Epenthesis in the Production of English Consonant Clusters by Tunisian EFL Learners

 Nadia Bouchhioua,[1]

[1]Assistant Professor at the Faculty of Lettres, Arts, and Humanities, University of La Manouba, *Tunisia*

ABSTRACT

The production of English consonant clusters by L2 speakers, whose native languages do not have a complex syllable structure, is often reported to be challenging. Unlike most varieties of Arabic, Tunisian Arabic (TA) disposes of a flexible syllable structure that allows two consonant clusters in different positions in the word. The present study explores the production of English consonant clusters by L2 speakers of English whose native language is TA. It also seeks to examine the effect of presence of epenthesis on their perceived comprehensibility and degree of foreign accent. A conversation containing target words with different types of clusters and in different positions was read aloud and role played by English major Tunisian students. An auditory and acoustic analysis of the target items was performed to determine the presence or absence of epenthetic vowels used to break the cluster, and results revealed that these English learners used epenthesis with three consonant clusters only. Native speakers of English rated their comprehensibility and degree of foreign accent. Results showed that while the use of epenthesis in target words did not harm the comprehensibility of these learners, it affected their degree of foreign accent highly. The significance of the results is discussed in relation to second language phonological acquisition theories (Eckman, 1977; Mackon & Freguson, 1987; Major, 1987) and pronunciation learning and teaching research.

Keywords: English consonant clusters; Epenthesis; L2 pronunciation; Tunisian Arabic.

Corresponding Author: Nadia Bouchhioua; Assistant Professor at the Faculty of Lettres, Arts, and Humanities, University of La Manouba, Tunisia

Phone: +21-671-600700
e-mail: nadia.bouchhioua@flm.rnu.tn

1. Introduction

Many learners of English as a second (ESL) or foreign language (EFL) often face difficulty in learning the sound system of English and might develop poor pronunciation that can lead to their classification as uneducated or lacking proficiency. Even though the people, who are judging them as such, are only reacting to their pronunciation, their general proficiency in English seems to be questioned. Fraser (1999, p.7) argues that "poor pronunciation can mask otherwise good language skills, condemning learners to less than their deserved social, academic and work advancement". English pronunciation is one of the most difficult skills to develop, especially for adult learners because there are many factors that can intervene in the acquisition process, mainly the influence of the first language (L1) sound system (Machizuki-Sudo& Kiritani, 1991; Oyama, 1976; Wenk, 1985). Learners of English as EFL/ESL do not only have to learn the segments of this language, that

is, vowels and consonants, but also its suprasegmental features such as, stress, intonation, and rhythm, which represent major components in the English sound system (McNerny & Mendelsohn, 1992; Pennington, 1998). In addition, learners have to develop cognitive awareness of the syllable structure of the second language and the phonotactic constraints that govern the combination of sounds to form syllables. These features have a significant role in successful communication in L2 English as they enable learners to develop a comprehensible pronunciation. The production of English complex syllables, that is, those syllables which contain consonant clusters in the onset and coda position by L2 English speakers was explored in ample body of the literature (Broselow, 1980; 1983; 1984; 1987; Galal, 2004, for instance). In most of these studies, however, the L2 speakers whose productions of complex syllables were explored had a mother tongue which does not allow consonant clusters. The present study attempts to explore the production of consonant cluster in different word positions by L2 English speakers whose native language is Tunisian Arabic; a language that has a flexible syllable structure and allows clusters in onset and coda positions.

2. Literature Review

2.1. Consonant cluster simplification cross-linguistically

English is a language that has a complex syllable structure as it allows complex codas and onsets. In English, a syllable can contain up to three consonants in the onset (consonants before the vowel), and up to four syllables in the coda (consonants after the vowel). In the monosyllabic word *skew* [skjuː], for instance, three consonants [skj] precede the vowel [uː], and in the word *sixths* [sɪksəs], four consonants follow the vowel [ɪ]. These complex onsets and codas often cause difficulty to learners whose native languages do not allow such combinations and have simpler syllable structures (Averly & Ehrlich, 1992). Arabic, for instance, in both its standard and dialectal forms is a language that has a simple syllable structure that mainly consists of CV (consonant-vowel) or CVC (consonant-vowel-consonant) syllables. Egyptian Arabic speakers are often reported to simplify complex onsets and codas of English words through inserting an epenthetic non-phonemic vowel to break consonant clusters and ease articulation (Broselow, 1980, 1983, 1984; Galal, 2004). For instance, they add [ɪ] or [ə] in words like *break* or *place* and pronounce them as [bɪreɪk] and [pɪleɪs], respectively. Sound addition of this kind is called *epenthesis* and is generally related to what sound sequences and syllable structures are permitted in the user's native language.

