International Journal of English Linguistics; Vol. 6, No. 2; 2016
ISSN 1923-869X E-ISSN 1923-8703
Published by Canadian Center of Science and Education

The Production of English Coda Clusters by Aljouf Arabic Speakers

Areej Rakha Alenazi[1]

[1] Master of Arts in Applied Linguistics, Southern Illinois University, USA

Correspondence: Areej Rakha Alenazi, 4098 Ghernatah St., Ashalhoob, Sakaka 72341-8176, Saudi Arabia. E-mail: areej.r.alenazi@gmail.com

Received: January 2, 2016 Accepted: February 15, 2016 Online Published: March 28, 2016

doi:10.5539/ijel.v6n2p34 URL: http://dx.doi.org/10.5539/ijel.v6n2p34

Abstract

This study examines how Aljouf Arabic speakers deal with English coda clusters containing two consonants, which will help in addressing the modification strategies used by the participants to simplify clusters. In addition, the study aims to examine whether or not markedness—based on the sonority distance—has an effect on the participants' pronunciation. Fifteen native speakers of the Aljouf Arabic dialect were asked to read a list of twenty-five nonwords that took into account the sonority distance between C1 and C2 in clusters. In general, the results showed that the participants tended to modify English coda clusters. They used two strategies to modify the clusters: epenthesis and deletion. Markedness based on sonority distance did not provide an explanation for participants' performance. Coda clusters in which the sonority distance is two were modified by all participants. On the other hand, some clusters in which the sonority distance is less than two were pronounced correctly by most of the participants. The clusters which were correctly pronounced by most of the participants include nasal-obstruent clusters and an obstruent-obstruent cluster.

Keywords: Aljouf Arabic, sonority, nonwords, sonority sequencing principle, markedness simplification, syllable

1. Introduction

L2 speakers' errors in producing consonant clusters have been analyzed as resulting from a variety of phonological processes, such as epenthesis, metathesis, deletion or reduction (Jabbari & Samvachi, 2011; Jurado, 2005; Mathew, 2005). Non-native forms produced by L2 speakers have been considered from the standpoint of interlanguage phonology. The process of simplification of consonant clusters has been attributed to different factors, such as interference from the native language, sonority and markedness.

The main aim of this study is to investigate how speakers of the Aljouf Arabic dialect deal with English coda clusters containing two consonants. Aljouf dialect is spoken in the northwest of Saudi Arabia (around Sakaka). In addition, the study aims to examine whether or not markedness based on sonority distance has an effect on the modification of clusters; marked forms seem to be avoided cross-linguistically. It is expected that marked clusters will be more modified than other unmarked clusters.

The study contributes to the field of second-language phonology, as it attempts to provide insights on how Arabic speakers deal with English consonant clusters. In addition, the findings of the study should be beneficial to the field of pedagogy, as the simplification strategies found in this study can help EFL instructors predict pronunciation errors produced by Arabic learners.

2. Background

A great deal of previous research has focused on the difficulties faced by L2 speakers in pronouncing consonant clusters (e.g., Jabbari & Samvachi, 2011). L2 speakers generally tend to use different strategies when simplifying consonant clusters. The process of simplification of consonant clusters has been attributed to different factors. One of the most important factors is sonority. Some have defined sonority in terms of "loudness" (Ladefoged & Johnson, 1993). Phonologically, sonority is significantly tied with the concept of syllable. Selkirk (1984) states: "In any syllable, there is a segment constituting a sonority peak that is preceded and/or followed by a sequence of segments with progressively decreasing sonority values" (p. 116).

The systematic arrangement of phonemes within a syllable is known as the Sonority Sequencing Principle (SSP) (Gandour, 1989). The most-sonorous phoneme occurs as the peak of the syllable, while other, less-sonorous phonemes occur in the syllable margins. Vowels are the most-sonorous phonemes, followed by glides and then liquids. Stops are the least-sonorous phonemes, preceded by fricatives, which are less sonorous than nasals. Hogg (1987) proposed a detailed scale that ranks consonants by their manner of articulation and voicing. Vowels were ranked according to their heights.

