" The Perception and Pronunciaiton of L2 Modern Standard Arabic Distinguished Consonants by L1 Chinese Speakers".

Mona Maamoun
m.almoatazbellah@alexu.edu.eg
menaelmoataz@gmail.com
Lecturer of phonology, Phonetics and Linguistics Department
The Alexandria University, Egypt

1. Introduction

Learner's first language (L1) could influence the learning process of a second (L2) language across the different linguistic levels. The pronunciation of second languages usually accented by the first language phonetic system. This accented speech impacts learners' expressive, and receptive skills to different extents (Derwing and Munro 2005)[1]. Many researchers mentioned that the evaluation of the process of learning L2 shouldn't rely neither on the amount of the learned vocabulary nor on the grammar. Otherwise, they focused on the importance of acquiring an accurate pronunciation for a mutual intelligible communication between non-natives and naitive speakers. (Derwing & Munro, 2015;)2 (Levis, 2018 3).

Accurate pronunciation of L2 governs by many factors such as the extent of the linguistic difference and similarity between L1 and L2. This extent could subsequently influence the type and degree of L1 transfer into L2 pronunciation. Transfer, could be either negative or positive. In the case of lacking the L1 phonetic and phonological system to some features of L2, the interference of L1 into L2 could be regarded as negative transfer. These dissimilarities my cause perception and production challenges to the L2 learners.

Whin the L2 phonemic inventory, researchers noted that there are some L2 phonemes that appear to be more difficult for L2 learners than others. (Eckman et al., 2003; Flege, 19874)5. For example, the L1 Egyptian Arabic speakers find the pronunciation of some L2 English phonemes such as /p/, /v/, /ch/, /T/, /Δ/ (don't exist in Egyptian Arabic) more complex than the pronunciation of others as /b, s, z, k, g/ (Hafez, 2001)[6].

On the opposite side the positive transfer, which represents the common phonetic and phonological features between L1 and L2 facilitates the

language learning process (Corder 1967)[7], and makes it much more easier (Lado 1957)[8].

L1 Transfer isn't restricted to the phonetic level, it can take place across the whole remain linguistic levels: phonology, morphology, syntax, and pragmatics. Zhanming (2014)[9] argued that the L1 transfer is well established across the phonetic and phonological levels, thus could influence the L2 pronunciation in a negative way. Phonological transfer is defined by Lowie (2015)[10] as the transfer of the L1 phonological system ranging from the individual sound to the prosodic characteristics of language. Moreover, Jarvis and Pavlenko (2007)[11] define phonological transfer as the way in which a person's knowledge of a specific language not only affects the pronunciation of a new language sound system but also its perception.

Carey (2002)[12], noted that many errors of L2 pronunciation result from the L1phonetic transfer. When a language learner tries to pronounce L2 sounds, their extent to reach near native pronunciation depends on their ability to discriminate and separate between the L2 utterance and their L1 phonemic inventory. L2 phonetics and phonology are often big obstacles for language learners across the pronunciation and perception levels (Adrian Wagner[13]).

Many theories studied and established the patterns of L2 speech perception, such as Fledge's Speech Learning Model (SLM; Fledge, 1995), and Best's Perceptual Assimilation Model for second language learning (PAM-L2; Best&Tyler, 2008) . Fledge theorizes that perception is a prerequisite for accurate production. Meanwhile, the L1 phonetic system will have an influence on the development of the L2 system. In regard to similar sounds, Flege has developed what is called equivalence classification (Flege, 1995). According to this principle, the L2 segments that are phonetically related, but not identical to L1 categories are perceptually assimilated to those L1 categories. (Flege and MacKay, 2004, p.56). With repeated exposure, the learner may become aware of the acoustic differences and begin to produce a sound more similar to the foreign sound. Especially, if the new sound is completely outside the phonological space of the learner`s native system. The greater the phonological distance between the perceived L2 sound and the nearest L1 sound, the more likely the phonetic differences between the sounds will be detected, and as a sequence a new phonetic category will be established. L2 categories that are perceptually discriminated from any L1 category are not assimilated to L1 category. They consider easier to learn since they fall into relatively unoccupied regions of the learner's phonological space. Once the perception of foreign speech sounds is accurately established, this will provide a base for accurate pronunciation. Best & Tyler, 2007 demonstrated that the challenging L2 phonetic learning

items can be predicted from the relationship between L1 and L2 phonology. It is hypothesized that the difficult L2 phonetic segments which don't exist in L1 will be assimilated into the existing L1 categories. This model represents patterns of incorrect and correct perception of L2 sounds. When a foreign sound is heard it will be perceptually assimilated by the listener to one of the three following patterns:

A single category pattern of assimilation is the one in which two distinguished L2 phones are assimilated to the same L1 category. L1 Japanese speakers of L2 English assimilate the English segments /ɹ/ (alveolar approximant as in "red" and "rip") and /l/ (alveolar lateral approximant) to the Japanese / ɽ/, which is an alveolar flap.

A two category assimilation pattern occurs when two distinguished L2 phones are assimilated to two different L1 phones, and discrimination is expected to be excellent. The Hindi voiced retroflex /ɖ/ and the Hindi breathy voiced dental stop /dʱ/ are perceptually assimilated to the English phonemes /d/ and /ð/ respectively. The English phonemes /t/ and /d/ are easily assimilated and distinguished by Japanese learners. Both segments are similar enough to sounds that exist in the Japanese language. At the same time, they are different enough to be discriminated and assimilated separately.

The Uncategorized – categorized contrast occurs when one of two L2 phonemes is identified with an L1 category, and the other isn't assimilated to any of L1 categories (one L2 phoneme is categorized and the other isn't categorized).

The Uncategorized – uncategorized contrast occurs when both L2 phonemes aren't assimilated to any of the L1 categories.

It is observed that many theories, models, and studies were developed and focused on describing the influence of L1 transfer into the L2.