This type of addition error is very common and is also used by Farsi L2 English speakers, who tend to insert a vowel between consonants in order to break a two-consonant cluster (CC), making the pronunciation of a word like *plight* sound like *polite*. These learners also insert vowels at the beginning of consonants clusters starting with /s/. As such, a word like *snow* is pronounced as *esnow. Spanish L2 English speakers, too, have the tendency of adding a vowel to the beginning of a consonant cluster starting with /s/. Words like *stop* or *school*, for instance, are pronounced as *e*snow* [əsnʊ] and *eschool* [əskuːl], respectively (Avery & Ehrlich, 1992). Another kind of sound addition consists of adding a vowel at the end of a word. This type of error is called *paragoge*. A classic example of paragoge is when a Korean speaker of English adds the vowel [i] at the end of the word *luggage,* for instance, and pronounces it as [lʌɡidʒi] (Jenkins, 2000, p.35). This behavior is also noticed among Italian L2 speakers of English who often add a final vowel to English words ending with consonants. They, therefore, render words such as *big* and *bad* as [bɪɡə] and [bædə], respectively. This type of production is often explained by the influence of the first language of these speakers as Italian is a language that does not allow any word-final consonants (Avery &Ehrlich, 1992, p.133). A different kind of insertion errors are those made by Greek L2 learners. These learners often produce English voiced stops /b/, /d/, and /g/ as /mb/, /nd/ and /ŋg/, rendering the pronunciation of the words *bubble* as *bumble*, *fodder* as *fonder*, and *juggle* as *jungle* (Avery &Ehrlich, 1992, p.126). It is clear that this type of sound addition errors might hinder communication as the meaning of words can alter completely, especially in the absence of contextual clues such as in phone conversations, where no medium other than speech is used for communication.

Sound addition or *epenthesis* in L2 English speech is in most of studies (Broselow, 1980, 1983, 1984, 1987; Galal, 2004) explained by transfer of the L1 syllable structure rules and is attributed to

the L1 influence. In other studies (Alezetes, 2007), however, it is explained through the Markedness Differential Hypothesis (Eckman, 1977), which postulates that because complex syllable margins (including complex onsets and complex codas) are more marked than simple syllable margins, L2 learners whose L1 does not allow complex syllable margins may have difficulty acquiring L2 forms containing complex syllable margins. The Markedness Differential Hypothesis predicts that L2 learners will have more difficulty acquiring more marked forms in their L2. Forms in the target language that are different or nonexistent in the L1 are expected to be easier to learn.

According to Jenkins (2000, p.101), consonant cluster simplification is related to universal phenomena that exist in most languages. She provides the example of the English word *scripts* which is often reduced by native English speakers to [skrɪps] and the example of the phrase *walked by*, which is pronounced as [wɔːk baɪ]. Jakobson (1968), Smith (1973), and Stampe (1969) identified universal tendencies in learning the sound system of the native language, including consonant cluster simplification. These universal tendencies involve existence of linguistic constraints imposed by the human articulatory and perceptual system, too (Macken & Ferguson, 1987). These constraints are believed to play a salient role in acquisition of L2 phonology. Major (1987) found tendencies which are similar to those operating in L1 while acquiring L2 phonology. For instance, there is a tendency among children acquiring their native language to simplify words containing consonant clusters by deleting certain consonants. As a result, a word like *bring* would be pronounced as [bɪŋ]. Indeed, the need to avoid clusters was linked to universal preferences for CV (consonant vowel) syllable structure only in a few studies. Tarone (1987, p.78), for instance, indicates that the CV syllable is "a universal articulatory and perceptual unit such that the articulators tend to operate in basic CV program in all languages". Nevertheless, different languages operate in different ways in what permissible combinations of consonants are allowed in onset and coda positions in syllables and L2 learners of English tend to reduce clusters by deleting consonants or by adding epenthetic vowels for various reasons and different purposes.

2.2. The sound system and syllable structure of Tunisian Arabic

The present study attempts to explore epenthesis in the pronunciation of English by learners whose native language is Tunisian Arabic (TA). Literature about Tunisian Arabic segmental and suprasegmental features though scarce reveals important aspects about this variety of Arabic and shows the complexity of its sound system in comparison to other dialects of Arabic or Modern Standard Arabic (MSA). Studies of the vocalic system of Tunisian Arabic (Ghazali, 1979; Touati, 2003) show that in TA durational difference is not the sole characteristic to distinguish high vowels. This distinction goes along and is sometimes even replaced by a quality distinction. In addition, mid and back vowels in TA display different characteristics than those of Eastern dialects of Arabic such as Jordanian or Iraqi Arabic (for more details, see Ghazali, 1979). Prosodic features such as stress and accent in TA have been thoroughly explored by Bouchhioua (2008, 2016) and proved to display interesting patterns that distinguish it from other languages such as English and from other dialects of Arabic such as Jordanian or Egyptian Arabic (Almbarik, Bouchhioua, & Hellmuth, 2014).