Table 1. Sonority scale

Sounds	**Sonority Index**
Low vowels	10
Mid vowels	9
High vowels	8
Flaps	7
Laterals	6
Nasals	5
Voiced fricatives	4
Voiceless fricatives	3
Voiced stops	2
Voiceless stops	1

Cross-linguistically, clusters with close sonority distances between consonants are more marked than clusters with large sonority distances. For instance, the coda clusters /lt/ and /ln/ both follow SSP, as there is a fall in sonority from the first segment to the second one. However, /ln/ is considered more marked than /lt/ because the sonority distance between the two consonants in /ln/ is closer than the sonority distance between consonants in /lt/.

In addition to sonority, the native language is viewed as one of the key factors affecting acquisition of the second language. One influential theory related to second-language acquisition is the Contrastive Analysis Hypothesis (CAH), formulated by Lado in 1957. This hypothesis is concerned with comparing two or more language systems in order to identify the similarities and differences between them. CAH is tied with the concept of interference. The term *interference* refers to the process in which speakers transfer some features from their native language to the second language. According to CAH, language interference is the major source of errors in second-language learning. This interference has two types: positive interference and negative interference. Negative interference is considered to be the source of errors as learners transfer some features from L1 that are different from L2.

In addition, markedness has been discussed extensively in the literature as a possible explanation for L2 errors. It has been argued by many researchers (e.g., Dinnsen & Eckman, 1975) that the modification of consonant clusters is related to the relative degree of markedness, asserting the notion that acquisition will be easier when L2 has less-marked features than L1.

Markedness Differential Hypothesis (MDH), which was proposed by Eckman in 1977, states that learners confront difficulties in acquiring the marked linguistic features of the target language that are different from the native language. He posits that differences between two or more languages are not important unless the target language contains more marked features than the native language.

Eckman (1977) summarized his hypothesis as three points: first, the linguistic features of the target language that are different from the first language are difficult to acquire by learners if they are more marked than the linguistic features existing in the first language; second, the difficulty of acquiring the marked linguistic features of the target language depends on the relative degree of their markedness; and third, the differences between the first language and the target language will not exhibit difficulties for learners unless the target language has more marked features than the first language.

However, in 1984, Eckman conducted a study to examine how Farsi speakers pronounce final obstruents. Surprisingly, the results showed that participants devoiced final obstruents in English, even though Farsi has voicing contrasts in word-final position. There are no differences between Farsi and English in terms of voicing contrasts of final obstruents, which is against the MDH (which takes into account the differences between L1 and L2 and markedness to explain learners' errors). To address shortcomings of the MDH, Eckman proposed the Interlanguage Structural Conformity Hypothesis (ISCH) in 1991. According to the ISCH, learners' native languages do not play a significant role in acquiring the target language; rather, the markedness of structures of the target language has a significant effect on the acquisition of these structures, even if the same structures exist in the target language.

3. Methodology

The main goal of the present study is to investigate how Aljouf Arabic speakers deal with English coda clusters. In addition, the study aims to investigate the effect of markedness—based on sonority—on the participants' pronunciation. To achieve the research goals, the following questions are addressed:

1) Do the speakers of the Aljouf Arabic dialect have difficulties in producing English coda clusters? If yes, what are the main strategies used to simplify coda clusters?

2) Is there a relationship between the sonority slope and the accurate production of English coda clusters?

3) Are marked coda clusters simplified more often than less-marked coda clusters?

Fifteen native speakers of the Aljouf Arabic dialect were asked to read a list of twenty- five nonwords that took into account the sonority distance between C1 and C2 in clusters. The study adopted the sonority scale proposed by Clements (1990): Vowels > Glides > Liquids > Nasals > Obstruents.