Syed, Ansari & Gopang (2017)[14] noted that the L1 Pakistani speakers have difficulty in perceiving and pronouncing some of the L2 English phonemes. For example, the aspirated stops of British English are produced without aspiration. They neutralize aspiration contrast in English stops. Voiced stops are produced with pre-voicing. Dental fricatives /θ ð/ produced by native speakers of English are perceived as [f z] or [s v] by Pakistani speakers but they produce these fricatives as stop.

The Japanese phonetics and phonological systems differ from the English ones in many aspects, such as, it has a limited vowel system that is substantially smaller than that of English. Consonant clusters are limited in the onset and do not occur in the coda. The only non-vowel that can occur in

the final position of a coda is the nasal /n/and its allophones /m/ and /ŋ/. These differences make Japanese L1 learners of English face difficulty with English vowel, consonant contrasts, and Consonant clusters (Collins, Mees, & Carley (2019) 15.

Coming to the acquisition of Arabic as L2, Nahla (2006)[16] noted that students who passed the beginner level are supposed to be able to utter correct and acceptable production of Arabic sounds and should be able to discriminate between sounds, syllables, and stress. However, this is not the case. There are students of intermediate and advanced levels that reveal major phonetics and phonological errors that affect their pronunciation and their perception. This may due to several factors such as , the studies which concern with describing and analyzing the acquisition of L2 Arabic phonology (production and/or perception) are very limited as Maamoun, 2018[17]; and Shehata (2018)[18]. Shehata (2018) studied the perception and production of Modern standard Arabic consonants by 45 naitive American English learners of Arabic aged from 18 to 30. The subjects were classified in three groups according to the duration they spent on learning Arabic as follows; beginner, intermediate, and advanced level. She investigated the perception and the production of 20 MSA phonemes represented in ten minimal pairs. The target MSA phonemes are /t-t↑/, /d-d↑/, /T-ð/, /ð-ð↑/, /s-s↑/, /h-□/, /k-q/, /?-ﺀ/, /x, ⊗/ , /□, ﺀ/ in initial position. Three Arabic naitive speakers participated in the study in order to evaluate the production of these pairs whether correct or incorrect. She found that all students irrespective of their language level face difficulties in discriminating between /h- □/. Coming to the production, they were able to produce /T-ð/, and /x, ⊗/ in an accurate way. She also claimed that perception and production are related and dependent. Maamoun (2018), studies the acquisition of MSA final consonant clusters by L1 Chinese speakers and she found that L1 Chinese speakers face difficulties in producing MSA coda clusters especially those types that violate the sonority sequence principle.

Hence, the real challenges in acquiring the Arabic pronunciation aren't sufficiently investigated and more research in the acquisition of L2 Arabic pronunciation is still needed.

Learning Arabic by L1 Chinese speakers becomes a must. Majority of Chinese students decide to study Arabic for better career opportunities, while others are interested in Arabic culture. Other Chinese choose to learn Arabic for religious reasons. Lin Feng Min (2017)19

Chinese speakers of L2 Arabic face major problems in perceiving and producing Arabic consonants phonemes. This may be due to the noticeable

differences between the Arabic phonemic system and the Chinese one as illustrated below.

1.1 The Modern standard Arabic (MSA) Phonemic Inventory

The Arabic phonemic inventory is composed of 28 consonant phonemes (Amayreh,2003)[20]. (See appendix I for the Arabic phonemes and their standing corresponding Arabic alphabet)

As we can see in the table below, the Arabic phonemic system contains some sound classes that could be considered as specific, marked, and unique ones such as the four emphatic phonemes, the pharyngeals, and the glottal. The Arabic sounds fully occupied the vocal tract as they extend from the lips up the glottal.

		Bi Labial	Labio dental	Inter Dental	Alveolar	Post alveolar	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	vls				τ τˤ			k	q		ʔ
	vd	**b**			d dˤ						
Nasal	vd	m			n						
Trill					r						
Fricatives	vls		f	θ	s sˤ		ç		x	ħ	
	vd			ð	z				ʁ	ʕ	h
Affricates	vd					ž					
Glide	vd	w					y				
Lateral	vd				l						

Table (1) MSA Consonant Phonemes Inventory

1.2 Modern Standard Chinese (Mandarin) Phonemic Inventory

The Chinese language consists of several dialect families; most of the time these dialects mutually unintelligible. The Northern family, which is also known as the Mandarin family is considered as the largest dialect family. Over 70% of the Chinese population speak Mandarin. The consonant inventory of SC consists of 22 phonemes The consonant inventory of SC consists of 22 phonemes as noted by Duanmu(2005)[21] and illustrated in the following table 2

		Labial	Labiodentals	Alveolar	Palatal	Retroflex	Velar	Uvular	Pharyngeal	Glottal
Plosive	Vls	p pʰ		t tʰ			k kʰ			
	vd									
Fricative	Vls		f	s	ç	ʂ	x			
	vd									
Nasal		m		n			ŋ			
Affricate				t s tsʰ	tç tçʰ	tʂ tʂʰ				
Approximant				l		ɻ				

Table (2) Standard Chinese Consonant Phonemes Inventory after Duanmu (2005)

There are some constraints on the distribution of the Chinese phonemes, all phonemes can occur at onset position except / ŋ /. At the same time, the final coda position is restricted to either / n / or /N/. The alveopalatal fricatives /tɕ- tɕʰ - ɕ/ occur in limited environments either with front vowels or with glides. Voicing is not distinctive between pairs of stops or affricates of the same place and manner of articulation, however, the feature aspiration is distinctive and discriminates between Mandarin's consonants.

From the contrastive approach, it is observed that the Chinese phonemic inventory lacks some phonemes that do exist in the Arabic phonemic inventory. From the place of articulation parameter, the Chinese consonant phonemic system has a reduced set of places as it doesn't include interdentals, uvulars, pharyngeals, and glottal. Coming to the distinctive features, the voicing and emphasis features are distinctive in MSA. Although /r/ do occur in both phonemic systems, they are phonetically different to the extent as they may regard as two different separated phonemes.

