Patterns of Coda Clustering Simplification in RP English by Omani Female Students : A Generative Perspective

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Abstract

This paper is a generative study of simplification patterns of RP English coda clustering as performed by adult Omani female learners. The subjects were (18) diploma and bachelor university college students (20-24 years old). They were Omani girls studying at the English Department, recently joined a course in phonetics. The tokens deployed were fifteen representing coda CC, CCC, and CCCC clusters. Two sessions were devoted for tape-recording carried out in a language "smart class". The data collected were analyzed in-depth to identify simplification strategies and their relevant contexts. Phonological rules were applied to allocate the phonetic features of the segments that undergo adaptation with due emphasis on the environment of this adaptation. The major findings of this work were: (i) the length of the cluster is directly related to the accuracy rates. The longer the cluster, the higher rate of errors is (CC (20%), CCC (54.4%), and CCCC (94.4%), (ii) deletion is the most preferable simplification strategy. It is favoured over consonant substitution and insertion. A combination of these patterns comes second,(iii) in terms of generative phonology, the contexts of elision were: a- the plosive obstruents /t/ and /d/ in final position preceded by the plosive obstruent /p/, the affricate obstruents /ʧ/ and /ʤ/, and the fricative obstruents /f/ and /s/. b- the plosive obstruent /p/ as post-final (1) preceded by the pre-final nasal sonorant /m/. c- the fricative obstruents /ɵ/ and /s/ before and after another consonant, /ɵ/ as post-final is deleted after the final fricative obstruent /f/, as post-final (1) after the final fricative obstruent /f/ and before the fricative obstruent /s/ as post-final (2), as post-final (2) before and after the fricative

obstruent /s/ as post-final (1) and (3). d- /s/ as post-final (1) after the final plosive obstruent /k/ and before the fricative obsruent /ɵ/ as post-final (2), as post-final (3) after the plosive obstruent /t/ and the fricative obstruent/ɵ/ as post-final (2). e- the fricative obstruent /z/ as post-final after the final nasal sonorant /m/, (iv) the only segments which were subjected to substitution were: the plosive obstruents /p/ and /t/, the affricate obstruents /ʧ/ and /ʤ/, (v) the most disfavoured strategy was insertion, (vi) there is a great correlation between the markedness of the cluster and the deployment of multiple simplification strategies, (vii) a considerable impact was scored for the structure of the cluster (the way consonants are concatenated) rather than the phonetic quality of the cluster elements, (viii) the nucleus quality had no considerable effect on the process of simplification, and (ix) the prominent parameters that control coda clustering simplification are: the size and the structure of the cluster, and word structure (simple vs. complex).

أنماط التبسيط لمجاميع السواكن الآخرية في الانجليزية الفصحى الظاهرة في اداء الطالبات العمانيات: دراسة توليدية

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الخلاصة :

تعد هده الورقة دراسة توليدية لانماط التبسيط لمجاميع السواكن الآخرية (المندمجة في تقفيلة المقطع) كما تظهر في اداء الطالبات العمانيات الكبار. تتلخص النتائج الرئيسة لهذه الورقة بالنقاط الآتية : (١) هناك علاقة مباشرة بين عدد الاخطاء التي ترتكبها المتعلمة وطول مجاميع السواكن حيث تكون هذه العلاقة طردية . (٢) يمثل الحذف الصوتي اكثر الاستراتيجيات التي تتبعها هؤلاء المتعلمات قياساً بالاستراتيجيات الاخرى . (٣) من وجهة نظر توليدية، ان السواكن التي خضعت للحذف هي سواكن الاعاقة في مواقع مختلفة . (٤) هناك ترابط وثيق بين صعوبة مجموعة السواكن واستخدام استراتيجيات التبسيط المتعددة . (٥) هناك تأثير ملحوظ لتركيبة مجموعة السواكن (طريقة دمجها) مقارنة بنوعية السواكن . (٦) عدم وجود أي تأثير لنواة المقطع في عملية التبسيط . (٧) تتلخص العوامل المؤثرة في عملية التبسيط بحجم وتركيبة مجموعة السواكن وتركيبة الكلمة (بسيطة ام معقدة) .

1- Introduction

The acquisition of interlanguage syllable structure has been a rich research material for many scholars a long the path of linguistics. This is because "native speakers demonstrate some sort of competence with syllables , and syllable structure interacts with other aspects of linguistic organization" (Harris, 1983:4). Literature survey revealed that the syllable and the related phonological processes have been tackled from different perspectives. Simplification of consonant clustering by different speakers of English, and the strategies adopted to achieve this process have been some of these research areas for decades.

Pioneer scholars who tackled consonant clustering in English (e.g. Lado, 1957; Broselow, 1983) admit that non-native speakers often find this clustering problematic due to the negative transfer of their source languages. Precisely, they state that most of these clusters are not allowed in the native language. Transformationalists (e.g. Radford, et.al, 1999) support this assumption by stating that languages offer various kinds of syllables, and native speakers of languages bring their knowledge of syllables and syllable structures in their attempt to produce words from other languages (p.88). Brosnahan and Malmberg (1970: 212) put it clearly and point out that consonants in English appear in licensed clusters. However, the concatenation of these consonants varies from language to another.

Modern researchers (e.g. Yoo, 2004; Power, 2007) attribute coda simplification to markedness (complexity) of coda clusters, particularly their structure and spelling. Power (ibid.) states that coda clusters are more problematic than initial ones because they form open-ended groups, and the spelling of these clusters is misleading since it serves as a very poor guide to the way they are pronounced. He concludes that the production of coda clustering entails tricky adjustments in place and manner of articulation, advising learners of English to be familiar with the most common simplification strategies advocated by native speakers, assimilation and elision.

