162528.025	17.000	9560.472		
	Lower-bound	162528.025	17.000	9560.472		

Furthermore, the ANOVA revealed no statistically significant main effects of the between-subjects factor Group, $F(1,17) = .000$, $p > .05$ (Table 4.7).

Table 4.7: Tests of Between-Subjects Effects

Measure: Production

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	170714417	1	170714417	6804.449	.000
Group	7.122	1	7.122	.000	.987
Error	426506.964	17	25088.645		

Given the analyses stated above, although no statistically significant differences between the pre- and post-tests across the participants in the control and experimental groups were found, it is noteworthy to state here that numerical differences do exist. Numerically speaking, the plain-emphatic differences in the pre-test among the control and experimental groups were in favor of the control group with 114 Hz vs. 68 Hz, respectively. However, in the post-test the plain-emphatic differences among the control and experimental groups were in favor of the experimental group with 88 Hz vs. 115 Hz, respectively. This is an indication that the effect of the sample size over the statistical power might impeded the detection of statistical significance in the data.

Table 4.8 below shows the descriptive statistics of the production data included in the analysis to answer the second research question. The mean for /i/ was M=2012.89 and SD=274.729 in the plain context and M=2139.89 and SD=166.824 in the emphatic context. In addition, /u/ had a mean and standard deviation of M=1149.68 and SD=82.561 for the plain context and M=996.42 and SD=51.694 for the emphatic context. Finally, /æ/ had a mean of M=1484.53 and SD=220.3 in the plain context and M=1227.42 and SD=75.937 in the emphatic context (figure 4.3[1]).

Table 4.8 Descriptive Statistics

	Mean	Std. Deviation	N
ProductionPlainA	1484.53	220.370	19
ProductionPlainE	2012.89	274.729	19
ProductionPlainO	1149.68	82.561	19
ProductionEmphaticA	1227.42	75.937	19
ProductionEmphaticE	2139.89	166.824	19
ProductionEmphaticO	996.42	51.694	19

[1] A, E, and O represent the vowels æ, i, and u, respectively.

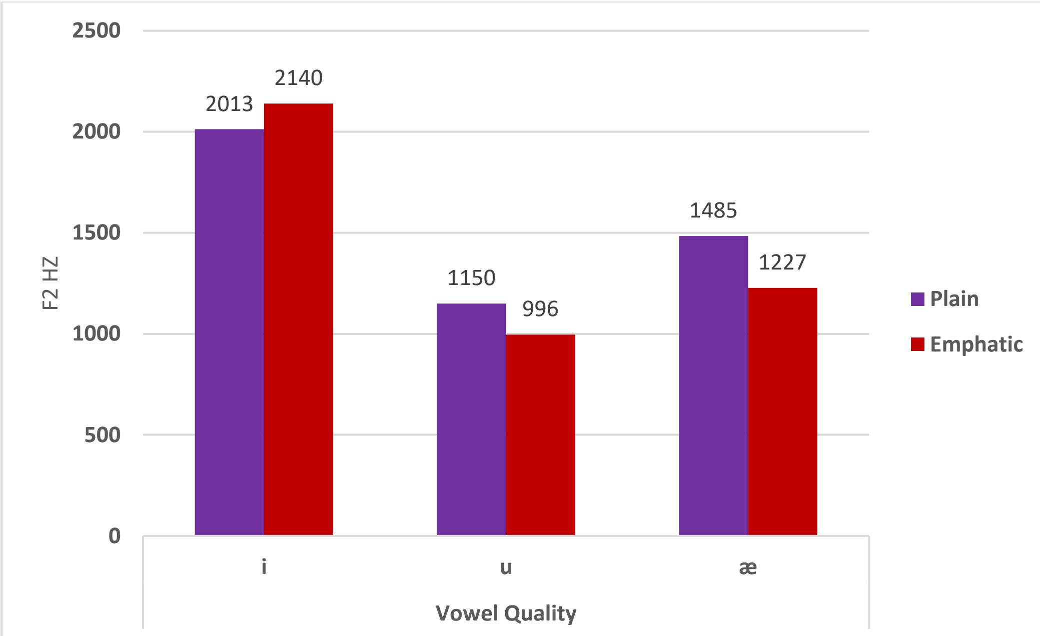

Figure 4.3: F2 Means for vowel quality across plain and emphatic contexts.

To answer the second research question, the production data was analyzed using a mixed analysis of variance (ANOVA) with the within-subjects factors Consonant Type (two levels: plain, emphatic) and Vowel Quality (three levels: i, u, and æ). The Greenhouse-Geisser correction was used for tests of effects with one degree of freedom in the numerator. The ANOVA revealed statistically significant main effects of the within-subjects factor Consonant Type, $F (1, 17) = 17.835$, $p < .001$ (Table 4.9). Additionally, the ANOVA revealed significant main effects for the within-subjects factor Vowel Quality, $F (1, 17) = 257.393$, $p < .001$. In the same context, further analyses showed statistically significant Consonant Type * Vowel Quality interaction (Table 4.9 and Figure 4.4).

