

8-1-2015

PERCEPTION OF /q/ IN THE ARABIC /q/- /k/ CONTRAST BY NATIVE SPEAKERS OF AMERICAN ENGLISH: A DISCRIMINATION TASK

Ousmane Sawadogo

Southern Illinois University Carbondale, sdg.ous@gmail.com

Follow this and additional works at: <http://opensiuc.lib.siu.edu/theses>

Recommended Citation

Sawadogo, Ousmane, "PERCEPTION OF /q/ IN THE ARABIC /q/-/k/ CONTRAST BY NATIVE SPEAKERS OF AMERICAN ENGLISH: A DISCRIMINATION TASK" (2015). *Theses*. Paper 1695.

This Open Access Thesis is brought to you for free and open access by the Theses and Dissertations at OpenSIUC. It has been accepted for inclusion in Theses by an authorized administrator of OpenSIUC. For more information, please contact opensiuc@lib.siu.edu.

PERCEPTION OF /q/ IN THE ARABIC /q/-/k/ CONTRAST BY NATIVE SPEAKERS OF
AMERICAN ENGLISH: A DISCRIMINATION TASK

by

Ousmane Sawadogo

B.S., Al Azhar University, 2003

M.S., Cheikh Anta Diop University, 2011

A Thesis

Submitted in Partial Fulfillment of the Requirements for the
Master of Arts in Applied Linguistics and Teaching English to Speakers of Other Languages.

Department of Linguistics
in the Graduate School
Southern Illinois University Carbondale
August 2015

THESIS APPROVAL

PERCEPTION OF /q/ IN THE ARABIC /q/-/k/ CONTRAST BY NATIVE SPEAKERS OF
AMERICAN ENGLISH: A DISCRIMINATION TASK

By

Ousmane Sawadogo

A Thesis Submitted in Partial

Fulfillment of the Requirements

for the Degree of

Master of Arts

in the field of Applied Linguistics and TESOL

Approved by:

Dr. Soo Jung Chang, Chair

Dr. Karen Baertsch

Dr. Krassimira Charkova

Graduate School
Southern Illinois University Carbondale
May 12, 2015

AN ABSTRACT OF THE THESIS OF

Ousmane Sawadogo, for the Master of Arts degree in Applied Linguistics and TESOL, presented on May 4, 2015, at Southern Illinois University Carbondale.

TITLE: PERCEPTION OF /q/ IN THE ARABIC /q/-/k/ CONTRAST BY NATIVE SPEAKERS OF AMERICAN ENGLISH: A DISCRIMINATION TASK

MAJOR PROFESSOR: Dr. Soo Jung Chang

Studies on speech perception have suggested that non-native sound perception is influenced by the listener's native language. Non-native sound contrast perception depends on a given sound's similarity or dissimilarity to the listener's equivalent native language sound. The Perceptual Assimilation Model (PAM) posits that it is difficult to distinguish non-native sounds when they are perceived as very similar to native sounds and are thus assimilated to a native sound category, but identification is easier when the non-native sound is dissimilar to a native sound (Best, 1994a). The present study investigated whether native speakers of American English would display very good discrimination of /q/ in the Arabic /q/-/k/ contrast as predicted by the PAM. The Speech Learning Model (SLM) posits that non-native perception is position-sensitive and hypothesizes that the listener's perception of non-native sounds would vary from one position to another (Flege, 1995). The current study also aimed to investigate whether the discrimination of the Arabic /q/-/k/ contrast would be position-sensitive. The current study also investigated the effect of the vocalic context on the discrimination of /q/.

Participants consisted of 22 (6 male and 16 female) native speakers of American English who were students or faculty members at Southern Illinois University. Their ages ranged between 19 and over 50. The data were collected through an online AXB discrimination task survey. Target sounds were represented in 108 pseudowords so that the sounds could be

contrasted in minimal pairs. The environments were word-initially followed by /i/, /u/, and /a/; word-medially, between two instances of /i/, two instances of /u/, and two instances of /a/; and word-finally, preceded by /i/, /u/, and /a/. Two pseudoword pairs were selected for each contrast. Four AXB combinations (AAB, ABB, BAA, and BBA) were generated for each of the nine contrasts, which resulted in a total of 36 stimuli. The participants were requested to click on a button to listen to the recordings of these word pairs and check the right answer.

The findings were consistent with predictions made by PAM that native speakers of American English would have a very good discrimination of /q/ in the Arabic /q/-/k/ contrast. The results suggested that the uncategorized versus categorized (UC) type could also be of excellent discriminability. SLM was not totally supported because the differences were not statistically significant. However, the data indicated that some positions resulted in better discrimination scores than other positions and that certain vowels likewise resulted in better vocalic discrimination scores.

Keywords: Discrimination task, non-native sound perception, Arabic /q/-/k/ contrast, position-sensitive, context-sensitive, vocalic context, UC type assimilation, Speech Learning Model (SLM), Perceptual Assimilation Model (PAM).

TABLE OF CONTENTS

<u>CHAPTER</u>	<u>PAGE</u>
ABSTRACT.....	i
LIST OF TABLES.....	iv
LIST OF FIGURES.....	v
CHAPTERS	
CHAPTER 1 – Introduction.....	1
CHAPTER 2 – Literature Review.....	16
CHAPTER 3 – Methodology.....	22
CHAPTER 4 – Results.....	33
CHAPTER 5 – Discussion, Limitations, and Conclusion.....	43
REFERENCES.....	52
APPENDICES	
Appendix A.....	61
Appendix B.....	62
Appendix C.....	63
Appendix D.....	64
VITA.....	68

LIST OF TABLES

<u>TABLE</u>	<u>PAGE</u>
Table 1	8
Table 2	13
Table 3	14
Table 4	15
Table 5	27
Table 6	28
Table 7	29
Table 8	30
Table 9	35
Table 10	36
Table 11	36
Table 12	37
Table 13	38
Table 14	38
Table 15	39
Table 16	40
Table 17	41
Table 18	41
Table 19	42

LIST OF FIGURES

<u>FIGURE</u>	<u>PAGE</u>
Figure 1	15
Figure 2	25
Figure 3	25
Figure 4	33

CHAPTER 1

INTRODUCTION

In Arabic, the uvular /q/ and the velar /k/ are contrastive; for example, /qalb/ means ‘heart’ while /kalb/ means ‘dog’. English on the other hand does not have /q/. It would therefore be interesting to test how native speakers of English perceive this non-native phoneme when they encounter it. Would they perceive it as /k/ or realize that /q/ is different from /k/? This study investigated the discrimination of non-native sound contrasts, testing the ability of native speakers of American English to discriminate the Arabic phoneme /q/.

Perception is the “transformation of an acoustic signal transmitted from a speaker to an intended communicative message heard by a listener” (Gierut & Pisoni, 1988, p. 253). It is “in general, the mapping from raw sensory data to a more abstract mental representation, or any step therein” (Boersma, 2006, p. 1). The perception of two sounds as the same phonological structure by a listener does not necessarily mean that the listener cannot hear the difference between them. Listeners are often able to discriminate sounds that they would label as the same phoneme (Boersma, 2006). Perception of contrastive sounds not only involves detecting the differences in the acoustic signals of the categories, but also deciding the right identity of the stimuli based on internalized phonetic categories. For these reasons, different experimental paradigms have been used to investigate adult speech perception, which include the presentation of a set of stimuli organized in a certain order to the participants (Strange & Shafer, 2008).

Adults generally perceive their native sounds with little effort (Strange & Shafer, 2008). However, more effort is needed in order to perceive non-native sounds. This effort to perceive non-native sounds may fail because of the native language sound system. For example, Japanese native speakers have difficulty discriminating /l/ from /ɾ/, and Arabic native speakers have a hard

time differentiating /p/ from /b/ (Aoyama, Flege, Guion, Akahane-Yamada, & Yamada, 2004; Buali, 2010). In addition, adult native English-speakers have difficulty differentiating the non-native dental/retroflex /t̪/-/t̚/ contrast found in Hindi initial stops (Werker, Gilbert, Humphrey, & Tees, 1981; Polka, 1992). They likewise have the same difficulty with the velar/uvular /kʰ/-/qʰ/ contrast in ejective stops in Nthlakampx (Strange & Shafer, 2008; Werker & Tees, 1984a, 1984b).

Cross-language speech perception recognizes that second language learners' perception of non-native sounds is influenced by their first language (L1) sound system. The contrastive analysis hypothesis formulated by Lado (1957) predicts for instance that L1 learners will have difficulty acquiring sounds and structures in their second language (L2) that are different from those in their L1. The contrastive analysis is based on the assumption that L1 formal features are transferred to the L2 (Yang, 1992). Lado (1957) stated that by methodically comparing the L1 and L2 as well as the cultures that use them, he could predict which patterns would be more likely to cause difficulties for L2 learners and those that would not.

A simple contrastive comparison between L1 and L2 phonemes does not explain why the differences between some L1 and L2 phonemes are easy to perceive whereas some remain difficult to perceive (Eckman, 1987; Gass & Selinker, 2001; Towell & Hawkins, 1994; Al Mahmoud, 2012). Studies on adult listeners' perception of non-native consonant and vowel contrasts, such as Strange and Shafer (2008), have shown poorer performance than with native language listeners but not all the non-native phonetic contrasts are perceived with the same level of difficulty. In a 1992 experiment conducted by Polka, English listeners performed better on the velar/uvular contrast in the voiced Farsi stops /g, ɟ/ than on the /kʰ/-/qʰ/ contrast. An earlier study

was conducted with adult English speakers who also had a very good discrimination of place and voicing contrasts among Zulu clicks (Best, McRoberts, & Sithole, 1988).

Iverson, Kuhl, Akahane-Yamada, Diesch, Tokura, and Ketteman (2001) stated that individuals are born with the ability to learn any language, but exposure during childhood modifies their neural organization to the extent that they develop perceptual and cognitive processes that are limited to their native language sounds. Furthermore, they postulated that the difficulties encountered by an L2 learner to perceive non-native sounds are evident from the change in neural organization. The loss of ability in adults to distinguish non-native sounds is not permanent. Adults can still acquire non-native sounds if they are trained, but the rate of success will be different from one person to another (Iverson et al., 2001; Pisoni, Lively, & Logan, 1994; Rvachew & Jamieson, 1995). More evidence that language exposure affects perception is found in Iverson et al. (2001). Their findings suggested that experience could affect the ability to acquire non-native phonemes without permanently preventing them from doing so.

Perception can be tested experimentally through two general tasks: *identification* and *discrimination*. The difference between these two tasks is that in an identification task, the stimuli are presented one at a time to the participants, who are asked to point out their categorization of each stimulus by selecting from a set of responses. In order to measure the difficulty of a non-native sound, some identification task experiments may also measure the reaction times (RT), the amount of time that passes from the presentation of each stimulus to the participant's response (Strange & Shafer, 2008). On the other hand, in a discrimination task, two or more stimuli are presented to participants, who are asked to identify the relationship between the stimuli and whether they are the same or different (Strange & Shafer, 2008). The discrimination task allows listeners to compare a stimulus with two possibilities and decide

which one is the same as the stimulus. The listener in the discrimination task is thus asked to detect small differences (Mora, 2007).

The AX paradigm is the simplest in the discrimination task. In an AX paradigm, two stimuli are presented to the participant; the second stimulus is either the same as the first (AA) or different from the first (AB); the correct response is “Same” or “Different” (Strange & Shafer, 2008). Speech researchers have developed more complicated trial structures in which comparisons are required among three stimuli, such as ABX, AXB, and Oddity. In the ABX task, A and B are different sound categories, and X is the same as A or B; after listening to all three sounds, the listener selects whether $X = A$ or $X = B$. In the AXB structure, A and B are also different sound categories, and X is the sound that needs to be compared. In the Oddity paradigm, three sounds are presented to the participant, two from the same sound category and one from a different sound category (Strange & Shafer, 2008).

Different hypotheses and models of speech perception have been developed to understand and predict areas of difficulty that L2 learners could encounter when acquiring non-native sounds. Among the numerous speech perception models, two are related to the current study: the Speech Learning Model (SLM) by Flege (1987, 1995) and the Perceptual Assimilation Model (PAM) by Best, McRoberts, and Sithole (1988) and Best (1995). The following section discusses these two models.

1.1. Related Theories

1.1.1. Speech Learning Model (SLM)

The Speech Learning Model (SLM) was developed by Flege and his colleagues (Flege, 1987, 1991, 1995; Flege, Schirru, & Mackay, 2003) to account for how second language learners learn to or fail to produce and perceive non-native phonetic segments (Flege, 2005). SLM

theorizes that during L1 acquisition, speech perception is shaped by the contrastive phonemes of the learner's L1. L2 learners may not successfully discriminate the phonetic differences of the L2 sounds or between L1 and L2 sounds for two reasons: either because phonetically distinct sounds in the L2 are assimilated to a single sound category or because the L2 sound features that are important phonetically, but not phonologically, are filtered by the L1 phonology (Flege, 1995). For instance, native speakers of English in the current study may not succeed in discriminating /q/ in the /q/-/k/ contrast if they assimilate /q/ to /k/. The model claims that production of L2 sounds would not be accurate without accurate perceptual targets that guide the L2 learning process (Flege, 1995).