Each participant was recorded individually using Speech Analyzer Software 3.0.1, 2007 (http://www-01.sil.org/computing/sa/). Each was asked to read each non-wordtwo times. Non-words that have the same production were not presented successively. The participants knew that they were being recorded; however, they were not informed about the purpose of this task. Finally, recordings obtained from participants were analyzed acoustically to identify any repair strategies.

Clusters in the instrument contained zero, one, and two steps of sonority. The study focuses mainly on the production of the following clusters: liquid-obstruent, nasal-obstruent, liquid-nasal, nasal-obstruent, obstruent-obstruent and liquid-liquid. All non-words included in this study have the same syllable structure (CVCC). That is, the study focused only on English coda clusters consisting of two consonants; it does not examine word-final consonant clusters in which the last consonant is an appendix, such as /nz/ in 'pins' /pʰɪnz/.

Having each of the 15 participants read 25 nonwords twice resulted in 750 tokens. The selected coda clusters, non-words and the sonority distance between consonants within clusters are provided below.

Table 2. Target coda clusters

Sonority Distance C2-C1	Target clusters		Real words	Tested words
2	Liquid + Obstruent	/ɹb/	Curb	Darb
		/ɹd/	Word	Dard
		/ɹg/	Burg	Karg
		/ɹp/	Scarp	Sarp
		/ɹt/	Flirt	Zart
		/ɹk/	Spark	Gark
		/lb/	Bulb	Shalb
		/ld/	Cold	Kald
		/lp/	Scalp	Talp
		/lt/	Adult	Dalt
		/lk/	Skulk	Kalk
		/ɹf/	Scarf	Karf
		/lf/	Self	Balf
		/lv/	Twelve	Dalv
1	Nasal + Obstruent	/mp/	Crimp	Damp
		/nt/	Ant	Dant
		/nd/	And	Kand
		/ŋk/	Sink	Tank
		/mf/	Triumph	Tamf
	Liquid + Nasal	/ɹm/	Arm	Barm
		/ɹn/	Corn	Karn
		/lm/	Film	Shalm
		/ln/	Kiln	Kaln
0	Obstruent + Obstruent	/st/	Rest	Dast
	Rhotic + Liquid	/ɹl/	Twirl	Tarl

4. Results and Discussion

The results showed that the percentage of the total modification is 65.6%.

Table 3. Simplification strategies

Errors: 65.6%		**Correct forms**
Epenthesis	Deletion	
481/750 (64.1%)	11/750 (1.5%)	258/750 (34.4%)

4.1 Simplification Strategies

Most participants tended either to insert an epenthetic vowel between C1 and C2 or to delete one of the consonants. The complex syllable CVCC was divided into CV and CVC. The participants had a tendency to insert two types of vowel sounds, /ə/ and /ɪ/, to break up coda clusters. The location of the epenthetic vowel can be attributed to L1 interference, because these two vowels are avoided word-initially and word-finally in Aljouf Arabic (Sabir & Alsaeed, 2014). An example of epenthesis used by Aljouf speakers to modify English coda clusters is shown in the spectrogram below.