Table 4.9 Tests of Within-Subjects Effects

Measure: Production

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
ConsonantType	Sphericity Assumed	254275.930	1	254275.930	17.835	.001
	Greenhouse-Geisser	254275.930	1.000	254275.930	17.835	.001
	Huynh-Feldt	254275.930	1.000	254275.930	17.835	.001
	Lower-bound	254275.930	1.000	254275.930	17.835	.001
Error(ConsonantType)	Sphericity Assumed	256621.737	18	14256.763		
	Greenhouse-Geisser	256621.737	18.000	14256.763		
	Huynh-Feldt	256621.737	18.000	14256.763		
	Lower-bound	256621.737	18.000	14256.763		
VowelQuality	Sphericity Assumed	20339451.8	2	10169725.9	257.393	.000
	Greenhouse-Geisser	20339451.8	1.536	13239319.0	257.393	.000
	Huynh-Feldt	20339451.8	1.651	12315870.5	257.393	.000
	Lower-bound	20339451.8	1.000	20339451.8	257.393	.000
Error(VowelQuality)	Sphericity Assumed	1422377.86	36	39510.496		
	Greenhouse-Geisser	1422377.86	27.653	51436.201		
	Huynh-Feldt	1422377.86	29.727	47848.502		
	Lower-bound	1422377.86	18.000	79020.992		
ConsonantType * VowelQuality	Sphericity Assumed	750080.333	2	375040.167	18.977	.000
	Greenhouse-Geisser	750080.333	1.354	553915.234	18.977	.000
	Huynh-Feldt	750080.333	1.426	526186.560	18.977	.000
	Lower-bound	750080.333	1.000	750080.333	18.977	.000
Error (ConsonantType*VowelQuality)	Sphericity Assumed	711458.000	36	19762.722		
	Greenhouse-Geisser	711458.000	24.375	29188.535		
	Huynh-Feldt	711458.000	25.659	27727.374		
	Lower-bound	711458.000	18.000	39525.444		

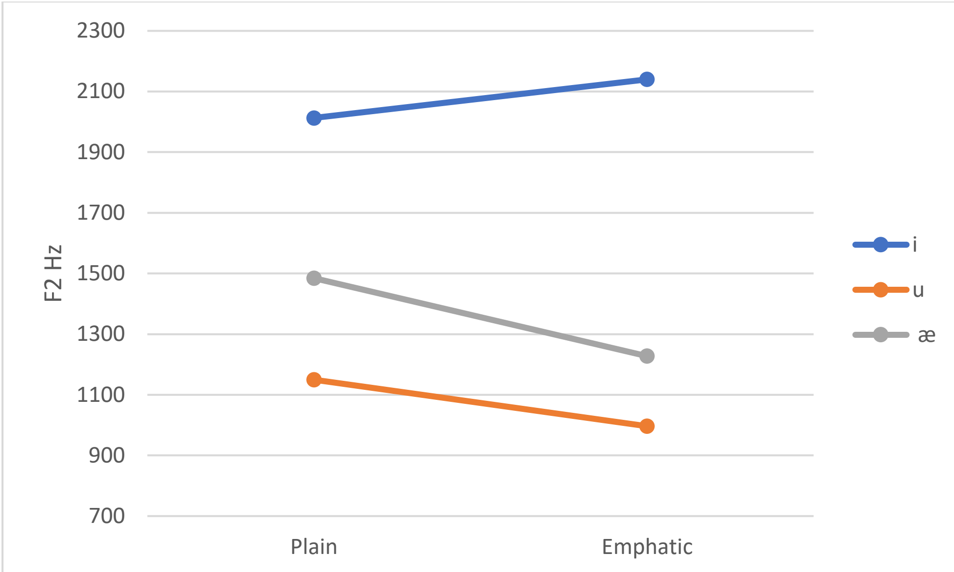

Figure 4.4: Consonant Type by Vowel Quality interaction for F2.

To investigate which vowel quality differs across consonant types, follow-up pair comparisons using ANOVA were performed. The ANOVA revealed statistically significant mean differences between the three vowel qualities, $F(2, 54) = 20.920$, $p < .001$ (Table 4.10). Post Hoc analyses were calculated using Bonferroni adjustment and the results revealed statistically significant F2 mean differences between /i/ and /u/ as well as between /i/ and / æ/; however, no statistical differences were found between /u/ and /æ/ (Table 4.11).

Table 4.10: ANOVA

Production

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1500160.667	2	750080.333	20.920	.000
Within Groups	1936159.474	54	35854.805		
Total	3436320.140	56			

Table 4.11 Multiple Comparisons
Dependent Variable: Production
Bonferroni

(I) VowelQ	(J) VowelQ	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
i	u	-280.26316*	61.43444	.000	-432.0583	-128.4680
	æ	-384.10526*	61.43444	.000	-535.9004	-232.3101
u	i	280.26316*	61.43444	.000	128.4680	432.0583
	æ	-103.84211	61.43444	.290	-255.6373	47.9531
æ	i	384.10526*	61.43444	.000	232.3101	535.9004
	u	103.84211	61.43444	.290	-47.9531	255.6373

*. The mean difference is significant at the 0.05 level.