SLM proposes that L2 learning is mostly influenced by the nature of the input received. As with learning L1 speech sounds, L2 speech learning requires time. Furthermore, the mechanisms that lead to successful L1 speech acquisition and the ability to form new phonetic categories remain perfect and accessible during one's lifetime, and phonetic elements of the L1 and L2 phonetic subsystems mutually influence one another because they remain in a "common phonological space" (Flege, 1995). SLM presents seven hypotheses derived from empirical data and from four assumptions. The postulate related to the current research states that the mechanism leading to successful L1 speech acquisition and the ability to form new phonetic categories remain perfect and accessible over the lifetime of a learner and can be applied to L2 acquisition. Consequently, the ability of native speakers of American English to perceive /q/ remains perfect and can be activated any time. Among the seven hypotheses mentioned by Flege (1995), the two following hypothesis are relevant to the current study.

SLM Hypothesis 1 states that "Sounds in the L1 and L2 are related perceptually to one another at a position-sensitive allophonic level, rather than at a more abstract phonemic level"

(Flege, 1995, p. 239). SLM Hypothesis 1 is supported by the fact that L2 learners of English have more success in producing and perceiving certain allophones of English phonemes in certain positions. For instance native speakers of Japanese, in general, have difficulties producing and perceiving English /l/ and /ɪ/ (Flege, 1995). However, they produce and perceive them more accurately in word-final than in word-initial position (Strange, 1992). Based on SLM Hypothesis 1, the accuracy in perceiving /q/ by native speakers of American English in the current study was expected to vary according to the position of /q/ in the word.

SLM Hypothesis 3 affirms that “The greater the perceived phonetic dissimilarity between an L2 sound and the closest L1 sound, the more likely it is that phonetic differences between the sounds will be discerned” (Flege, 1995, p. 239). Support for Hypothesis 3 comes from the fact that Japanese /ɾ/ is perceptually closer to the English /l/ than to the English /ɪ/ (Flege, 1995; Sekiyama & Tohkura 1993; Takagi, 1993). This can lead to an expectation that the majority of Japanese learners of English would be able to discriminate all or some of the phonetic differences between Japanese /ɾ/ and English /ɪ/ but would have difficulties discriminating between Japanese /ɾ/ and English /l/ (Flege, 1995). Hypothesis 3 is not fully applicable to the current study since there is no English phoneme other than /k/ close to the Arabic /q/. However, it could be expected that native speakers of American English in the current study would have difficulties discriminating /q/ simply because it can be assimilated to English /k/ and the dissimilarity between /q/ and /k/ may not be great. It took me years to hear the difference between /q/ and /k/ when I was learning Arabic.

The next section discusses the Perceptual Assimilation Model (PAM), the second speech perception theory related to the current study.

1.1.2. Perceptual Assimilation Model (PAM)

When perceiving a speech contrast that is not used in their native language, adult listeners are confronted with differences between their native sounds and the non-native sounds they hear. This situation raises questions about how listeners approach these differences and perceptually what the relationship between the properties of the native phonemes and the non-native phonemes would be (Best, 1994a). The Perceptual Assimilation Model (PAM) hypothesizes that the listeners' perception of non-native sounds is based on similarities to native phonemes. Listeners have difficulties identifying the differences between the native and non-native sounds if they perceive the sounds as very similar to their native sounds. In this case, they assimilate the non-native sound to a native sound category. In contrast, they perceive the differences between the native and non-native sounds if they are not able to detect a similarity between the non-native sound and native phoneme. No assimilation would take place in this case (Best, 1994a).

PAM (Best, 1995) theorizes that non-native sound categories perceptually assimilate into the native phonemic inventory and that the discrimination of non-native sounds can be predicted. PAM expects listeners to detect the similarities and dissimilarities to the native sound at the same time, especially when the difference is particularly large (Best, 1995). It argues that in some cases, when the difference is very large, the non-native sounds may not assimilate strongly to any specific native sound but instead be perceived as having global speech-like sound properties. In cases where the difference is extremely large, they are heard as non-speech sounds, such as choking or fingers snapping and not even be recognized as speech (Best, 1995).

According to PAM (Best, 1995), assimilation is determined by tests that measure identification, classification, or categorization of non-native sounds. Non-native phonemes are assimilated in three categories. First, they are assimilated to a native category when the sound is

clearly assimilated to a specific sound category in which it may be heard as a good, acceptable, or notably aberrant model of the category. Second, they are assimilated as uncategorizable speech sounds when the sound is assimilated as a speech-like sound, but not as a clear model of any specific native category. Third, they are not assimilated to a speech sound when the sound is heard as a non-speech sound.

Predictably, non-native contrast assimilation patterns follow the assimilation of each member of the contrast. Based on the assimilation of each of the contrasting non-native sounds, the degree of perceptual discriminability for diverse non-native contrasts can be predicted (Best, 1995). Table 1 shows the different possible types of assimilation and their expected discriminability according to PAM. They are listed according to a hierarchy of easy to difficult, not according to Best's (1995) order. Two-category assimilation is the easiest to perceive since its discrimination is expected to be excellent, whereas single category assimilation is the most difficult to perceive since its discrimination is expected to be poor. In the current study, the grading scale was arbitrary set as follows: 90+= excellent, 80-89= very good, 70-79= good, 60-69= moderate and 0-59= poor.

Table 1

Assimilation Type and Expected Discrimination

Assimilation Type	Expected Discrimination
1- Two-category assimilation (TC type)	Excellent
2- Uncategorized versus categorized (UC type)	Very good
3- Nonassimilable (NA type)	Good to very good
4- Category-goodness difference (CG type)	Moderate to very good
5- Both uncategorizable (UU type)	Poor to very good
6- Single-category assimilation (SC type)	Poor

The PAM theorizes that there are six types of possible assimilations of non-native sounds. Based on these types of assimilations, it could be predicted whether the non-native sound would have a

poor or an excellent discriminability by listeners. The first type of assimilation is the two-category assimilation (TC type). In this type of assimilation, each non-native sound is assimilated to a different native sound category. For instance, native speakers of English are expected to assimilate the Hindi retroflex stop /ɖ/ to the English [d], but they may assimilate the Hindi breathy-voiced dental stop /ɖʱ/ to the English voiced dental fricative /ð/, which is a different English phoneme (Best, 1994b). PAM predicts that the discrimination of this type of sound would be excellent (Best, 1995).

The second type of assimilation is the category-goodness difference (CG type). In this type of assimilation, both non-native sounds are assimilated to the same native category. The two sounds are different from the perfect native sound, but one is an acceptable example whereas the other is a deviant model. For example, native speakers of English are expected to assimilate both the voiceless aspirated velar /k/ and the ejective velar /k'/ in Zulu to the English [k^h]. However, the Zulu voiceless aspirated /k/ is expected to be perceived by native speakers of English as identical to English /k/, whereas the ejective velar /k'/ is expected to be perceived as a different sound from English /k/ (Best, 1994b). PAM predicts that the discrimination of this type of sound would be moderate to very good (Best, 1995).

The third type of assimilation is the single-category assimilation (SC type). In this type of assimilation, both non-native sounds are assimilated to the same native category, but are equally different from the perfect native sound. They are both either equally acceptable models or equally deviant models of the native sound. For instance, native speakers of English are expected to assimilate the Nlaka'pamux ejective velar /k'/ and uvular /q'/ to the English [k^h], even though both sounds would be heard as different from the English /k/ (Best, 1994a). Another example of this type of assimilation is that Japanese speakers' are expected to assimilate the English /ɪ/ and

/l/ as poor examples of either the Japanese /r/ or /w/ (Best & Strange, 1992; Takagi & Mann, 1995; Yamada & Tohkura, 1992; Best, 2001). PAM predicts that the discrimination of this type of sound would be poor (Best, 1995).

The fourth type of assimilation is the both uncategorizable (UU type). In this type of assimilation, both nonnative sounds are different from any native sound. For example, native speakers of Japanese and Korean are expected to assimilate the English /ɹ/-/l/ contrast to both, the English /ɹ/ and /l/ as poor model of their native /r/ or /w/ as uncategorizable sounds. That is because their native languages do not have /l/ and because their /r/ is a flap /r/, which is deferent from the American English /ɹ/ (Yamada & Tohkura, 1991; Best, 1994b). PAM predicts that the discrimination of this type of sound would range from poor to very good (Best, 1995).

The fifth type of assimilation is the uncategorized versus categorized (UC type). In this type, one non-native sound is assimilated to a native sound category, and the other is not assimilated to any native sound category. For example, in the English /w/-/ɹ/ contrast, native speakers of Japanese are expected to assimilate the English /w/ to the Japanese /w/, but the English /ɹ/ is not assimilated to any Japanese sound category (Guion, Flege, Akahane-Yamada, & Pruitt, 2000; Best, 2001; Al Mahmoud, 2012). PAM predicts that the discriminability of this type of sound would be very good (Best, 1995).

The sixth type of assimilation is the nonassimilable (NA type). In this type, neither non-native sound exists in the listener's native languages. As a result they are heard by the listener as non-speech sounds. For example, native speakers of English perceived Zulu click consonants as non-speech sounds in Best et al. (1988) and Best (2001), and they failed to assimilate them to any English consonants. PAM predicts that the discrimination of this type of sound would range from good to very good (Best, 1995).

Uncategorized versus categorized (UC type) is the type most closely related to the current study. In UC type, one non-native sound is assimilated to a native category, but the other sound does not fall under any native category. For example, in a Japanese native speaker's perception of the English /w/-/ɪ/ contrast, /w/ is assimilated as Japanese /w/ but English /ɪ/ is not assimilated to any Japanese category (Guion, Flege, Akahane-Yamada, & Pruitt, 2000; Best, 2001; Al Mahmoud, 2012). Likewise, in a native American English speaker's perception of the Arabic /k/-/q/ contrast, /k/ is assimilated as the English /k/ but /q/ is not assimilated to any English sound category. PAM predicts that in this case, discrimination would be very good (Best, 1995). Consequently, native speakers of American English, like native speakers of Japanese, are expected to have “very good” discrimination of /q/ in the Arabic /q/-/k/ contrast.

1.1.3. Vocalic Context Influence in the Perception of Consonants

Besides the two hypotheses mentioned above, some speech perception studies have shown that stop consonants, such as /b, d, g, p, t, k/, have significant acoustic features that are context-sensitive. The physical energy associated with these types of stops changes according to the following or preceding phonemes (Just, Suslick, Michaels, & Shockey, 1978). Shafiro, Levy, Khamis-Dakwar, & Kharkhurin (2013) found that the discrimination of American-English consonants was context-sensitive. The discrimination accuracy in their study was different in the three vocalic contexts /aCa/, /iCi/, and /uCu/. Thus, it was expected that participants' discrimination in the current study would also be context-sensitive.

The current study tested the predictions made by PAM and SLM on the discrimination of /q/ in the Arabic /k/-/q/ contrast by native speakers of American English. In addition, it tested whether the type of vowel served as a significant cue in the discrimination of /q/ and if so, which of the three vowels—/i/, /u/, or /a/—had the strongest perceptual effect. After discussing SLM

and PAM and the role of the adjacent vowel in the perception of stops, the next section gives an overview of the Arabic consonant inventory.

1.1.4. Arabic Background and Consonant Inventory

Ferguson (1959) mentioned Arabic along with Greek, Haitian Creole, and Swiss German as prime examples of diglossia. In a diglossic speech community, there is a “High” language variety that is very prestigious and a “Low” variety that does not have an official status, and the two varieties are in complementary distribution (Ferguson, 1959; Hashem-Aramouni, 2011). An important aspect of diglossia is that the speakers have high personal perception of the “High” variety and see it as the real, official, or pure form of the language. On the other hand, they see the “Low” variety as corrupt and incorrect usage of the language (Hashem-Aramouni, 2011).

The diglossia in Arabic stems from the fact that the formal structure of the language, called in Arabic *al-fuṣḥa* and often referred to as Modern Standard Arabic (MSA), is used for religious purposes, drama, and literature. This form is not used for ordinary conversation. A slightly less formal version of MSA called Educated Spoken Arabic (ESA) may be used in schools, speeches, public meetings, conversations among professionals, and among those whose local dialects would be unintelligible (Ferguson, 1959; Amayreh, 2003; Mitchell, 1986; Zughoul, 1980). In contrast, spoken Arabic, referred to as colloquial Arabic, dialects, or vernaculars, remains largely unwritten. Each regional variety represents a unique culture and people. It is this cultural variety along with its people that differentiate colloquial Arabic from the uniform MSA. The colloquial Arabic varieties are almost entirely mutually unintelligible (Palmer, 2007). Table 2, adapted from Palmer (2007), shows the different varieties of spoken Arabic. The English sentence “I want to go now” is expressed differently in MSA from the Iraqi, Syrian, Jordanian,

Egyptian, and Moroccan dialects. The “(q)” represents a glottal stop /ʔ/ and the capital “H” represents the pharyngeal fricative /ħ/.

Table 2

MSA and Colloquial Arabic

English:	I want to go now	
MSA:	/uri:du an aħhaba alʔa:n/ (Ureedu an ath-haba alaan)	
Iraqi:	/ari:d ar:uħ hassa/	(Areed aruuH haessa)
Syrian:	/bididi: rur:uħ hallaʔ/	(Bididi ruuH haellae(q))
Jordanian:	/bididi: rur:uħ hallaʔ/	(Bididi aruuH haellae(q))
Egyptian:	/a:wiz arur:uħ dilwaʔti/	(Aawiz aruuH dilwa'ti)
Moroccan:	/bgi:t nimshi da:ba/	(Bgheet nimshi daaba)

An important distinguishing characteristic of Arabic diglossia is how the uvular /q/ is represented. The MSA uvular plosive /q/ is maintained in some dialects, such as many Syrian and North African dialects and in sedentary dialects spoken in the west and south of the Arabian Peninsula (Watson, 2002). In the large cities around the Mediterranean, including Cairo, Jerusalem, Damascus, and Beirut, it is produced as a glottal-stop /ʔ/. In many regions of rural Palestine, it is produced as a voiceless velar stop /k/. In Bedouin dialects and the dialects spoken in the central region of northern Yemen, it is produced as a voiced velar stop /g/. Finally, in a few dialects spoken in western regions of northern Yemen, it is produced as a voiced uvular stop /g/ (Watson, 2002). Since the perception tested in the current study was the uvular /q/ of MSA, the Arabic consonant inventory was limited to that of MSA.