Other group of researchers (e.g. Hindson and Byrne, 2002; Yoo, 2004) view simplification of final clustering from optimality point of view. Yoo (ibid.), for example, reveals that coda position is less salient (noticeable) and relatively free from the constraints imposed on onset position. Coda clusterings, therefore, are more marked than single consonants, which makes them difficult for learners. On the other hand, Hindson and Byrne (op.cit.) justify the possibility of coda simplification by the phonetic quality of post-vocalic consonants. They point out that the more strong type of consonants occurring within coda, the more coherent the coda clustering is. The same fact is true with onset clustering.

To my best knowledge, there is no in-depth research work which has been completely devoted to coda simplification as elicited in the performance of adult Omani learners of English. The current paper is an attempt to investigate the effect of markedness, and the phonetic context on the production of coda clustering by these speakers, and to identify the patterns of simplification. To investigate the role of the context, the experiment data will be treated in terms of phonological rules .

2- Literature Review

Studies on the simplification of consonant clustering in English fall within the scope of second language phonology, where different aspects of interlanguage syllable structure have been investigated. Different approaches emerge in the area, the most significant of which are: conformity between source language and target language, and conformity to universal principles, optimality theory (markedness relationship), articulatory and acoustic viewpoints, phonological perspective, typological (patterning) framework, representational-based account, and asymmetry perspective.

Scholars have also placed due emphasis on the sources of difficulty concerned with the perception and production of various types of consonant clusters. The strategies adopted by non-native speakers to adapting target

language onset and coda consonant concatenations are other areas of interest to many researchers.

A number of scholars (e.g. Osburne, 1996; Klove and Young- Scholten 2008) conclude that non-native speakers of English simplify consonant clustering not only in terms of conformity with their native language syllable structures, but also to conform to the universal linguistic principles. They stress that these learners have a general tendency toward avoiding violations of universal rules. Simplification usually takes different forms like consonant deletion, epenthesization, etc. The prediction of the reduced consonant, they point out, is determined by the interaction with universal considerations, and with the native language syllable structure. Klove and Young-Scholten (ibid.) updated the theory of conformity to universal principles by adding a new justification, the operation of feature-based processes.

Simplification of English consonant clusters in terms of optimality theory has occupied a wide range in the literature of interlanguage phonology. Scholars (e.g. Catts and Kamhi, 1984; Broselow and Finer 1991; Eckman 1991 and 1997; Eckman and Inverson 1993, 1994; Carlisle, 1994, 1997, 1998; Hancin- Bhatt and Bhatt 1997; Hindson and Byrne, 2002; Kim, 2002; Hansen, 2003; and Yoo, 2004) investigate the frequency of occurrence of cluster reduction in relation to phonological processes like neutralization, assimilation, syllabification, metathesis, and elision. Technically speaking, they interpret this frequency in relation to markedness. For them, the more marked clustering (i.e. the more complex one), is the more subjected to simplification as compared to the less marked. They agree that the more marked clusters are more problematic than the unmarked ones. Within the same trend of typological universals, Carlisler (1999) showed that there is a close relation between onset cluster simplification and the sonority (the length) of the nucleus.

Hindson and Byrne (op.cit.) explain simplification of coda clusters in relation to the phonetic quality of the post-vocalic consonant. For instance, they state that coda clusters with nasals and obstruents are more opt for simplification than those with liquids. They also clarify that the more robust type of coda clusters form the more coherent units, exhibiting less possibility of simplification.

Recently(2008), MacCarthy approached consonant cluster simplification within a derivational version of optimality school of thought. He showed that the final output (simplification) is attained by a series of derivational steps that gradually improve harmony to which he referred as "Harmonic Serialism" He observed that cluster simplification follows a gradual path. For example, deletion or place assimilation is the second step in a derivation (simplification) process. He stressed that these two processes come as a result of a former step represented by deleting place features which entails improving harmony only in coda position .

Other scholars(e.g. Son, 2006; Elsevier, 2006) examine clustering simplification from articulatory and acoustic perspectives. Son (ibid.) attempts to find out whether the closure duration of the final consonant causes reduction in the final two-element clusters in Korean. He found that the duration of closure (gestural formation) of the / k/ in the sequence / lk/ is longer than the duration of /p/ in the sequence / lp/. Accordingly, reduction is elicited in / lk/ sequence but not in the / lp/ to compensate the lengthening in the production of /k/.

Elsevier (ibid.) conducts an acoustic (perceptual) study to investigate coda cluster simplification patterns in English loanwords as spoken in different languages. He concludes that the most noticeable case of this simplification is in the postsonorant context, /n- #/, pointing out that similar patterns of reduction are elicited in the productive synchronic alternations in the course of language evolution, and also in child acquisition data. He recommends that in order to identify final cluster reduction in English loan

words, perceptual scales should be incorporated into the grammar of each language where English loan words are used.

The phonological environment where consonant clustering simplification takes place has been an interesting research area to many scholars. Dell (1985) and Pooley (1996), as a case in point, highlight some facts about such environment. Dell (ibid.) reveals that the liquids / l/ and / r/ are deleted only before other consonants and pauses , while Pooley (ibid.) falsifies this finding since he has found that these two liquids are also dropped in prevocalic contexts.

In a similar vein, Bobda (2006) identifies the phonological patterns of cluster simplification elicited in English. The prominent findings of his work are: (i) the two patterns of initial cluster simplification are dropping the initial
consonant and vowel insertion, (ii) simplification in coda comes as a result of eliding the first, second, or third element, and the epenthesization of /i/ and /ə/, and (iii) the majority of simplification patterns often follow neat phonological rules.