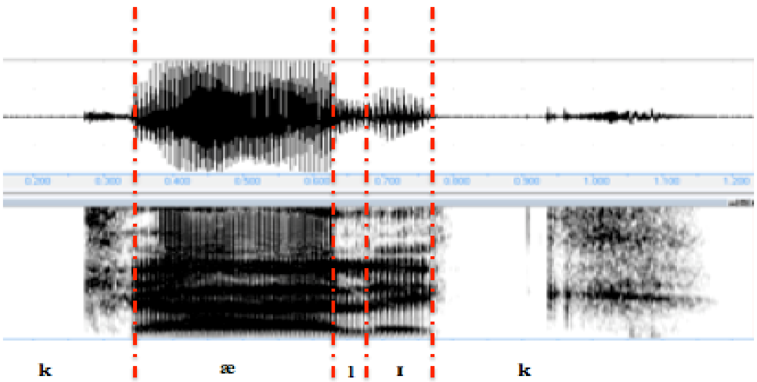

Figure 1. The spectrogram of the non-word "kalk" by a speaker of Aljouf Arabic

Deletion occurred in the production of the following clusters: /[illegible]l/, /mf/, /[illegible]m/, /ln/, /lf/, /lv/, /[illegible]g/ and /[illegible]d/.The few cases of deletion in this study demonstrate that participants tended to delete the second consonant and preserve the first consonant adjacent to the vowel. In most cases, the less-sonorous consonant was deleted, while the more sonorous consonant was preserved. This provides a support to the claim made by Baertsch (1998, 2002) that sonorous consonants tend to occur in coda position, while less-sonorous consonants tend to occur in onset position. An example of deletion can be shown below.

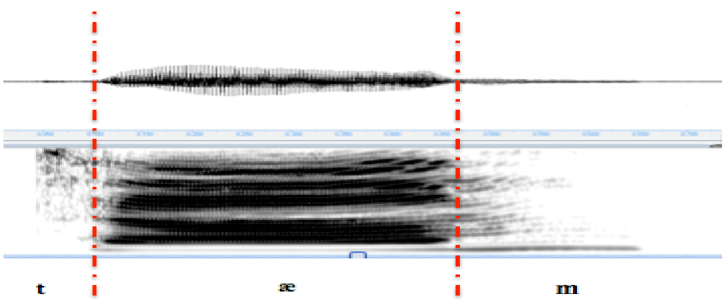

Figure 2. The spectrogram of the non-word "tamf" by a speaker of Aljouf Arabic

In fact, most participants replaced sounds not existing in their native language. For instance, the voiced labio-dental fricative /v/was always substituted with the voiceless labio-dental fricative /f/, and the approximant /ɹ/ was changed into trill /r/. Moreover, all participants substituted the velar nasal /ŋ/ with the alveolar nasal /n/.

In Arabic, the surface representation matches the underlying representation. Orthography may have a significant effect on the production of the /ŋk/ cluster. Arabic orthography is shallow; that is, there is a connection between the letter and the sound. In Arabic, the nasal /n/ does not assimilate to the place of articulation of the voiceless velar stop /k/. However, substituting the L2 sound with the existing L1 sound was not considered as a simplification strategy in this study.

In general, results showed that the participants tended to simplify English coda clusters no matter the sonority distance between the two consonants. There were, of course, some exceptions (e.g., the cases of obstruent/obstruent cluster and nasal/obstruent clusters which have a close sonority distance).

The environments in which the modification percentage was less than 50% are:

- Obstruent followed by obstruent
- Nasal followed by obstruent

In contrast, English coda clusters in which the modification percentage was over 50% were found in the following environments:

- Liquid followed by obstruent
- Liquid followed by nasal
- Liquid followed by liquid

These findings were quite unexpected because some marked clusters had few errors compared to unmarked clusters. Clusters that have a close sonority distance are considered to be more marked than clusters with consonants having a wide sonority distance. The modification percentage of liquid/obstruent clusters, which have a large sonority distance (two), is higher than some nasal/obstruent clusters (those having one sonority distance) and obstruent/obstruent clusters in which the sonority distance is zero.