As mentioned earlier, there are three different levels of Arabic: 1) Modern Standard Arabic (MSA), used in religious ceremonies and literature; 2) Educated Spoken Arabic (ESA), used in schools and public areas; and 3) Colloquial Arabic, which is specific to different regions and is used at home and in the local community (Amayreh, 2003). MSA has 28 letters and three diacritics—one each for the nominative, accusative, and genitive cases (Amer, 2012). Modern

Standard Arabic has three short vowels /i, u, a/ and their three long counterparts /i:, u:, a:/ (Watson, 2002). Table 3, adapted from Amayreh (2003), shows the consonant inventory of MSA, which is contrasted with the consonant inventory of English adapted from Edwards (1992) given in Table 4. Figure 1, adapted from Thelwall and Sa'Adeddin (1990), shows the three Classical Arabic vowels.

Table 3

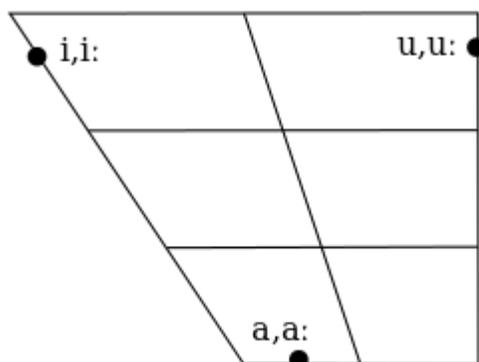
Arabic Consonant Inventory

	Bilabial	Labiodental	Dental	Alveodental	Palatal	Velar	Uvular	Pharyngeal	Glottal		
Stop	b ب			t ت tʰ ط	d د dʰ ض	k ك	q ق		ʔ أ		
Fricative		f ف	θ ث	ð ذ ðʰ ظ	s س sʰ ص	z ز	ʃ ش	χ خ	ʁ غ	ħ ح	ʕ ع
Affricate						dz ج					
Nasal	m م				n ن						
Liquid					l ل						
Tap/trill					r/r̄ ر						
Glide	w و					j ي					

Table 4

English Consonant Inventory

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Labiovelar
Stop	p b			t d				k g	
Fricative		f v	θ ð	s z	ʃ ʒ				ʍ*
Affricate					tʃ dʒ				
Nasal	m			n				ŋ	
Approx.				l		ɹ	j		w

*Figure 1.* Classical Arabic vowels, adapted from Thelwall and Sa'Adeddin (1990).

The Arabic consonants that are not found in English are emphatic (pharyngealized) /t^ʕ, d^ʕ, ð^ʕ, s^ʕ/, uvular /q, χ, ʁ/, pharyngeal /ħ, ʕ/, and glottal /ʔ/ (Amayreh, 2003; Al Mahmoud, 2003, Laufer & Baer, 1988; Kopczynski & Meliani, 1993; Al-Solami, 2013; Javed, 2013). As mentioned above, in Arabic, the uvular /q/ and velar /k/ are contrastive; /kul/ is a command to eat, whereas /qul/ is a command to speak. The voiceless uvular stop /q/ is pronounced with the back of the tongue raised against the uvula. For example, Kuwait starts with /k/ whereas Qatar starts with /q/ (Javed, 2013).

After discussing the theoretical background in this chapter, the next chapter will examine the empirical literature related to the current study.

CHAPTER 2

REVIEW OF EMPIRICAL LITERATURE

While the previous chapter discussed the theoretical background of L2 sound perception and L2 phonological acquisition, this chapter discusses and summarizes empirical research related to the current study. Some of these empirical studies did not use the same sample or variables as the present study, but they have a strong connection to the topic in the sense that they address L2 sound perception.

Al Mahmoud (2012) examined the ability of native speakers of American English to perceive and discriminate Arabic phonemic contrasts. He tested PAM in a forced choice AXB discrimination task. Twenty-two students already exposed to Arabic in a university-level program took part in the study. The Arabic consonant contrasts he tested were 1) voicing (voiceless vs. voiced): /t/-/d/, /θ/-/ð/, /χ/-/ʁ/; 2) manner (emphatic vs. non-emphatic): /tˤ/-/t/, /ðˤ/-/ð/; (plosive vs. continuant) /q/-/χ/; and 3) place (pharyngeal vs. glottal): /ħ/-/h/; (velar vs. uvular): /q/-/k/; (uvular vs. pharyngeal): /χ/-/ħ/. The results yielded partial support for PAM predictions. For /q/-/k/, PAM predicted Arabic /q/ would be assimilated to English /k/ as a very poor exemplar of the UC type, where the non-native sound is assimilated to a native category, and the other falls in the phonetic space outside native categories. PAM expected that discrimination in this situation would be “very good” (Best, 1995). Al Mahmoud (2012) found the discrimination of the /q/-/k/ contrast by native speakers of American English to be poor, hovering around the range of 64.8%, contradicting PAM.

Hong and Sarmah (2009) aimed at figuring out how Arabic phonemes are perceived by native Korean speakers. They conducted two perception experiments with 22 native speakers of Korean who were divided into two groups based on their level of experience with Arabic. Group

1 (the KA group) consisted of ten college students majoring in Arabic at the Hankuk University of Foreign Studies, and Group 2 (the KN group) consisted of participants with no prior knowledge of Arabic. Experiment 1 used an AX discrimination task designed to test native Korean speakers' perception of Arabic phonemes. Experiment 2 was designed to see how native speakers of Korean mapped Arabic phonemes onto Korean phonemes by means of orthography as well as to see how they perceived the similarities between Arabic and Korean phonemes. The stimuli were categorized into 13 categories based on voicing, place of articulation, manner of articulation, and pharyngealization. They found that the KN group had a better performance than the KA group in discriminating the pharyngeal phonemes from their non-pharyngeal counterparts. The KN group also performed better in discriminating between phonemes that differed in their manner of articulation. They also found that longer vowel duration seemed to facilitate better discrimination of voicing contrasts.

Rose (2010) tested whether PAM could predict how native speakers of American English discriminated L2 contrasts in Spanish. She compared five different word-medial intervocalic contrasts in Spanish: /r/-/r/, /r/-[r̄f], [r]-[r̄f], /r/-/t/, and /r/-/d/. She tested both phonemic and allophonic contrasts to determine whether L1 speakers of Spanish and L2 Spanish learners differed in their discrimination of these contrasts at the word level. The 90 participants consisted of 15 L1 speakers of Spanish, 60 L1 speakers of American English learning Spanish, and 15 L1 speakers of American English who had never studied Spanish. She found that the /r/-/r/ contrast was discriminated well by the L2 learners of all levels (ranging from 86.7% to 94.4%) in the uncategorized vs. categorized contrasts (/r /-/r/ and /r /-[r̄f]). Both sounds contain an uncategorized phoneme (/r/) that can potentially be mapped with the categorized phoneme (either /r/ or [r̄f]). Her findings confirmed PAM's prediction that all discriminations of uncategorized vs.

categorized contrasts would be very good. Her results differed from those obtained by Guion et al. (2000) that discrimination was poor when the uncategorized sound was close in the phonological space to the categorized sound.

Bohn and Best (2010) tested PAM and SLM in a study that examined the impact of phonetic and phonological properties of L1 German on the discrimination of the approximant contrasts /r/-/l/, /w/-/r/, and /w/-/j/ in American English. German and American English realize /j/ almost identically. However, /r/ and /l/ in German are realized differently from their counterparts in American English, and there is no /w/ in German. Eighteen native speakers of Northern German who were students at Kiel University participated in the study. The results of their AXB discrimination revealed both phonological and phonetic influences on the discrimination of American English approximants, but neither PAM nor SLM were quite successful in predicting how L1 German listeners perceived American English approximants.

Guion, Flege, Yamada, and Pruitt (2000) conducted two experiments with L1 speakers of Japanese. Experiment 1 tested near-monolingual Japanese listeners in the identification of English and Japanese consonants in terms of a Japanese category. Experiment 2 used the same set of stimuli but for a discrimination test. The participants consisted of three groups of L1 speakers of Japanese with different levels of English language experience and one group of L1 speakers of English. They were tested with contrasting pairs consisting of two English consonants, two Japanese consonants, and one English and one Japanese consonant. Their results revealed that the perceived phonetic distance of the L2 consonant from the closest L1 consonant predicted the discrimination of L2 sounds and the learning effects in discrimination of L1 and L2 sounds in some cases. Their findings in the /ɪ/-/w/ contrast confirmed PAM's predictions for the discrimination of the uncategorized vs. categorized type to very be good. They found that the

results for this type of contrast improved with L2 experience whereas the results for both uncategorized types of contrast, predicted to be poor, did not improve. The results for the /s/-/θ/ contrast, which was an uncategorized vs. categorized type, did not support the predictions of PAM. All three Japanese groups obtained low scores when they were supposed to obtain very good scores according to PAM. They suggested a revision of PAM in the uncategorized vs. categorized type to include poor discrimination in cases where the uncategorized sound is close in phonological space to the categorized sound. The previously mentioned study Rose (2010) confirmed PAM's prediction and suggested further investigation before recommending a possible revision of PAM.

Best (2001) tested the predictions of PAM regarding discrimination levels for non-native contrasts. She evaluated PAM's hypotheses with two experiments that assessed native English speakers' perception of Zulu and Tigrinya contrasts expected to fit PAM's predictions. The participants for Zulu contrasts consisted of 22 native speakers of American English (15 female, 7 male). Their age range was 18–20 years old and none of them had experience with Zulu or any other languages using consonant contrasts similar to Zulu. The contrasts selected for the experiment were the voiceless vs. voiced lateral fricatives (/ɬ/-/ɮ/), the voiceless aspirated vs. ejective (glottalized) velar stops (/kʰ/-/kʷ/), and the plosive vs. implosive voiced bilabial stops (/b/-/ɓ/). The participants for the Tigrinya contrast consisted of 19 native speakers of American English (10 female, 9 male) who were 18–20 years old and had no experience with Tigrinya or any other languages using ejective consonants similar to Tigrinya. The contrast selected was between the ejective bilabial vs. alveolar stops /pʰ/-/p/ and /tʰ/-/t/. Multiple tokens of each of the target consonants in CV nonsense syllable pairs were presented to the participants. The participants completed a categorical AXB discrimination test for each of the Zulu and Tigrinya

contrasts. They were asked to circle on their answer sheets for each trial whether the middle item (X, or target) was the same syllable as the first or third item. Her results supported the predictions made by PAM.

Lai (2010) examined L2 learners' discriminatory and assimilatory of the tense-lax vowel contrast patterns in English vowels. Experiment 1 investigated native Mandarin speakers' discrimination of English vowels. Experiment 2 tested how these learners categorized English vowels and assimilated them to Mandarin phonetic categories. In Experiment 1, the participants listened to two pre-recorded sounds and had to decide whether these two sounds were the same or different. They were asked to circle SAME and circle the word they thought matched the segment they heard if they decided that it was the same. If different, they had to identify which word contained the first they had heard and which contained the second. In Experiment 2, they were asked to label each of eleven English vowels as "Similar" or "New" then transcribe each English vowel with Mandarin vowel categories. The participants consisted of 90 speakers of Mandarin Chinese in Taiwan who learned English as a foreign language. They were college students, with ages ranging from 19 to 22 years old. The learners were divided into two groups, the first group comprising 45 English majors (10 male and 35 female). The second group consisted of 45 non-English majors (20 male and 25 female). The findings of this study supported SLM but were somewhat in disagreement with PAM.

Delattre, Liberman, and Cooper (1955) revealed that participants' perception of /b, d, g/ differed according to the following or preceding vowels (Delattre, Liberman, & Cooper, 1955). Their study demonstrated that the type of vowel can be an important cue in the perception of these stop consonants. This is because the transition from vowel to stop or stop to vowel is not the same for all types of vowels.

The nature of vowels' effect on the perception of consonants is a subject of debate in perceptual studies on CV or VC co-articulation. Some studies—such as Sharf and Hemeyer (1972), Sharf and Beiter (1974), and Ohde and Sharf (1977)—have argued that more listeners would correctly identify the consonants from the vocalic transition in VC syllables than they would in CV syllables (as cited in Lee, 1997). Other studies—including Repp (1978); Fujimura, Maccini, and Streeter (1978); Dorman, Raphael, and Liberman (1979); and Ohala 1990—have claimed that a CV transition is perceptually stronger; therefore, more listeners would correctly perceive the consonants in a CV context than they would in a VC transition (as cited in Lee, 1997).

Shafiro et al. (2013) investigated the perception of American-English vowels and consonants by young adult native speakers of Arabic and native speakers of American English who are Arabic-English bilinguals. The participants were asked to identify 20 American English consonants (/p, t, k, f, d, s, ʃ, tʃ, b, d, g, v, z, dʒ, r, l, w, j, m, n/) presented in three vocalic contexts: /aCa/, /iCi/, and /uCu/. Their results showed a success rate of 94–95% in the identification of the consonants. Their results also revealed that the identification of /ð/ was vocalic-context dependent. The participants had more errors in the /iCi/ context and fewer errors in the /uCu/ context.