It is known that words in most languages of the world are composed of rhythmic units called feet and these consist of one or more syllables. Feet embody the rhythmic structure of the word and are the units that make it possible to describe stress patterns. In each foot, one of the syllables is more prominent or stronger than the other syllable(s) and it is called the heavy syllable. The other syllables in the foot are the weak syllables. Unlike most other varieties of Arabic, TA is reported to possess a complex syllable structure that allows consonant clusters even word initially. Angougard (1981) analyzed the phonological structure of a few Arabic dialects including Tunisian Arabic. His basic conclusion about syllable structure in TA is that the final syllable of a certain word is necessarily interpreted either as a complete foot or as the strong branch of a foot. In general, syllables in TA can be either closed, ending with at least one consonant such as /kuːl/ *'eat in the imperative form'*, or open ending in a long vowel as in /buː /, *'father'*. What is more distinctive about TA is that, unlike most other varieties of Arabic, it allows consonant clusters whether the syllable is initial such as in /ks̱ɪb/ *'he owned'*, medial such as in /ferks̱uːna/ *'they inspected us,'* or syllable final as in /ktaḇli/, *'he wrote to me.'* It is also important to note that unlike most other dialects of Arabic, TA allows

gemination (doubling consonants) even word initially such as in the words /mmɛliħ/, *'pickles'*, and /ffeħ/, *'spices'*, and /bbɛdɪn/, *'cans'*. It is worth mentioning, however, that all the examples provided here are clusters composed of two consonants only. No words of three or more consonant clusters are found in this variety of Arabic. The questions that arise then are:

> **1**. How would Tunisian EFL learners, whose mother tongue is quite flexible in terms of syllable structure, pronounce English words with different types of consonant clusters?

> **2**. Would their productions of English words containing consonant clusters in different positions affect their comprehensibility and degree of accentedness?

Recent research on L2 pronunciation focused on concepts of Intelligibility, Comprehensibility, and Accentedness as goals of L2 pronunciation acquisition rather than the traditional goal of native-like pronunciation. According to Derwing and Munro (2005, p.385), *intelligibility* is "the extent to which a listener actually understands an utterance," while *comprehensibility* refers to "a listener's perception of how difficult it is to understand an utterance". *Accentedness*, however, is defined as "a listener's perception of how different a speaker's accent is from that of the L1 community" (Derwing and Munro (2005).

The present study explores the production of English consonant clusters by Tunisian EFL learners and seeks to find out whether possible use of epenthesis would have an impact on these speakers' comprehensibility and degree of foreign accent. Results will be discussed in relation to literature in the field.

3. Methodology

3.1. Participants

The participants in this study were 24 female English major students. Their ages were between 21-23 years old. They have studied English as a foreign language in Tunisian public schools since the age of 12 and have chosen to major in it at university. They were at their first year of MA in linguistics at the time of the recording. This group of students represents a homogenous population as all of them have attended public schools, come from a similar socio-economic background and have a comparable degree of exposure to the English language outside the classroom (as was determined by background questionnaire designed for the sake of the present study). It was also made sure that none of these students has a parent who is not Tunisian in order to avoid the risk of another language or dialect affecting the production of English sounds by this group of learners. Table1 provides demographic and proficiency level information about the participants.

Table1. *Demographic Information and Proficiency Level of Participants*

Gender	Female
Number	24
Mean age	22.3
Educational level	MA in linguistics
Length of learning English	11 years
Length of residence in English speaking countries	0
Length of exposure to English outside the classroom (through internet, TV, and chatting with native/non-native speakers)	2.3 hours per week
Native language	Tunisian Arabic

3.2. Instruments

A conversation was designed to be read and role played by pairs of students (see Appendix A).Most of the vocabulary included in the conversation was common English words with which

students are familiar. Eighteen target words, however, were included as test items. All the target words were also familiar to students as many of them are technical terms used in their Advanced Prosody Course (an optional course they take in the MA linguistics program). These words contained consonant clusters in different positions and in different words as illustrated in Table 2. The number of consonants cluster ranged from two to three in the test items. Clusters occurred word initially as in *plot* or *scatter*, word medially as in *extract,* word finally as in *formants*, but also across boundaries in the words *background*, *feedback*, and *guidebook'*. The aim was to test the production of these clusters in different word positions and also to check the effect of orthography on the production of consonant clusters across word boundary.