Along the same lines, Sato (2006) investigates syllable structure in the interlanguages of two Vietnamese learners of English. He finds that the major patterns of simplification as elicited in the data of these learners are: (i) a preference for the closed syllables in the adaptation of coda clusters, (ii) onset clusters are easier in the production in comparison with coda clusters, and (iii) negligible use of vowel epenthesis as a syllable modification strategy. These findings disconfirm the hypothesized universal preference for the open syllable, and of the hypothesized prevalence of epenthesization as a syllable adaptation strategy in interlanguage phonology.

Within the scope of generative phonology, the modification of target language syllable structure is investigated in terms of representational-based account. Steele (2000), for example, notes that this modification is controlled by two factors; importance of segmental preservation between

deep and surface representations, and constraints on word shape. With regard to coda cluster simplification, he observes that simplification is directly related to the type of prosodic licensing permitted in the interlanguage grammar. He finds out that target language learners, as a case in point, delete segments which are not available in their source language.

Other scholars (e.g. Anderson, 1987; Eckman, 1997; Hancin- Bhatt and Bhatt, 1997; Sato, 2006) study consonant clustering from a symmetry (similarity) point of view. Eckman (ibid.) for instance, found that initial three-element clusters are more frequently modified by Spanish learners of English as compared with initial two-element clusters. With reference to native speakers of Egyptian Arabic, Anderson (ibid.) concluded that coda clusters are more adapted than the onset ones. He supported this conclusion with evidence for the relative markedness relationship between onset and coda.

The sources of difficulty inherited in the production of English consonant clusters were highlighted by many researchers. Pioneer researchers who tackled consonant clustering admitted that negative transfer is the dominant source of difficulty (cf. Lado, 1957; Broselow, 1983; Major,2001; Kim 2002, Hybae,2004;Yoo, 2004; Sato, 2006). They typically claim that the more marked (complex) syllable structure in the target language, the higher possibility of simplification is.

The strategies adopted by non-native speakers to simplify English consonant clusters were examined via a number of research works. Some of these works (e.g. Whitman, 1985; Cho, 1990; Oh, 1994; Kim, 2002) have identified three strategies, namely, neutralization, syllabification, and assimilation.

Anderson (1987) refers to insertion and deletion. He concludes that the former is favoured in onset clusters, and the latter in coda clusters. Hansen (2001) found that preference was given to epenthesization and feature change (assimilation) to adapt coda clusters. The choice; however, is governed by the coda structure. Yoo (2004), on the other hand, shows that consonant deletion is more frequent in the coda compared to the onset position.

3- RP English and Omani Arabic Syllable Structure

RP English has totally different syllabic structure from that of Omani Arabic (OA). The maximum number of consonants occurring within onset is three, and within coda is four. Accordingly, syllable structure in RP English can be summarized in the formula C_{0}-$_{3}$ V C_{0}-$_{4}$. (OA) maximally allows two consonants within onset and coda clusters. This can be formulated in the formula C_{1}-$_{2}$ V C_{0}-$_{2}$. This implies that three-element onset clusters, and three and four-element coda clusters are not permitted in (OA). Another significant difference is that the onset in (OA) should begin with single or two consonants, viz, zero onset is not licensed as it is in English.

4- Research Questions

This paper explores the following research questions:

1- Does the size of the cluster have a significant effect on coda simplification?

2- Is simplification controlled by the quality of the post-vocalic consonants?

3- Does the type of the nucleus have any role in simplification?

4- What are the common patterns of coda simplification?

5- Method & Procedure

The work is an experimental one. Participants were 18 female Omani college students (20-24 years old) studying in Muscat. They pursue their diploma and bachelor degrees in English language and literature. They were selected from two groups (9 students from each group) joining a course in phonetics. To avoid the instructional effect, the experiment was carried out at the second week of the course.

Twenty tokens were given to the subjects the first five of which are dummy.These dummy tokens were randomly chosen to alleviate the expected tension. The other fifteen tokens present words with different types of coda clusters in RP English adapted from Roach (2009). These tokens were selected on the basis of different criteria, frequency of use, size of the cluster, and the phonological structure of the cluster. Final two-

element, three-element, and four-element consonant clusters were used. We have selected different structures of coda clusters to elicit the effect of the phonetic context on the process of simplification. Recording was made on two sessions with an average time of 22.5 minutes. Both groups were given three minutes for silent reading.

The number of errors, percentages, contexts of errors, and typology of errors were tabulated. A detailed analysis of these errors was provided as an appendix. The patterns of simplification will be treated via phonological rules in terms of generative phonology.

5- Results & Discussion

This section is divided into three parts; general overview, simplification patterns, and generative analysis of these patterns.

5.1 General Overview

Table (1)
A Summary of the Subjects' Errors

Token No.	Token	Type of Cluster	No. of Errors	Percentage	Typology of Errors
1	slept	plosive + plosive	0	0%	-
2	change	nasal + affricate	1	6%	Consonant Substitution
3	jump	nasal+ plosive	0	0%	-
4	laughed	fricative + plosive	6	33%	Consonant Substitution Syllable Reduction
5	watched	affricate + plosive	11	61%	Syllable Reduction Epenthesization Epenthesization+ Consonant Substitution
6	fixed	plosive + fricative + plosive	13	72%	Syllable Reduction Consonant Substitution Epenthesization+ Consonant Substitution
7	twelfth	lateral + fricative +	17	94%	Syllable Reduction Consonant Substitution