Following this review of empirical research related to the current study in terms of non-native phoneme perception, the next chapter discusses the methodology of the present study.

CHAPTER 3

METHODOLOGY

The current study investigated the perception of Arabic /q/ by L1 speakers of American English. The methodology adopted for this purpose is stated below.

3.1. Research Problem

In Arabic, the uvular /q/ and velar /k/ are contrastive; for instance, /salaqa/ means ‘to boil food’, while /salaka/ means ‘to go along a path’. On the other hand, English does not have the uvular /q/. It was thus interesting to investigate how L1 speakers of American English perceived this L2 phoneme and whether they would be able to discriminate the uvular /q/ (L2) from the velar /k/ (L1)?

As mentioned earlier, PAM theorizes that L2 sound perception depends on the relationship between the L2 and L1 sounds and that the L2 sound is assimilated to an L1 sound if the two sounds are very similar. PAM hypothesizes that the discriminability of an L2 sound can be predicted based on the assimilation of each of the contrasting L1 sound types (Best, 1995). The Arabic /q/-/k/ contrast falls under PAM’s uncategorized versus categorized (UC type). That is, when the listener is confronted with two L2 sounds, one is assimilated to an L1 sound category as a good model. The other sound is perceived as an accepted different type, but not the ideal model, of the L1 sound. For example, when L1 speakers of American English are confronted with the Arabic /q/-/k/ contrast, they are expected to assimilate the Arabic /k/ to the English /k/ as a good model of the L1 English /k/. Similarly, they are expected to assimilate the Arabic /q/ to the English /k/ but as strange and imperfect model of the L1 English /k/, because it falls in a phonetic space outside the L1 sound category. PAM predicts that this type of contrast would yield a “very good” discriminability, with a score ranging from 80% to 89%.

In this sense, the current study was a test of PAM as it analyzed whether L1 speakers of American English had a “very good” discriminability of /q/ in the Arabic /q/-/k/ contrast as predicted by PAM.

SLM also theorizes that L2 learners have difficulty discriminating L2 sounds, because phonetically distinct sounds in the L2 are assimilated to a single sound category or because the L2 sound features that are important phonetically are filtered by L1 phonology (Flege, 1995). Hypothesis 1 of SLM states that sounds in the L1 and L2 are related perceptually to one another at a position-sensitive allophonic level (Flege, 1995). SLM hypothesizes that the position of the L2 sound in a word has an impact on its perception. The current study also tested the SLM as it analyzed the success of L1 speakers of American English in discriminating /q/ in the Arabic /q/-/k/ contrast and whether it depended on whether /q/ was in word-initial, word-medial, or word-final position.

The last research problem was the effect of the vowel context in which /q/ occurs on the discrimination of /q/. As stated earlier, Modern Standard Arabic has only three short vowel phonemes /i, u, a/. This study analyzed whether these vowels influenced the discriminability of /q/ by L1 speakers of American English.

3.2. Research Questions

The research questions for the present study were formulated as follows:

- 1) Can native speakers of American English have a very good discrimination of /q/ in the Arabic /q/-/k/ contrast as predicted by PAM?
- 2) Is the discrimination of /q/ in the Arabic /q/-/k/ contrast position-sensitive as hypothesized by SLM?

- 3) Does the vocalic context have different effects on the discrimination of /q/ by native speakers of American English?

3.3. Participants

The participants consisted of 22 students or faculty members at Southern Illinois University who were native speakers of American English with no background in Arabic. Originally, the total number of participants was 24 participants, but two of them were excluded from the analysis: one for reporting in the demographic information that he was not a native speaker of American English and the second for having scored 36 out of the 36 contrasts. The participants' ages ranged between 19 to over 50 and they were selected according to their availability. The participants' ages were divided into seven groups: Group 1: 19–25 (8 participants), Group 2: 26–30 (3 participants), Group 3: 31–35 (5 participants), Group 4: 36–40 (1 participant), Group 5: 41–45 (1 participant), Group 6: 46–50 (2 participants), and Group 7: over 50 (2 participants). There were 6 male and 16 female participants. The educational status of the participants was divided into four groups: Group 1: Undergraduate Student (5 participants), Group 2: Graduate students (10 participants), Group 3: Academic Faculty (6 participants), and Group 4: Administrative Faculty (1 participant). Ten participants reported Arabic among the languages that they had been exposed to, while 12 did not. Fifteen participants reported that they had taken a phonetics or phonology class, whereas seven participants reported that they had no phonetics or phonology background.

3.4. Instrument and Procedure

To create the contrasts for the discrimination task, 108 pseudowords were selected. These pseudowords presented the target sounds so that they could be contrasted in environments where they formed minimal pairs. That is, in word-initial position, followed by /i/, /u/, and /a/; in word-

medial position, between two instances of /i/, two instances of /u/, and two instances of /a/; and in word-final position, preceded by /i/, /u/, and /a/. Two pseudoword pairs were selected for each contrast. The words selected for each contrast were: 1) /qi.ta/-/ki.ta/, 2) /qu.ta/-/ku.ta/, and 3) /qa.ta/-/ka.ta/ word-initially; 4) /ti.qi/-/ti.ki/, 5) /tu.qu/-/tu.ku/, and 6) /ta.qa/-/ta.ka/ word-medially; and 7) /ti.iq/-/ti.ik/, 8) /tu.uq/-/tu.uk/, and 9) /ta.aq/-/ta.ak/ word-finally.

The stimuli were produced by two native speakers of Modern Standard Arabic from Saudi Arabia who had been living in the United States for an average of two years. The speakers were recorded in a quiet computer lab. The words were presented to them randomly, allowing them to produce each word randomly. To ensure that the stimuli were clearly recorded, a third native speaker of Arabic as well as the researcher listened to the recordings and confirmed their clarity. Figures 2 and 3 illustrate the spectrogram of the /q/-/k/ contrast in Trial 2 produced by one of the two native Arabic speakers.

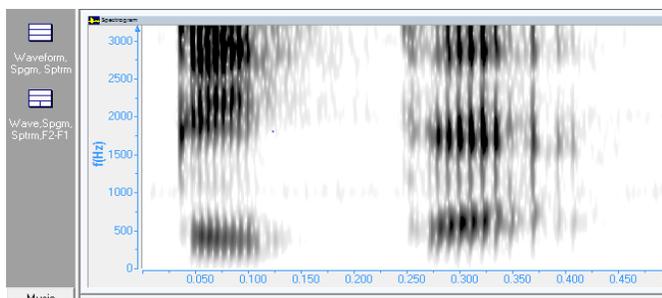


Figure 2. Spectrogram of /qi.ta/ in Trial 2, Stimulus 4.

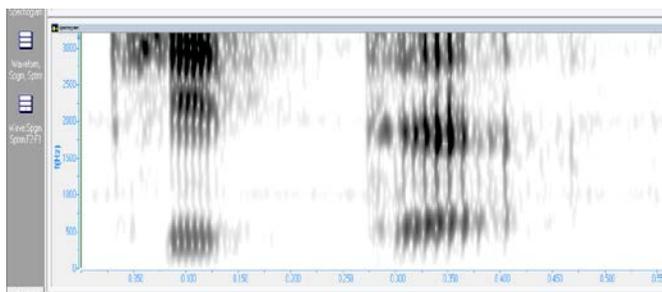


Figure 3. Spectrogram of /ki.ta/ in Trial 2, Stimulus 6.

In the discrimination task, each trial of the AXB were presented in triads, since the AXB test required the participants to listen to three words and determine whether the first word (A) or the third word (B) was the same as the word in the middle (X). According to Best and Strange (1992), the AXB discrimination test has relatively low memory and sensitivity demands. The AXB discrimination task has four possible combinations (AAB, ABB, BAA, and BBA). In the AAB combination, X is the same as A, and in ABB, X is the same as B in the /q/-/k/ contrast. The contrast order is switched to /k/-/q/ in the BAA, where X is the same as A, and in the BBA, X is the same as B. For example, /qa.ta/-/qa.ta/-/ka.ta/ is AAB and /qa.ta/-/ka.ta/-/ka.ta/ is ABB, whereas /ka.ta/-/qa.ta/-/qa.ta/ is BAA and /ka.ta/-/ka.ta/-/qa.ta/ is BBA.

The four combinations were generated for each one of the nine contrasts (three word-initially, three word-medially, three word-finally), which gave a total of 36 stimuli. The 36 items were presented in triads, yielding 108 stimuli ($4 \times 9 \times 3 = 108$), which were randomly presented to the participants in triads of 36 trials. The 36 trials were randomized using an online randomizer. For each AXB comparison, the inter-stimulus interval (ISI) was one second, and the inter-trial interval was three seconds. It is believed that longer ISI encourages phonemic rather than phonetic perception of L2 contrasts (Werker & Logan, 1985). The stimuli were presented in the form of word A, word X, and then word B. The participants were asked to decide if word X was the same as word A or the same as word B. Tables 5, 6, and 7 show the nonrandomized list of the stimuli used in the experiment, including the X stimulus. The number of the trial and triad is given in square brackets [] and the number of the stimulus in parentheses ().

Table 5

Word-Initial Nonrandomized List of AXB Discrimination Task with Word X in Bold

/q/ in word-initial position, followed by the high front unrounded vowel /i/

[1] AAB (1) qi.ta, (2) qi.ta , (3) ki.ta	[2] ABB (4) qi.ta, (5) ki.ta , (6) ki.ta
[3] BAA (7) ki.ta, (8) qi.ta , (9) qi.ta	[4] BBA (10) ki.ta, (11) ki.ta , (12) qi.ta

/q/ in word-initial position, followed by the high back rounded vowel /u/

[5] AAB (13) qu.ta, (14) qu.ta , (15) ku.ta	[6] ABB (16) qu.ta, (17) ku.ta , (18) ku.ta
[7] BAA (19) ku.ta, (20) qu.ta , (21) qu.ta	[8] BBA (22) ku.ta, (23) ku.ta , (24) qu.ta

/q/ in word-initial position, followed by the low front unrounded vowel /a/

[9] AAB (25) qa.ta, (26) qa.ta , (27) ka.ta	[10] ABB (28) qa.ta, (29) ka.ta , (30) ka.ta
[11] BAA (31) ka.ta, (32) qa.ta , (33) qa.ta	[12] BBA (34) ka.ta, (35) ka.ta , (36) qa.ta

Table 6

Word-Medial Nonrandomized List of AXB Discrimination Task with Word X in Bold

/q/ in word-medial position, between two high front unrounded vowels /i/

<p>[13] AAB (37) ti.qi, (38) ti.qi, (39) ti.ki</p>	<p>[14] ABB (40) ti.qi, (41) ti.ki, (42) ti.ki</p>
<p>[15] BAA (43) ti.ki, (44) ti.qi, (45) ti.qi</p>	<p>[16] BBA (46) ti.ki, (47) ti.ki, (48) ti.qi</p>

/q/ in word medial-position, between two high back rounded vowels /u/

<p>[17] AAB (49) tu.qu, (50) tu.qu, (51) tu.ku</p>	<p>[18] ABB (52) tu.qu, (53) tu.ku, (54) tu.ku</p>
<p>[19] BAA (55) tu.ku, (56) tu.qu, (57) tu.qu</p>	<p>[20] BBA (58) tu.ku, (59) tu.ku, (60) tu.qu</p>

/q/ in word medial-position, between two low front unrounded vowels /a/

<p>[21] AAB (61) ta.qa, (62) ta.qa, (63) ta.ka</p>	<p>[22] ABB (64) ta.qa, (65) ta.ka, (66) ta.ka,</p>
<p>[23] BAA (67) ta.ka, (68) ta.qa, (69) ta.qa</p>	<p>[24] BBA (70) ta.ka, (71) ta.ka, (72) ta.qa</p>

Table 7

Word-Final Nonrandomized List of AXB Discrimination Task with Word X in Bold

<i>/q/ in word-final position, preceded by the high front unrounded vowel /i/</i>	
<p>[25] AAB (73) ti.iq, (74) ti.iq, (75) ti.ik</p>	<p>[26] ABB (76) ti.iq, (77) ti.ik, (78) ti.ik</p>
<p>[27] BAA (79) ti.ik, (80) ti.iq, (81) ti.iq</p>	<p>[28] BBA (82) ti.ik, (83) ti.ik, (84) ti.iq</p>

<i>/q/ in word-medial position, between two high back rounded vowels /u/</i>	
<p>[29] AAB (85) tu.uq, (86) tu.uq, (87) tu.uk</p>	<p>[30] ABB (88) tu.uq, (89) tu.uk, (90) tu.uk</p>
<p>[31] BAA (91) tu.uk, (92) tu.uq, (93) tu.uq</p>	<p>[32] BBA (94) tu.uk, (95) tu.uk, (96) tu.uq</p>

<i>/q/ in word-final position, preceded by the low front unrounded vowel /a/</i>	
<p>[33] AAB (97) ta.aq, (98) ta.aq, (99) ta.ak</p>	<p>[34] ABB (100) ta.aq, (101) ta.ak, (102) ta.ak</p>
<p>[35] BAA (103) ta.ak, (104) ta.aq, (105) ta.aq</p>	<p>[36] BBA (106) ta.ak, (107) ta.ak, (108) ta.aq</p>

For the procedure, a link to an online survey was sent to the participants. The link was included in an email explaining the purpose of the research, that participation was optional, and that they could withdraw at any time. The online survey consisted of 43 total items; eight items were related to demographic information, and the remaining 36 items were related to the

discrimination task. The participants were asked to click on the correct items for their demographic information and then click the sound icon to hear the recorded sound. Finally, they had to click the appropriate answer according to what they heard and then submit the survey. All the survey items had to be answered in order to be submitted; if an item was not answered, the survey could not be submitted.