Although there is no significant F2 mean difference between /u/ and /æ/, a numerical difference does exist. /æ/ has a mean difference of 257 Hz whereas /u/ has a mean difference of 153 Hz between emphatic and plain contexts (figure 4.5).

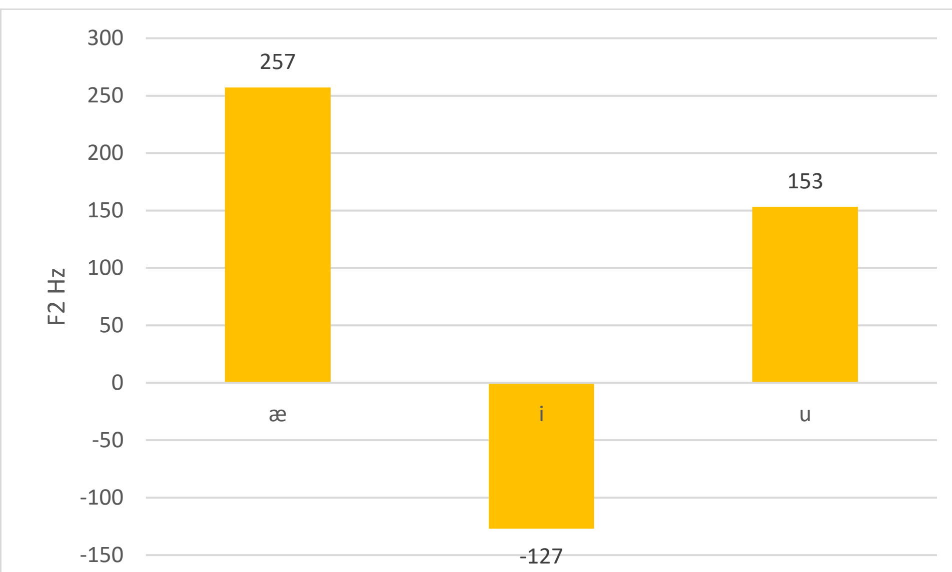

Figure 4.5: F2 mean differences between emphatic and plain contexts for vowel types.

Chapter 5: Discussion

The present study examined whether perception and production training is successful in improving the perception and production of Arabic emphatic-plain consonant contrasts. The perception and production training in this study incorporated the use of a communicative intervention along with the traditional form-based pronunciation teaching. The intervention for the experimental group was conducted by the researcher himself and lasted for 90 minutes. The intervention consisted of presenting the target sounds in minimal pairs through a variety of formats. The activities focused on both perception and production of emphatic-plain consonant contrasts.

The study consisted of two main experiments: a perception experiment and a production experiment involving acoustic analysis of this production. In both experiments, mono- and disyllabic words were used where plain-emphatic consonant contrasts occurred in initial position. The perception experiment included a discrimination task and an identification task. Both tasks were conducted before and after the intervention. The discrimination task was designed from 10 minimal pairs along with 10 additional word pairs. There was a total of 40 items on the test, i.e., 20 were minimal pairs and the remaining 20 were pairs of the same word. Participants listened to a recording made by the researcher saying each pair of words. Afterwards, students marked the corresponding column indicating whether the words were the same or different. For the identification task, 10 minimal pairs were used. Participants listened to one word at a time and identified it by marking it on the answer sheet.

In the production experiment, the students were recorded while reading aloud the target words embedded in a carrier phrase in a sound-proof booth. The recordings were conducted before and after the intervention. The minimal pairs were contrasted in terms of whether the initial consonant was emphatic or plain.

The results of both the perception and production experiments did not provide enough evidence in support of previous studies' (e.g. Shehata, 2015; Odisho, 1981) claim that emphatic consonants are perceptually and articulatory problematic for English-speaking learners of Arabic; the mixed ANOVA revealed no main effects of the within-subjects factor Test and no main effects of the between-subjects factor Group. Moreover, there was no Test by Group interaction. However, the results of the perception experiment provided evidence in support of Hayes-Harb and Durham's (2016) claim that the contrast between plain and emphatic consonants is perceptually salient; both the control and experimental groups' overall performance on the perception tasks was excellent in both the pre- and post-tests. Interestingly, however, this study showed that the traditional form-based pronunciation teaching could also be effective (e.g. Gonzalez-Bueno & Quintana-Lara, 2011) in perceiving emphatic-plain consonant contrasts.

As for the production experiment, both the control and experimental groups exhibited a statistically significant drop in their F2 values in the emphatic context. However, the mixed ANOVA did not reveal significant main effects for the within-subjects factor Test or the between-subjects factor Group. Moreover, the mixed ANOVA did not reveal statistically significant Test by Group, Consonant Type by Group, or Test by Consonant Type interactions. In other words, the statistically significant decline in F2 values was maintained in both the pre- and post-tests by both the control and experimental groups. These results show that the emphatic consonants are not necessarily articulatory problematic as suggested by previous research (e.g. Odisho, 1981, 2005; Shehata, 2015).