4.1.1 Simplification Strategies in Rhotic/Obstruent Clusters

Table 4. Production of rhotic/obstruent clusters

	Cluster	**Total Modification**	**Modification Strategy**	
			Epenthesis	**Deletion**
Sonority Distance is 2	/ɹb/	26/30 (86.7%)	26/30 (86.7%)	0/30 (0%)
	/ɹd/	22/30 (73.3%)	21/30 (70%)	1/30 (3.3%)
	/ɹg/	24/30 (80%)	23/30 (76.7%)	1/30 (3.3%)
	/ɹp/	24/30 (80%)	24/30 (80%)	0/30 (0%)
	/ɹt/	24/30 (80%)	24/30 (80%)	0/30 (0%)
	/ɹk/	18/30 (60%)	18/30 (60%)	0/30 (0%)
	/ɹf/	20/30 (66.7%)	20/30 (66.7%)	0/30 (0%)

The results were unexpected; all clusters in this category were modified. The modification percentage of all clusters was over 50%. As shown in the table, the modification percentage ranges from 60% to 86.7%. The large sonority distance between C1 and C2 didn't have an effect on how participants produce these clusters. Strategies used to modify coda clusters in this section were epenthesis and deletion. Most clusters were simplified by the addition of an epenthetic vowel. There were two instances in which one of two consonants was deleted. The obstruent was deleted in /ɹg/ and /ɹd/.

4.1.2 Simplification Strategies in Lateral/Obstruent Clusters

Similar results were observed in the case of clusters that start with laterals. That is, the majority of participants simplified lateral/obstruent clusters using two strategies: epenthesis and deletion (see Table 5).

Table 5. Production of lateral/obstruent clusters

	Cluster	Total Modification	Modification Strategy	
			Epenthesis	Deletion
Sonority Distance is 2	/lb/	23/30 (76.7%)	23/30 (76.7%)	0/30 (0%)
	/ld/	22/30 (73.3%)	22/30 (73.3%)	0/30 (0%)
	/lp/	23/30 (76.7%)	23/30 (76.7%)	0/30 (0%)
	/lt/	20/30 (66.7%)	20/30 (66.7%)	0/30 (0%)
	/lk/	23/30 (76.7%)	23/30 (76.7%)	0/30 (0%)
	/lf/	17/30 (56.6%)	16/30 (53.3%)	1/30 (3.3%)
	/lv/	18/30 (60%)	17/30 (56.7%)	1/30 (3.3%)

As shown in the table, the modification percentage ranges from 56.6% to 76.7%. The large sonority distance between C1 and C2 didn't have an effect on how participants produce these clusters. Most clusters were simplified by epenthesis. However, there were two cases in which deletion was used as a simplification strategy. The obstruent was deleted in /lv/ while the lateral was deleted in /lf/.

4.1.3 Simplification Strategies in Nasal/Obstruent Clusters

Table 6. Production of nasal/obstruent clusters

	Cluster	Total Modification	Modification Strategy	
			Epenthesis	Deletion
Sonority Distance 1	/mp/	10/30 (33.3%)	10/30 (33.3%)	0/30 (0%)
	/nt/	14/30 (46.7%)	14/30 (46.7%)	0/30 (0%)
	/nd/	10/30 (33.3%)	10/30 (33.3%)	0/30 (0%)
	/ŋk/	11/30 (36.7%)	11/30 (36.7%)	0/30 (0%)
	/mf/	14/30 (46,7%)	12/30 (40%)	2/30 (6.7%)

Participants repaired most nasal/obstruent clusters that have one sonority distance by epenthesis. Only one cluster, /mf/, was simplified by deletion. Two participants deleted the obstruent. In general, participants performed better on nasal/obstruent clusters with respect to other clusters. The modification percentage of all clusters in this category was less than 50%. The modification percentage ranges from 33.3% to 46.7%.