Since the survey was taken online, the consent form was summarized and adapted to more easily fit within the email message sent with the survey link. The email message sent to the participants with the link is given in Appendix C.

Prior to data collection, the online survey was sent to six native Arabic speakers to test the clarity of the sound files and their discrimination of the contrast. Table 8 summarizes the descriptive statistics of the six native Arabic speakers' discrimination of /q/.

Table 8

Descriptive Statistics for the Six Native Speakers' discrimination of /q/

Native discrimination	N	Mean	SD	% Success	95% Confidence Interval	
					Lower Bound	Upper Bound
/q/ in word-initial	6	11.66	.51	97.22%	11.12	12.20
/q/ in word-medial	6	11.66	.51	97.22%	11.12	12.20
/q/ in word-final	6	11.83	.40	98.61%	11.40	12.26
/q/ in /i/ context	6	11.83	.40	98.61%	11.40	12.26
/q/ in /a/ context	6	11.66	.51	97.22%	11.12	12.20
/q/ in /u/ context	6	11.66	.51	97.22%	11.12	12.20

Note. Success rate was calculated by dividing the group Mean by the total possible score of 12 for each position and vowel context, then, multiplied by 100.

The six native participants, four male and two female, were all graduate students in the Linguistics Department at SIU, and their ages ranged between 19 and 36. The native speakers'

discrimination ranged between 97.22% and 98.61%. Two native participants made two mistakes, and one made four mistakes, which were probably due to the use of pseudowords instead of real Arabic words.

The individual and group scores for the nine contrasts were collected and analyzed. The results are presented in Chapter 4, followed by a discussion of them in Chapter 5.

3.5. Data Analysis and Scoring

The data were analyzed using IBM SPSS Statistics 20, particularly using descriptive and inferential statistics. The age group 19–25 was coded 1, age group 26–30 was coded 2, age group 31–35 was coded 3, age group 36–40 was coded 4, age group 41–45 was coded 5, age group 46–50 was coded 6 and age group over 50 was coded 7. For gender, male was coded 1 and female was coded 2. For educational status, undergraduate student was coded 1, graduate student was coded 2, academic faculty was coded 3, and administrative faculty was coded 4. For languages, “Arabic among languages exposed to” was coded 1, and “no Arabic among languages exposed to” was coded 0. For previous experience in phonetics or phonology, “had Phonetics or Phonology” was coded 1, and “had no Phonetics or Phonology” was coded 0.

Overall, the highest score possible for the entire discrimination task was 36 and the lowest was 0. A set of three dependent t-tests were performed to determine whether the position of /q/ in the word made a difference in its discrimination. The first t-test was used to compare word-initial /q/ and word-medial /q/. The second t-test compared word-medial /q/ and word-final /q/. The last t-test compared word-initial /q/ and word-final /q/. The maximum mean score for each position was 12 and the minimum was 1.

In a similar manner, another set of three dependent t-tests was performed to determine the significant differences between /q/ in the three Arabic vowel environments, /i, a, u/. /q/ in the

context of /i/ was compared with /q/ in the context of /a/. Then /q/ in the context of /a/ was compared with /q/ in the context of /u/. Finally, /q/ in the context of /i/ was compared with /q/ in the context of /u/. The mean scores could range between 12 and 1 for each vowel context.

CHAPTER 4

RESULTS

4.1. Results for Research Question 1

4.1.1. Overall Discrimination Results

Research Question 1 was concerned with the overall discrimination of uvular /q/ by native speakers of American English. It aimed to provide evidence that confirmed or contradicted the prediction made by the Perceptual Assimilation Model (PAM). The results revealed that the overall individual discrimination of native speakers of American English ranged from poor to excellent. Figure 4 summarizes the overall discrimination frequency results for the 36 AXB trials.

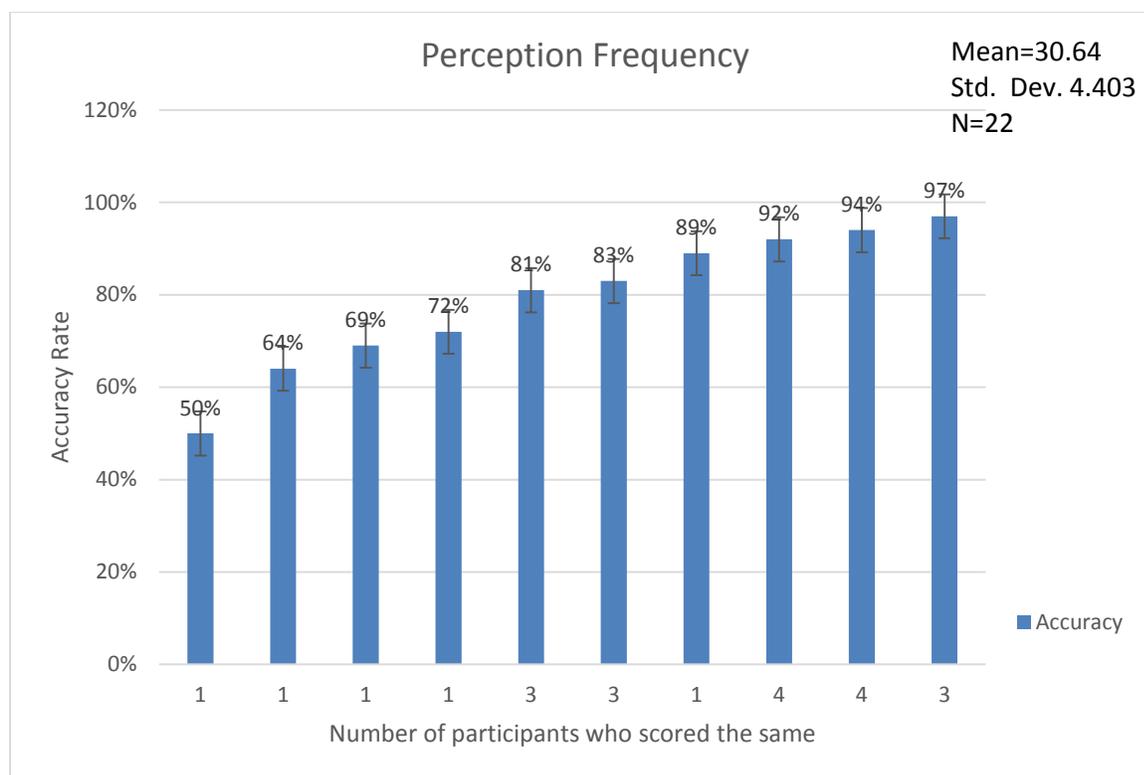


Figure 4. General discrimination frequency of the 36 trials.

The group discrimination score, however, had a high group Mean score of 30.64. This high group Mean score illustrated a very good discrimination of the uvular /q/. Only one participant scored below 60%, as shown in Figure 4. The highest discrimination score was 97%, which was realized by three participants. The lowest discrimination score was 50%, which was realized by only one participant. Can native speakers of American English perceive the uvular /q/ in the Arabic /q/-/k/ contrast? The overall discrimination results revealed that 50% of the participants had a rate of 92–97% accurate discrimination of the contrast. As mentioned earlier, three of them had a score of 97%; they accurately perceived 35 out of the 36 /q/-/k/ contrasts, showing very close to native-like discrimination. More than one third of the participants (36.38%) scored between 72% and 89%, and the remaining 13.62% scored between 50% and 69%. More details about the overall discrimination results are addressed in Chapter five. Before that, the next section explores Research Question 2.

4.2. Results for Research Question 2

Research Question 2 investigated whether the position of /q/ in a word affects its discrimination by native speakers of American English. The results were expected to uphold or challenge the assumption made by the Speech Learning Model (SLM) about the position sensitivity of L2 sound perception.

4.2.1. t-test Results

The discrimination score of three different positions—word-initial, word-medial, and word-final—were scrutinized, and the results were analyzed and compared. The results were analyzed by performing a set of three dependent t-tests, one for each of the three word positions. The group Mean result of the discrimination task in word-initial position was compared with the group Mean result of the discrimination test in word-medial position. Then the group Mean

result of word-medial position was compared with the group Mean result of world-final position. Last, the group Mean result of word-initial position was compared with the group Mean result of world-final position.

Prior to the dependent t-test, the distribution of scores within each position was examined and it was found that all three scores' distribution met the assumption of normality. Table 9 summarizes the descriptive statistics for the three positions in which /q/ occurred.

Table 9

Descriptive Statistics of the Three Positions in which /q/ Occurred

Position of /q/ in the word	N	Mean	SD	% Success	95% Confidence Interval	
					Lower Bound	Upper Bound
Word Initial	22	9.95	2.10	82.95%	9.02	10.88
Word Medial	22	10.31	1.49	85.98%	9.65	10.97
Word Final	22	10.36	1.70	86.36%	9.60	11.11

Note. Success rate was calculated by dividing the group Mean by the total possible score of 12 and multiplied by 100.

4.2.3. Initial-Medial t-test

The first dependent t-test results, as shown in Table 10, revealed that the group Mean score of /q/ discrimination in word-initial and word-medial position was not significantly different from each other, $t(21) = -.87, p = .395$, Cohen's $d = .20$. In addition, Cohen's (1988) effect size scale states that $d=.20$ indicates a small effect size, $d=.50$ indicates a medium effect size, and $d=$ or $> .80$ indicates a large effect size. Accordingly, the small value of the effect size (Cohen's $d=.20$) provided further evidence for the non-significant difference between discrimination of initial and medial /q/.

Table 10

Dependent t-test for the Discrimination Success of Initial and Medial /q/

Position	N	Mean	SD	% Success	95% CI		MD	t	df	Sig. (2-tailed)	Effect size d
					Lower	Upper					
Initial	22	9.95	2.10	82.95%	9.02	10.88					
							-.363	-.87	21	.395	.20
Medial	22	10.31	1.49	85.98%	9.65	10.97					

Note. Success rate was calculated by dividing the group Mean by the total possible score of 12 and multiplied by 100.

4.2.4. Medial-Final t-test

The second dependent t-test results, as shown in Table 11, also revealed that the group Mean score of /q/ discrimination in word-medial and word-final position was not significantly different from each other, $t(21) = -.15, p = .883$, Cohen's $d = .03$.

Table 11

Dependent t-test for Discrimination Success of Medial and Final /q/

Position	N	M	SD	% Success	95% CI		MD	t	df	Sig. (2-tailed)	Effect size d
					Lower	Upper					
Medial	22	10.31	1.49	85.98	9.65	10.97					
							-.045	-.15	21	.883	.03
Final	22	10.36	1.70	86.36	9.6	11.11					

Note. Success rate was calculated by dividing the group Mean by the total possible score of 12 and multiplied by 100.

4.2.5. Initial-final t-test

The third dependent t-test results, as shown in Table 12, also revealed that the group Mean score of /q/ discrimination in word-initial and word-final position was not significantly different from each other, $t(21) = -1.04, p = .310$, Cohen's $d = .021$.

Table 12

Dependent t-test for Discrimination Success of Initial and Final /q/

Position	N	M	SD	% Success	95% CI		MD	t	df	Sig. (2-tailed)	Effect size d
					Lower	Upper					
Initial	22	9.95	2.10	82.95%	9.02	10.88					
Final	22	10.36	1.70	86.36%	9.60	11.11	-.409	-1.04	21	.310	.21

Note. Success rate was calculated by dividing the group Mean by the total possible score of 12 and multiplied by 100.

4.3. Results for Research Question 3

Research Question 3 investigated whether the vowel environment in which /q/ occurred affected its discrimination by native speakers of American English. For this purpose, the discrimination score for the three different vowels were analyzed and compared. A set of three dependent t-tests, one for each of the three vowels, were analyzed. The group Mean results for the discrimination of /q/ followed by /i/, preceded by /i/, and between two instances of /i/ were compared with the group Mean results for the discrimination of /q/ followed by /a/, preceded by /a/, and between two instances of /a/. Then the group Mean results for the discrimination of /q/ followed by /a/, preceded by /a/, and between two instances of /a/ were compared with the total Mean results for the discrimination of /q/ followed by /u/, preceded by /u/ and between two instances of /u/. Finally, the group Mean results for the discrimination of /q/ followed by /i/, preceded by /i/, and between two instances of /i/ were compared with the group Mean results for the discrimination of /q/ followed by /u/, preceded by /u/, and between two instances of /u/.

Prior to the dependent t-test, the distribution of scores within each vowel was examined, and it was found that all three vowel score distributions met the assumption of normality. Table 13 summarizes the descriptive statistics for the three vowel environments in which /q/ occurred.

Table 13

Descriptive Statistics of the Three Vowel Contexts in Which /q/ Occurred

/q/ vowel environment	N	Mean	SD	% Success	95% Confidence Interval	
					Lower Bound	Upper Bound
/i/	22	11.13	1.24	92.80%	10.58	11.68
/a/	22	10.36	1.70	86.36%	9.60	11.11
/u/	22	9.13	2.09	76.14%	8.20	10.06

Note. Success rate was calculated by dividing the group Mean by the total possible score of 12 and multiplied by 100.