Moreover, the results showed that the participants produced F2 values that are significantly lower in the emphatic context when the following vowels are /æ/ and /u/. However, they produced F2 values that are significantly higher in the emphatic context when the following vowel is /i/. During the production experiment, the participants persistently struggled with the vowel /i/ in emphatic contexts, and the participants themselves reported that producing the vowel /i/ was more difficult than /u/ and /æ/ in emphatic contexts. Articulatory speaking, /i/ is a front vowel. Therefore, the tongue is positioned at the front of the oral cavity. However, when /i/ is in an emphatic context, the tongue also needs to be retracted towards the back wall of the pharynx. This especially complex articulation might explain the participants' struggle with the vowel /i/ when it occurs in the emphatic context, but not with the vowels /u/ and /æ/ where tongue root retraction is already involved in their production.

Even though no statistically significant differences between the pre- and post-tests across the participants in the control and experimental groups were found, it is noteworthy to state that numerical differences do exist. Numerically speaking, the plain-emphatic differences in the pre-test among the control and experimental groups were in favor of the control group with 114 Hz vs. 68 Hz, respectively. However, in the post-test the plain-emphatic differences among the control and experimental groups were in favor of the experimental group with 88 Hz vs. 115 Hz, respectively. Interestingly, the experimental group lowered F2 by 12 Hz in the post-test in the emphatic context, whereas the control group raised it by 44 Hz. This suggests a possible positive effect of the pronunciation instruction provided to the experimental group, which might have helped them produce more accurate emphatic-plain consonant contrasts. However, the effect of the sample size over the statistical power might have impeded the detection of statistical significance in the data. Again, this study showed that the traditional form-based pronunciation teaching could also be effective (e.g. Gonzalez-Bueno & Quintana-Lara, 2011) in producing emphatic-plain consonant contrasts with one important caveat as explained below.

Al-Masri and Jongman (2004) examined emphasis in monosyllabic, disyllabic, and trisyllabic words. The findings of their study revealed an average of 500 Hz drop in F2 of vowels adjacent to emphatic consonants compared to the same vowels adjacent to plain consonants. In a more recent study, Al-Masri (2009) showed that in monosyllabic CVC words with initial target consonants produced by native speakers, F2 midpoint was 1680 Hz in plain context and 1427 Hz in emphatic context, with a drop of 253 Hz in F2 of the vowel in the emphatic context compared to the same vowel in the plain context. Interestingly, the experimental group lowered F2 by 12 Hz in the post-test in the emphatic context, whereas the control group raised it by 44 Hz. In this study, the control group maintained a difference of 114 Hz in the pre-test and 88 Hz in the post-test while the experimental group maintained a difference of 68 Hz in the pre-test and 115 Hz in the post-test. In addition, it was only the experimental group that lowered F2 further by 12 Hz in the post-test in the emphatic context. The control group raised it by 44 Hz.

Finally, the results revealed statistically significant F2 mean differences between /i/ and /u/ as well as between /i/ and / æ/; however, no statistical differences were found between /u/ and /æ/. Even though there was no significant F2 mean difference between /u/ and /æ/, a numerical difference did exist. /æ/ had a mean difference of 257 Hz whereas /u/ had a mean difference of 153 Hz between emphatic and plain contexts. This indicates that the effect of emphasis is larger for the vowel /æ/ than for the vowels /i/ and /u/.

The present acoustic results raise questions about how the English-speaking learners' productions would be perceived by native speakers of Arabic. Future perception experiments should be designed to determine whether learners' emphatic productions are indeed perceived as emphatic. The acoustic results of this study suggest that this may be the case for the participants in the experimental group but not for the participants in the control group.

As previously discussed, the Native Language Magnet Model makes predictions for adults learning a second language. Iverson and Kuhl (1995) argue that adult L2 learners "would find it difficult to perceive a phonetic contrast from a new language when the sounds are proximate to a native-language prototype" (p. 561). The results of the perception experiment indicated that the participants could easily perceive the phonetic contrast existing between plain and emphatic consonants because only the plain consonants are proximate to their English counterparts.

In terms of the Speech Learning Model (Flege, 1995), discernibility of phonetic differences between L2 and L1 sounds depends on the perceived phonetic distance existing among them and establishing new phonetic categories will enable L2 learners to perceive and produce L2 sounds in a native-like fashion with significantly less interference from the L1. Since both the control and experimental groups obtained high scores in the pre- and perception post-tests, the participants perceived the emphatic consonants as "new" because they do not have a direct correspondence to sound categories in the their L1 (Flege, 1995). It seems that the participants had already created new phonetic categories for the emphatic consonants and this might explain why they obtained such high scores on the perception pre- and post-tests. Discerning the phonetic differences existing between Arabic plain and emphatic consonants resulted in maintaining a significant difference in F2 values in plain and emphatic contexts in the production experiment.

Concerning the Perceptual Assimilation Model (Best, 1995), the results showed that the Arabic plain consonants were assimilated to their English counterparts and the emphatic consonants were not assimilated to any category in English (UC Type). In the case of a UC Type, the predicted discrimination of the contrast is very good. The perception experiment provided evidence in support of this type of assimilation.