From this review of the Arabic and Chinese phonemic systems, it is quite hypothesized that L1 Chinese of L2 MSA may face difficulties in pronouncing and perceiving MSA consonant phonemes. Hence, this study will focus on investigating this hypothesis.

2. The aim of the study

This study aims at:

- Investigating the pronunciation abilities of ten L1 Chinese speakers while producing the Arabic distinguished phonemes /ħ- ʕ- h- ʔ- ʁ-x - q-k - z- s, sˤ -t- tˤ - d- dˤ- ðˤ - ð -θ/.
- Illustrate L1 Chinese speakers' error patterns phonological processes of pronouncing L2 MSA previously mentioned distinguished phonemes.
- Examine the perceptual abilities of L1 Chinese speakers while auditory discriminating between the following Arabic distinguished phoneme pairs /ħ - h/ /ħ- ʕ/ /ʕ - ʔ/ - /ʁ-x/ - /q-k/ - /s- sˤ/ - /ð- ðˤ/ - /s- θ/ - /z- ð/ - t- tˤ/ - /d- dˤ/.

2.1 Research Questions

- Does the absence of many of the Arabic phonemes from the Chinese Phonemic inventory influence negatively on the pronunciation, and the perception of these phonemes by L1 Chinese speakers?
- Is there a correlation between the acquisition of pronunciation and the acquisition of perception along each phoneme?
- What are the most challenging Arabic phonemes to L1 Chinese speakers either in pronunciation or in perception?
- Does the pronunciation class inhance their pronunciation skills over their perception skills?

3. Material and Methods

3.1 Participants

The participants of the current study are 10 Chinese students who learn Arabic as a foreign language. They accomplish their study at the Arabic Language Division for non- native Speakers, FlA program, faculty of Arts, Alexandria University, Egypt. They underwent an OPI by certified OPI testers, and the results showed that can be categorized into two sub novice levels; novice low, and novice mid. They were taking a pronunciation class of 2 credit hours per week for 10 weeks.

3.2 Speech material

Each one of The ten Chinese participants was asked to accomplish two tasks,an auditory discrimination perception task and Read aloud pronunciation task. The perception task was preceded the pronunciation one. The goal of perception task is to test the participants' ability to auditory discriminate between eleven MSA phoneme pairs /ħ - h/ - /ħ- ʕ/ /ʕ - ʔ/ - /ʁ-x/ - /q-k/ - /s- sˤ/ - /ð- ðˤ/ - /s- θ/ - /z- ð/ - t- tˤ/ - /d- dˤ/. While the aim of the pronunciation task is to test the participants' ability to pronounce each one of these phonemes within words.

3.2.1 The perception test and Procedure

In this test, participants were asked to accomplish an auditory discrimination task. Thirty three words were audio played to the participants to test their perception ability to distinguish between the eleven target phoneme pairs /ħ - h/ - /ħ- ʕ/ /ʕ - ʔ/ - /ʁ-x/ - /q-k/ - /s- sˤ/ - /ð- ðˤ/ - /s- θ/ - /z- ð/ - t- tˤ/ - /d- dˤ/. Each phoneme pair was tested three times by three words. The target minimal pairs were represented to the participants written in Arabic script and they have to choose between two written answers and circle around the target word they heard (See Appendix II). For example, in order to test the participants' ability to discriminate between //ħ/ and /h/, they hear the word "هس and they have to decide whether the answer is (A) for the word حسor (B) for the word هس by putting a circle around their response.

For scoring, the answers of each participant were filled in another sheet. The scoring sheet consists of five major columns, the first for the target phoneme pair, the second represents the target word that has been audio represented for students, the third the minimal pairs words of the target phonemes pair The fifth for classifying the participants answers whether its correct or incorrect. **(**See Appendix III).

3.2.2 The pronunciation test and Procedure

After finishing with the perception task, each participant was asked to read the 66 minimal pairs (Appendix I) that are written in Arabic and introduced to them in the perception task.

For scoring, the answers of each participant were filled in another sheet. The scoring sheet consists of eight columns, the first for the target phonemes /ʔ, h, ħ, ʕ , x, ʁ, q, k, s, sˤ, z, t, tˤ, d, dˤ, T, ∆, ðˤ/. The second for the target words represented in Arabic and these words are phonemically transcribed and added to the third column. Each phoneme was tested three times in

three different positions (Initial , medial, final) and in different syllabic structure (cvcc, cvc/cv(c) , cvc/cvc) respectively.

The participants pronunciation of each word is transcribed and listed in the fourth column. Live phonemic transcription was accomplished for each participant. Later, the recordings were replayed to revise the transcription.

The participants' word pronunciations are classified as correct or incorrect across the fifth and sixth columns. When a participant pronounce a phoneme incorrectly, the type of the resulted phonological process error is described in the seventh column. Finally, any observable notes are established in the eighth column. (See Appendix IV)

Participants were asked to read aloud these 54 target words. Their pronunciations were audio recorded using an HP lab top with beats audio technology.

4. Statistical analysis of the data (pronunciation and perception)

Data was fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp). Quantitative data were described using mean, standard deviation. The significance of the obtained results was judged at the 5% level. The used tests were Paired t-test for normally distributed quantitative variables, to compare and Pearson coefficient to correlate between two normally distributed quantitative variables.