4.3.1. Vowels /i/ and /a/ t-test

The first dependent t-test results, as shown in Table 14, revealed that the group Mean scores of /q/ discrimination in the /i/ context and the /a/ context were significantly different from each other, $t(21) = -2.35$, $p = .029$, Cohen's $d = .52$. The medium value of the effect size (Cohen's $d = .52$) provided more evidence for the significant difference between the discrimination of /q/ in the /i/ and /a/ contexts.

Table 14

Dependent t-test for Discrimination Success of /q/ in /i/ and /a/ Contexts

Vowel	N	M	SD	% Success	95% CI		MD	t	df	Sig. (2-tailed)	Effect size d
					Lower	Upper					
/i/	22	11.13	1.24	92.80%	10.58	11.68	.77	2.35	21	.029	0.52
/a/	22	10.36	1.70	86.36%	9.60	11.11					

Note. Success rate was calculated by dividing the group Mean by the total possible score of 12 and multiplied by 100.

4.3.2. Vowels /a/ and /u/ t-test

The second dependent t-test results, as shown in Table 15, revealed that the group Mean scores of /q/ discrimination in the /a/ and /u/ contexts were also significantly different from each

other, $t(21) = 4.29, p < .001$, Cohen's $d = .64$. The medium value of the effect size (Cohen's $d=.64$) was another illustration of the significant difference between the discrimination of /q/ in /a/ and /u/ contexts.

Table 15

Dependent t-test for Discrimination Success of /q/ in /a/ and /u/ Contexts

Vowel	N	M	SD	% Success	95% CI		MD	t	df	Sig. (2-tailed)	Effect size d
					Lower	Upper					
/a/	22	10.36	1.70	86.36%	9.60	11.11	1.23	4.29	21	.000	0.64
/u/	22	9.13	2.09	76.13%	8.20	10.06					

Note. Success rate was calculated by dividing the group Mean by the total possible score of 12 and multiplied by 100.

4.3.3. Vowels /i/ and /u/ t-test

The third dependent t-test results, as shown in Table 16, revealed that the group Mean scores of /q/ discrimination in /i/ and /u/ contexts were significantly different from each other, $t(21) = -5.37, p < .001$, Cohen's $d = 1.16$. The large value of the effect size (Cohen's $d=1.16$) revealed that the same participants who had a success rate of 76.13% in the discrimination of /q/ in the /u/ context demonstrated significantly better discrimination of /q/ in the /i/ context, increasing their success rate to 92.80%.

Table 16

Dependent t-test for Discrimination Success of /q/ in /i/ and /u/ Contexts

Vowel	N	M	SD	% Success	95% CI		MD	t	df	Sig. (2-tailed)	Effect size d
					Lower	Upper					
/i/	22	11.13	1.24	92.80%	10.58	11.68					
/u/	22	9.13	2.09	76.13%	8.20	10.06	2.00	5.37	21	.000	1.16

Note. Success rate was calculated by dividing the group Mean by the total possible score of 12 and multiplied by 100.

The abovementioned results were directly related to the research questions and are discussed in Chapter 4.

4.4. Post Hoc Analyses

Additional results related to the demographic items in the survey could also be meaningful for further research. For instance, it would be interesting to explore differences between the male and female participants, between the participants who had been exposed to Arabic and those who had no exposure to Arabic, as well as between the participants who had a background in phonetics or phonology with the ones who did not have such a background.

To answer these questions, descriptive statistics were analyzed and the results showed that female participants had a success rate of 85.59%, whereas male participants had a success rate of 83.80%, as shown in Table 17.

Table 17

Descriptive Statistics for the Discrimination Success of Male and Female Participants

Female vs. Male	N	Mean	SD	% Success	95% Confidence Interval	
					Lower Bound	Upper Bound
Female	16	30.81	4.79	85.59%	28.26	33.37
Male	6	30.17	3.49	83.80%	26.51	33.83

Note. Success rate was calculated by dividing the group Mean by the total possible score of 36 and multiplied by 100.

The data analysis also showed that those who had exposure to Arabic were slightly better than those who had no exposure to Arabic (See Table 18). Those who had exposure to Arabic had a success rate of 86.94%, while those who had no exposure had a success rate of 83.56%.

Table 18

Descriptive Statistics for Discrimination Success of Those with and without Exposure to Arabic

Exposed vs. Never Exposed	N	Mean	SD	% Success	95% Confidence Interval	
					Lower Bound	Upper Bound
Have been exposed	10	31.30	4.00	86.94%	28.44	34.16
Have not been exposed	12	30.08	4.81	83.56%	27.02	33.14

Note. Success rate was calculated by dividing the group Mean by the total possible score of 36 and multiplied by 100.

For the difference between those who had experience in phonetics or phonology and those with no such experience, the data showed that those who had taken phonetics or phonology classes had more success than those without that background. Those who had phonetics or phonology experience had a success rate of 87.78%, whereas those who had no phonetics or phonology experience had a success rate of 79.37%, as shown in Table 19.

Table 19

*Descriptive Statistics for the Discrimination Success According to Phonetics/Phonology**Experience*

Phonetics or Phonology Background	N	Mean	SD	% Success	95% Confidence Interval	
					Lower Bound	Upper Bound
Took Phonetics or Phonology	15	31.60	3.52	87.78%	29.65	33.55
Did not take Phonetics or Phonology	7	28.57	5.62	79.37%	23.37	33.77

Note. Success rate was calculated by dividing the group Mean by the total possible score of 36 and multiplied by 100.

The next section discusses the findings of the current study in comparison with previous research.

CHAPTER 5

DISCUSSION, LIMITATIONS, AND CONCLUSION

Perception of L2 sounds presents a range of difficulties, with some L2 sounds being more difficult to perceive than others. Hence, discrimination of L2 sounds varies from poor to excellent. The current study investigated whether L1 speakers of American English could perceive and discriminate /q/ in the Arabic /q/-/k/ contrast. It did so by examining the success rate in their discrimination. Additionally, the study observed how the position of /q/ in a word and the vowel context in which /q/ occurs affects the discrimination of /q/.

5.1. Discussion

5.1.1. Data Analysis and Predictions Based on PAM

Based on PAM's assimilation types, the Arabic /k/-/q/ contrast falls under the uncategorized versus categorized (UC type). Native speakers of English were thus expected to assimilate the Arabic /k/ to English /k/, but the Arabic /q/ was not expected to be assimilated to any native English sound category. PAM predicts that the discrimination in this case would be very good (Best, 1995).

As stated in Chapter 4, individual success in the discrimination of /q/ by the participants ranged from poor to excellent. Eleven out of the 22 participants had excellent discriminations and were able to discriminate /q/ from the /k/-/q/ contrast with a high rate of success. Three of them had a success rate of 97%, four had a success rate of 94%, and four had 92%. Seven participants had very good discrimination. One of them had a score of 89%, three scored 83%, and three scored 81%. Only three participants had moderate discrimination. One scored 72%, one 69%, and another 64%. One participant had a score of 50%; he was the only participant who displayed poor discrimination. Overall, 50% of the participants displayed excellent

discrimination, 31.82% very good discrimination, 13.64% moderate discrimination, and only 4.55% (1 out of 22) showed poor discrimination.

In contrast, the overall group score was very good, with a group Mean score of 30.64, which meant that the group had an overall success rate of 85.11%. This very good rate of success was consistent with the prediction made by PAM that the UC type would yield a very good discrimination. Similar results were also obtained by Rose (2010) in the UC type of the Spanish /r/-/r/ contrast discrimination by native speakers of English. She found that their discrimination success ranged from 86.7% to 94.4%. Conversely, in Al Mahmoud (2012), the /q/-/k/ contrast revealed poor-to-moderate discrimination, with a success rate of 64.8%. Likewise, Guion et al. (2000) found that the predictions made by PAM were supported by the results of their experiments except for one contrast containing UC type. They stated that contrary to PAM's predictions, the UC type contrast was poorly discriminated. Therefore, they proposed a revision of PAM to allow for poor discrimination in the UC type assimilation.

The overall group discrimination results of the present study supported PAM's prediction for the UC type assimilation. Nevertheless, the individual discrimination results supported the revision proposed by Guion et al. (2000) to include the possibility of poor discrimination in the UC type. This is because one participant in the present study scored 50%. Furthermore, another revision to PAM to include the possibility of excellent discrimination in the UC type could also be proposed since half of the participants in the current study displayed excellent discrimination.

5.1.2. Data Analysis and Hypothesis 1 of the SLM

As mentioned earlier, the SLM posits that the mechanisms used for successful L1 sound acquisition and the ability to produce or perceive new L2 sounds remain perfect and accessible during one's lifetime. However, some elements of the L1 and L2 are influenced by one another

because they share a common phonological space (Flege, 1995). Furthermore, SLM states that sounds in the L1 and L2 are related perceptually to one another at a position-sensitive allophonic level (Flege, 1995). This means that the position in which the L2 sound occurs affects its production and perception. Some L2 learners may have more success in producing or perceiving certain L2 sounds in certain positions than they have in other positions. This was the case with L1 speakers of Japanese, for example, when they produced and perceived the English /l/-/ɹ/ contrast more accurately in word-final than in word-initial position (Strange, 1992).

Analysis of the present study's data revealed that the three positions of /q/ in a word were not significantly different from each other. A total of three dependent t-tests were performed, one for each of the positions /q/ appeared in, but none of them displayed a significant difference. As mentioned earlier, the dependent t-test for /q/ in the word-initial and word-final pair revealed that discriminations of /q/ in these two positions were not significantly different from each other. The t-test for the word-medial and word-final pair also did not result in a significant difference in the discrimination of /q/. The t-test for the word-initial and word final pair also failed to show a significant difference in their discrimination.

In view of the data analysis, the SLM hypothesis was not fully supported, although word-final discrimination was slightly better with a success rate of 86.36%. Better word-final discrimination in the current study was consistent with the results obtained by Strange (1992) in the discrimination of the English /l/-/ɹ/ contrast by L1 speakers of Japanese in word-final position. Therefore, the present study also partially supported the SLM. Additionally, word-medial discrimination, with a score 85.98%, was slightly better than word-initial discrimination, with a score of 82.95%. However, these results deviated from the predictions and findings of

Redford and Diehl (1999) whose results supported the prediction that syllable-initial consonants are better identified than syllable-final consonants.

The data analysis of the present study suggested the possibility of an addition to SLM Hypothesis 1. It might be assumed that word-final position would have better discrimination than word-medial discrimination and that word-medial discrimination would be better than word-initial discrimination. This assumption may be premature, however, and more research is needed to determine whether this hierarchy is consistent. SLM might also be expanded to include the fact that the difference between the perceptions of consonants in different positions might not always be statistically significant.

5.1.3. The Effect of Vocalic Context in the Discrimination of /q/

As stated previously, vocalic context influences the perception of some consonants. The discrimination of uvular /q/ by native speakers of American English was tested to see whether their discrimination would be context-dependent. In other words, would the participants' success in perceiving /q/ differ according to the type of vowel used with /q/? A total of three dependent t-tests were performed to determine whether /q/ in the context of the vowels /i/, /a/, or /u/ had different discrimination success rates. The three t-tests revealed a significant difference in the discrimination of /q/ in each of the three vowel contexts. The dependent t-test for /q/ in the /i/ and /a/ contexts revealed that the discriminations of /q/ in these two positions were significantly different from each other. The dependent t-test for the /a/ and /u/ also resulted in a significant difference in the discrimination of /q/. The pair /i/ and /u/ was not an exception; the t-test also resulted in a significant difference in their discrimination, in addition to a greater effect size value.

Overall, the data analysis revealed that participants had the most success discriminating /q/ in the /i/ context (with a success rate of 92.80%), followed by /q/ in the /a/ context (with a success rate of 86.36%), and the least success was observed in the /u/ context (with a success rate of 76.14%). The fact that English /k/ has different productions, depending on whether it occurs in the context of front vowels or the context of back vowels might have influenced the discrimination task results. English /k/ occurring next to front vowels is fronted and this suggests that /qi/ would be a very bad model of /k/ for native speakers of English, whereas /qu/ would be a moderate bad model of /k/ for them. The data analysis thus suggested that vocalic context affected the discrimination of /q/. The type of vowels had different effects on participant discrimination. These results were partly consistent with the findings of Shafiro et al. (2013) whose results showed that the type of vowel played a role in the discrimination of consonants, since the success rates were different from one vowel to another. However, the present study's results were not consistent with Shafiro et al.'s (2013) findings that vowel context favored better discrimination of the consonant. According to their results, the vowel context that best favored the consonant discrimination was /a/ with 97% discrimination success among native speakers of Arabic and 95% among native speakers of American English. This was followed by /u/ with 95% and 94%, respectively. The vowel that least favored discrimination was /i/ with 93% and 92%, respectively.

As a result, it could be assumed that no single vowel type always has the same effect on consonant perception. How vocalic context affects consonant perception depends on the type of consonant. A certain type of vowel may facilitate the discrimination of a particular consonant, while with another consonant the same vowel may distract from a better discrimination. For

instance, /i/ in the current study seemed to have facilitated the discrimination of /q/ but showed the lowest discrimination rate in Shafiro et al. (2013).

5.1.4. Limitations and Suggestions for Further Research

One of the limitations of the current study was that the data was collected online without restricting the number of times a participant could listen to the trial. The participants were free to listen to the trials as many times as they wanted, which may have improved their chances of attaining a higher discrimination score. As a result, future research might benefit from limiting the number of times each participant can listen to the trials to two or three times.