Conclusion

The perception results indicated that the participants in both groups had no difficulty in perceiving emphatic-plain consonant contrasts in both the pre- and post-tests; the two groups obtained high scores of correct responses on the perception pre- and post-tests. These high scores on both the pre- and post-tests provide empirical support for Hayes-Harb and Durham's (2016) claim that the contrast between plain and emphatic consonants is perceptually salient. As for production, the results also indicated that the participants in both groups generally had no difficulty in producing emphatic-plain consonant contrasts in both the pre- and post-tests. However, the production results indicated a general positive effect for pronunciation instruction (e.g. Akahane-Yamada et al., 1996; Gonzalez-Bueno, 1997; Gonzalez-Bueno & Quintana-Lara, 2011; Wang et al., 1999; Wang & Munro, 2004; Wayland & Guion, 2004). This effect was greater at the perception level than at the production. Flege, Bohn, and Jang's (1997) study showed that "production and perception of L2 vowels do not always match perfectly. At times, their perception may be somewhat more native-like than is their production" (p. 465).

It is important to point out that relatively short communicative pronunciation instruction (e.g. Wang et al., 1999; Wayland & Guion, 2004) seems to have helped the experimental group to relatively increase emphatic-plain consonant contrast differences in the post-test, whereas this effect was not observed in the control group. On the contrary, the control group reduced this difference. The promising effect of the communicative intervention received by the participants in the experimental group might be due to the fact that it combined Dalton and Seidlhofer's (1994) "exercise' and "explanation" procedures discussed above. The exercise procedure refers to "the traditional procedure of identifying specific sound features and providing practice in perception and production" (p. 72). It focuses on the explicit forms practice of the pronunciation features, i.e., it encourages imitation. In the explanation procedure, the idea is "to make students consciously aware of phonetic and phonological facts" (p. 72) because imitation (i.e., listen-and-repeat drills) might not be sufficient without conscious awareness of the pronunciation features. Moreover, the intervention represented an approach that is more analytic and explicit in nature and it is focused on analyzing linguistic features of the target language (Celce–Murcia et al., 1996).

Pedagogical Implications

The pronunciation component addressed by the present study was the perception and production of Arabic emphatic-plain consonant contrasts, which proved relatively difficult to produce, but not to perceive. Therefore, emphatic-plain consonant contrasts should be highlighted in pronunciation teaching in the language classroom. The present study seems to indicate that the participants' performance in the perception and production tasks are associated (e.g. Flege, 1995; Akahane-Yamada et al., 1996). However, perception of emphatic-plain consonant contrasts seems to be less challenging than production.

Therefore, it is suggested that pronunciation instruction materials should include more exercises at the production level when the target sound presents more difficulties in production that in perception (as is the case with Arabic emphatic consonants.). Including more production exercises throughout teaching materials will offer further practice with production skills. This study provided empirical evidence in support of both the traditional form-based as well as the communicative pronunciation teaching approaches. However, the findings are in favor of the communicative approach more than the traditional form-based one.

Due to the especially complex articulatory nature of the Arabic vowel /i/ in the emphatic context as explained above, instructors of Arabic should provide their English-speaking learners of Arabic with more activities that focus on producing this vowel in the emphatic context. Acquisition of emphatic-plain consonant contrasts when the following vowel is /i/ should always be prompted by an understanding of the importance of these contrasts for distinguishing meaning in their L2 (Dalton and Seidlhofer, 1994).

Limitations and Suggestions for Future Research

The present study dealt with only beginning learners. This made it relatively difficult to design tasks to collect more naturalistic production data due to the participants' inability to perform this type of tasks at the time the pre- and post-tests were administered. Consequently, the present study cannot make any claims concerning the effects of pronunciation teaching in more naturalistic speech contexts; the participants were tested only in a sentence-reading task in the production task. Future research should look into the effectiveness of communicative pronunciation teaching with higher proficiency learners to collect and compare production data from spontaneous speech.

Furthermore, the present study is limited in that it tested a small sample due to the limited number of students studying Arabic available at the University of Kansas. The effect of the sample size over the statistical power might have impeded the detection of statistical significance in the data collected from participants in the control and experimental groups. Another limitation is that only F2 of vowels in plain and emphatic environments was measured. In addition to measuring F2, further research needs to measure other acoustic cues on target vowels such as F1 and F3 as well as acoustic cues on target consonants such as VOT (Voice Onset Time) and COG (Center of Gravity). Measuring and comparing these acoustic cues will yield a more comprehensive view of the acquisition of emphatic-plain consonant contrasts by English-speaking learners of Arabic. Production experiments should be followed by perception experiments with naïve native listeners designed to determine whether learners' emphatic productions are indeed perceived as emphatic.

To perceptually evaluate learners' productions, a comprehensibility task might be designed where a panel of Arabic-speaking listeners rate each learner's emphatic productions for comprehensibility using Likert rating scale (e.g. Derwing & Munro, 1997; Munro & Derwing, 1995). The scale can range from 1 (extremely difficult to understand) to 9 (extremely easy to understand). In this task, the points on the scale represents the listeners' perception of the amount of effort involved in understanding the learners' productions. Another way of testing the learners' plain and emphatic productions is by having naïve native speakers of Arabic perform the same perception tasks used in this study. However, the stimuli in this case would be each learner's plain and emphatic productions. A third option would be a paired comparison task (adapted from Akahane-Yamada et al., 1996). In this task, a panel of naïve Arabic-speaking listeners provide their preference ratings between the target plain words and their emphatic counterparts (for both the pre-test and post-test versions). More specifically, the listeners indicate to what degree the emphatic word was better pronounced than its plain counterpart on a scale ranging from, say, 1 (no difference) to 7 (completely different).