5. Results and Discussion

5.1 Results of pronunciation task

Table (3) Descriptive analysis of the Mean proportion correct for learner's pronunciation (n = 10)

%	Pronunciation
	Mean ± SD.
ħ	46.67 ± 35.83
h	86.67 ± 23.31
ʁ	73.33 ± 40.98
q	63.33 ± 36.68
s	83.33 ± 23.57
ð	30.0 ± 18.92
t	86.67 ± 17.21
d	86.67 ± 17.21
ʕ	70.0 ± 39.91
ʔ	93.33 ± 21.08
X	90.0 ± 22.50
K	80.0 ± 17.21
$s^ʕ$	80.0 ± 35.83
θ	63.33 ± 48.30
$ð^ʕ$	20.0 ± 42.16
Z	93.33 ± 21.08
$t^ʕ$	73.33 ± 34.43
$d^ʕ$	73.33 ± 37.84
Overall	**71.85 ± 12.64**

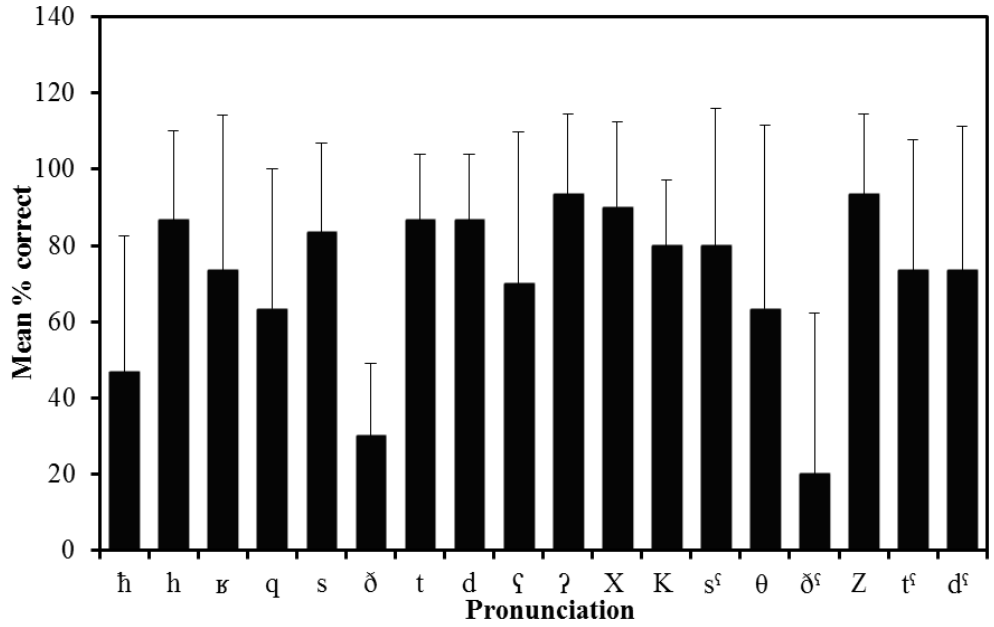


Figure (1): Descriptive analysis of the Mean proportion correct for learner's pronunciation (n = 10)

These previous results represent the participants' level of pronouncing the MSA distinguished phonemes /ʔ, h, ħ, ʕ , x, ʁ, q, k, s, sˤ, z, t, tˤ, d, dˤ, T, ∆, ðˤ/. From figure 2, it is observed that the phonemes in which their correct pronunciation scored less than 50% are as following from the least to the highest /ðˤ, ð , ħ/. Those phonemes which score between 60% to 80% correct pronunciation are /T, q, ʁ, tˤ, dˤ, ʕ, k, sˤ/. The correct pronunciation of the phonemes / s, h,z, t,d,x,ʔ/ scored from 81% to 95% of correct occurrence.

The pronunciation difficulty of MSA phonemes by L1 Chinese speakers across the different places of articulation can be analyzed as follows. Regarding the pronunciation of the glottals, /ʔ/ scored 93%, which is the highest percentage of correct pronunciation across the whole target phonemes. Its pronunciation is easier for L1 Chinese than the phoneme /h/. Coming to the pharyngeals, it is noticed that the percentage of pronouncing /ħ/ incorrectly is higher than /ʕ /, especially in cv ħ.cv ħ position in word as حرج. Hence, / ʕ/ is easier in its pronunciation than / ħ/. In most instances, / ħ/ is substituted by /h/, and / ʕ / is replaced by /ʔ/.

Regarding the uvulars / ʁ, x, q/. /x/ is the easiest in its pronunciation, and /q/ is the hardest. It is observed that when Chinese participants are trying to pronounce / ʁ/ they produced it as /x/. One participant in the current study pronounced it as /g/. The pronunciation error of /q/ has two representations, either /k/ or /g/.

Concerning the MSA emphatic phonemes / ðˤ, tˤ, dˤ, sˤ/ versus their non-emphatic counter members /ð, t, d, s/, it is illustrated that the highest percentages of correct pronunciation go to the non-emphatic phonemes, and the phoneme /ðˤ/ is the most difficult one. The emphatic phonemes are placed by their non- emphatic phonemes. For example, the pronunciation of / tˤ, dˤ, sˤ/ is produced as /t,d,s/ respectively by the Chinese participants.

Counting the dentals versus the interdentals /s, z/ and /θ, ð, ðˤ/, it is found that the pronunciation of interdentals is more difficult than the dental ones. The interdentals are replaced by dentals. For example, /θ, ð, ðˤ/ are substituted by /s,z,zˤ/ respectively.

To sum up these findings, L1 Chinese learners of L2 Arabic show difficulties in pronouncing pharyngeals, uvulars, interdentals, and emphatic phonemes. These pronunciation challenges may be result from the absence of these types of sound classes from the Chinese phonemic inventory. This finding agrees with to Carey (2002), many errors in second language pronunciation are caused by negative transfer of L1 into L2.