4.1.4 Simplification Strategies in Liquid/Nasal Clusters

Table 7. Production of liquid/nasal clusters

	Cluster	Total Modification	Modification Strategy	
			Epenthesis	Deletion
Sonority Distance 1	/ɹm/	20/30 (66.6%)	19/30 (63.3%)	1/30 (3.3%)
	/ɹn/	21/30 (70%)	21/30 (70%)	0/30 (0%)
	/lm/	23/30 (80%)	23/30 (80%)	0/30 (0%)
	/ln/	27/30 (90%)	25/30 (83.3%)	2/30 (6.7%)

By comparing these results with the results of production nasal/obstruent clusters, we can see that sonority distance didn't play a significant role on how participants' performance because liquid/nasal clusters and nasal/obstruents clusters have the same sonority distance. However, participants performed better on nasal/obstruent clusters with respect to liquid/nasal clusters. The modification percentage ranges from 66.6 % to 90%. The participants used epenthesis and deletion to simplify clusters. Deletion occurred in three cases. Two participants deleted the nasal in /ln/ and one participant deleted the nasal in /ɹm/.

4.1.5 Simplification Strategies in Obstruent/Obstruent Clusters

The table below includes one cluster, /st/, that has one sonority distance between C1 and C2.

Table 8. Production of obstruent/ obstruent clusters

	Cluster	Total Modification	Modification Strategy	
			Epenthesis	Deletion
Sonority Distance 0	/st/	12/30 (40%)	12/30 (40%)	0/30 (0%)

Interestingly, most participants produced /st/ correctly although it is marked as the sonority distance between the two consonant is zero. The modification percentage of the obstruent/obstruent cluster (/st/) was only 40%. /st/ cluster was modified only by epenthesis.

4.1.6 Simplification Strategies in Rhotic/Lateral Clusters

Not all clusters in which consonants are separated by one sonority distance are allowed to surface. Similarly, not all clusters with zero sonority distance are preferred by the participants. Table 9 includes one cluster that consists of rhotic followed by lateral. The modification percentage of the liquid-liquid cluster (/ɹl/) is 83.3%. /ɹl/ cluster was modified by epenthesis and deletion. Most participants used epenthesis as a simplification strategy. However, one participant deleted the lateral.

Table 9. Production of rhotic/lateral clusters

	Cluster	Total Modification	Modification Strategy	
			Epenthesis	Deletion
Sonority Distance 0	/ɹl/	25/30 (83.3%)	24/30 (80%)	1/30 (3.3%)

Based on these results, markedness based on sonority did not provide an explanation for participants' production errors. The results did not provide support to Eckman's (1977) claim that marked features are more difficult to acquire than unmarked features. Unlike unmarked clusters, marked clusters seem to be allowed in Aljouf Arabic. Goldsmith (1990) explained that some languages may treat the final consonant in words that violate SSP as extra-syllabic. The segment that is not included in the syllable is considered as an appendix. It is attached to the highest prosodic node. Many studies done on Arabic verities also indicated that the last consonant in CVCC syllable is an appendix. Watson (2002) claimed that the final consonant in the superheavy syllable (e.g., CVCC) in Arabic is not part of the syllable. Kiparsky (2003) provided an example, he indicated that /t/ is an appendix in /bɛnt/, "girl" (see Figure 3).

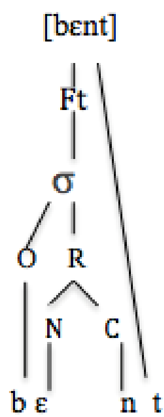

Figure 3. Extra syllabification for the non-word "dast"

Thus, the final consonant in clusters, (e.g., obstruent-obstruent clusters), which were pronounced correctly by most participants in the present study, might be treated as sort of extra or appendix.

5. Conclusion

The study showed that Aljouf Arabic speakers tended to modify English coda clusters using two strategies: epenthesis and deletion. Substitution was used along with epenthesis and deletion. They did replace English consonants with other consonants available in their L1's phonemic inventory.

In this study, it was predicted that clusters with two sonority distances would be pronounced more correctly than marked clusters with one or equal sonority distances. However, markedness based on sonority distance did not provide an explanation for participants' performance. The participants tended to simplify English coda clusters no matter the sonority distance between the two consonants. Some clusters in which the sonority distance is less than two were pronounced correctly by most of the participants. A possible reason for this is that Aljouf Arabic treats the final consonant in marked clusters as an appendix that is not linked to the syllable. The environments in which the modification percentage was less than 50% were nasal followed by obstruent and obstruent followed by another obstruent. On the other hand, the environments in which the modification percentage was less than 50% were liquid followed by obstruent, liquid followed by nasal and liquid followed by liquid.