Despite its limitations, this study represents an important contribution to the field of pronunciation teaching. It has brought together theory, research, and practice in designing and testing of pronunciation materials. In addition, this study examined empirical data that should help instructors and researchers better understand to what extent explicit instruction affects learners' outcomes. Language instructors may help their students improve their pronunciation and speaking skills using communicative interventions. The teaching materials developed for this study could be a good starting point for Arabic language instructors.

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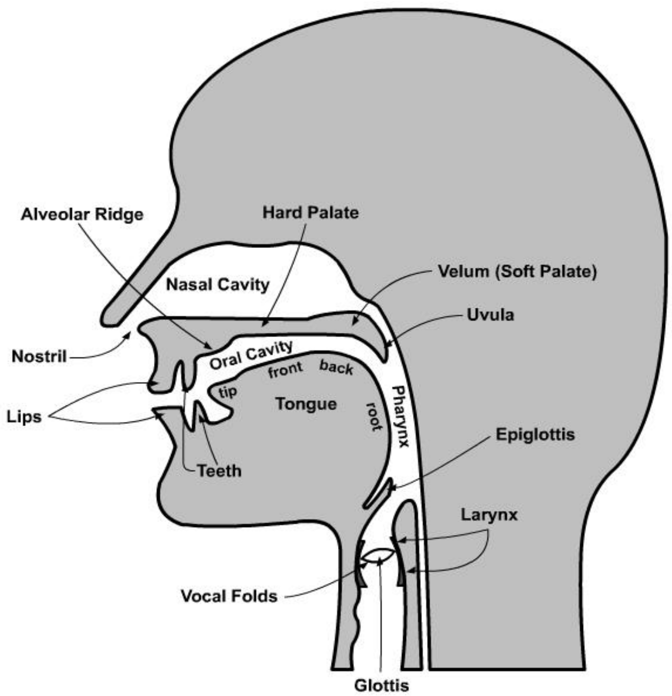
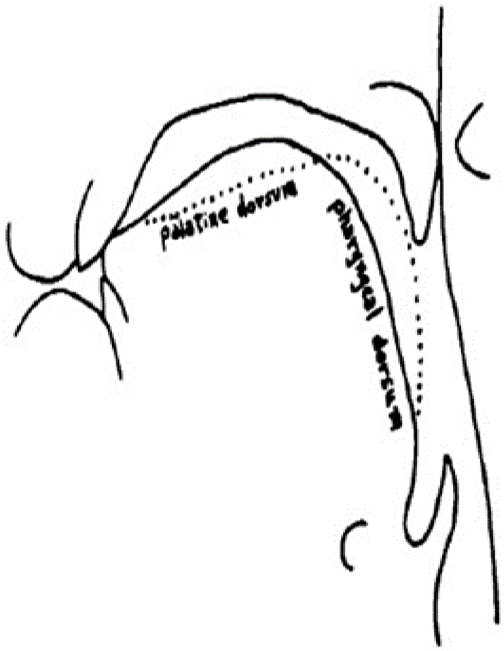
Appendices

Appendix I

Intervention

i. Visual Articulatory Description (Plain vs Emphatic Consonants)





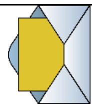
ii. Contrastive Analysis of the Differences between Arabic and English

iii. You will hear pairs of words. Sometimes the two words will be identical, and some other times they will be different. Listen carefully and indicate (X) in the following table whether the two elements of the pair sound the SAME or DIFFERENT.

NUMBER	SAME	DIFFERENT
1		
2		
3		
4		
5		
6		

7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

iv. You will listen to 10 words containing the target sounds. You will listen to one word at a time. Put a tick in the box under the picture representing the meaning of the word in the order you hear them.

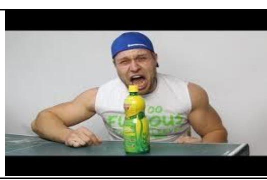
										
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

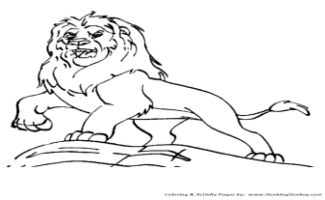
v. You will now work in pairs. Student A will read out one word from each minimal pair and then cross it out. Student B will in turn cross out the words he or she hears. Check answers!

Minimal Pair	
ظِلّ	ذِلّ
صِين	سِين
طِين	تِين
ضَلّ	دَلّ
طَاب	تَاب
صُور	سُور
صَاد	سَاد
ظَرْف	ذَرْف
ضَمّ	دَمّ

تَبَّل	طَبَّل

vi. You will work in pairs. Student A will read out one sentence from each sentence pair. Student B will place a checkmark in the box under the correct picture representing the meaning of the sentence. Exchange roles and check answers!