Table 2. *Test items*

Word	Target cluster
Excuse	/ɪkskjuːz/
Extract	/ɪkstrɛkt/
Contours	/kɔntuːrz/
Extreme	/ɪkstriːm/
Explore	/ɪksplɔːr/
Explain	/ɪkspleɪn/
Background	/bækɡrəʊnd/
Plot	/plɔːt/
Files	/faɪlz/
Formants	/fɔrmænts/
Sounds	/səʊndz/
Scatter	/skætər/
Collect	/kəlɛkt/
Speakers	/spiːkərz/
Guidebook	/ɡaɪdbʊk/
Start	/stɑːrt/
Feedback	/fiːdbæk/
Praat	/prɑːt/

3.3. Data collection procedure

The 24 students who volunteered to take part in this study were asked to choose a partner, read the conversation aloud in pairs, and exchange roles so that each one of them produces all the words in the conversation including the target words. They were allocated time to practice reading aloud the conversation to feel comfortable and ready for being recorded while role playing it. The participants were also instructed to speak naturally, use a normal pace, and take pauses when needed while role-playing the conversation. A third student recorded her mates reading the conversation aloud to avoid the risk of participants being embarrassed by the presence of the author-researcher. Recordings were made through Praat software 6021-win64 in a quiet language laboratory. All students were naïve to the purpose of the study.

3.4. Data analysis

Data then contained 24 conversations read by each student; 12 times playing the role of speaker A, and 12 times playing the role of speaker B (see Appendix A). Thus, each of the 24 participants produced the 18 target test items. The total number of words analyzed was then 18*24=432. Two steps were followed in the analysis of the data. The first step aimed to answer research question 1. Each of the target words was analyzed in terms of presence or absence of *epenthesis* (inserting a vowel to break cluster) while producing the target test item. The data were, therefore, subjected

to double blind error analysis by two experienced phoneticians based on auditory impression. The analysis consisted of listening carefully to the recordings in order to diagnose the production of the target words and check the presence or the absence of epenthesis. The inter-transcriber agreement was high (91%). In addition, analysis of epenthesis was further verified through *Praat* to determine the existence of vowel-like spectra between the consonants forming the cluster.

The second step aimed to answer research question 2 which aspires to explore the effect of epenthesis use on the comprehensibility and degree of foreign accent of the speakers' productions. Three native speakers of British English listened twice to the conversations recorded and were asked to rate the comprehensibly and accentedness levels of the speakers. The raters listened to all the conversations in a quiet room through good quality headphones attached to the computer. The comprehensibility of the speakers utterances was rated using a 5-point Likert scale (*1=impossible to understand, 5= extremely easy to understand*). This scale is common in comprehensibility measurements and was reported to provide reliable ratings (Bouchhioua, 2017; Derwing & Munro, 1997; Gordon *et al.*, 2013). A similar rating scale was used to determine the degree of foreign accent of each speaker (1= *very strong foreign accent, 5= no foreign accent)*, (See Appendix B).

4. Results

Analysis of the data as to the presence or absence of epenthesis in the target words, both auditory and acoustic showed that there is no significant number of productions containing epenthesis in two-consonant cluster words, whatever the position of the cluster is (initial, or final) such as *start, plot*, or *collect*. However, the degree of epenthesis produced when the cluster is composed of three consonants was highly significant. In words such as *background*, *feedback*, or *guidebook*, where epenthesis was expected to occur at the level of word boundary, results were non-significant. Table 3 below provides descriptive statistics of the results obtained.

Table 3. *Descriptive Statistics of Epenthesis Production in Test Words*

	Epenthesis			No Epenthesis		
	%	Mean	SD	%	Mean	SD
CC	8%	1.23	0.32	92%	27.6	11.33
CCC	66%	18.44	19.61	24%	5.53	3.75
Across boundary	22%	4.3	1.22	88%	24.33	7.66

The values obtained were also subjected to an analysis of variance (ANOVA) with *cluster type* [CC, CCC, word boundary] and *epenthesis* [+E, −E] as fixed effects, and *subject* as a random factor. Results show that factor *cluster type* was significant (F (1, 3) = 28.54; p < .001), *epenthesis* was non-significant (F (1, 2) = 7.3; p > .001), while the interaction between *cluster type* and *epenthesis* was highly significant (F (1, 3) = 48.96; p < .001. This significant interaction shows that it is the number of consonants in the cluster that determines whether participants will insert a vowel to break the cluster or not. While most of the participants in the study had no problems in producing two consonant clusters, a significant number found it difficult to produce three consonant clusters. The clusters that seemed to cause more difficulty to the participants were those found in the words, *extract*, *excuse*, *explain*, and *extreme*.

