JKAU/ Arts amd Humanities, **Vol. 21**, pp: 165 - 197 (2013 A.D. /1434 A.H)
DOI: 10.4197/Art. 21.5

Tongue Twisters in English: A Psycholinguistic Investigation of the Relationship between Language Production of Saudi ESL and Verbal Working Memory

Reem Omar Maghrabi

English - Arts and Humanities

Department, King Abdulaziz University, Jeddah, Saudi Arabia

Abstract. This study explores the production-working memory relationship through English tongue twisters used by learners of English as a second language. By the recalling of a sequence of phonologically listed formal and informal production of English tongue twisters, errors are interpreted as occurring at all the phonological and sub-phonological levels. The use of speech error analyses in the context of verbal working memory tasks (tongue twisters) could reveal important insight into people's performance.

The study aims at examining the existence of some phonological processes underlying segmental change such as addition, movement and substitution, and sequential change such as metathesis, assimilation and blending. The study is done on two types of tongue twisters, formal and informal. This could help reveal if verbal working memory performance could be triggered by mental processes or mental strategies. Forty speakers of English as a second language participate in this study at King Abdulaziz University/English department whose ages range from 19 to 22. Surprisingly enough, the results of the study have shown that formal production of English tongue twister orders elicits more errors than informal production of English tongue twister orders. Thus, there could be a correlation between consciousness and the frequency of phonological errors in speech.

Introduction

Speech errors are not analyzed because they are particularly interesting or important but because they are assumed to reveal how correct speech

is created. Moreover, errors provide little evidence about the planning processes involved in phonological encoding, revealing little about the temporal coordination of different processes and nothing about their function. Sound errors are utterances that deviate from the speaker's intention in the placement or identity of one or more phonological segments not corresponding to a complete morpheme of the target utterance, (Dell, 1986). Verbal working memory, the temporary maintenance and processing of verbal information, has long been viewed as an important component to word learning and language comprehension (Baddeley, 1986).The production-working memory relationship was explored in a recent review by Acheson and MacDonald (2009), who argued that the mechanism for maintaining serial order in verbal working memory may emerge from the language production architecture. This study explores the production- working memory relationship in relation to the production of formal and informal tongue twisters used by learners of English as a second language. By the recalling of a sequence of phonologically listed twisters, errors are interpreted as occurring at all the phonological and sub-phonological levels. The use of speech error analyses in the context of verbal working memory tasks (tongue twisters) could reveal important insight into people's performance. Moreover, the present study attempts to investigate the assumption that the serial ordering processes in verbal working memory is harder to achieve with informal production of tongue twisters. The study also examines if there is correlation between the production of tongue twisters and mental processes or strategies in relation to formal and informal production of tongue twisters.

I. Research questions

1. Could verbal working memory trigger speech errors in formal or informal production of tongue twisters by Saudi ESL?
2. How far could verbal working memory affect the accuracy in the formal and informal production of tongue twisters by Saudi ESL?

II. Significance of the Study

Psycholinguistics is an area of study which draws from linguistics and psychology and focuses upon the comprehension and production of

language. Although psychologists have long been interested in language, and the field of linguistics is an older science than psychology, scientists in the two fields have had little contact until the work of Noam Chomsky who had the effect of making psychologists acutely aware of their lack of knowledge about the structure of language, and of focusing attention exclusively upon the surface structure of language. As a result, psycholinguists have been attempting since the early 1960s to gain a better understanding of how the abstract rules are acquired and used to communicate meaningful messages from one person to another via the vocal-auditory medium. Therefore, the present study intends to sort out and verify types of speech errors based on mental processes and strategies. Moreover, it is hoped that this study could give insights on phonological language learning mechanisms through investigating the production of tongue twisters and the errors they may elicit.

IV. Objectives of the Study

1. To examine the correlation between the accuracy of production of tongue twisters and mental processes or strategies

2. To investigate if the errors of formal or informal speech are related to verbal working memory or speech apparatus

3. To examine if speech errors are structural with regard to syllable place

4. To examine if language interference could play a role in formal or informal production of tongue twisters

V. Review of Literature

"May I sew you to another sheet?". This is a substitute joking for the familiar question: May I show you to another seat? The mere exchange of two initial sibilants, one hushing and the other hissing, or in other words, a metathesis of the two sounds changes the meaning of two words (show to sew and seat to sheet) and creates a comic effect. In like fashion, wordplays or speech errors recorded from spoken languages often cling to the same principle. However, Arab linguists were interested in different types of speech errors. Many Arab linguists tried to

provide explanations for speech errors. They attributed many of them to assimilation or to substitution, closeness of point of articulation, anticipation, deletion or addition, or to analogy, or to over correctness (Johnstone ,1967). Tongue twisters have been employed in verbal working memory tasks before (*e.g*. Saito & Baddeley, 2004); however, researchers have not conducted the detailed error analysis provided here. This type of analysis is hoped to detect a long-term constraints on the production architecture that may be present in verbal working memory tasks. Bock's (1996) suggests that rather than viewing immediate recall in verbal working memory tasks as the emptying of a short-term store, the process may be better likened to one of producing a response by assembling highly activated linguistic elements, using the mechanisms of production to do so.

One challenge to language-independent, short-term storage comes from findings that show the influence of long-term, linguistic knowledge on putatively short-term recall. For example, words are easier to recall than nonwords (Hulme, Maughan, & Brown, 1991), and high frequency words are easier to recall than low frequency ones (Roodenrys, Hulme, Lethbridge, Hinton, & Nimmo, 2002). Similarly, concrete words are easier to recall than abstract words (Walker & Hulme, 1999). In addition to these lexical or semantic influences, long-term phonological knowledge affects working memory performance: Nonwords with higher phonotactic probabilities (*i.e*., having higher frequency phonemes in higher frequency combinations) are easier to recall than those with lower phonotactic probabilities.

Ellis (1980) examined the extent to which errors in serial recall obey those in normal speech production and demonstrated that errors are more likely to occur between speech elements which share more similar phonetic features; that errors between consonants are more common than errors between vowels; and that speech sounds are more likely to exchange with each other when they occur within the same syllable position. Treiman and Danis (1988) also examined the extent to which errors in serial recall abided by syllable structure in CVC, CCV and VCC syllables. Across three studies, errors occurred primarily between speech sounds within a list, and they tended to maintain the onset-rhyme distinction within the syllable structure. Thus, errors in verbal working

memory abide by what production researchers have called the syllable-position constraint (Dell, 1986).