		
		هَذا الضَرْب لَن يُوصِلْك إلى مُبْتَغاك. This hitting will not help you achieve your goal.
		هَذا الدَرْب لَن يُوصِلْك إلى مُبْتَغاك. This path will not help you achieve your goal.
		
		يُوجَد فِي البُسْتَان تِين كَثِير. There is a lot of figs in the orchard.
		يُوجَد فِي البُسْتَان طِين كَثِير. There is a lot of mud in the orchard.
		
		صَدِيقي سَبّ العَصِير الّذِي اشْتَرَيْتُه. My friend cursed the juice I bought.
		صَدِيقي صَبّ العَصِير الّذِي اشْتَرَيْتُه. My friend poured the juice that I bought.
		
		صَدِيقَتِي مَهَا تَابَت بَعْد الحَادِث.

		My friend, Maha, repented after the accident.
		صَدِيقَتِي مَهَا طَابَت بَعْد الحَادِث. My friend, Maha, recovered after the accident.
		
		الأسَد سَاد حيوانات الغَابَة كُلّها. The lion dominated all the animals in the jungle.
		الأسَد صَاد حيوانات الغَابَة كُلّها. The lion hunted all the animals in the jungle.

vii. You will work in pairs. Student A will describe a picture using relevant words containing the target sounds and the other student will react to that description appropriately. Exchange roles!

A.

Student A says either one of the two sentences	Student B reacts according to which sentence s/he hears	Translation (A)	Translation (B)

يُوجَد في الحَدِيقة تِين/طِين كَثِير.	هَيَّا نَقْطِف بَعْضاً مِنْه للتَحْلِيَة.	There is a lot of figs/mud in the garden.	Let’s pick up some for desert!
	إحذَر أنْ تَدُوس عَلَيه.		Be careful not to step on it!

B.

Student A	Student B	Translation (A)	Translation (B)
صَدِيقي أحمد طَاب/تَاب بَعْد الحَادِث الحَمْدُلله.	مَاذا حَدَث له؟	My friend, Ahmed, recovered/repented after the accident, thank God!	What happened to him?
	ماذا كان يَفْعل؟		What was he doing?

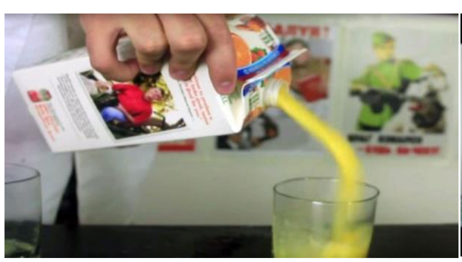
C.

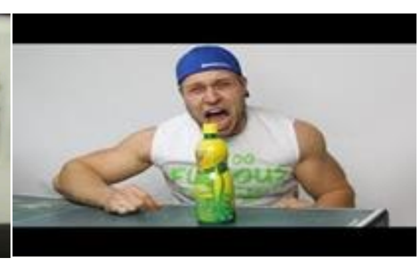
Student A	Student B	Translation (A)	Translation (B)
نَحْتَاج أن نَبْنِي سُور/صُور (مِن) جَدِيد.	مَاذا حَدَث للسُور القَدِيم؟	We need to build (a) new fence/Sour again.	Why? What happened to the old one?
	سَيَحْتاج ذلك لسنوات طَوِيلَة وأَمْوال كَثِيرة.		This will take many years and a lot of money.

D.

Student A	Student B	Translation (A)	Translation (B)
هَل تُرِيد شِرَاء عَصِير/عَسِير؟	نعم، سَأَشْتَرِي عَصِير البُرتُقال	Do you want to buy juice/Asir?	Yes, I will buy orange juice.
	هَل جُنِنت؟ كَيف أَستَطيع ذلك؟		Are you crazy? How can I do that?

E.





Student A	Student B	Translation (A)	Translation (B)
فَيصَل صَبّ/سَبّ العَصير.	هَل سَكَبَه على الأرض؟	Faisal poured/cursed the juice.	Did he spill it onto the floor?

	لِماذا؟ ألم يُعْجِبَه؟		Why? Didn't he like it?

viii. Tongue twister

فِي صُور جَنْب السُور يَجْلِسُ رَجُلٌ طَوِيل يَصُبُّ العَصِير لِرَجُلٍ قَصِير مِن عَسِير.

In Sour by the fence a tall man is sitting pouring juice for a short man from Asir.

Appendix II

Minimal Pairs used in the intervention

Number	Plain	Gloss	Emphatic	Gloss
1	tæ:b	He repented.	tˤæ:b	He recovered.
2	ti:n	Figs	tˤi:n	Mud
3	tæbbæl	He added spices.	tˤæbbæl	He played the drum.
4	tærib	He caught dust.	tˤærib	He felt amused.
5	dæll	He guided.	dˤæll	He went astray.
6	dæm	Blood	dˤæm	Hugging
7	sæ:d	He dominated.	sˤæ:d	He hunted.
8	ðærf	Shedding tears	ðˤærf	Envelope
9	dærb	Path	dˤærb	Hitting
10	ðil	Humiliation	ðˤil	Shadow
11	si:n	The letter س	sˤi:n	China
12	su:r	Fence	sˤu:r	A name of a city
13	sæb	He cursed.	sˤæb	He poured.