References

Baertsch, K. (1998). Onset sonority distance constraints through local conjunction. In M. Gruber, D. Higgins, K. Olson, & T. Wysocki (Eds), *The Proceedings from the Panels of Chicago Linguistic Society* (pp. 1-6). Chicago: Chicago Linguistic Society

Baertsch, K. (2002). *An optimality theoretic approach to syllable structure: The split margin hierarchy* (doctoral dissertation, Indiana University, Bloomington, US).

Clements, G. (1990). The role of the sonority cycle in core syllabification. In J. Kingston & M. Beckman (Eds.), *Papers in laboratory phonology: Between the grammar and physics of speech* (pp. 283-333). Cambridge: Cambridge University Press. http://dx.doi.org/10.1017/CBO9780511627736.017

Dinnsen, D., & Eckman, F. (1975). A functional explanation of some phonological typologies. In R. Grossman, J. San & T. Vance (Eds.), *Papers inFunctionalism* (pp. 126-134). Chicago: Chicago Linguistic Society.

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

Eckman, F. (1984). Universals, typologies and interlanguage. In W. Rutherford (Eds.), *Language universals and second language acquisition* (pp. 79-105). Amsterdam: John Benjamins. http://dx.doi.org/10.1075/tsl.5

Eckman, F. (1991). The structural conformity hypothesis and the acquisition of consonant clusters in the interlanguage of ESL learners. *Studies in Second Language Acquisition, 13*, 23-41. http://dx.doi.org/10.1017/S0272263100009700

Gandour, J. (1998). Phonetics and phonology. In B. Stemmer & H. Whitaker (Eds.), *Handbook of Neurolinguistics* (pp. 207-218). London: Academic Press. http://dx.doi.org/10.1016/B978-012666055-5/50017-4

Goldsmith, J. (1990). *Autosegmental and metrical phonology*. Cambridge: Basil Blackwell Ltd.

Hogg, R. (1987). *Metrical phonology: A coursebook*. Cambridge: Cambridge University Press.

Jabbari, A., & Samavarchi, L. (2001). Persian learners' syllabification of English consonant clusters. *International Journal of English Linguistics, 1*, 236-246.

Jurado, E. (2005). A study on the acquisition of English consonants clusters by Spanish students. *Interlinguistica, 16*, 749-761.

Kiparsky, P. (2003). Syllables and moras in Arabic. In C. Féry & R. Vijver (Eds.), *The syllable in optimality theory* (pp. 147-182). Cambridge: Cambridge University Press. http://dx.doi.org/10.1017/CBO9780511497926

Ladefoged, P., & Johnson, K. (1993). *A course in phonetics*. Fort Worth: Harcourt Brace Jovanovich College.

LADO, R. (1957). *Linguistics across cultures: Applied linguistics for language teachers*. Michigan: The University of Michigan Press.

Mathew, I. (2005). Errors in pronunciation of consonants by learners of English as a foreign language whose firstlanguages are Indonesian, Gayo and Acehnese. *Monash University Linguistics Papers, 3*(2), 29-44.

Sabir, I., & Alsaeed, N. (2014). Disquisition of long and short vowels in colloquial Arabic. *IPEDR, 79*, 32-35. http://dx.doi.org/10.7763/IPEDR

Selkirk, E. (1984). On the major class features and syllable theory. In M. Aronoff & R. Oehrle (Eds.), *Language sound structure* (pp. 107-136). Cambridge: MIT Press.

WatsoN, J. (2002). *The phonology and morphology of Arabic*. NY: Oxford University Press Inc.