Many researchers' views of the architecture underlying working memory have been shaped by the multi-component model (Baddeley, 1984) and (Baddeley and Hitch, 1974), in which an attentional control mechanism termed the central executive oversees the functioning of two systems responsible for the temporary maintenance of verbal (the phonological loop) and visual (the visuospatial sketchpad) information. The phonological loop component of the model is in turn phonological store whose contents decay with time unless refreshed via an articulatory control process. A number of key phenomena have been used to support the phonological loop concept. Among them, 1) effects of phonological similarity (Conrad, 1964), (Conrad and Hull, 1964) and (Wickelgren, 1965)), 2) word length (Baddeley, Thomson, & Buchanan, 1975), 3) irrelevant sound (Colle and Welsh, 1976) and (Salame and Baddeley, 1982), 4) and concurrent articulation (Baddeley *et al*., 1984, (Levy, 1971) and (Murray, 1968). On this view, while participants must engage in language production to complete the recall task, an independent storage mechanism is responsible for memory maintenance.

These studies suggest a system which, at the very least, uses linguistic representation that has been acquired over a lifetime to constrain performance on recall tasks. The idea that long-term, linguistic knowledge influences and should be incorporated into accounts of verbal working memory is not a new one. Researchers have used one of the classic findings in verbal working memory, the phonological similarity effect, as a means of testing the functional relationships between language and working memory (Nimmo & Roodenrys, 2004). Past research has demonstrated that memory for the order of items sharing phonological features is worse than items which do not share these features (Fallon *et al.*, 1999), (Gupta *et al.*, 2005) and (Nimmo and Roodenrys, 2004). These studies thus support claims for a role of long-term knowledge in immediate recall by demonstrating that the linguistic structure of the material (in this case, the syllabic structure), is central to how manipulations of phonological similarity affect performance.

Analysis of naturally occurring speech errors suggests that ordering effects due to phonological similarity are not mis-orderings of whole words but are more likely have a sublexical source, reflecting errors in phonemes across the same syllable position in different items (Dell, 1984). MacKay (2007) investigated sub-lexical errors in recall using "spoonerized" lures. Spoonerisms occur when an exchange of speech sounds between two words results in the production of real words (*e.g.*, "you've *h*issed my *my*stery lecture" instead of "you've missed my history lecture;" MacKay, 2007). Thus, when people do make speech errors with such stimuli, there is no ambiguity as to the unit over which the errors is occurring as the error results in the production of an unintended word. Using such lures in a serial recall task, MacKay. (2007) demonstrated that people produced many more errors when the two lures were adjacent to each other than when they were not. The study will apply the theories of both Shattuck-Hufnagel (1983) and Dell (1986) for a better understanding of how Saudi ESL attempt to produce formal and informal tongue twisters and how errors are elicited.

Shattuck-Hufnagel (1983) assumes that during phonological encoding an ordered set of sub-lexical units is associated to the ordered positions of

independently created syllable frames. Word forms are created out of segments and segment sequences. The model presupposes the generation of the syllable frames for a stretch of speech, probably a phrase, and the retrieval of the corresponding ordered set of sub-lexical units. It describes the association of the segments to the positions of the syllable frames. A scan-copier is proposed, which selects the correct insert for each slot from the set of retrieved units and copies the units into the slots. This is done sequentially, proceeding slot-by-slot and unit-by-unit from the beginning of the utterance to its end. As soon as a given unit has been inserted into a slot, it is marked by a check-off monitor as "used". A second monitor inspects the developing representation and deletes or edits sequences that are likely to be the result of errors. Second errors arise when slots are filled by wrong units, and the minority fails to notice this. In sound exchange, is a unit is inserted into a slot too early, and the segment that should have taken that slot is inserted into the slot that was meant to be filled by the anticipated segment. Anticipations and preservations are more complex errors in that they involve not only wrong placements of segments, but also failures of the check-off routine.

In anticipation, a unit is inserted into a slot preceding its target slot, is not checked-off, and is later inserted again into another slot. The model predicts that most sound errors are segmental errors. In order to create a well-formed utterance, the speaker must integrate information about word forms and syntactic information, as they jointly determine the stress pattern and rhythm of the utterance.

Dell's model describes the retrieval of sub-lexical units within a spreading activation framework. The linguistic units participating in phonological encoding are morphemes, syllables, rhymes, segments clusters and features. The nodes representing these units are connected to form a hierarchical structure in which each unit is linked to a constituent. When a particular unit is activated, it spreads some of its activation to all units to which it is connected. In addition, the first syllable node initially receives an extra boost of activation. Sound misorderings arise when segments or clusters are the most highly activated units of their categories at wrong moment and are therefore associated to incorrect positions. Errors are usually phonetically well formed because they arise during the creation of phonological representation and thus before the phonetic form of the utterance is specified. It is important to say that most of the studies examined the perception and repletion skills of subjects in limited environments of tongue twisters. This study is done on formal and informal tongue twisters for two reasons. In formal speech where the subjects are asked to read from a list, the reading of sentences involves the skills of both speech perception and production. This task would probably elicit better performance in pronunciation

than informal tongue twisters which could be affected by physiological or psychological factors.

Additional evidence that advance planning in sentence production comes from the experiments by Ferreira (1999), who studied sentence initiation times and pauses when subjects reproduced sentences of varying length and syntactic complexity from memory. She found that initiation for sentences of tongue twisters depended on the number of phonological words in the subject of the sentence given and on the syntactic

complexity of the structure of that sentence. In other words, the production of sentences is relevant to whether the encoded fragment is a syntactic unit or a phonological unit.

According to Cambell (1998), sound changes are classified as regular an sporadic. Regular changes are systematic and affect the system of language whereas sporadic changes affect only one or few words. Generally, regular changes occur frequently and take place whenever the same phonetic environments are encountered. Linguists give more attention to regular sound changes are they are considered to be important to the foundations of theories and methodologies of language change.

Sound changes are classified according to phonetically conditioned bases. Thus sound changes are either conditioned or unconditioned changes. An unconditioned change is one which applies to every single occurrence of a particular segment in the language , regardless of its position in a word or its neighboring segments. In contrast, a conditioned change is one which applies to a particular segment only in certain phonetic circumstances.