Appendix III

Perception Activity (discrimination: same or different?)

Minimal Pair		Same	Different
طَاب Brightened; ripened	تَاب He repented.		
ذَرْف Shedding tears	ذَرْف Shedding tears		
طِين Mud	تِين Figs		
ظَرْف Envelope	ظَرْف Envelope		
تَبَّل He added spices.	طَبَّل He played the drum.		
سَاد He dominated.	سَاد He dominated.		
طَرِب He felt amused.	تَرِب He caught dust.		
دَلّ	ضَلّ		

He guided.	He went astray.		
ذِلّ Humiliation	ذِلّ Humiliation		
ضَمّ Hugging	دَمّ Blood		
صَاد He hunted.	سَاد He dominated.		
ذَرْف Shedding tears	ظَرْف Envelope		
سُور Fence	سُور Fence		
دَمّ Blood	دَمّ blood		
طِين Mud	طِين Mud		
دَلّ He guided.	دَلّ He guided.		
طَاب	طَاب		

Brightened; ripened; recovered	Brightened; ripened		
ضَرْب Hitting	دَرْب Path		
صُور A name of a city	صُور A name of a city		
صَبّ He poured.	سَبّ He cursed.		

Appendix IV
Minimal Pairs Worksheet

Minimal Pair	
ظِلّ Shadow	ذِلّ Humiliation
صِين China	سِين The letter س
طِين mud	تِين Figs
ضَلّ He went astray.	دَلّ He guided.
طَاب Brightened; ripened	تَاب He repented.
صُور A name of a city	سُور Fence
صَاد He hunted.	سَاد He dominated.
ظَرْف	ذَرْف

Envelope	Shedding tears
ضَمّ Hugging	دَمّ Blood
تَبَّل He added spices.	طَبَّل He played the drum.

Appendix V

Perception Test: discrimination task

You will hear pairs of words. Sometimes the two words will be identical, and some other times they will be different. Listen carefully and indicate (X) in the following sheet whether the two elements of the pair sound the SAME or DIFFERENT.

Example:

You hear **"سَار- سَار"**

You mark (X) the column "SAME":

	SAME	DIFFERENT
1.	X	

You hear **"سَار- صَار"**

You mark (X) the column "DIFFERENT":

	SAME	DIFFERENT
1.		X

Training Session:

Word Pairs[2]			SAME	DIFFERENT
سَار He walked.	سَار He walked.	1.		
صَار He turned into (something).	سَار He walked.	2.		
صَار He turned into (something).	صَار He turned into (something).	3.		
صَك He fastened with a lock.	سَك He made coins.	4.		
صَك He fastened with a lock.	صَك He fastened with a lock.	5.		

[2] These two columns will be deleted in the actual test.

Test

Minimal Pair[3]			SAME	DIFFERENT
طِب Medicine	تِب Tape	1.		
ذَرْف Shedding tears	ذَرْف Shedding tears	2.		
طِين Mud	تِين Figs	3.		
ظَرْف Envelope	ظَرْف Envelope	4.		
تَبّل He added spices.	طَبّل He played the drum.	5.		
سُد Dominate!	سُد Dominate!	6.		
طَرِب He felt amused.	تَرِب He caught dust.	7.		
دَل	ضَل	8.		

[3] These two columns will be deleted in the actual test.

He guided.	He went astray.			
ذِل humiliation	ذِل Humiliation	9.		
ضُم Hug!	دُم Remain!	10.		
صِد Hunt!	سِد Close!	11.		
ذَرْف Shedding tears	ظَرْف Envelope	12.		
سُور Fence	سُور Fence	13.		
دُم Remain!	دُم Remain!	14.		
طِين Mud	طِين Mud	15.		
دُل Guide!	دُل Guide!	16.		
طَاب	طَاب	17.		

Brightened; ripened; recovered	Brightened; ripened			
ضَرْب Hitting	دَرْب Path	18.		
صُور A name of a city	صُور A name of a city	19.		
صِب Touch!	سِب Leave!	20.		

Appendix VI

Perception Test: identification task

You will hear individual words read from either one of two columns. Mark (X) the word that you think is being pronounced.

Example:

You hear "تِين"

You mark (x) the word "تِين" from list A

You hear "طِين"

You mark (x) the word "طِين" from list B

Training Session:

		B		A
1.		صَبّ He poured.		سَبّ He cursed.
2.		ضَرْب Hitting		دَرْب Path
3.		ذَرْف Shedding tears		ظَرْف Envelope
4.		صَاد He hunted.		سَاد He dominated.
5.		ضَمّ Hugging		دَمّ Blood

Test

		B		A
		B		A
1.		طَاب Brightened; ripened		تَاب He repented.
2.		طِين Mud		تِين Figs
3.		تَبّل He added spices.		طَبّل He played the drum.
4.		طَرِب He felt amused.		تَرِب He caught dust.
5.		دُل Guide!		ضُل Go astray!
6.		ضُم Hug!		دُم Remain!
7.		صور Name of a city		سور Fence
8.		صين China		سين The letter س
9.		ضَرْب Hitting		دَرْب Path
10.		صيب Touch!		سيب Leave!