Most of the participants who used epenthesis in these words seemed to have problems with parsing the syllable structure of such words. Put differently, these students had difficulty in finding the boundaries between syllables in these words. For instance, the word *excuse* which should be produced as containing two syllables, the first being /ɪk/ and the second/skjuːz/ was often wrongly parsed as /ɪks/ and /kjuːz/. Finding themselves faced with a complex coda in the first syllable and a complex onset in the second, students resort to adding an epenthetic vowel which has a similar quality to vowel [i] and produced the word as /ɪksi-kjuːz/ in order to facilitate pronunciation. The same tendency was observed with the words *explain* and *extract*. Figure 1 displays the spectrogram of the word '*explain*' produced with an epenthetic vowel.
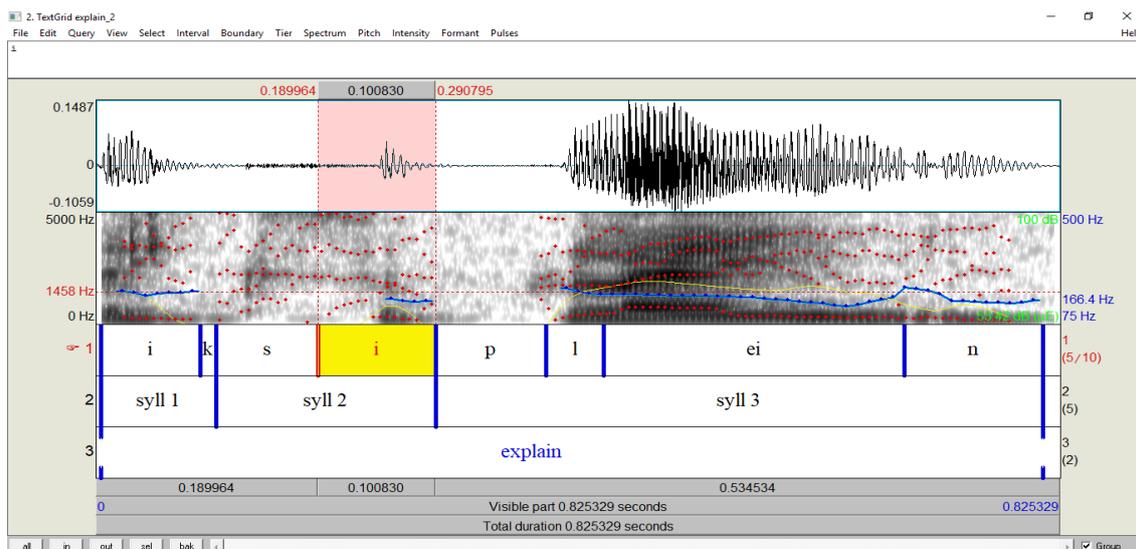
Figure1: Production of the word '*Explain*' with an epenthetic vowel segment by a Tunisian EFL learner

As can be noticed from Figure1, a vowel is inserted after the sequence of sounds /iks/. This epenthetic segment does not have a phonemic status but resembles the quality of vowel [i] (*f1*=403Hz, *f2*=1982 Hz). The speaker in this utterance changed the syllable structure of the word *explain* and produced it with three syllables instead of the two syllables normally produced by native speakers. Although the number of utterances in which epenthesis across boundary was non-significant, two speakers seemed to produce an epenthetic vowel and separate the sequence /kgr/ in the word *background*, for instance. The speakers, here, seem to be affected by the orthography of English and consider *background* to be made of two words *back* and *ground* that need to be separated through an extra sound, producing thus /bæki grəʊnd/. The same tendency was also found for the words *feedback*, and *guidebook*.

In order to see whether epenthesis is going to affect the comprehensibility of these EFL learners, three native speakers of British English listened twice to all the conversations and rated the comprehensibility of all the speakers using a 5-point Likert scale (*1= impossible to understand, 5= extremely easy to understand*). They were also asked to rate the degree of foreign accent of each speaker on a 5-point Likert scale, too (1= = *very strong foreign accent, 5= there is no accent),* (See Appendix B). The analysis started by checking the inter-rater reliability among the three raters. The inter-rater reliability coefficients (Cronbach's alpha) were computed across the ratings given for the speakers. They were found to be high (.87 and .91), indicating therefore a strong agreements between the three raters.

The scores allocated by native speaker raters to the *comprehensibility* of Tunisian EFL learners who produced epenthesis in the target words were compared to those who did not produce epenthesis in the target words. The results showed that there was no significant differences between the two scores as proved through a *paired-sample t-test* which compared means of both groups (t= 7.66, df=23; p>.05). The results thus reveal that although some of those learners produced epenthesis in the target words and changed the syllable structure of some the target words, mainly those with a three-consonant cluster, their utterances were still comprehensible to native English speakers.

Parallel measures were used in the analysis of the *accentedness* scores attributed to L2 speakers by native raters. The scores of those who produced epenthesis were compared to those who did not produce epenthesis in the target words. The results of a *paired-sample t-test* that compared means of both groups were highly significant (t= 33.15, df =23; p>.05), indicating consequently that the presence of epenthesis in the target words contributed to the rating of Tunisian EFL learners as foreign accented. (3=*somewhat a strong foreign accent* was the most recurrent score). Table 4 provides descriptive statistics of the comprehensibility and accentedness results, while Figure 2 provides a visual display of the distribution of mean scores of the accentedness measure.