Chinese speakers never experienced touching and feeling the place of articulation of these phonemes. During the Arabic pronunciation class, they face major difficulties in realizing how to push their tongues backwards to the extent of the uvular, and pharyngeals zones. On the opposite, they struggled with following the instructions in order to push the tongue forward to a certain amount and located it between the upper and lower teeth to pronounce interdentals. The markedness characteristics of the Arabic emphatic phonemes make it hard for them to tolerate their pronunciation. The pronunciation of Arabic emphatic phonemes doesn't require just following the instructions of their primary place of articulation. Otherwise, a secondary articulation is accompanied with their pronunciation, such as lip protrusion. Besides to these pronunciation errors, one dominant error appeared in their speech and it wasn't from the tested phonemes. The pronunciation error of producing /r/ as /l/, this type of error was very widespread and nearly occurred in the speech of all the Chinese participants. Describing these pronunciation errors in terms of substitution phonological processes, it is noticed that the substitution error patterns that appear in the speech of the Chinese participants are in the forms of glottal replacement, De-interdentalization, De-emphasization, uvular fronting, devoicing, and

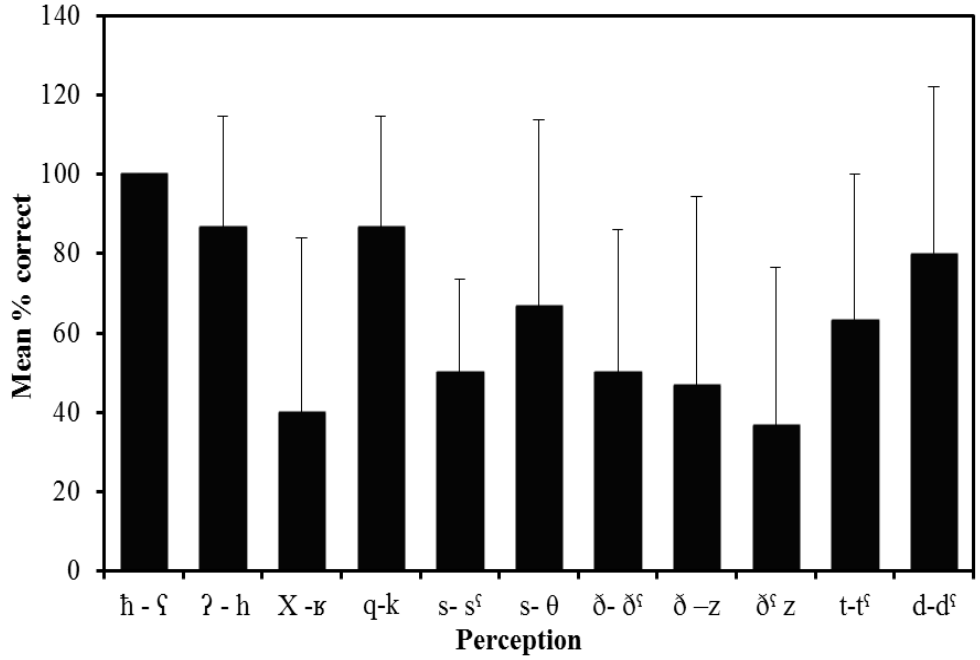
lateralization. The glottal replacement phonological process illustrates the substitution of pharyngeal by glottals such as / ħ/ and / ʕ/ are by /h/ and /ʔ/ respectively. The De-interdentalization phonological process occurs when the interdentals are replaced by dentals such when the phonemes / ð, ðˤ/ are replaced by /z, zˤ/. The De-emphasization phonological process happens when the emphatic phonemes lose their emphasis feature by substituting them by non- empahtic phonemes. The uvular fronting phonological process represents the replacement of uvulars by velars as /q/ when it turns into /k/ or /g/. The devoicing phonological process describes the replacement of a voiced phoneme by a voiceless one. The lateralization phonological process describes the replacement of /r/ by /l/.

The phonological process substitution isn't the only type of phonological processes that appears in the participants' speech, other type also revealed. It is the phonological process cluster reduction, which is considered as a type of the syllabic structure phonological processes. The Chinese participant show difficulty in producing the CVCC syllable, they replaced it by CVVC syllable causing the final cluster to break by eliminating one of the cluster members accompanied by a vowel lengthening to preserve the syllable weight. For example, the word /sˤabb/ is produced as /sa:b/.

5.2 Results of perception test

Table (4) Descriptive analysis of the Mean proportion correct for learner's pronunciation (n = 10)

%	Perception
	Mean ± SD.
ħ - ʕ	100.0 ± 0.0
ʔ - h	86.67 ± 28.11
X ʁ	40.0 ± 43.89
q-k	86.67 ± 28.11
s- sˤ	50.0 ± 23.57
s- θ	66.67 ± 47.14
ð- ðˤ	50.0 ± 36.0
ð –z	46.67 ± 47.66
ðˤ - z	36.67 ± 39.91
t-tˤ	63.33 ± 36.68
d-dˤ	80.0 ± 42.16
Overall	**64.24 ± 17.01**



Figure(2) : Descriptive analysis of the Mean proportion correct for learner's perception (n = 10)

It is revealed from the perception task results in table 4 and figure 2, that Chinese learners of Arabic face the most challenging perception task in discriminating between the following phoneme pairs / ðˤ,z/, /ʁ-x/, / ð,z/, /ðˤ,ð/, and /s, sˤ/ as they scored > 50% of correct responses. They show the highest percentage of correct auditory discrimination between / ħ -ʕ/.

These previous results of the L2 Arabic perception by L1 Chinese can be related to Best's Perceptual Assimilation Model for second language learning (PAM-L2; Best&Tyler, 2008) theory hypotheses mentioned above. The L2 perception patterns that established in the current study can be categorized as follows:

Single L2 is assimilated to the most closely related L1Chinese sound such as:

The uvualr /q/ is perceived as /k/. The interdental /T/ is perceived as /s/, and the emphatic phonemes /tˤ,dˤ, sˤ/ are perceived as /t, d, s/ respectively. The L2 Arabic trill /r/ is perceived as /l/. These findgins agree with the equivalence classification principle of Fledge (1995).22 According to this principle, L2 sounds will be assimilated to the most similar L1 sound.

The assimilation of both /T/ and / sˤ/ to /s/ agree with Best (1995) "Single Category Assimilation of in Perceptual Assimilation Model (PAM) theory[23]. In this model, nonnative sounds are assimilated to the same L1 sound.