On analytical bases, linguist recognize two different levels of phonological analysis: the phonetic level and the phonemic level (Roach, 1991). Accordingly, the distinction is formed between phonemic and non-phonemic changes. Non-phonemic changes are not counted to be as important as phonemic ones. Some linguists called a non-phonemic change allophonic change, as it does not change the number of phonemes in the language. Others called it phonological shift (Roach, 19931).

VI. Methodology

In the present study, two experiments are held to examine how far mental processes and strategies could affect speech production. Forty female Saudi ESL participate in this study at King Abdulaziz University / English department. These informants are divided into two groups of

twenty. The first group are asked to read ten formal tongue twisters while the second group are asked to repeat one tongue twister ten times by memory. The informants' ages ranges from 19 to 22. All had corrected-to-normal English proficiency.

The study uses two phonological stimulus. The formal stimuli are ten tongue twisters based on the phonological sequence put by Wilshire (1999:110) and made specifically for measurements of read tongue twisters. The lists of tongue twisters are put in a way that would be likely to induce speech errors. Twenty subjects who are selected randomly are asked to read each tongue twister silently and then another time in a rapid, paced manner. Then, they are tape-recorded for later analysis. The researcher intends to figure out if language awareness could play a role in minimizing the number of phonological errors. Recordings are transcribed using the IPA symbols of transcription to be compared to the target list. The formal stimuli are presented on a sheet of paper for twenty of the informants in black font on a white background as follows:

TT1: she sees seeds on the shelves
TT2: Teeb deer in deep tear
TT3: Beam peek a pier a beak
TT4: A venial fist of a female fest
TT5: Jell in cheer and chill in jeer
TT6: The key is geared by a geisha not feared
TT7: Shore leper with a lore shipper
TT8: Sheaf sawed a chair on a seed showed there
TT9: The file of vote and the vile that fought
TT10: The tie of a dope that sighed from a tope

For the informal stimuli, the other twenty subjects, who are also selected randomly are given one English tongue twister and they are asked to repeat it ten times. Basically, this is done as to examine the working memory of memorized utterances unlike the formal list which is produced once to examine the working memory of read utterances. This tongue twister is comprised of multiple alternations of very similar phonological sequences. It is not more than seven words long. This was in order to avoid difficulties in memorizing the sentence. The phonological structure of the tongue twister is selected from tongue

twisters listed by Cutler (1982:22) in such a way as to achieve some variation in type (e.g consonants vs. vowels) and place of error. The tongue twister is as follows:

A big black bug bit a big black dog on a big black nose

The required tempo was further indicated while uttering each sentence. For example, if the speaker stops or slows down, she is told to continue or speed up. If the speaker had difficulties memorizing or repeating the tongue twisters, the investigator repeats them twice or more until the subject feels comfortable with it. Also, clear hesitation events or repetitions or sound interjections (such as "uh") are reported. It is worth noting that the total number of produced utterances of both formal and informal tongue twisters are the same although the tongue twisters' production differs in number of repetitions and number of utterances repeated. The main technique used in the analysis of data is the frequency count technique. The number of errors produced is counted and given percentages that indicate clearly which experiment (formal or informal production of tongue twisters) elicits more errors.

This study will trace the existence of the five types of segmental change: segment addition, segment loss, segment movement, and segment substitution. Segment addition is called "epenthesis", which is a process that involves the insertion of a consonant or vowel into a particular environment. Segment loss involves the deletion of a word-final vowel, which is a phonologiocal process called (apocope), or a word-internal vowel, which is called (syncope). Segment movement may be identified as a change in the relative positioning of sounds. In other words, sounds may change their places. Substitution occurs when a sound may substitute another sound segment in a particular phonetic environment (Bock,1996).

VII. Results

This analysis is based on comparing the formal spoken responses of the list to the informal spoken responses of English Tongue twisters. To do this, the total list of errors in formal and informal tongue twisters are presented as a whole, then these errors are categorized in accordance to segmental and sequential phonological changes. Almost all of the informants could not succeed to complete the list, and a lot of hesitations

occurred. However, the informal production of tongue twister scored higher levels of accuracy and speed then formal production of tongue twisters. From the statistical account illustrated, mostly, participants misrecalled the words initially in both formal and informal production of tongue twisters.

Five main segmental sound errors are coded: deletion, addition, movement, substitution and blending. Deletion occurred only in formal tongue twisters. It is noticed that there were two kinds of substitution; exchanges between two list

Surprisingly, formal production of tongue twisters triggered more segmental sound errors (42.25%) than informal production of tongue twisters (32.5%). Examining segmental sound errors, it is found that substitution occurs more in formal tongue twisters (26.75%) than in informal tongue twisters (19.75%). This may drive us to assume that being aware of speech production may trigger higher occurrence of sound change and in particular segmental substitution. However, segmental sound movement shows to be a little higher in informal production of tongue twisters (12.75%) than formal production of tongue twisters (11.5%). Moreover, segment loss appears only in formal tongue twisters (4%), while it is absent in both formal and informal tongue twisters.

Blending occurred more in informal tongue twisters (6.75%) than in formal tongue twisters (1.25%). It is noticed that the occurrence of segment addition is found only in formal tongue twisters. Segment movement occurs a little higher in informal tongue twisters (12.75%) where subjects were not much aware of the flow of sounds but the flow of production, whereas in formal reading of tongue twisters the opposite happened (11.5%). It is obvious that substitution is the most frequent sound change in formal tongue twisters. Interference of Arabic was clear in that it drove the subjects to use sounds that could be closer to sounds found in Arabic in production of tongue twisters. Similar to substitution, assimilation occurs more frequently in formal tongue twisters (11%) than in informal tongue twisters (4.75.%). Metathesis also happens more in formal tongue twisters (2.25%) than in forma tongue twisters (1.25%). On the other hand blending occurs more in informal tongue twisters

(6.75%) than in formal tongue twisters (1.25%). Instead on blending, subjects tend to delete phonemes in formal tongue twisters.

Error Analysis

Table 1 below illustrates the number of errors made by the 20 subjects who were asked to read the ten tongue twisters by Wilshire (1999:110) once. It is noticed that the tenth tongue twister has the most frequent number of errors (22-11%) followed by the sixth tongue twister (21-10.5%). On the other hand the seventh tongue twister has the least frequent number of error (12-6%) followed by the second one (13-6.5%).