Table 4: *Comprehensibility and Accentedness Ratings*

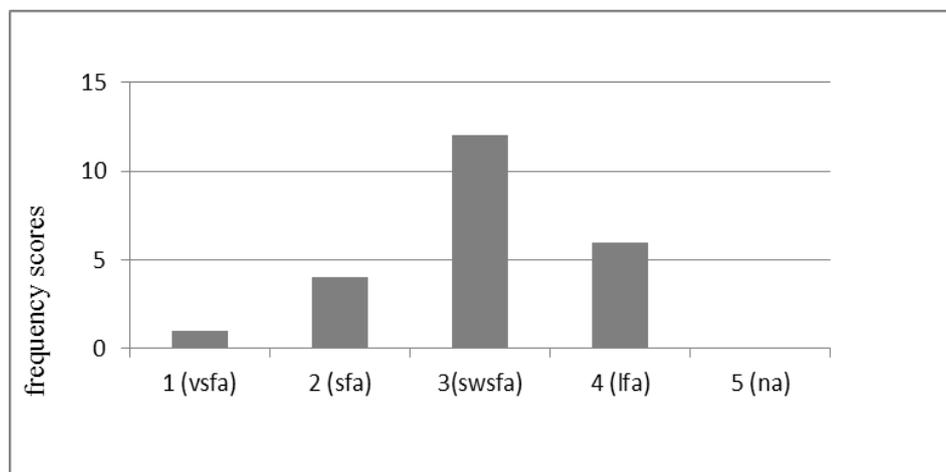| Comprehensibility scores		Accentedness scores	
[+Epenthesis]	[-Epenthesis]	[+Epenthesis]	[-Epenthesis]
Mean= 16.5	Mean= 13.4	Mean= 47.33	Mean= 15.52
SD= 2.1	SD= 1.83	DS= 9.5	SD= 3.6

Figure 2: Raters' judgments of the speakers' degree of foreign accent

NB: Check Appendix B for full labels of raters' judgments of degrees of foreign accents

5. Discussion

The present study aimed to explore the way Tunisian EFL learners produced English words containing various types of consonant clusters (CC, CCC, across boundary) and in different word positions (initial, medial, or final). The aim was to check whether this group of learners whose mother tongue (Tunisian Arabic) disposes of a highly flexible syllable structure that allows two consonant clusters in initial, medial, and final word positions face difficulty in producing English consonant clusters. Results which were performed both through auditory and acoustic analysis revealed that this group of English learners did not have any difficulty in producing two consonant clusters in any position of the word.

Three consonant clusters, however, caused difficulty to these learners as a significant number of participants continuously inserted an epenthetic vowel to break the cluster and facilitate pronunciation of words such as *explain*, *extract*, or *excuse*. The performance of these learners can be explained by the Markedness Differential Hypothesis (Eckman, 1977) which predicts that L2 learners will have more difficulty acquiring more marked forms in their L2. Clusters of three consonants seem to be a marked form in the L2 English of this group of learners. They, therefore, resort to vowel epenthesis to simplify the cluster and ease its articulation. Unlike, Egyptian, Farsi, or Iraqi L2 learners of English (Avery & Ehrlich, 1992), Tunisian EFL learners are used to the production of two consonant clusters in their first language and had therefore no problems in producing a similar structure in the target language. Nevertheless, a marked structure such as the presence of a three consonant cluster in various word positions seemed to be challenging and caused a deviant production from native speech.

The inclusion of words such as *background*, *feedback*, and *guidebook* as target was meant to check the way participants in this study parse across-word boundary clusters. Results showed that only a few students inserted an epenthetic vowel between *back* and *ground,* for instance. This behavior, though statistically non-significant raises the question of whether theses speakers were treating the word as containing a three consonant cluster /kgr/, and therefore inserted an epenthetic vowel to break it as was the case with words such as *explain* or *excuse*, or whether

it is the effect of orthography that affected the performance of the speakers who would place a boundary between *back* and *ground* through epenthesis because they treat them as separate words. A clear cut answer to this question could not, yet, be provided because of the limited number of test items of this kind in the study. Further experiments with more test items should be carried out to explore cases of epenthesis in similar words and get more insight into how clusters of this type are produced by L2 learners. The theory of universal tendency of consonant cluster simplification advanced by Jakbson (1968), Smith (1973), Stample (1969) for first language acquisition and maintained by Mackon and Freguson (1987) and Major (1987) for second language acquisition can also partly explain the tendency of breaking English three consonant clusters by this group of learners as the articulatory system of these speakers seems to impose constraints on permissible sequences of sounds both in their L1 and in their L2 English.