		fricative			
8	**helped**	**lateral + plosive + plosive**	**13**	**72%**	**Syllable Reduction Epenthesization + Consonant Substitution Double Consonant Substitution**
9	**tempt**	**Nasal + plosive + plosive**	**5**	**28%**	**Syllable Reduction Epenthesization + Consonant Substitution**
10	**films**	**lateral + nasal + fricative**	**1**	**6%**	**Syllable Reduction**
11	**twelfths**	**lateral + fricative + fricative + fricative**	**18**	**100%**	**Syllable Reduction Epenthesization + Syllable Reduction**
12	**texts**	**plosive + fricative + plosive + fricative**	**18**	**100%**	**Syllable Reduction**
13	**sixths**	**plosive + fricative + fricative + fricative**	**18**	**100%**	**Syllable Reduction Epenthesization Epenthesization + Syllable Reduction**
14	**prompts**	**nasal + plosive + plosive + fricative**	**16**	**89%**	**Epenthesization Epenthesization + Consonant Substitution Syllable Reduction Syllable Reduction + Consonant Substitution**
15	**attempts**	**nasal + plosive + plosive + fricative**	**15**	**83%**	**Syllable Reduction Epenthesization + Consonant Substitution Epenthesization + Syllable Reduction + Consonant Substitution Syllable Reduction + Consonant Substitution**
Total			**152**	**84%**	

Table (1) presents a summary of the errors' rating, type of the coda cluster, and typology of errors. Final CC clusters register the lowest

percentage (20%), final CCC exceed the half (54.4%), and final CCCC show the highest percentage (94.4%). In final CC, the highest rating was scored in the affricate + plosive combination(61%). The lowest rating (6%) was scored in the clustering of nasal + affricate. Final fricative + plosive combination reads a considerable rating (33%). Final CC of the structures plosive + plosive and nasal+ plosive reveal no difficulty.

As for CCC clusters, the highest percentage was scored by token number 7 "twelfth" (94%). The combination tested was lateral + fricative + fricative. Tokens number 6 and 8 "fixed" , " helped" were equally weighted, 72% each. The structures involved were plosive + fricative + plosive, and lateral + plosive + plosive, respectively. Token number 9 "tempt" reads (28%) , and token number 10 "films "scores (6%). The combinations given were nasal+ plosive + plosive, and lateral + nasal + fricative, in the order mentioned.

Looking at CCCC clusters, tokens 11, 12, and 13 " twelfths, texts, sixths" scored 100% each. The other two tokens (14 and15) " prompts", "attempts" read 89% and 83%, respectively. These results supplement Yoo's (2004) findings that the accuracy of the pronunciation is affected by the number of consonants in coda, as compared with a negligible effect of the number of consonants in onset.

5.2 Simplification Patterns

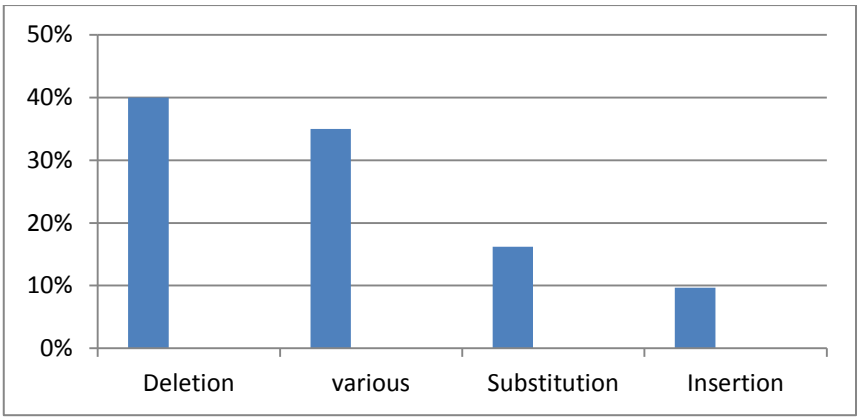

Figure (1): Simplification Types

The strategies (simplification types) which emerged in the production of the subjects are shown in Table (1). The errors were classified in terms of deletion (reduction), substitution, insertion, and a combination of these (Figure 1). Generally, deletion was the most prominent simplification type (40%), Once again, this result comes in alignment with Yoo's(ibid.) finding who concluded that deletion and substitution are the dominant patterns of cluster simplification by non-native speakers. Combination of strategies comes second (35%). Phoneme substitution was third (16.12%), and epenthesization was the least (9.67%). The outcome revealed here is similar to that of (Smith, 1974; Bernhardt and Stemberger, 1998; Weinberger,1994; Yoo, 2004; Sato, 2006) who found that vowel insertion is a disfavoured modification strategy.

The results obviously show that the longer the coda cluster is, the more potential types of simplification are. Coda CC clusters demonstrated only four patterns; deletion, substitution,insertion, and a combination of insertion and substitution.

Coda CCC showed more types; deletion, substitution, double consonant substitution, and a combination of insertion and substitution. What is interesting , insertion is not used separately as in coda CC clusters. It is only used in combination with substitution. Double substitution is also found here for the first time.

A combination of simplification strategies is the predominant phenomenon of coda CCCC clusters. Three simultaneous processes are found, namely, epenthesization, deletion, and substitution. This gives a clear support to the notion of markedness. Double processes are the most common ones in the adoption of these strategies. However, deletion and substitution function separately in certain contexts.

The contexts where these processes are elicited, and the consonants underlying modification are identified through repeated listening to the recorded data. Deleted consonants are the post-final voiceless dental fricative /ɵ/, the post-final voiceless alveolar fricative /s/,the post-final voiced alveolar fricative /z/, the post-final voiceless plosive /t/, the post-final voiced alveolar /d/. With CCCC coda clusters, some subjects elide post-final (2) /ɵ/ together with post-final (3) / s/. That is, double elision is used. In other positions, they drop both post-final (2) / t/ together with post-final (3) /s/. Another case of double consonant deletion involves / s/ as post-final (1) and (3).