Table: Error Analysis of formal Tongue Twisters

No. of utterance	Target	error	Total no. of errors
1	/ʃi:/ /si:z/ /si:d/ /ʃelvz/	/si:/ /ʃi:z/ /si:t/ /selvz/	4 6 2 4 - 16= 8%
2	/teeb/ /deer/ /deep/ /ti:r/	/ti:p/ /ti:r/ /ti:p/ /di:r/	3 2 5 3 - 13= 6.5 %
3	/bi:m/ /peek/ /pi:r/ /bi:k/	/pi:m/ /bi:k/ /bi:r/ /bi:g/	5 4 2 8 - 19= 9.5%
4	/vi:nial/ /fest/ /fi:meil/ /fest/	/fi:nial/ /vest/ /fi:mial/ /vest/	3 7 4 6 _ 20= 10%
5	/ʒel/ /tʃi:r/ /tʃel/ /ʒi:r/	/tel/ /tʃi:/ /ʒel/ /ʒi:/	5 3 3 4 15= 7.5%
6	/ki:/	/gi:/	1

	/gi:rd/ /gi:ʃa/ /fi:rd/	/gi:d/ /ki:ʃa/ /gi:rd/	9 3 8 21= 10.5%
7	/ʃD:r/ /leper/ /lD:r/ /ʃepər/	/lD:r/ /ʃepər/ /ʃD:r/ /lepər/	2 3 6 1 12= 6%
8	/ʃi:f/ /səʊd/ /si:d/ /ʃəʊd/	/si:/ /ʃəʊd/ /ti:f/ /təʊd/	4 4 7 2 17=8.5%
9	/fail/ /vəʊt/ /vail/ /fəʊt/	/faiv/ /fəʊp/ /vaip/ /vəʊp/	4 4 5 1 14= 7 %
10	/tai/ /dəʊp/ /said/ /təʊp/	/dai/ /dəʊ/ /dait/ /dəʊp/	5 9 6 2 22= 11%
169 84.5 %			

Table 2 below illustrates the number of errors made by the 20 subjects who were asked to repeat the tongue twister by Cutler (1982:22) ten times after being introduced to it. The word (bug) elicited the most frequent number of errors (50-25%), followed by the word (big) (30-15%). The word (dog) elicited the least number of errors (2-1%) followed by the word (bit) (12-5.5%).

Table: Error Analysis of informal Tongue Twisters

Target	error	1	2	3	4	5	6	7	8	9	10	Total no. of errors
/big/	/bit/	2	1	3	1	2	1	1	1	0	0	12
	/pig/	2	0	0	0	0	0	0	0	0	0	2
	/mig/	1	0	0	1	0	0	0	0	0	0	2
	/nig/	1	0	1	3	0	0	0	0	0	0	5
	/but/	0	0	2	0	1	0	0	0	0	0	3
	/g^b/	0	0	1	2	1	0	0	0	0	0	4
	/gib/	0	0	1	0	1	0	0	0	0	0	_2
	/bid/	0	0	0	0	1	0	0	0	0	0	30= 15%
/black/	/blæt/	4	0	0	0	0	0	0	0	0	0	4
	/plæt/	1	0	1	2	1	0	0	0	0	0	5
	/blæd/	0	0	1	0	2	0	0	0	0	0	4
	/blæg/	0	0	0	1	2	0	0	0	0	0	3
	/blæk/	0	1	2	1	2	0	0	0	0	0	6
	/blig/	0	0	0	0	1	0	0	0	0	0	1_
												23= 11.5 %
/b^g/	/dDg/	1	3	3	3	3	0	0	0	0	0	13
	/d^g /	1	0	3	3	4	0	0	0	0	0	11
	/bDg/	1	0	0	0	0	0	0	0	0	0	1
	/b^t/	1	0	0	1	4	0	0	0	0	0	6
	/m^g/	0	1	3	2	1	0	0	0	0	0	7
	/n^g/	0	1	0	0	0	0	0	0	0	0	1
	/t^g/	0	1	3	1	3	0	0	0	0	0	8
	/d^k/	0	1	0	0	0	0	0	0	0	0	1
	/b^k/	0	0	1	0	0	0	0	0	0	0	1
	/g^b /	0	0	0	1	0	0	0	0	0	0	_1
												50= 25%
/bit/	/bid/	1	1	2	2	1	0	0	0	0	0	7
	/tib/	1	1	0	0	0	0	1	0	0	1	4
												12= 5.5 %
/dDg/	/tDg/	1	1	0	0	0	0	0	0	0	0	2= 1%
/nəʊz/	/məʊz/	1	4	1	2	1	0	0	0	0	0	9
	/bəʊz/	1	0	0	0	1	0	0	0	0	0	2
	/dəʊz/	0	1	0	1	0	0	0	0	0	0	2
	/kəʊz/	0	2	0	1	1	0	0	0	0	0	4
	/gəʊz/	0	1	0	0	3	0	0	0	0	0	4
	/pəʊz/	1	1	0	1	3	0	0	0	0	0	6
	/pləʊz/	0	0	1	0	2	0	0	0	0	0	3
	/kləʊz/	0	0	0	1	1	0	0	0	0	0	2
	/zəʊn/	1	0	0	0	1	0	0	0	0	0	2
	/gləʊz/	1	0	0	0	1	0	0	0	0	0	_2
												36= 18%
152 76%												

Table 3 below illustrates that formal tongue twisters produced more errors (80%) than informal tongue twisters (38%).

Table: A comparison between the total occurrences of errors in formal and informal tongue twisters

Total no. of utterances	Total no. of errors	%	Total no. of errors in formal tongue twisters	%	Total no. of errors in formal tongue twisters	%
400	321	80.25 %	169	42.25%	152	38%

Segmental Change

As we break down the stream of speech into its component parts, we come up with sound segments. The four types of sound change are traced though the spontaneous and formal speech to figure the prominent type.

1. Segment Addition

By analyzing the data of both formal and informal tongue twisters, it is found that segment addition never occurs.

2. Segment Loss

This process occurs only in formal production of tongue twisters. Deletions occur (8%). It is noticed, also, that deletion happens on final segments.

The following table shows the number of segment loss made by the 20 subject as they read the formal tongue twisters.

Table: Segment loss in Formal Tongue Twister Orders

Target TT	Error	Type of error	No. of errors
/tʃi:r/	/tʃi:/	/r/	7
/ʒi:r/	/ʒi:/	/r/	3
/gi:rd/	/gi:d/	/r/	2
/ʃi:f/	/ʃi:/	/f/	2
/dəʊp/	/dəʊ/	/p/	2
Total			16 %8

3. Segment Movement

Segment movement is identified as a change in the relative positioning of sounds. The following table shows the number of movements produced by the 20 subjects as they read the 10 tongue twisters.