Though many learners produced epenthesis in three consonant cluster words, their comprehensibility was not affected by this deviant pronunciation. Native speaker ratings of the comprehensibility of the speech of the 24 participants in this study were all favorable ranging between '*somewhat understandable, easy to understand*, and *extremely easy to understand'* (see Appendix B). The productions of the participants, however, were rated as having *'somewhat strong foreign accent'* as was shown in Figure 2. These findings, thus, show that although epenthesis in the case of Tunisian EFL learners was not detrimental to comprehensibility since it happened at the level of complex three consonant clusters only, its effect on their degree of foreign accent was remarkable. Their tendency of simplifying clusters to ease articulation seems to break the rules of English phonology. Although native English speakers have the universal tendency to simplify clusters as in the example provides by Jenkins (2000) (*scripts* reduced to [skrɪps]), non-native speakers productions seemed deviant and helped to their identification as non-native with a *somewhat strong foreign accent*. The somewhat strong accent perceived by the native listeners cannot, however, be solely attributed to epenthesis. Since native speakers listened to full conversions that contain suprasegmental features of spoken utterances such as intonation, rhythm, or sentence and phrasal stress, listeners' ratings of the participants in this study can only be cautiously attributed to epenthesis solely. Suprasegmental features can be used as cues to foreign accent detection, too. It would be, nonetheless, artificial to ask listeners to listen to words in isolation and rate the speakers' degree of foreign accent. Consonant cluster production and English phonotactic constraints should therefore be treated as an undividable part of the general features of English speech and should be integrated with other segmental and suprasegmental features in the teaching of English pronunciation to L2 learners.

6. Conclusion

L2 English phonological acquisition is a complex cognitive process of integrating new phonology knowledge into the pre-existing cognitive structure of the learner's mind. The phonetic features of the leaner's native language, the phonetic attributes of the language input, and the phonetic receptiveness of the learner him/herself all contribute to correct or deviant reproductions of L2 phonological knowledge in the learners' brain. It is the role of pronunciation teachers to raise students' awareness of the importance of developing second language phonological competence to general English proficiency and to successful communication in this language. Goals of pronunciation instruction vary from one linguistic context to another and are generally determined by the language policy of each country. It is, however, the role of teachers to set priorities on which areas to emphasize in pronunciation instruction and respond to their learners' needs of pronunciation acquisition. Though consonant cluster simplification did not affect comprehensibility of L2 speakers in this study, it partly contributed to their classification as having a strong foreign accent, which may lead to negative judgments about their general English proficiency, especially in contexts where native-like pronunciation is targeted or demanded. It is therefore recommended that the phonotactic constraints of English and the production of various types of consonant clusters in various positions be included in pronunciation syllabi with the aim of raising learners' awareness of their importance in English speech production

References

Alezetes, E. D. (2007). A markedness approach to epenthesis in Arabic speakers' L2 English. *Theses, Dissertations, Professional Papers*. Paper 270.

Almbark, R., Bouchhioua, N., & Hellmuth, S. (2014). Acquiring the phonetics and phonology of English word stress: comparing learners from different L1 backgrounds. *Proceedings of the International Symposium on the Acquisition of Second Language Speech: Concordia Working Papers in Applied Linguistics*, *5*, 19-35

Angougard, J. P. (1981). Contribution à l'analyse prosodique: Parlers de Tunis, Caire et de Damas. *Analyse, Thoerie. Etudes Arabe, 1.*

Avery, P. & Ehrlich, S. (1992). *Teaching American English pronunciation*. Oxford: Oxford University Press.

Bouchhioua, N. (2008). The acoustic correlates of stress and accent in Tunisian Arabic: A comparative study with English. *Unpublished PhD thesis*. University of Carthage.

Bouchhioua, N. (2016). Typological variation in the phonetic realization of lexical and phrasal stress: Southern British English vs. Tunisian Arabic. *Loquens* (*Spanish Journal of Speech Sciences), 3(2)*, 1-14.
http://dx.doi.org/10.3989/loquens.2016.034

Bouchhioua, N. (2017). The effects of explicit pronunciation instruction on the comprehensibility and intelligibility of Tunisian EFL learners. *International Journal of Research Studies in Language Learning, 6 (3)*, 73-88.
http://dx.doi.10.5861/ijrsll.2016.1480

Broselow, E. (1980). Syllable structure in two Arabic dialects. *Studies in the Linguistic Sciences, 10*, 13-24.

Broselow, E. (1983). Non-obvious transfer: On predicting epenthesis errors. In S. Gass and L. Selinker (Eds.), *Language transfer in language learning*, Rowley, MA: Newbury House, (pp. 269-280).

Broselow, E. (1984). An investigation of transfer in second language acquisition. *International Review of Applied Linguistics, 22*, 253-269.
https://doi.org/10.1515/iral.1984.22.4.253

Broselow, E. (1987). An investigation of transfer in second language phonology. In G. Ioup & S. Weinberger (Eds.), *Interlanguage phonology*: *The acquisition of a second language sound system* (pp.261-279). Cambridge, MA: Newbury House.