Consonant substitution is another considerable simplification type. The consonants which are subjected to this process are the voiceless bilabial plosive / p/, the voiceless alveolar plosive / t/, the voiceless labio-dental fricative / f/, the voiceless post-alveolar affricate / tʃ/,and the voiced post-alveolar affricate / ʤ/. They are replaced by the voiced bilabial plosive /b/, the voiced alveolar plosive / d/, the voiced labio-dental fricative /v/, the voiceless post- alveolar fricative /ʃ/, and the voiced post-alveolar fricative /ʒ/, respectively. The substitution of /p/ by /b/ is interpreted in terms of transfer effect because the former is not used in the source language. The

change of / t/ by /d/ is due to inaccurate pronunciation where this change is preceded by inserting the vowel /ɪ/, that is, as a result of cluster simplification. The change of /tʃ/ into /ʃ/, and /ʤ/ into /ʒ/ is due to dialectal variation where the latter consonants are commonly used instead of the former ones. The substitution of / v/ for / f/ resulted from inaccuracy of pronunciation although the former is not permitted in the source language. However, this is found very rarely in the data analyzed.

It is worth noting here that vowel epenthesization is a very rare type of simplification in the data collected. This gives an indication that non-native speakers have preference to other strategies when they deal with coda clusters. However, this process is predominant in onset clusters simplification. The inserted vowel is the short close-mid front /ɪ/(cf. Anderson,1987;Bernhardt and Stemberger,1998; Yoo, 2004; Sato,2006).

As stated earlier a combination of various simplification patterns comes in the second rank. This combination takes different forms: epenthesization and consonant substitution, epenthesization and deletion, epenthesization, deletion and consonant substitution. However, the first type was the most prominent one. The frequency of these combinations increases as long as the size of the cluster increases. This implies that the most marked coda clusters reqiure more muscular energy, and in turn more tricky articulatory adjustments are needed.

A number of incidental results are elicited in the fieldwork data. The most common ones are: vowel change, vowel lengthening, and vowel shortening. Vowel change takes three different forms; a short vowel into another short vowel or a long vowel, a long vowel into a short vowel, and a diphthong into a short vowel or a long vowel. Short vowels subjected to change are the short front vowel /e/ and the short central vowel /ʌ/. The first vowel registers the highest frequency, changing more commonly into / ɪ/, and less into /ɔ/ , / i:/ and /ɜ:/. The second vowel is altered into the short front vowel /æ/. However, this change is very rare. The only diphthong which

undergoes change is the closing / eɪ/ which is pronounced by some informants as /æ/ or /ɜ:/ .

Vowel lengthening involves only the short front vowel /e/ which is lengthened into either the long close front vowel /i:/ or the long central /ɜ:/. However, vowel shortening is more frequent as compared to lengthening. The only long vowel which registers shortening is the open back /a:/ which becomes more commonly as the short central vowel / ʌ/ and less as the short front /æ/. All these incidental findings can be interpreted in terms of source language transfer, and minor simplification types.

In the following section, simplification types will be closely examined where details about the segments involved, and the relevant contexts are highlighted. For consistency of presentation, these issues are dealt with in terms of the size of the cluster criterion.

5.2.1 Detailed Account of Simplification Types

5.2.1.1 Deletion

Earlier Section 5.2, it has been stated that coda CC clusters registered the lowest rating of errors. The only elided segments were the post-final voiceless plosive / p/ in the token " watched", and the voiced plosive / d/ as a post-final in "changed". However, this deletion was very rare.

Deletion cases elicited in coda CCC clusters are more as compared to the cases found in coda CC. Elided segments were the voiceless plosive / t/ as a post-final (1) in " "tempt", and as a post-final (2) in "fixed", the voiceless fricative /ɵ/ as a post-final in " twelfth", and the voiced fricative /s/ as a post-final in " films".

Due to the complexity of final CCCC, data analysis shows more contexts of elision.

In certain environments, double elision was elicited. Cases of single elision has affected the voiceless plosive /t/ as a post-final in "attempts" and " prompts", the /p/ as post-final (2) in " prompts", / ɵ/ as post-final (1)

in " twelfths", the /s/ as post-final (1) in " sixths", as post-final (2) in " prompts" and " attempts", and as post-final (3) in "texts".

Double elision affects plosives and fricatives alike, where coarticulatory consonants are sometimes dropped. This is elicited in the elision of /t/ as post-final (2) and /s/ as post-final (3) in "texts". Other examples of double deletion occur with fricatives having the same or different place of articulation. The cases found are: the /ɵ/ as post-final (1) together with /s/ as post-final (2) in "twelfths", the /ɵ/ as post-final (2) together with /s/ as post-final (3) in" sixths". Elision in coarticulatory consonants are found in /s/ as post-final (1) and (3) in " sixths".

5.2.1.2 Various Simplification Patterns

To attain the maximum degree of simplification, the informants sometimes adopt a variety of strategies (table 1).These include epenthesization plus consonant substitution, double elision, double substitution, and epenthesization plus elision. As usual, the frequency of using this variety increases in a longitudinal way,as the cluster becomes longer.

Final two-element clusters reveal a combination of epenthesization together with consonant substitution. The case elicited is the insertion of /ɪ/ together with the substitution of /t/ by /d/ in "watched" , viz, / wɔʧɪd/.

CCC coda shows epenthesization plus consonant substitution, double substitution, and elision plus substitution. The first pattern is represented by inserting / ɪ/ before the voiceless plosive /k/ together with the replacement of /t/ by /d/ in / fɪksɪd/ for /fɪkst/ , inserting / ɪ/before /t/ together with the change of /p/ by /b/ before /m/ in /tembɪt/ for / tempt/, and inserting /ɪ/ after /p/ together with the change of /t/ by /d/ in /helpɪd/ for / helpt/.

Double substitution involves the change of /p/ into /b/ simultaneously with /t/ into /d/. A word like " helped" is pronounced as /helbd/. In certain contexts, elision is accompanied with substitution. The above mentioned token is also pronounced by some informants as / helb/.