Table: Segment Movement in formal Tongue Twister Orders

Target Non-TT	Error	Type of error	No. of errors
/bi:m/ /bi:k/	/mi:b/ /ki:b/	b-m +bilabial b-k +plosive	7 4
/fist/	/fits/	s-t +alveolar	3
/tʃi:r/	/ri:tʃ/	tʃ-r +post-alveolar	7
/ʃD:r/ /lD:r/	/rD:ʃ/ /rD:l/	ʃ-r +post-alveolar l-r +lateral	5 6
/si:d/	/di:s/	s –d +alveolar	7
/fail/ /fəʊt/	/laif/ /dəʊf/	f-l + f-d	4 3
Total			46 %23

Table 6 below shows the number of segment movement made by the 20 subjects as they produce the tongue twister 10 times.

Table: Segment Movement in informal Tongue Twister Orders

Target	Error	Type	%
/big/	/gib/	g-b +plosive	15
/blæk/	/bælk/	l-æ	17
/b^g/	/g^b/	b-g +plosive	5
/bit/	/tib/	b-t +plosive	6
/nəʊz/	/zəʊn/	n-z +alveolar	8
			51 25.5%

It is noticed that share either the same place or manner of articulation. For example reordering happens between /g/-/b/, /l/- /æ/, /b/-/g/, /b/-/t/,/n/-/z/ in the following words successfully; /big/-gub/, /blæk/-bælk/, /b^g/- /g^b/, /bit/-/tib/, /nəʊz/- /zəʊn/.

Table: A comparison between the total no. of occurrences and segment movement in formal and informal tongue twisters

Total no. of utterances	Total no. of errors	%	Total no. of errors in formal tongue twisters	%	Total no. of errors in informal tongue twisters	%
400	97	24.25%	46	11.5%	51	12.75 %

The above table shows that sound movement occurs more in informal tongue twisters (11.5%) than in formal tongue twisters (12.75%).

4. Segment Substitution

In this analysis, errors were commensurate with predictions about tongue twisters in speech production. It is found that formal tongue twisters produce more errors (26.75%) than informal tongue twisters (19.75%). The majority of substitution errors at the item level were repetitions of the same items and participants produced many more errors when the two phonemes were adjacent to each other than when they were not. Within the list, most repetitions tended to be perseveratory. Thus, people had a tendency to repeat items they had already said when they made a repetition error, e.g, exchange between /gi:rd/ and fi:rd/ in formal tongue twisters. In addition, spoonerisms occur when an exchange of speech sounds between two words results in the production of real words. It is also noticed that errors are more likely to occur between speech elements which share more similar phonetic features. Errors between consonants are more common than errors between vowels; and that speech sounds are more likely to exchange with each other when they occur within the same syllable position. The following table displays the number of substitution in the list of formal and informal tongue twisters. The following table 8 shows the number of substitutions in formal tongue twisters.

Table: Substation in formal Tongue Twister Orders

Target TT	Error	Type of error	No. of errors %
/ʃi:/	/si: /	ʃ-s +fricative	10
/si:z/	/ʃi:z/	s-ʃ +fricative	8
/si:dz/	/ʃi:dz/	s-ʃ +fricative	2
/ʃelvz/	/selvz/	ʃ-s +fricative	3
/ti:b/	/ti:p/	b-p +plosive +bilabial	5
/di:r/	/ti:r/	d-t +plosive +alveolar	3
/di:p/	/ti:p/	d-t +plosive +alveolar	2
/ti:r/	/di:r/	t-d +plosive +alveolar	2
/bi:m/	/pi:m/	b-p +plosive +bilabial	6
/pi:k/	/bi:k/	p-b +plosive +bilabial	4
/pi:r/	/bi:r/	p-b +plosive +bilabial	3
/bi:k/	/bi:g/	k-g +plosive +velar	2
/vi:nijal/	/fi:njal/	v-f +fricative +labiodental	4
/fest/	/vest/	f-v +fricative +labiodental	2
/fi:meil/	/fi:mial/		3
/fest/	/vest/	ei-ai +dephthong	2
/ʃi:r/	/ʃi:l/	r-l +lateral	4
/ki:/	/gi:/	k-g +plosive +velar	4
/gi:ʃa/	/ki:ʃa/	g-k +plosive +velar	6
/fi:rd/	/gi:rd/	f-g	2
			2

/ʃD:r/ /leper/ /lD:r/ /ʃeper/	/ lD:r/ /ʃeper/ /ʃD:r/ /leper/	ʃ-l l-ʃ l-ʃ ʃ-l	3 2 3 2
/səʊd/ /si:d/ /ʃəʊd/	/ʃəʊd/ /ti:f/ /təud/	s-ʃ +fricative s-t +alveolar, d-f (item) ʃ-t	5 2 2
/fail/ /vəʊt/ /vail/ /fəʊt/	/faiv/ /f∂up/ /vaip/ /v∂up/	l-v v-f +fricative +labiodental, t-p +plosive (item) l-p f-v +frictaive , t-p +plosive (item)	2 2 2 3
/tai/ /said/ /təʊp/	/dai/ /dait/ /dəʊp/	t-d +plosive +alveolar s-d +alveolar t-d +plosive +alveolar	3 1 1
107 53.5%			

The following table 9 shows the number of substitutions in informal tongue twisters.

Table: substitution in informal tongue twister orders

Target	error	Type	%
/big/	/bit/ /pig/ /mig/ /nig/ /bid/	m-b +bilabial p-b +plosive +bilabial b-m +bilabial b-n g-d +plosive	21
/blæk/	/blæt/ /plæt/ /blæd/ /blæg/	k-t +plosive b-p +plosive +bilabial k-d +plosive k-g +plosive +velar	16
/b^g/	/dDg/ /b^t/ /m^g/ /n^g/	d-g +plosive g-t +plosive b-m +bilabial b-n	7

	/t^g/ /p^g/	b-t +plosive p-b +plosive +bilabial	
/bit/	/bid/	t-d +plosive +alveolar	16
/dDg/	/tDg/	d-t +plosive +alveolar	2
/nəʊz/	/ məʊz / / bəʊz / / dəʊz / / kəʊz / / gəʊz / / pəʊz / / təʊz / /pləʊz/ /kləʊz/	n-m +nasal n-b n-d +alveolar n-k n-g n-p n-t +alveolar n-pl n-kl	17
79 39.5%			

The following table shows a comparison between substitution in formal and informal tongue twisters in relation to total number of utterances.