Derwing, T. M. & Munro, M. J. (1997). Accent, intelligibility, and comprehensibility: Evidence from four L1s. *Studies in Second Language Acquisition 19*, 1–16.
https://doi.org/10.1017/S0272263197001010

Derwing, T. M. & Munro, M. J. (2005). Second language accent and pronunciation teaching: A research-based approach. *TESOL Quarterly, 39,* 379-397.
https://doi.org/10.2307/3588486

Eckman, F. (1977). Markedness and the contrastive analysis hypothesis. *Language Learning, 27,*315 -330.
https://doi.org/10.1111/j.1467-1770.1977.tb00124.x

Fraser, H. (1999). ESL pronunciation teaching: Could it be more effective? *Australian Language Matters, 7(4),* 7-8.

Galal, M. (2004). An OT Approach to Loanword Adaptation in Cairene Arabic. In O. Abdel-Ghafer, B. Montgomery-Anderson, and M. Parafita Couto (Eds.), *Kansas Working Papers in Linguistics, 27*.
https://doi.org/10.17161/KWPL.1808.1241

Ghazali, S. (1979). Du statut des voyelles en Arabe. *Analyses et Théories n°2/3, n° spécial Etudes Arabes.* Université de Paris 8.

Gordon, J., Darcy, I., & Ewert, D. (2013). Pronunciation teaching and learning: Effects of explicit phonetic instruction in the L2 classroom. In J. Levis & K. LeVelle (Eds.). *Proceedings of the 4th pronunciation in second language learning and teaching conference* (pp. 194-206). Ames, AI: Iowa State University

Jakobson, R. (1968). *Child language, aphasia, and phonological universals* (A. Keiler, Trans.). The Hague: Mouton.
https://doi.org/10.1515/9783111353562

Jenkins, J. (2000). *The phonology of English as an international language*. Oxford: Oxford University Press.

Macken, M. A. & Ferguson, C. A. (1987). Phonological universal in language acquisition. In G.Ioup & S.H. Weinberger. (Eds.), *Interlanguage phonology*: *The acquisition of a second language sound system* (pp.3.32). Cambridge, MA: Newbury House

Major, R. C. (1987). A model for interlanguage phonology. In G. Ioup & S.H. Weinberger (Eds.) *Interlanguage phonology*: *The acquisition of a second language sound system* (pp.101-124). Cambridge, MA: Newbury House.

McNerny, M. & Mendelsohn, D. (1992). Suprasegmentals in the pronunciation class: Setting priorities. In *Teaching American English pronunciation*, Oxford University Press, pp. 185-196.

Mochizuki-Sudo, M. & Kiritani, S. (1991). Production and perception of stress-related durational patterns in Japanese learners of English. *Journal of Phonetics, 19*, 231–248.

Oyama, S. (1976). A sensitive period for the acquisition of a nonnative phonological system. *Journal of Psycholinguistic Research 5*, 261-285.
   https://doi.org/10.1007/BF01067377

Pennington, M. (1989). Teaching pronunciation from the top down. *RELC Journal, 20*(1), 21-38.
   https://doi.org/10.1177/003368828902000103

Smith, N. V. (1973). *The acquisition of phonology*. Cambridge: Cambridge University Press

Stampe, D. (1969). The acquisition of phonetic representation. *Chicago Linguistic Society, 5*: *Papers from the Fifth Regional Meeting*, 433-444.

Tarone, E. (1987). The phonology of interlanguage. In G. Ioup & S. H. Weinberger (Eds.), *Interlanguage phonology*: *The acquisition of a second language sound system* (pp.70-85). Cambridge, MA: Newbury House.

Touati, S. (2003). A contrastive study of Tunisian Arabic and English tense and lax vowels. *Unpublished M.A. Thesis*. ISLT University of Carthage, Tunis

Wenk, B. (1985). Speech rhythms in second language acquisition. *Language and Speech*, *28(2),* 157–175.
   https://doi.org/10.1177/002383098502800205

Appendix A

Conversation

A: Excuse me please, can you show me how to extract visible intonation contours through Praat?

B: Sure, it's extremely easy. What variables are you going to explore?

A: Let me explain to you. I want to explore the effect of stress on vowel duration.

B: That's interesting. Let me first check there is no background noise in your files.

A: Ok. I also want to plot vowel formants and see the way they scatter.

B: It sounds good. Did you collect background information about your speakers?

A: Yes, I followed everything in the guidebook. I also asked for permission from the administration.

B: Great. Let's start work then.

A: Ok, your feedback is of extreme importance to me. Thank you.

Appendix B

Comprehensibility and Accentedness Measure Scales

a) The comprehensibility scale

Mark below how understandable you found the speaker to be

1	2	3	4	5
Impossible to understand	Difficult to understand	Somewhat understandable	Easy to understand	Extremely easy to understand

b) The accentedness scale

Mark below to what degree the speaker has a foreign accent of English

1	2	3	4	5
Very strong foreign accent	Strong foreign accent	Somewhat strong foreign accent	Light foreign accent	There is no accent