Coda CCCC demonstrates more patterns of combined phonological processes. They are insertion plus elision, insertion, substitution, and elision, double elision, and elision and double elision plus substitution.

Insertion is accompanied by deletion of different segments. The cases *routed are:* insertion with the elision of /ɵ/ as post-final (1) in / twelfɪs/ for / twelfɵs/, insertion with the elision of /s/ as post-final (1) in /sikɵɪs/ for /siksɵs/, insertion plus the elision of /s/ as post-final (2) in /twelfɪɵ/ for / twelfɵs/, insertion and elision of /p/as a final consonant and /s/ as post-final (2).

A combination of three processes are applied by the subjects to minimize the economy of effort in coda clustering production. They practice epenthesization, substitution, and elision. The examples registered are: insertion, replacing /p/ by /b/ and the deletion of /s/ as post-final (2) in / brombɪt/ for / prompts/, and /ətembit/ for /ətempts/.

Double elision is the most common combinatory process. Coarticulatory consonants as well as others are affected by this process. The former case is elicited in / teks/ for /teksts/ where /t/ and /s/ as post-final (2) and (3) are lost, /sɪkɵ/ for /sɪksɵs/ in which the /s/ as post-final (1) and (3) is deleted. Other segments which undergo elision are /ɵ/ and /s/ as post-final (2) and (3) in /twelf/ for /twelfɵs/.

The last pattern of various processes involve elision and substitution. The context found is the elision of /t/ as post-final (1) together with the change of / p/ by /b/ in / brombs/ for / prompts/. The first /p/ is also changed into /b/.

As for the effect of the nucleus quality on simplification patterns, no considerable impact was observed. The prominent variables were relevant to the word structure (simple or complex- with suffixation), the structure of the cluster (the way consonants are concatenated), and the size of the

cluster. To be more precise, the quality of the post-vocalic consonants showed no effect (Appendix 2)

Simplification in simple words having coda CC scores very low rating (0% -6%). Complex words of the same group with –ed suffix register significant ratings (33%, 61%). Although the two related tokens have the same cluster structure (obstruent + obstruent), the one with the affricate /ʧ/ followed by the plosive /t/, in comparison with the one with the fricative /f/ followed by the plosive /t/ scores higher percentage (61% vs. 33%).

As we move down, the rating of errors increases clearly. This points in the direction that the size of the cluster has an important role in simplification. The only simple word included in coda CCC tokens (tempt) reveals low rating as compared to the complex ones (28% vs. 94%). Concatenation of sonorant+ obstruent+ obstruent scores the highest rate (94%) in the sequence /-lfθ/. However, the sequence of /-lpt/ registers lower rate (72%). The combination of obstruent+ obstruent+ obstruent /-kst/ reads a significant percentage (72%). The sequence sonorant + obstruent + obstruent /-mpt/ scores lower rate (28%). The lowest percentage (6%) is given to the combination of sonorant + sonorant + obstruent /-lmz/.

The highest percentages of errors registered in coda CCCC were in the combination of obstruent+ obstruent+ obstruent+ obstruent /-ksts/, /-ksθs/, and sonorant + obstruent + obstruent + obstruent /- lfθs/, (100%) each. However, clustering of sonorant + obstruent + obstruent + obstruent / -mpts/ scores 89%, 83% in two different tokens, monosyllabic and disyllabic, respectively. This gives an evidence that the consonant quality has relative effect, whereas the phonological structure of the word (the number of syllables) has a considerable role (89% vs. 83%).

5.2.1.3 Consonant Substitution

Informants follow phonemic substitution as a strategy to adapt coda clustering. This is found very rarely in two-element and four-element coda,

and very commonly in three-element coda. Two cases are elicited in CC coda where the voiceless fricative /f/ is changed into the voiced fricative /v/ before /t/ in /lʌvd/ for "laughed", and the voiceless plosive /t/ into /d/ after /tʃ/ in /wɔʧd/ for "watched". CCCC coda registers one case only; the voiceless plosive /p/ into the voiced plosive /b/ before /t/ in/brɔmbs/ for "prompts", and /ətembɪt/ for" attempts". The cases of /f/ and /t/ are attributed to inaccuracy of pronunciation where the –ed suffix is pronounced /d/ before the voiceless / f/ and / tʃ/ after substituting the preceding consonant. As for the change of /p/ into /b/, it is read in terms of transfer effect since the /p/ phoneme is not used in (OA).

CCC coda shows two contexts of substitution in different tokens: the voiceless plosive /p/ into the voiced plosive /b/ before the voiceless plosive /t/ and the nasal /m/ in /helbɪd/ for "helped", /brɔmbit/ for" prompt", and /ətembit/ for"attempt", the voiceless plosive /t/ into the voiced plosive /d/ in /fiksɪd/ for" fixed". Once again, these examples of substitution are explained as cases of transfer and inaccuracy of pronunciation.

5.2.1.4 Insertion

As the least common simplification strategy(9.67%) , insertion is elicited in the production of some informants. The aim is to break coda clusters basically for economy of effort and ease of articulation. The informants insert the epenthetic vowel /ɪ/ less frequently in coda CC, and more frequently in coda CCC and CCCC. In two-element coda, it is inserted in one context, before the post-final /t/ in "watched". Final three-element coda reveals insertion in two contexts only, before the /t/ as post-final in "helped", and as post-final (2) in "fixed". Insertion in four-element coda is elicited in two contexts, before the post-final /t/ in " prompts" and "attempts", and before the /s/ as post-final (3) in "sixths", and " twelfths".