Table : A comparison between the total no. of occurrences and segment substitution in formal and informal tongue twisters

Total no. of utterances	Total no. of errors	%	Total no. of errors in formal tongue twisters	%	Total no. of errors in informal tongue twisters	%
400	186	46.5 %	107	26.75 %	79	19.75 %

In all the figures, it is noticed that the participants always substitute onsets with onsets and vowels with vowels, and codas with codas. In addition, spoonerism occurs as an attempt to overcome mispronunciation of tongue twisters, *e.g*, in formal tongue twisters we find; /si:t/ for /si:d/, /di:r/ for /ti:r/, /bi:r/ for pi:r/, /tel/ for /ʒel/, /faiv/ for /fail/. In informal tongue twisters, we find; /pig/ for /big/, /but/ for /big/dDg/ for /b^g/, /m^g/ for /b^g/, /d^k/ for /b^g/, and /zəʊn/ for /nəʊz/. Participants extend spoonerism as they code mix words from their first language which is Arabic only in informal tongue twisters as they substitute missing tongue twisters with Arabic words, *e.g*, /məʊz/ which means 'banana' for /nəʊz/. In addition, It is noticed that substitution happens between sounds that share phonological features. *E.g*. /bi:m/, /pi:m/, /ti:b/, /ti:p/ as /b-p/ are both bilabials and plosives, /ʃi:/, /si:/ , /ʃi:z/, /si:z/ as /ʃ-s/ are both fricatives and, fist/, /vest/, /vi:nial/, /fi:nial/ as both /f-v/

are fricatives and labiodentals, /gi:rd/, /ki:rd/, /gi:ʃa/,/ki:ʃa/ as /k-g/ are both plosives and velars. Also, subjects mispronounce almost all the tongue twisters in the list although they are asked to recall them after reading (formal) or hearing (informal) them immediately.

5. Blending

The following table shows the number of blendings in formal tongue twisters produced by the 20 subjects.

Table : Blending in formal production of tongue twisters

Target	Error	Explanation	%
/vəʊt/	/fəʊp/	/ fəʊt /+/dəʊp/= / fəʊp /	2
/fəʊt/	/vəʊp/	/ vəʊp /+/dəʊp/= / vəʊp /	3
5 1.25%			

the following table shows the number of blendings in informal tongue twisters produced by the 20 subjects.

Table: Blending in informal production of tongue twisters

Target	Error	Explanation	%
/big/	/blig/	/big/+/blæk/= /blig/	17
/blæk/	/bləʊz/	/blæk/+/nəʊz/= /bləʊz/	10
27 6.75%			

The following table compares between the number of blendings in formal and informal tongue twisters produced by the 20 subjects.

Table: A comparison between sequential blending in formal and informal tongue twisters

Total no. of errors	%	Total no. of errors in formal TT	%	Total no. of errors in informal TT	%
32	8%	5	1.25%	27	6.75 %

Surprisingly enough, blending occurs more in informal tongue twisters (6.75%) than in formal tongue twisters (1.25%).

Table (14): percentages of segmental sound changes between spontaneous and formal speech

Segment change process	No. of occurrence in formal speech	%	No. of occurrence in informal speech	%
Segment addition	0	0 %	0	0 %
Segment loss	16	4 %	0	0 %
Segment movement	46	1.5 %	1	2.75 %
Segment substitution	107	26.75%	79	19.75%
Blending	5	1.25%	27	6.75%
Total no. of errors	174	43.5%	157	39.25%

Contrary to expectations, formal production of tongue twisters (43.5%) triggered more segmental sound errors than informal production of tongue twisters (39.25%). In addition substitution occurs more in formal tongue twisters (26.75%) than in informal tongue twisters (19.75%) and it is the most frequent segmental change. This may drive us to assume that being aware of speech production may trigger higher occurrence of sound change and in particular segmental substitution. However, segmental sound movement shows to be a little higher in informal production of tongue twisters (12.75%) than formal production of tongue twisters (11.5%). Moreover, segment loss appears only in formal tongue twisters (4%), while it is absent in both formal and informal tongue twisters. S less in formal tongue twisters (1.25%) than in informal tongue twisters (6.75%).

VIII. Discussion

A number of sound errors have been analyzed. Two general questions have guided most of these analyses. First, how the subjects' representations of formal and informal tongue twisters can be characterized. Second, which form of tongue twisters produced more sound errors. Participants misrecalled the words initillay in both formal and informal production of tongue twisters which reinforces what Allport (1984) and Baddeley *et al*., (1975) have said, that people who have word on the tip of their tongue very often have intuitions about the sentence's

beginning or end. An important property of sound errors is that they are almost always phonetically well formed, and as (Fromkin, 1973) stated, errors usually accommodated to their new environment by assimilation to adjacent regressive or progressive sounds. However, not all sounds are well formed. The occurrence of ill-formed sounds errors can trigger sound deletion which occurred only during the production of formal tongue twisters when sound have failed to apply, or when they arise during later planning processes. The most frequent error units are single segments, which could be sequences of two adjacent segments. In addition, the representations of word forms capture not only which segments, but also which phonological features the words include. There are errors that are best described as movements of individual features like assimilation of phonemic pairs e. /p/,/b/, /f/,/v/, and errors that show a strong tendency to share more features than expected on the basis of anticipation or preservation segments, eg, /n/, /z/. in most sound errors, the displaced and displacing segments share at least one feature. Also, the featured shared most frequently by interacting consonants are manner and place and the general tendency of errors involve similar segments which are consonantal mostly. However, errors always belong to the same syllable. There are no errors in which the error unit includes the last segment of one syllable and the first syllable of the next syllable even in complex units that consist more than one syllables. The analysis has shown occurrences of initial consonant clusters substituting the one phonememe /n/ only in informal production of tongue twisters, e.g, /pləʊz/-/kləʊz/ for /nəʊz/. Also, the data analysis illustrate evidence for the representation of syllabic structure that is shown in positional constraint on sound exchange in the majority of sound errors in all forms of tongue twisters. In other words, initial segments in origin syllable replace initial segments in the target syllable and the final replaces the final., e.g. /biːm-piːm/, /ʃiː-siː/. This tendency could be explained by reference to syllable frames (MacKay, 1970). Ordering errors were more reflective of phoneme rather than item substitutions. Also, it was clear that the most occurring type of phoneme substitution was an onset substitution as predicted by Walker and Hulme (1999). The analysis has shown the applicability of the models of both Shattuck-Hufnagel (1968) and Dell (1986) in sound error description. According to Shattuck-Hufnagel (1968), sound errors arise when slots are filled by wrong units, and the monitor fails to notice this, and a frame unit is created with