The second limitation came from Question 6 of the demographic survey, “What are the language(s) that you have been exposed to, other than English?” The question is vague in what it means by “exposed to”, and fails to indicate how long participants have been exposed to these other languages. “Exposed to” could be as much applicable to a participant who had been around Arabic speakers for ten years as to a participant who had been around them for three days. Moreover, a participant who had spent years in an Arabic-speaking country and a participant who had an Arabic class would be considered equal in this category as it was defined in the present study. The intention behind this question was to identify those who had experience with Arabic, but it would have been better to be more specific. Further research should ask clearer, more specific questions, such as the following: “Have you taken Arabic class?” “Have you been around people who speak Arabic?” “If so, for how long?” “Have you been in an Arabic speaking country?” “If so, for how long?” Another suggestion would be to take into consideration the languages other than Arabic with /q/ in their inventories, such as Hebrew, Kazakh, and Serbo-Croatian. Exposure to languages that have /q/ could also potentially make discrimination easier.

Another limitation was the age group of the participants. The distance between the age groups might have been too large; it ranged from 19 years to over 50. It might have been better to survey participants who were closer in age, such as 19–25 and 35–40. This is not because discrimination between a larger age group was expected to be different but rather because it helps define a more specific population. Therefore, further research should limit the distance between age groups. In the current study, the larger distance was justified by the need for participants.

The small sample size could be considered as one of the reasons for the lack of significant differences, especially for word positions. Larger sample size of least 34 participants, could have resulted in significant differences between the three positions.

A final limitation was the overall discrimination results for the categories of gender, background experience in phonetics and phonology, and exposure to Arabic, which were reported but not discussed. This was because they were not part of the research question. Further research might therefore benefit from taking such distinctions into account.

5.1.5. Implications and Conclusion

This study investigated the perception of /q/ by native speakers of American English. First, it tried to determine whether native speakers of American English had a very good discrimination and discrimination of /q/ in the Arabic /q/-/k/ contrast as predicted by PAM. The data analysis provided evidence that native speakers of American English had a very good discrimination and discrimination of /q/ in the Arabic /q/-/k/ as predicted by PAM. Not only were the results consistent with PAM, but they also provided evidence that some participants had an excellent discrimination of the contrast. However, considering the individual scores, it was

suggested that PAM adjust the UC type assimilation to allow moderate and excellent discrimination as well as poor discrimination.

Second, the study tried to determine whether the discrimination of /q/ in the Arabic /q/-/k/ contrast by native speakers of American English was position-sensitive as hypothesized by the SLM. The data analysis was partially consistent with SLM Hypothesis 1 in the sense that there was a slight difference in the discrimination of /q/ in the three positions: word-initial, word-medial, and word-final. SLM was not totally supported because the differences were not statistically significant. The data analysis also provided evidence that word-final position resulted in better discrimination, followed by word-medial and then word-initial position, which was consistent with the findings of Strange (1992). A suggestion was made to adjust SLM Hypothesis 1 to posit that perception would slightly be better in word-final position than medially or initially, though the difference may not be statistically significant.

Finally, the present study attempted to determine whether the vocalic context in which /q/ occurs influences its discrimination. The data analysis revealed that the vocalic context had different effects on the discrimination of /q/. The /i/ context favored the best discrimination of /q/, followed by /a/, with /u/ being the least likely to improve discrimination. These findings, in comparison with Shafiro et al. (2013), suggested that how vowels influence consonant perception differs from one consonant to another. The same vowel may promote better discriminability of a particular consonant but serve to distract in the case of another consonant.

The current study expands upon the literature on L2 sound perception in general and to that of PAM, SLM, and vocalic context influences on consonant perception in particular. Moreover, the study could help instructors of Arabic in teaching Arabic L2 learners with an American English background. While preparing Arabic sound pronunciation, they may take into

consideration that /q/ is easier to acquire in word-final position and in the /i/ context.

Consequently, teachers could start pronunciation tasks and activities with /qi/ in initial syllables then gradually move to /iqi/ in medial syllables and /iq/ in final syllables. Afterwards, the activities should be /qa/ in initial syllables, gradually moving to /aqa/ in medial syllables, and finally /aq/ in final syllables. Lastly, they would teach the pronunciation of /qu/ in initial syllables then gradually move to /uqu/ in medial syllables and /uq/ in final syllables. This study contributed to the understanding of L2 sounds perception. Its results and findings were not definite, however, and further research is needed to determine the consistency of the present study's data.

REFERENCES

- Al Mahmoud, M. S. (2012). Discrimination of Arabic contrasts by American learners. *Studies in Second Language Learning and Teaching*, 3(2), 261–292.
- Al-Solami, M. (2013). Arabic emphatics: Phonetic and phonological remarks. *Open Journal of Modern Linguistics*, 3(4), 314–318.
- Amayreh, M. M. (2003). Completion of the consonant inventory of Arabic. *Journal of Speech, Language, and Hearing Research*, 46, 517–529.
- Amer, W. M. (2012). An investigation into the differences between English and Arabic position and order of adjectives: A contrastive study with pedagogical implications. *Albahr Al-Ahmer University Journal*.
- Aoyama, K., Flege, J. E., Guion, S. G., Akahane-Yamada, R., Yamada, T. (2004). Perceived phonetic dissimilarity and L2 speech learning: The case of Japanese /r/ and English /l/ and /r/. *Journal of Phonetics* 32(2), 233–250.
- Best, C. T. (1994a). The emergence of native-language phonological influences in infants: A perceptual assimilation model. In J. C. Goodman & H. C. Nusbaum (Eds.), *The development of speech perception: The transition from speech sounds to spoken words* (pp. 167–224). Cambridge, MA: MIT Press.
- Best, C. T. (1994b). Learning to perceive the sound pattern of English. In C. Rovee-Collier & L. Lipsitt (Eds.), *Advances in infancy research, volume 8* (pp. 217–304). Hillsdale, NJ: Ablex Publishers.
- Best, C. T. (1995). A direct realist perspective on cross-language speech perception. In W. Strange (Ed.), *Speech perception and linguistic experience: Issues in cross-language research* (pp. 171–204). Timonium, MD: York Press.

- Best, C. T., McRoberts, G. W., & Sithole, N. M. (1988). Examination of perceptual reorganization for nonnative speech contrasts: Zulu click discrimination by English-speaking adults and infants. *Journal of Experimental Psychology: Human Perception and Performance*, *14*(3), 345–360.
- Best, C. T., & Strange, W. (1992). Effects of phonological and phonetic factors on cross-language perception of approximants. *Journal of Phonetics*, *20*, 305–330.
- Best, C. T., McRoberts, G. W., & Goodell, E. (2001). Discrimination of non-native consonant contrasts varying in perceptual assimilation to the listener's native phonological system. *Journal of the Acoustical Society of America*, *109*(2), 775–794.
- Boersma, P. (2006). Polivanov's idea of phonology in perception. Retrieved from <http://www.fon.hum.uva.nl/paul/papers/Polivanov.pdf>
- Bohn, O-S., & Best, C. T. (2010). Testing PAM and SLM: Perception of American English approximants by native German listeners. *New Sounds 2010: Proceedings of the Sixth International Symposium on the Acquisition of Second Language Speech*. Poznan, Poland.
- Buali, I. (2010). *The perception and production of /p/ in Saudi Gulf Arabic English: A variationist perspective* (Unpublished master's thesis). Québec, Canada: Concordia University. Retrieved from http://spectrum.library.concordia.ca/7001/1/Buali_MA_S2011.pdf
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd edition). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Delattre, P. C., Liberman, A. M., & Cooper, F. S. (1955). Acoustic loci and transitional cues for consonants. *Journal of the Acoustical Society of America*, *27*, 769–773.

- Dorman, M. E, Raphael, L. J., & Liberman, A. M. (1979). Some experiments on the sound of silence in phonetic perception. *Journal of the Acoustical Society of America*, 65, 1518–1532.
- Eckman, F. (1987). Markedness and the contrastive analysis hypothesis. In I. Georgette & S. Weinberger (Eds.), *Interlanguage phonology: The acquisition of a second language sound system* (pp. 55–69). Cambridge, MA: Newbury House.
- Edwards, H. T. (1992). *Applied phonetics: The sounds of American English*. San Diego, CA: Singular Press.
- Ferguson, C. A. (1959). Diglossia. *Word*, 15, 325–340.
- Flege, J. E. (1987). The production of “new” and “similar” phones in a foreign language: Evidence for the effect of equivalence classification. *Journal of Phonetics*, 15, 47–65.
- Flege, J. E. (1991). Perception and production: The relevance of phonetic input to L2 phonological learning. In T. Huebner & C. A. Ferguson (Eds.), *Crosscurrents in Second Language Acquisition and Linguistic Theories* (pp. 249–290). Amsterdam, Netherlands: John Benjamins.
- Flege, J. E. (1995). Second-language speech learning: Theory, findings and problems. In W. Strange (Ed.), *Speech perception and linguistic experience: Theoretical and methodological issues in cross-language speech research* (pp. 233–272). Timonium, MD: York Press.
- Flege, J. E. (2005). Origins and development of the speech learning model. *1st ASA Workshop on L2 Speech Learning*. Vancouver, Canada.
- Flege, J. E., Schirru, C., & MacKay, I. R. A. (2003). Interaction between the native and second language phonetic subsystems. *Speech Communication*, 40(4), 467–491.

- Fujimura, O., Maccini, M.J., & Streeter, L. A. (1978). Perception of stop consonants with conflicting transitional cues: A cross-linguistic study. *Language and Speech*, 21(4), 337–346.
- Gass, S. M., & Selinker, L. (2001). *Second language acquisition: An introductory course*. London, UK: Lawrence Earlbaum.
- Gierut, J. A., & Pisoni, D. B. (1988). Fundamental differences in speech perception across populations. In N. Lass, L. McReynolds, J. Northern, & D. Yoder (Eds.), *Handbook of speech-language pathology and audiology* (pp. 253–276). Philadelphia, PA: B. C. Decker.
- Guion, S. G., Flege, J. E., Akahane-Yamada, R., & Pruitt, J. C. (2000). An investigation of current models of second language speech perception: The case of Japanese adults' perception of English consonants. *Journal of the Acoustical Society of America*, 107, 2711–2724.
- Hashem-Aramouni, E. (2011). *The impact of diglossia on Arabic language instruction in higher education: Attitudes, experiences of students, and instructors in the U.S.* (Unpublished doctoral dissertation). California State University, Sacramento, CA. Retrieved from <http://www.csus.edu/coe/academics/doctorate/research/dissertations/cohort-2/assets/hashem-aramouni-eva-impact-diglossia-arabic.pdf>
- Hong, S., & Sarmah, P. (2009). Korean perception of Arabic phonemes. *Current Issues in Linguistic Interfaces*, 2, 375–386.
- Iverson, P., Kuhl, P., Akahane-Yamada, R., Diesch, E., Tokura, Y., & Ketterman, C. (2001). A perceptual interference account of acquisition difficulties for non-native phonemes. *Speech, Hearing and Language*, 13, 106–118.

- Javed, F. (2013). Arabic and English phonetics: A comparative study. *The Criterion: An International Journal in English*, 4(4). Retrieved from <http://www.the-criterion.com/V4/n4/Javed.pdf>
- Just, M. A., Suslick, R. L., Michaels, S., & Shockey, L. (1978). Acoustic cues and psychological processes in the perception of natural stop consonants. *Perception & Psychophysics*, 24, 327–336.
- Kopczynski, A., & Meliani, R. (1993). The consonants of Arabic and English. *Papers and Studies in Linguistics Volume XXVII*. Poznań, Poland.
- Lado, R. (1957). *Linguistics across cultures*. Ann Arbor, MI: University of Michigan Press.
- Lai, Y. H. (2010). English vowel discrimination and assimilation by Chinese-speaking learners of English. *Concentric: Studies in Linguistics*, 36(2), 157–182.
- Laufer, A., & Baer, T. (1988). The emphatic and pharyngeal sounds in Hebrew and in Arabic. *Language and Speech*, 31(2), 181–205.
- Lee, J-K. 1997. The asymmetry of c/v coarticulation in CV and VC structures and its implications in phonology. *Studies in the Linguistic Sciences*, 27(1), 139–152.
- Liberman, A. M., Cooper, F. S., Shankweiler, D. P., & Studdert-Kenedy, M. (1967). Perception of the speech code. *Psychology Review*, 74, 431–461.
- Mitchell, T. F. (1986). What is educated spoken Arabic? *International Journal of the Sociology of Language*, 61, 7–32.
- Mora, J. C. (2007). Methodological issues in assessing L2 perceptual phonological competence. *Proceedings of the PTLC 2007 Phonetics Teaching and Learning Conference*. London, UK: Department of Phonetics and Linguistics, University College London.

- Ohala, J. J. (1990). The phonetics and phonology of aspects of assimilation. In J. Kingston & M. E. Beckman (Eds.), *Papers in laboratory phonology I: Between the grammar and physics of speech* (pp. 258–275). Cambridge: Cambridge University Press.
- Ohde, R. N., & Sharf, D. J. (1977). Order effect of acoustic segments of VC and CV syllables on stop and vowel identification. *Journal of Speech and Hearing Research, 20*, 543–554.
- Palmer, J. (2007). Arabic diglossia: Teaching only the standard variety is a disservice to students. *Arizona Working Papers in SLA & Teaching, 14*, 111–122.
- Pisoni, D. B., Lively, S. E., & Logan, J. S. (1994). Perceptual learning of nonnative speech contrasts: Implications for theories of speech perception. In J. C. Goodman & H. C. Nusbaum (Eds.), *The development of speech perception: The transition from speech sounds to spoken words* (pp. 121–166). Cambridge, MA: MIT Press.
- Polka, L. (1992). Characterizing the influence of native experience on adult speech perception. *Perception & Psychophysics, 52*, 37–52.
- Redford, M. & Diehl, R. (1999). The relative perceptual distinctiveness of initial and final consonants in CVC syllables. *Journal of the Acoustical Society of America, 106*, 1555–1565.
- Repp, B. H. (1978). Perceptual integration and differentiation of spectral cues for intervocalic stop consonants. *Perception & Psychophysics, 24*, 471–485.
- Thelwall, R., & Sa'Adeddin, M. A. (1990). Arabic. *Journal of the International Phonetic Association, 20*, 37–39.
- Rose, M. (2010). Differences in discriminating L2 consonants: A comparison of Spanish taps and trills. In M. T. Prior (Ed.), *Selected Proceedings of the 2008 Second Language Research Forum* (pp. 181–196). Somerville, MA: Cascadilla Proceedings Project.