5.3 Generative Analysis of Simplification Patterns

To approach the contexts where the above mentioned adaptation patterns occur, and to specify the consonants which are affected, the

phonological rules adopted by Hyman (1975) (with modification) are applied. Three different processes will be analyzed, deletion, substitution, and insertion. The other simplification type is a combination of these.

5.3.1. Deletion

(1) [+ obstruent] → ∅/ [+ obstruent] _____ #

This rule shows that an obstruent is deleted in final position when it is preceded by another obstruent. The corpus of data shows that the plosive obstruents /t/ and /d/ are elided in syllable final position after the plosive obstruent /p/, the affricate obstruents /ʧ/ and /ʤ/, and the fricative obstruents / f/ and / s/.

(2) [+ obstruent] → ∅/ [+ obstruent] _____ (C)

The other context where deletion is elicited is when an obstruent follows another obstruent but not in final position. Segments which are dropped here are the plosive obstruent /t/ , and the fricative obstruents /ɵ/ and /s/. /t/ is deleted after /p/ and / s/. /ɵ/ is elided after / f/ and /s/, and /s/ is dropped after /k/.

(3) [+ obstruent] → ∅/ [+ sonorant] _____ #

The rule clearly states that an obstruent is dropped in final position after a sonorant. The fricative obstruent /z/ is the only one which is deleted after the nasal sonorant / m/.

5.3.2. Consonant Substitution

(1) [+ obstruent] → [+obstruent] / [+obstruent] _____ #

As stated above, simplification strategies involve the replacement of one element of the cluster by another. Formula (1) indicates that an obstruent is changed into another obstruent in final position when it follows another obstruent. Specifically, the data point out that the voiceless plosive obstruent / t/ is changed into the voiced plosive obstruent /d/ when it is preceded by /p/, / ʧ/, and/ s/.

(2) [+ obstruent] → [+obstruent] / [+sonorant] _____#

In other contexts, an obstruent is changed in final position into another obstruent after a sonorant. The two cases found were the replacement of the affricate / ʤ/ by the plosive / g/, and the fricative /ʒ/ after the nasal / n/.

(3) [+ obstruent] → [+obstruent] / _____ [+ obstruent]

Obstruents also change into other obstruents when they precede other obstruents. The only two cases elicited were the replacement of /p/ by /b/, and / f/ into /v/ before /t/ and / v/, respectively.

(4) [+ obstruent] → [+obstruent] / _____ [vowel]

Obstruents are also changed into other obstruents before vowels. The two cases worked out were the change of the affricate obstruent / ʧ/ into the fricative obstruent / ʃ/ before the closing diphthong / eɪ/, and the affricate obstruent / ʤ/ into the fricative obstruent / ʒ/ before the central vowel /ʌ/.

5.3.3. Insertion

The only epenthetic vowel elicited in the data was the weak vowel /ɪ/. It is inserted before obstruents and after obstruents or sonorants. The following formula clarifies this point.

(1) Ø → ɪ/ C _____ C

The contexts of insertion clarify that the epenthetic vowel /ɪ/ is inserted before the plosive obstruents /t/,/d/, as in /prɔmpɪts/, /əttembɪts/, /wɔʧɪd/, /fiksɪd/, and the fricative obstruents / s/, /ɵ/ as in / twelfɪs/ /,/sikɵɪs/, and /twelfɪɵ/. The preceding consonants are the plosive obstruents /p/, /b/, the affricate obstruent /ʧ/ , and the fricative obstruents /s/,/f/ and /ɵ/. In few contexts the preceding consonant was the nasal sonorant /m/ as in /prɔmɪt/. As mentioned earlier, other simplification types are combinations of these.

6- Conclusions

This paper investigates the strategies adopted by adult Omani female learners when they produce RP English coda clusters. The following conclusions were drawn from the analysis of the data:

(i) The length of the coda cluster is directly related to the accuracy rates. CC showed more accurate performance than CCC(80% vs. 45.6%), and the latter showed more accuracy than CCCC(45.6% vs. 5.6%).

(ii) The highest rating of errors in CC (61%) is elicited in the concatenation of affricate + plosive, and the lowest rating (6%) in the combination of nasal + affricate. The highest rating for CCC (94%) is registered by lateral +fricative + fricative, and the lowest one (6%) is in the clustering of lateral+ nasal + fricative. The top percentage of errors in CCCC (100%) is scored by the concatenations lateral + fricative + fricative + fricative, plosive + fricative+ plosive + fricative, and plosive + fricative + fricative + fricative. The lowest rating(83%)
is scored by the concatenation of nasal + plosive + plosive + fricative.

(iii) Regarding simplification strategies, deletion (40%) is favoured over substitution (16.12%) and insertion (9.67%). A combination of these strategies (35%) comes in the second rank.

(iv) In terms of generative phonology, the contexts where elision takes place are: (1) the plosive obstruents / t/ and /d/ in final position when they follow the plosive obstruent / p/, the affricate obstruents / ʧ/ and /ʤ/, and the fricative obstruents /f/ and /s/. (2) the plosive obstruent / p/, the fricative obstruents / ɵ/, /s/ before another consonant. /t/ is deleted before /s/, /ɵ/ before /s, and /s/ before /ɵ/. (3) the fricative obstruent /z/ is deleted syllable-finally after the nasal sonorant /m/.

(v) As far as substitution is concerned, the only consonants which are affected are the obstruents in different contexts: (1) the plosive obstruent /t/ is replaced in final position by the obstruent plosive /d/ after / p/, /ʧ/, and /s/. (2) the affricate obstruent /ʤ/ is changed in final position into the plosive

obsruent /g/, and into the fricative obstruent /ʒ/ after the nasal sonorant /n/. (3) the voiceless plosive obstruent /p/ into the voiced plosive obstruent /b/ before the voiceless plosive obstruent /t/, and the voiceless fricative obstruent /f/ into the voiced fricative obstruent /v/ before the voiceless plosive obstruent /t/. (4) the replacement of the affricate obstruent /ʧ/ into the fricative obstruent /ʃ/ before the closing diphthong /eɪ/, and the change of the affricate obstruent /ʤ/ into the fricative obstruent /ʒ/ before the central vowel /ʌ/.