segment sized position. This is proven throughout the data, as all errors are confined to the same frame of original items being produced either in formal or informal tongue twisters. On the other hand, Dell (1986)'s theory describes the activation of segments' framework. When a particular unit is activated, it spreads some of its activation to all units to which it is connected, and these activated unites feed part of their activation back to the unit that activated them in the first place. Sound errors arise when segments are activated at the wrong moment and are therefore associated to incorrect positions. The analysis has shown that the activation of sounds occurs initially and spreads to the entire list of words in both formal and informal production of tongue twisters. However, it proved to occur more in formal tongue twisters than informal tongue twisters which was contradictory to the researcher's expectations. A thing that resulted in higher levels of sound errors in formal representations at all types of sound change. In formal and informal production of tongue twisters, subjects tend to minimize memory load by relying on local information rather than looking far ahead. For example when assigning sounds to a particular word, they consider the sound pattern of preceding words, the word under consideration and the following word but not more ahead than that.The results of the study supports Shattuck-Hufnagel's (1983) view that phonological segments are important planning units, and frames are built to whose positions the segments are associated. Formal and informal representations of tongue twister could reveal what the products of the speaker's planning activities are and could also permit certain inferences about the corresponding representations and planning processes. Sound errors are almost phonetically well-formed. Misplaced sounds are usually phonetically accommodated to their new environment, or the environment is accommodated to the intruding sound following the rules of the language in question. The phonetic well-formedness of sound errors shows that they arise before the phonetic form of the utterance is created and before illegal sound sequences are edited out or changed. As Shattuck-Hufnagel's (1983) has stated, errors tend to involve similar segments, vowels interact with vowels and consonants interact with consonants. In the majority of sound error in formal and informal tongue twisters, segmental slips are structural with regard to syllable place, that is initial segments in the origin syllable replace initial segments in the target syllable and final replace final. This proves that the segments' positions are specified independently of the segments themselves as Shattuck-

Hufnagel's (1983) has declared. As Dell (1986) has predicted, The segments of a word onset have a higher error rate and activation than segments of other word positions. Another observation that supports the assumption of Shattuck-Hufnagel's (1983) of syllable frames is that sound errors are systematically affected by the stress pattern of the words in which they appear. It is found that in formal and informal tongue twisters, a segment prefers to move from its target syllable to a syllable with the same stress value rather than to a syllable with a different stress value. In other words, a segment from a stressed syllable tends to move to anew stressed syllable and a segment from an unstressed syllable tends to move to anew unstressed syllable. Errors provide little evidence about the planning processes involved in phonological working memory. Thus, evidence gained from speech errors is far more limited than has often been assumed. It has been found that adherence to the syllable-position constraint and the preponderance of syllable-onset relative to consonant and coda errors is evidence that long-term constraints on language production are evident in verbal working memory tasks. In addition, as Ferreira (1999) has declared, it is found that the syntactic structure of informal tongue twisters has helped in eliciting less errors than the phonological structure of formal tongue twisters. This is evidenced by the occurrence of spoonerism in informal tongue twisters. The present results point to a critical contribution of both phonological encoding and articulation in producing the serial ordering errors observed under conditions of phonological similarity, as assumed by (Gupta et al., 2005), Fromkin, 1971, and (Wilshire, 1999). In informal tongue twisters, the skills of both speech perception and production elicit better performance in pronunciation than formal tongue twisters which supports the emperist's views of communicative language acquisition. The role of language transfer is important in the production of tongue twisters. Nakuma (1998) claims that the learner's misconception of the relationship between L1 and L2 forms will persist until the learner no longer perceives the forms as being identical. Interference of Arabic is clear in that it drives the subjects to use sounds that could be closer to sounds found in Arabic in production of tongue twisters. And this repeats what Firn (1983) states. The interesting thing is that langue transfer occurs by spoonerism in both formal and informal tongue twisters. As Selinker (1979) notes, under certain circumstances like excitement, second language learners tend to decode their encoded mother tongue

language which was clear in both formal and informal tongue twisters. There could be a one to one relation between consciousness and accuracy of speech production. The more conscious the speaker is, the more errors would arise. On the other hand, the less conscious the speaker is, the less errors would arise. Blends are a rather more complex forms of error in that they involve the fusion of two lexical items that are, so to speak, in competition for the same slot in the utterance. Sentence blends have long been recognized as a distinct phenomenon in speech production. From Cutler (1982) early description of speech errors to Fromkin's (1971) more recent survey, blends have played a prominent role in discussions of linguistic lapses. However, the question asked is : "Do word blends show that two or more distinct plans for speech have been created at the same time? And if so, what kind of memory can simultaneously contain two plans so that they may combine". Fromkin (1971) declared that a blend occurs when a speaker has in mind simultaneously two ways of expressing the same message. Instead of one or the other expression being used, they are combined in some way to give a new, synthesized utterance that does not match exactly either of the intended expressions. In the examples; /big/-/blæck/, /blæk/+/nəʊz/. The best way to explain what happened was to show how two different words were blended to form a third combination of the two. For example,/big/+/blæk/=/blig/, /blæk/+/nəʊz/= /bləʊz/. In the example /blik/, the two segments /big/ and /blæk/ are blended to produce the first segment of both /big/ and /blæk/ the /b/ together with the second segment of /blæk/ that is /l/ and then go back to the first word /big/ to take the last syllable /ig/. So the final utterance would be /blig/. In the example /pləʊz/, blending happens in two stages. First, /blæk/ has the first segment substituted as /b/ becomes /p/. Then, /plæk/ is blended with /nəʊz/ to produce /pləʊz/ by deleting the /n/ in /nəʊz/. The interesting thing is that blending occurs so rapidly that the listener would not notice the change until the produced utterance is being heard more than once. In addition, blending as a phonological process occurs less in formal tongue twisters than in informal tongue twisters. This may indicate that mental processes focus on production of utterances regardless of proficiency. Instead on blending, subjects tend to delete phonemes in formal tongue twisters. And this again may happen due to the possibility that in formal production of tongue twisters, mental processes stimulate productions of correct utterance, and when mind fails to do so, deletion occurs. It is noticed, also, that deletion happens on final segments. This could be