L2 Arabic phoneme is perceived as another L2 Arabic phonemes (the one that doesn't exist in Mandarine phonemic inventory)

The L2 Arabic pharyngeal /□/ is perceived as glottal /h/. The Arabic pharyngeal /ʕ/ is perceived as glottal /?/ . The L2 /⊗/ is perceived as either /x/ or /ʕ/. The L2 uvular /x/ if it is perceived incorrectly, it goes to /□/. The L2 Arabic Emphatic phonemes are perceived as non-emphatic such as / ðˤ / as either / ð/ or /z/ and /dˤ/ as /d/.

5.3 The Correlation between Pronunciation and Perception

Table (5) Mean proportion correct for learner's pronunciation and perception (n = 10)

%correct	Pronunciation	Perception	t	p
	Mean ± SD.	Mean ± SD.		
ħ	46.67 ± 35.83	100.0 ± 0.0	4.707*	0.001*
h	86.67 ± 23.31	86.67 ± 28.11	0.000	1.000
ʁ	73.33 ± 40.98	40.0 ± 43.89	1.677	0.128
q	63.33 ± 36.68	86.67 ± 28.11	1.300	0.226
s	83.33 ± 23.57	50.0 ± 23.57	2.739*	0.023*
ð	30.0 ± 18.92	50.0 ± 36.0	1.327	0.217
t	86.67 ± 17.21	63.33 ± 36.68	1.655	0.132
d	86.67 ± 17.21	80.0 ± 42.16	0.408	0.693
ʕ	70.0 ± 39.91	100.0 ± 0.0	2.377*	0.041*
ʔ	93.33 ± 21.08	86.67 ± 28.11	0.557	0.591
X	90.0 ± 22.50	40.0 ± 43.89	4.025*	0.003*
K	80.0 ± 17.21	86.67 ± 28.11	0.612	0.555
sˤ	80.0 ± 35.83	50.0 ± 23.57	2.862*	0.019*
θ	63.33 ± 48.30	66.67 ± 47.14	0.130	0.899
ðˤ	20.0 ± 42.16	50.0 ± 36.0	3.250*	0.010*
Z	93.33 ± 21.08	46.67 ± 47.66	2.941*	0.016*
tˤ	73.33 ± 34.43	63.33 ± 36.68	1.152	0.279
dˤ	73.33 ± 37.84	80.0 ± 42.16	0.802	0.443
Overall	**71.85 ± 12.64**	**64.24 ± 17.01**	**1.611**	**0.142**

t: **Paired t-test**
p: p value for comparing between **Pronunciation** and **Perception**
*: Statistically significant at $p \leq 0.05$

From table 5, it is illustrated that the pronunciation skill of the Chinese participants is slightly better than their perception skills, but this difference isn't statistically significant. This may due to the influence of the pronunciation class of two credit hours per week.
This class wasn't devoted only to enhance the pronunciation skills of the participants,but also working on the participants' perception wasn't neglected (especially when it comes to the target phoneme and its replaced error one). For instance, pronunciation instructions and training were given to the participants to pronounce /r/ correctly, meanwhile auditory discrimination training between /r/ and /l/ is a goal that must be integrated with the objective of teaching Arabic /r/ pronunciation. In order to achieve accurate L2 sounds pronunciation it is necessary for these L2 sounds to be perceptually and articulatory distinguished and separated from the L1 sounds.
This result support those previous studies which found that both the pronunciation and perception of L2 improved by the phonetic training (Herd et al., 2013)24 Wade et al., 2007)25 Wang et al., 2003)26
Going deep into the correlation between the pronunciation and perception skills, the coming figure illustrates the percentage of correct responses of each of the target phonemes across the pronunciation level and the perception level

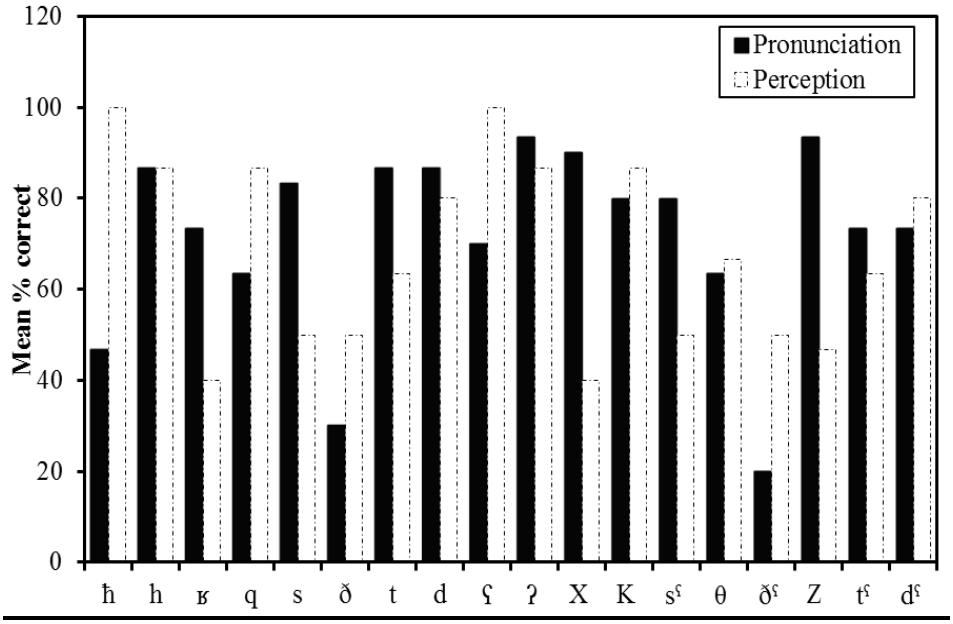


Figure (3) Mean proportion correct for learner's pronunciation and perception (n = 10)

From figure 3, the Chinese participants in the current study show better performance in the perception of some phonemes over their pronunciation. For example / ħ /, /q/, /ʕ/, /k/ , / θ /, / ð/, / $ð^ʕ$ /, and / $d^ʕ$ /. Other phonemes seemed to be easier in their pronunciation over their perception by Chinese participants. For example, /t/ , /d/, /s/, /ʔ/, /x/, / ʁ /, /$s^ʕ$/, /z/, and /$t^ʕ$/. The percentage of the correct pronunciation responses of one phoneme, which is the /h/ is nearly the same as its perception value by the Chinese.