(vi) Insertion strategy was the most disfavoured one in the simplification of coda clustering. The only epenthetic vowel elicited in the data was the weak vowel /ɪ/. Its frequency of use increases as we move longitudinally, viz, as the size of the cluster becomes bigger. From a generative point of view, it is inserted before obstruents and after obstruents or sonorants. The contexts routed are: before the plosive obstruents /t/ and /d/, after the plosive obstruents /p/ and /b/, the affricate obstruent /ʧ/, the fricative obstruents /s/, /f/, /ɵ/, and rarely after the nasal sonorant /m/.

(vii) There is a great impact for the markedness of the cluster on the use of the multiple strategies. That is, the more marked the cluster is the more multiple simplification patterns are found. CC coda only shows the combination of epenthesization and elision. CCC coda reveals epethesization and substitution, double substitution, and elision plus substitution.CCCC clusters demonstrate more patterns; epenthesization plus elision, epenthesization, substitution, and elision, double elision, and elision, double elision, plus substitution. It is worth noting here that double elision is the most common combinatory process.

(viii) The quality of the post-vocalic consonants within the cluster registers relative effect. A considerable impact is scored for

the structure of the cluster, viz, the way the elements of the cluster are concatenated(the way they are arranged).

(ix) The nucleus quality has no considerable effect on the process of simplification.

(x) Generally, the prominent variables on coda cluster adaptation are: the size of the cluster, the concatenation of consonants within the cluster , and word structure (complex tokens read higher rating as compared to the simple ones).

(xi) The major sporadic errors are: vowel quality change, vowel lengthening, and vowel shortening.

In conclusion, this study provides evidence for the effect of markedness on the production of coda clustering by adult Arab speakers of English. It highlights many facts about the main parameters that contribute to coda simplification. The work offers in-depth analysis of the strategies deployed by non-native speakers to adapt these clusters. The treatment of the data via phonological rules is of value to those interested in generative phonology.

7- Recommendations

The conclusions outlined so far give an evidence that coda clustering is an area of learning that necessitates much concern on the part of teachers and learners alike. The following proposed recommendations might be useful tips to minimize the oddities elicited in this practice of pronunciation:

1- The acquisition of interlanguage syllable structure should be given due concern by syllabus designers and teachers.
2- Similarities and differences in consonant clustering of L1 and L2 are to be outlined and explained as clear as possible.
3- Teaching English pronunciation has to be conducted by specialist teachers to approximate the performance of native speakers or minimally native-speakers like.

4- Sufficient exposure to English is quite necessary to improve ear training, and to acquaint learners with the phonological processes adopted by native speakers in everyday speech, particularly those relevant to consonant clustering simplification.
5- Extensive drilling is of immense value to facilitate the production of tricky coda clustering.
6- Presenting coda clustering has to be gradual where the start point is from the less difficult ones.
7- Advocating special techniques that better suit the different patterns of simplification in coda clustering.
8- Transcription practice can be channeled toward teaching difficult areas of pronunciation including coda clusters.
9- Making use of the facilities provided by the language lab to deal with the related oddities of pronunciation.

8- Suggestions for Future Studies

Many aspects of RP English coda clustering can be investigated from different perspectives. A comparison of the onset clustering and the relevant adaptation strategies to those of coda is a good area of research. Investigating the articulatory and acoustic properties of the elements that form coda clusters could provide another evidence of the markedness inherited in these concatenations. The role of source language transfer on the acquisition of target language coda clusters needs to be deeply investigated. Testing the usefulness of drilling on the production of coda clustering can be conducted via control group. The effect of the sonority of the nucleus on the coherence of the post-vocalic consonants can be studied acoustically to draw some important conclusions. A metrical study of the patterns of simplification may result in important findings of syllable structure adaptation and syllabification.

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(Appendix 1)

Please read the following list of words carefully, make a pause between one word and another.

1- college
2- student
3- tree
4- class
5- chair
6- slept
7- change
8- jump
9- laughed
10-watched
11-fixed
12-twelfth
13-helped
14-tempt
15-films
16-twelfths
17-texts
18-sixths
19-prompts
20-attempts

With many thanks for your kind cooperation

Appendix (2)*

Detailed Statistics of the Subjects' Errors

Token No.	Token	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	Total	Percen.
1	slept	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0%
2	change	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	1	6%
3	jump	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0%
4	laughed	-	-	-	-	-	x	-	x	x	-	-	x	-	-	-	-	x	x	6	33%
5	watched	-	-	-	x	-	x	x	x	x	x	x	x	-	x	-	-	x	x	11	61%
6	fixed	-	-	x	x	-	x	x	x	x	-	x	x	x	x	-	x	x	x	13	72%
7	twelfth	x	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	17	94%
8	helped	-	x	-	x	-	x	-	x	x	x	x	x	x	x	-	x	x	x	13	72%
9	tempt	-	-	-	-	-	x	x	x	-	-	x	-	-	x	-	-	-	-	5	28%
10	films	-	-	-		-	-	-	-	-	x	-	-	-	-	-	-	-	-	1	6%
11	twelfths	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	18	100%
12	texts	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	18	100%
13	sixths	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	18	100%
14	prompts	-	x	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	16	89%
15	attempts	-	-	x	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x	15	83%
Total		4	6	7	9	6	11	9	11	9	10	10	10	8	10	4	8	10	10	152	84%

- The cross sign refers to the error, while the blank sign refers to the correct pronunciation