attributed to simplification. Speakers omit sounds to make pronunciation much easier**.** The study reveals two complementary sources of deletion errors. It could result of a failure to properly activate the lexical representation that preceded phonological encoding. In this sense, deletions reflect a failure to maintain lexical activation (*i.e*., a "memory" error). Some support for this view comes from the fact that item deletions tended to occur later in the list, as is predicted by some models of verbal working memory. Deletions may also reflect the functioning of an error monitoring system that prevents people from repeating themselves,(Dell, 1986**).** Even with this account, however, it is unclear why one should expect more deletion errors in the tongue twister condition. It could be assumed that over consciousness of subjects while producing formal tongue twisters may drive them towards dropping phonemes to maintain the format of the read tongue twisters. Looking at the Arabic and English phonemes and vowels, we could assume that errors in the pronunciation of second language learners are predicted on the basis of a contrastive analysis of the phonologies of native language (NL) and target language (TL). Most of learner errors in pronunciation were felt to originate from negative transfer-that is the learner's attempt to use inappropriate sound patterns of the NL in place of sound patterns of the TL. A very simplistic contrastive analysis of the NL and the TL might reveal the patterns in the following table:

Table: Examples of positive and negative transfer

No.	Native language	Target language
1	/t/	/t/
2	/f/ /v/	/f/ ---

In example (1) we have a case of positive transfer: both the native language and the target language have the phoneme /t/, so we would expect that the learner will have no difficulty with this sound in the target language. In example (2) we have an example of negative transfer which might be called "convergence" (Loup &Weinberrger ,1992) where there are two phonemes /f/ and /v/ in the native language, these two sounds are considered variants in the target language of a single phoneme /f/. In the present study, the prediction of sound change by the subject is done

through tracing the changes in pronunciation of English words either in the formal or the informal tongue twisters. Trask (1996) states that : " All types of change in pronunciation are collectively known as phonological change, or, using a more traditional term, as sound change".

A traditional view of sound change regards it as a gradual process as speakers seem to be unaware of ongoing sound changes (Hocket,, 1965). Passy (1890) states that sound change occurs as a result of imperfectly trying to master the SL.

IX. Conclusion and suggestions

It could be said that the high occurrence of sound errors in formal production of tongue twisters than in informal production of tongue twisters may show that subjects' awareness of language production may result in more errors. This also leads to the idea that the acquisition of English as a second language should be unconscious. This would suggest that teachers of ESL should follow the empirists' view as they say that mimicking should come before comprehension in second language learning. Moreover, English tongue twisters could be part of learning ESL process as it may enhance natural communication in English. This could be due to the possibility that the informal production of tongue twisters, mental processes stimulate production more than proficiency. Thus, more mental processes are created to enhance production of tongue twisters.

X. Obstacles

This paper was an attempt to investigate sound errors production by learners of English as a second language in relation to formal and informal tongue twisters. It also attempts to examine the existence of discrepancies between both forms in production and if this could be attributed mental processes or strategies. Despite the investigation of sound errors and the application of speed-error-based models, it could be stated that the creation of utterance forms is not well understood as it is far more complicated unless new research methods are employed. Despite results of sound errors have shown insights of speech production in different forms, many questions remain unanswered. For example, the available evidence does not reveal whether there are only syllable frames, or only one word frames or perhaps both types of frames. Another

problem is that sound errors depend on listener judgments which could detect higher rates of errors than others. Another obstacle is the ambiguity of errors which could result in different error types in speech production. This is evident in assigning phonological processes that could undergo several or single sound changes. Furthermore, errors provide little evidence about the planning process involved in phonological encoding, revealing little about the coordination of different processes and nothing about their functions. Therefore, it appears that the evidence that can be gained from speech errors is far more limited than has often been assumed. Consequently, new research strategies are required in ordered to understand phonological-verbal working memory in relation to speech production.

Acknowledgement

This project was funded by the Deanship of Scientific Research (DSR), King Abdulaziz University, Jeddah, under grant no. (429 / 004ج -19). The authors, therefore, acknowledge with thanks DSR technical and Financial support Principal Investigator.

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التلعثم اللغوي في اللغة الإنجليزية: بحث لغوي نفسي في العلاقة بين نطق متعلمات اللغة الإنجليزية السعوديات وعمليات التذكر اللغوية

ريم عمر مغربي

قسم اللغة الإنجليزية، كلية الآداب والعلوم الإنسانية

جامعة الملك عبدالعزيز، جدة، المملكة العربية السعودية

المستخلص. يبحث هذا البحث العلاقة بين الذاكرة وعملية التذكر في المنطوق اللغوي، وذلك باستخدام جمل للتلعثم اللفظي حيث يقوم متعلمو اللغة الإنجليزية كلغة ثانية باستخدامها. من خلال تذكر جمل التلعثم اللفظي تظهر الأخطاء اللغوية على المستوى الصوتي الأساسي والفرعي. إن تحليل الأخطاء اللغوية الناتجة عن عمليات التذكر في سياق التلعثم اللفظي قد تعمل على تحسين الأداء اللغوي. تشمل الدراسة العمليات الذهنية اللغوية التي تكون على المستوى الصوتي للحديث ذو المقاطع الأحادية و الحديث المتواصل و التغيير الصوتي الذي يتبع العمليات التالية :حركة الصوت و استبدال الصوت و فقدان الصوت و إضافة الصوت .أما الأنواع الأخرى كالإبدال الصوتي و الإدغام و حركة الصوت فقد أدرجت كأنواع أساسية تؤدي إلى التأثير في التغيير الصوتي .أجريت الدراسة على نوعين من جمل التلعثم الصوتي و هما التلقائي و الرسمي من قبل المتحدث ثنائي اللغة. يشارك في هذه الدراسة 40 من متعلمات اللغة الإنجليزية كلغة ثانية من جامعة الملك عبد العزيز– قسم اللغة الإنجليزية واللاتي تتراوح أعمارهن بين 19– 22. وقد أظهرت نتائج البحث على عكس المتوقع حدوثه, أن الأخطاء اللغوية الصوتية في الحديث الرسمي أكثر ظهورا منه في الحديث التلقائي من قبل المتحدث ثنائي اللغة. وعلى ذلك فان هناك علاقة بين وعي المتحدث و تكرار حدوث الأخطاء الصوتية.