6. Conclusion and Research Questions Answers

- The absence of many of the Arabic phonemes from the Chinese Phonemic inventory influence negatively on their pronunciation and perception by L1 Chinese speakers.
- The pharyngeals, uvulars, interdentals, and emphatic phonemes are the hardest in their pronunciation for the L1 Chinese.
- The glottal phoneme /ʔ/ is the easiest and the interdental emphatic phoneme /ðˤ/ is the hardest in pronunciation.
- Pronunciation errors lead to homonyms in the participants' speech. For example, when / ħ/ is substituted by /h/ both the words / ħabb/

and /habb/ are pronounced as /habb/. This type of phenomena causes a kind of ambiguity in their speech.

- The pronunciation errors can be grouped under two types of phonological processes, the substitution and cluster reduction.
- The positive impact of the pronunciation class illustrates in the results that indicate that the pronunciation skill of the Chinese participants is better than their perception skills.
- The Arabic pronunciation class usually initiates with auditory perception exercises, this integration leads to insignificant results differences.
- The most challenging Arabic phoneme pairs to L1 Chinese speakers to be perceived and discriminated are / ðˤ,z/, /ʁ-x/, / ð,z/, /ðˤ,ð/, and /s, sˤ/.
- L1 Chinese participants show two models of perception assimilation; Single L2 is assimilated to the most closely related L1Chinese sound & L2 Arabic phoneme is perceived as another L2 Arabic phonemes.

References

[1] Derwing and Munro 2005 Accent and Pronunciation Teaching: A Research Based Approach TESOL *Quarterly Journal Volume39, Issue3* Pages 379-397

[2] TRACEY M.Derwing & MURRAY J. MUNRO (2015) pronunciation Fundamentals: Evidence-based Perspectives for L2 Teaching and Research (Language Learning & Language Teaching) John Benjamins Publishing Company; UK ed. Edition.

3 John M. Levis (2018), intelligibility, Oral communication, and the teaching of Pronunciation, Cambridge University Press

[4] Flege, J. (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

[5] Eckman, F., Elreyes, A. & Iverson, G. (2003). Some principles of second language phonology. Second Language Research, 19, 169-208

[6] Hafez, O (1996) . Phonological and Morphological Integration of Loanwords into Egyptian Arabic, Égypte/Monde Arabe (première série) 27–28

[7] Corder ,S.P. (1967), The Significance of Learner's Errors , international Review of applied Linguistics in Language Teaching journal, volume 4, Heidelberg/Germany.

[8] Lado, R. (1957) Linguistics across Cultures: Applied Linguistics and Language Teachers. University of Michigan Press, Ann Arbor

[9] Zhanming, W., 2014. Review of the Influence of L1 in L2 Acquisition. *Studies in Literature and Language*, Vol. 9 (2) , 57-60

[10] Lowie,W., 2015. L2 Phonology. In : P.Andreson , ed. *the Routledge Encyclopedia of Second Language Acquisition* . Taylor and Francis Group, 348-353

[11] Jarvis, S., and Pavlenko, A., (2007). *Cross linguistic Influence in Language and Cognition.* Taylor and Francis Group

12 Carey,M (2002) .An L1-specific CALL pedagogy for the instruction of pronunciation with Korean learners of English, unpblished PhD, Macquarie University.

13 Wagner, A (2012). Second language phonology and perceptual assimilation of English sounds by Japanese learners of English. Proceedings of the 8 th annual pronunciation in second language learning and teaching conference (ISSN: 2380-9566)

[14] Syed,M ., Ansari , S., & Gopang, I. (2017). Perception and Production of Consonants of English by Pakistani Speakers , International Journal of English Linguistics; Vol. 7, No. 3, Published by Canadian Center of Science and Education.

[15] Collins,B., Mees,I., & Carley,P. (2019). Practical English Phonetics and Phonology, A resource book for students. (4.ed.) Abingdon: Routlege. Routlege English languge introductions.

[16] Nahla,M., 2006. Teaching Arabic to non-native Speakers at Alexandria University. *In*: K.M. Wahba, Z.A. Taha, and L. England, eds. *Handbook of Arabic language teaching professional in the 21st century.* Routledge ,67-80

17 Maamoun, M (2018).The L2 acquisition of Modern Standard Arabic final consonant clusters by L1 Chinese speakers. Routledge Handbook of Arabic Second Language Acquisition.

[18] Shehata, A (2018) . Native English speakers' perception and production of Arabic consonants. Routledge Handbook of Arabic Second Language Acquisition.

[19] https://www.thenational.ae/world/asia/arabic-is-now-a-must-learn-language-in-china-1.682090

[20] Amayreh, M., 2003. Completion of the consonant inventory of Arabic. *Speech, Language and Hearing Research*, 46, 517-529

[21] Duanmu, S.,(2005). *The Phonology of Standard Chinese*. In. Encyclopedia of Language and Linguistics. USA : Elsevier Publication House

[22] Fledge, (1995) Flege, 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. Timonium, MD: York Press.

[23]

[24] Herd, W., Jongman, A., & Sereno, J. (2013). Perceptual and production training of intervocalic /d, ɾ, r/ in American English learners of Spanish. Journal of Acoustic Society of America, 133(6), 4247-4255

[25] Wade, T., Jongman, A. & Sereno, J. (2006). Effects of acoustic variability in the perceptual learning of non-native-accented speech sounds. Phonetica, 64, 122- 144.