- Rvachew, S., & Jamieson, D. G. (1995). Learning new speech contrasts: Evidence from adults learning a second language and children with speech disorders. In W. Strange (Ed.), *Speech perception and language experience: Issues in cross-language research* (pp. 411–432). Baltimore, MD: York Press.
- Sekiyama, K., & Tohkura, Y. (1993). Inter-language differences in the influence of visual cues in speech perception. *Journal of Phonetics*, *21*, 427–444.
- Shafiro, V., Levy, E. S., Khamis-Dakwar, R., & Kharkhurin, A. (2013). Perceptual confusions of American-English vowels and consonants by native Arabic bilinguals. *Language & Speech*, *56*(2), 145–161.
- Sharf, D. J., & Hemeyer, H. (1972). Identification of place of consonant articulation from vowel formant transitions. *Journal of the Acoustical Society of America*, *51*, 652–658.
- Sharf, D. J., & R. C. Beiter. 1974. Identification of consonant from formant transitions presented forward and backward. *Language and Speech*, *17*, 110–118.
- Strange, W. (1992). Learning non-native phoneme contrasts: Interactions among subject, stimulus, and task variables. In Y. Tohkura, E. Vatikiotis-Bateson, & Y. Sagisaka (Eds.), *Speech Perception, Production, and Linguistic Structure*, (pp. 197–219). Tokyo, Japan: Ohmsha.
- Strange, W., & Shafer, V. (2008). Speech perception in second language learners: The re-education of selective perception. In J. G. Hansen Edwards & M. L. Zampini (Eds.), *Phonology and Second Language Acquisition* (pp. 153–191). Amsterdam, Netherlands: John Benjamins.

- Takagi, N. (1993). *Perception of American English /r/ and /l/ by adult Japanese learners of English: A unified view* (Unpublished doctoral dissertation). University of California, Irvine.
- Takagi, N., & Mann, V. (1995). The limits of extended naturalistic exposure on the perceptual mastery of English /r/ and /l/ by adult Japanese learners of English. *Applied Psycholinguistics*, 16(4), 379–405.
- Towell, R., & Hawkins, R. (1994). *Approaches to second language acquisition*. Clevedon, UK: Multilingual Matters.
- Watson, J. C. E. (2002). *The phonology and morphology of Arabic*. Oxford, UK: Oxford University Press.
- Werker, J. F., Gilbert, J. H. V., Humphrey, K., & Tees, R. C. (1981). Developmental aspects of cross-language speech perception. *Child Development*, 52, 349–355.
- Werker, J. F., & Tees, R. C. (1984a). Cross-language speech perception: Evidence for perceptual reorganization during the first year of life. *Infant Behavior and Development*, 7, 49–63.
- Werker, J. F., & Tees, R. C. (1984b). Phonemic and phonetic factors in adult cross-language speech perception. *Journal of the Acoustical Society of America*, 75, 1866–1878.
- Werker, J., & Logan, J. S. (1985). Cross-language evidence for three factors in speech perception. *Perception & Psychophysics*, 37, 35–44.
- Yamada, R. A., & Tohkura, Y. (1992). The effect of experimental variables on the perception of American English /r/ and /l/ by Japanese listeners. *Perception & psychophysics*, 52(4), 376–392.
- Yang, B. (1992). A review of contrastive analysis hypothesis. *Donguei Journal*, 19, 133–149.

Zughoul, M. R. (1980). Diglossia in Arabic: Investigating solutions. *Anthropological Linguistics*, 22, 201–217.

APPENDICES

APPENDIX A
CONSENT FORM

Dear participant,

My name is Ousmane Sawadogo. I am a graduate student in the Department of Linguistics at Southern Illinois University-Carbondale.

I have been granted approval by the Human Subjects Committee at SIUC to request your participation in a research study that I am conducting, as part of my thesis requirement. The purpose of my study is to investigate perception of Arabic /q/ by native speakers of American English.

Participation in this study is voluntary. If you chose to participate, it will take approximately 20 minutes of your time. You will listen to a list of Arabic pseudowords that contains /q/ and /k/ and you will be asked to identify and discriminate /q/ from /k/.

All your responses will be kept confidential within reasonable limits and will not be linked to your name. Only those directly involved with this project, such as my thesis chair, Dr. Soo Jung Chang, the Department of Linguistics, and myself will have access to the data.

If you agree to participate in my study, please sign this form and return it to me. **You can withdraw from participation at any time you want.**

If you have any questions about the study, please contact me, Ousmane Sawadogo, address: 88 Southmoor st, phone: (618) 434-0462; email: sdg.ous@siu.edu or contact my thesis chair, Dr. Soo Jung Chang, Department of Linguistics, Faner Building 3227 SIUC, Carbondale, IL, 62901, phone: (618) 536-3385, email: soojungchang@siu.edu.

Thank you for taking the time to assist me in this research.

Signing this form indicates voluntary consent to participate in this study.

Participant Signature and Date

This project has been reviewed and approved by the SIUC Human Subjects Committee. Questions concerning your rights as a participant in this research may be addressed to the Committee Chairperson, Office of Sponsored Projects Administration, Southern Illinois University, Carbondale, IL 62901-4709. Phone (618) 453-4533. E-mail: siuhsc@siu.edu

APPENDIX B

DEMOGRAPHIC INFORMATION

Dear participant,

I appreciate your time and effort in answering this questionnaire. I need this information for my research and I would appreciate if you could share your demographic information and give the appropriate answer.

Many thanks,

Ousmane Sawadogo

1. Age: 19-25 26-30 31-35 36-40 41-45 46-50 Over 50

2. Gender: male female

3. Status: Undergraduate Graduate Academic Faculty Administrative Faculty

4. Are you a native speaker of English? Yes No

5. What are the language(s) that you speak other than English?

6. What are the language(s) that you have been exposed to, other than English?

7. Have you taken any phonetic or phonology class?

APPENDIX C

SOLICITATION REQUEST (E-MAIL)

Dear Participant,

My name is Ousmane Sawadogo; I am a Graduate Student in the Department of Linguistics at Southern Illinois University, Carbondale.

I understand how valuable your time is. I am hoping that you may be able to set aside 15-20 minutes to participate in my research study. The purpose of this online survey is to investigate the perception of the Arabic /q-k/ contrast.

Your feedback is very important for my study.

I have been granted approval by the Human Subjects Committee at SIUC to request your participation. Please know that participation in this study is voluntary. You may withdraw from participation at any time you want. Completion of this survey indicates voluntary consent to participate in the study.

If you have any questions about the study, please contact me, Ousmane Sawadogo, phone: (618) 434-0462; email: sdg.ous@siu.edu or contact my thesis chair, Dr. Soo Jung Chang, Department of Linguistics, Faner Building 3227 SIUC, Carbondale, IL, 62901, phone: (618) 536-3385, email: soojungchang@siu.edu.

In order to participate, you may either:

1. [Click on this link](#)

or

2. Copy-paste the entire following link between quote marks (NOT including the quote marks) in a web browser

" <http://www.sogosurvey.com/k/SsSVPPVsQTsPsPsP> "

Thank you for your time and participation.

This email is sent on behalf of the person/organization whose name appears in the FROM field by SoGoSurvey . If you have any questions about the email, please contact the sender by replying to this email.

If you prefer not to receive future reminders about this survey, please [Click here](#).

If you prefer not to receive future surveys from the organization behind this survey, please [Click here](#).

If you know someone who may be interested in this survey, I would appreciate that you send him an invitation. [Click here](#)

word A: / tu.ku / تُكُو	word X: / tu.ku / تُكُو	word B: / tu.qu / نُقُو
Trial 11 (35) (BAA/k-q-q)		
word A: / ta.ak / تَأَكْ	word X: / ta.aq / تَأُقْ	word B: / ta.aq / تَأُقْ
Trial 12 (18) (ABB/q-k-k)		
word A: / tu.qu / نُقُو	word X: / tu.ku / تُكُو	word B: / tu.ku / تُكُو
Trial 13 (16) (BBA/k-k-q)		
word A: / ti.ki / تِكِّي	word X: / ti.ki / تِكِّي	word B: / ti.qi / تِقِّي
Trial 14 (4) (BBA/k-k-q)		
word A: / ki.ta / كِتَا	word X: / ki.ta / كِتَا	word B: / qi.ta / قِتَا
Trial 15 (30) (ABB/q-k-k)		
word A: / tu.uq / تُوقْ	word X: / tu.uk / تُوكْ	word B: / tu.uk / تُوكْ
Trial 16 (1) (AAB/q-q-k)		
word A: / qi.ta / قِتَا	word X: / qi.ta / قِتَا	word B: / ki.ta / كِتَا
Trial 17 (32) (BBA/k-k-q)		
word A: / tu.uk / تُوكْ	word X: / tu.uk / تُوكْ	word B: / tu.uq / تُوقْ
Trial 18 (31) (BAA/k-q-q)		
word A: / tu.uk / تُوكْ	word X: / tu.uq / تُوقْ	word B: / tu.uq / تُوقْ
Trial 19 (27) (BAA/k-q-q)		
word A: / ti.ik / تِيكْ	word X: / ti.iq / تِيُقْ	word B: / ti.iq / تِيُقْ
Trial 20 (24) (BBA/k-k-q)		
word A: / ta.ka / تَكَا	word X: / ta.ka / تَكَا	word B: / ta.qa / تَقَا
Trial 21 (19) (BAA/k-q-q)		
word A: / tu.ku / تُكُو	word X: / tu.qu / نُقُو	word B: / tu.qu / نُقُو

Trial 22 (6) (ABB/q-k-k)

word A: / qu.ta / قُنَّا

word X: / ku.ta / كُنَّا

word B: / ku.ta / كُنَّا

Trial 23 (23) (BAA/k-q-q)

word A: / ta.ka / تَكَّا

word X: / ta.qa / تَقَّا

word B: / ta.qa / تَقَّا

Trial 24 (17) (AAB/q-q-k)

word A: / tu.qu / تُقُو

word X: / tu.qu / تُقُو

word B: / tu.ku / تُكُو

Trial 25 (21) (ABB/q-q-k)

word A: / ta.qa / تَقَّا

word X: / ta.qa / تَقَّا

word B: / ta.ka / تَكَّا

Trial 26 (36) (BBA/k-k-q)

word A: / ta.ak / تَأَكُّ

word X: / ta.ak / تَأَكُّ

word B: / ta.aq / تَأُقُّ

Trial 27 (14) (ABB/q-k-k)

word A: / ti.qi / تَقِي

word X: / ti.ki / تَكِي

word B: /ti.ki/ تَكِي

Trial 28 (5) (AAB/q-q-k)

word A: / qu.ta / قُنَّا

word X: / qu.ta / قُنَّا

word B: / ku.ta / كُنَّا

Trial 29 (9) (AAB/q-q-k)

word A: / qa.ta / قَنَّا

word X: / qa.ta / قَنَّا

word B: / ka.ta / كَنَّا

Trial 30 (15) (BAA/k-q-q)

word A: / ti.ki / تَكِي

word X: / ti.qi / تَقِي

word B: / ti.qi / تَقِي

Trial 31 (34) (ABB/q-k-k)

word A: / ta.aq / تَأُقُّ

word X: / ta.ak / تَأَكُّ

word B: / ta.ak / تَأَكُّ

Trial 32 (26) (ABB/q-k-k)

word A: / ti.iq / تَقُّ

word X: / ti.ik / تَقُّ

word B: / ti.ik / تَقُّ

Trial 33 (22) (ABB/q-k-k)

word A: / ta.qa / تَقَا

word X: / ta.ka / تَكَا

word B: / ta.ka / تَكَا

Trial 34 (10) (ABB/q-k-k)

word A: / qa.ta / قَتَا

word X: / ka.ta / كَتَا

word B: / ka.ta / كَتَا

Trial 35 (33) (AAB/q-q-k)

word A: / ta.aq / تَأُقْ

word X: / ta.aq / تَأُقْ

word B: / ta.ak / تَأَكْ

Trial 36 (3) (BAA/k-q-q)

word A: / ki.ta / كِتَا

word X: / qi.ta / قِتَا

word B: / qi.ta / قِتَا

VITA

Graduate School
Southern Illinois University

Ousmane Sawadogo

sdg.ous@gmail.com

Al Azhar University Cairo, Egypt
Bachelor of Arts in Religious Studies, October 2003

Cheikh Anta Diop University Dakar, Senegal
Master of Arts in Arabic Studies, March 2011

Thesis Title:

Perception of /q/ in the Arabic /q/-/k/ Contrast by Native Speakers of American English:
A Discrimination Task

Major Professor: Dr. Soo Jung Chang