[26] Wang, Y., Jongman, A. & Sereno, J. (2003). Acoustic and perceptual evaluation of Mandarin tone productions before and after perceptual training. Journal of Acoustic Society of America, 113(2), 1033-1043

Appendix I
The Arabic Alphabet

The Arabic Phoneme	The Arabic Equivalent Alphabet
b	ب
m	م
w	و
f	ف
θ	ث
ð	ذ
τ	ت
tˤ	ط
d	د
dˤ	ض
n	ن
r	ر
s	س
sˤ	ص
z	ز
l	ل
ž	ج
ç	ش
y	ى
k	ك
q	ق
x	خ
ʁ	غ
ħ	ح
ʕ	ع
ʔ	ء
h	ه

Appendix II
The Participants' Perception Test

1.	عب	حب
2.	خم	غم
3.	كب	قب
4.	صب	سب
5.	ظب	ذب
6.	طب	تب
7.	ضل	دل
8.	ثم	سم
9.	زل	ذل
10.	زل	ظل
11.	أعجب	أحجب
12.	مرأب	مرعب
13.	أخضر	أغدر
14.	أكرب	أقرب
15.	أصفر	أسفر
16.	أظكر	أذكر
17.	أطول	أتول
18.	أضمن	أدمن
19.	أسمن	أثمن
20.	مذمن	مزمن
21.	مظلة	مزلة
22.	رعرع	رحرح
23.	رأرأ	رعرع
24.	رخرخ	رغرغ
25.	ركرك	رقرق
26.	رصرص	رسرس
27.	رظرظ	رذرذ
28.	رطرط	رترت
29.	رضرض	ردرد
30.	رسرس	رثرث
31.	رذرذ	رزرز
32.	رجرج	رقرق
33.	رظرظ	رزرز

Appendix III
The Perception Test

The target phonemes		The target word	The target minimal pairs		Correct	Incorrect
ħ	h					
		حس	حس	هس		
		أحمر	أحمر	أهمر		
		رحرح	رحرح	رهره		
ħ	ʕ	عب	حب	عب		
		أعجب	أحجب	أعجب		
		رعرع	رحرح	رعرع		
ʕ	ʔ	أب	عب	أب		
		مرأب	مرعب	مرأب		
		رأرأ	رعرع	رأرأ		
ʁ	X	غم	غم	خم		
		أغدر	أغدر	أخضر		
		رغرغ	رغرغ	رخرخ		
q	K	كب	قب	كب		
		أكرب	أقرب	أكرب		
		ركرك	رقرق	ركرك		
q	g	قم	قم	جم		
		مقار	مقار	مجار		
		رقرق	رقرق	رجرج		
s-	sˤ	صب	سب	صب		

The target phonemes		The target word	The target minimal pairs		Correct	Incorrect
		أصفر	أسفر	أصفر		
		رصرص	رسرش	رصرص		
S	T	ثم	سم	ثم		
		أثمن	أسمن	أثمن		
		رثرث	رسرس	رثرث		
∆	ðˤ	ذب	ذب	ظب		
		أذكر	أذكر	أظكر		
		رذرذ	رذرذ	رظرظ		
∆	Z	ذل	ذل	زل		
		مذمن	مذمن	مزمن		
		رذرذ	رذرذ	رزرز		
ðˤ	z	ظل	ظل	زل		
		مظلة	مظلة	مزلة		
		رظرظ	رظرظ	رزرز		
T	tˤ	طب	تب	طب		
		أطول	أتول	أطول		
		رطرط	رترت	رطرط		
d	dˤ	ضل	دل	ضل		
		أضمن	أدمن	أضمن		
		رضرض	ردرد	رضرض		

Appendix IV
The Pronunciation Test

The target phoneme	The target words in Arabic	The target transcribed words	The participants transcribed word	Correct	In-correct	The type of phonological processes error	Notes
ʔ	أب	ʔabb					
	مرأب	marʔab					
	رأرأ	raʔraʔ					
h	هس	hæss					
	أهمر	ʔæhmar					
	رهره	rahrah					
ħ	حب	ħæbb					
	أحجب	ʔæħgæb					
	رحرح	raħraħ					
ʕ	عب	ʕæbb					
	أعجب	ʔæʕgæb					
	رعرع	raʔraʔ					
ʁ	غم	ʁæmm					
	أغدر	ʔaʁdar					
	رغرغ	raʁraʁ					
x	خم	xæmm					
	أخضر	ʔaxdar					
	رخرخ	raxrax					
q	قب	qabb					

The target phoneme	The target words in Arabic	The target transcribed words	The participants transcribed word	Correct	In-correct	The type of phonological processes error	Notes
	أقرب	ʔaqrab					
	رقرق	raqraq					
k	كب	kæbb					
	أكرب	ʔækræb					
	ركرك	rækræk					
s	سب	sæbb					
	أسفر	ʔæsfær					
	رسرس	ræsræs					
sˤ	صب	sˤabb					
	أصفر	ʔasfar					
	رصرص	rasras					
z	زل	zæll					
	مزمز	mæzmæz					
	رزرز	ræzræz					
t	تب	tæbb					
	أتول	ʔætwæl					
	رترت	rætræt					
tˤ	طب	tˤabb					
	أطول	ʔa tˤwal					
	رطرط	ra tˤra tˤ					
d	دل	dæll					
	أدمن	ʔæmæn					

The target phoneme	The target words in Arabic	The target transcribed words	The participants transcribed word	Correct	In-correct	The type of phonological processes error	Notes
	ردرد	rædræd					
dˤ	ضل	dˤall					
	أضمن	ʔa dˤman					
	رضرض	ra dˤra dˤ					
T	ثم	θæmm					
	أثمن	ʔæθmæn					
	رثرث	raθraθ					
∆	ذب	∆æbb					
	أذكر	ʔæ∆kar					
	رذرذ	ræ∆ræ∆					
ðˤ	ظب	ðˤabb					
	أظكر	ʔæ ðˤkar					
	رظرظ	raðˤ raðˤ					