ARTICLES

Supremacy of Suprasegmentals in Arabic Phonology: Evidence from Malapropisms[1]

Mohammed Nour Abu Guba [a,] *, Bassil Mashaqba [b], Anas Huneety [b], Khalid Alshdifat [c]

[a] University of Sharjah, UAE
[b] The Hashemite University, Jordan
[c] Jordan University of Sciences and Technology, Jordan

Received December 12, 2022; Revised January 4, 2023; Accepted March 5, 2023

Abstract. Speech errors are an important source of information to understand language processing and production. Earlier research focused on different types of errors including semantic and phonological errors while malapropisms, which refer to slips of the tongue involving whole word substitutions that share phonological similarities but are not related semantically, have not received adequate attention in the Arabic language. Drawing on malapropisms in Jordanian Arabic, we bring evidence on the supremacy of suprasegmental phonological aspects in Arabic phonology. This is unexpected as stress in Arabic is non-phonemic and fully predictable, besides Arabic rhythm is much less stress-timed than that of Germanic languages. Data was collected from spontaneous speech over a period of three years. Results showed that malapropisms share the primary stress position, the number of syllables and the word rhythmic pattern with the target words. To a lesser degree, the target and the error share the same rime and initial segments. Findings suggest that suprasegmental features are very crucial in Arabic phonology, like in Indo-European languages. Evidence suggests that formal similarity that is based on the syllabic and metrical structure of words plays a significant role in language processing and the organization of the mental lexicon in Arabic, which suggests that this is a language universal. Furthermore, our findings do not agree with earlier claims that Arabic has a flat syllabic structure. Rather, evidence suggests that Arabic, like English, has a hierarchical syllable structure, which seems to represent another language universal. More research on other Arabic dialects is recommended to corroborate these findings.

Keywords: *Arabic phonology, mental lexicon, malapropisms, suprasegmentals.*

Абу Губа Могамед Нур, Машакба Басіл, Гуніті Анас, Алшдіфат Халід. Первинність надсегментних одинць в арабській фонології: дані на основі вивчення малопропізмів.

Анотація. Мовленнєві помилки є важливим джерелом інформації для розуміння процесів перероблення та породження мови. Попередні дослідження зосереджувалися на

[1] This paper is the result of an inter-departmental collaboration between Bassil Mashaqba, Anas Huneety from the Department of English Language and Literature, Faculty of Arts, Hashemite University, Zarqa, Jordan, Khalid Alshdifat from the Department of Rehabilitation Sciences, Jordan University of Sciences and Technology, and Mohammed Nour Abu Guba from the University of Sharjah, UAE.

* Corresponding author. Mohammed Nour Abu Guba, https://orcid.org/0000-0002-5007-6439 mabu-gub@sharjah.ac.ae

East European Journal of Psycholinguistics, 10(1), 9–23. https://doi.org/10.29038/eejpl.2023.10.1.gub

різних типах помилок, включаючи семантичні та фонологічні помилки, в той час як малапропізми, що стосуються помилок, пов'язаних із цілковитою заміною слів, які мають фонологічну схожість, але не пов'язані семантично, не отримали належної уваги в арабській мові. На прикладі малапропізмів у йорданській арабській мові ми наводимо дані щодо домінування надсегментних фонологічних аспектів в арабській фонології. Цей результат є несподіваним, оскільки наголос в арабській мові не є фонематичним і цілковито передбачуваним, до того ж арабський ритм набагато менш напружений, ніж ритм германських мов. Матеріал дослідження склали сегменти спонтанного мовлення протягом трьох років. Результати засвідчили, що спільною рисою малапропізмів є первинна позиція наголосу, кількість складів і ритмічний рисунок поідбний до цільового слова. Меншою мірою, цільове слово і помилкове мають однакові рими та початковий сегмент. Одержані дані свідчать про те, що надсегментні одиниці дуже важливі і в арабській фонології, і в індоєвропейських мовах. Формальна схожість, яка базується на складовій та метричній структурі слів, відіграє суттєву роль у мовній обробці та організації ментального лексикону в арабській мові, що дає змогу припустити, що це є мовною універсалією. Крім того, наші висновки не узгоджуються з попередніми твердженнями про те, що арабська мова має пласку складову структуру. Натомість, дані свідчать про те, що і арабська, і англійська, мають ієрархічну структуру складів, яка, видається, є ще одним кандидатом на мовну універсалію. Для підтвердження цих висновків рекомендуємо провести додаткові дослідження інших арабських діалектів.

Ключові слова: *арабська фонологія, ментальна лексика, малапропізми, надсегментні одиниці.*

Introduction

Slips of the tongue can be defined as “involuntary deviation in performance from the speaker’s current phonological, grammatical, or lexical intention” (Boomer & Laver, 1968). This covers deviations at different linguistic levels: semantic, syntactic, or phonological/phonetic. At the phonological level, slips of the tongue can occur at different levels: a featural level, as in ‘turn the knop’ instead of ‘knob’, where one feature (voicing) was changed while the other features (place and manner of articulation) were intact; a phonemic level, as in ‘flock of bats’ instead of ‘block of flats’, involving one phoneme, or a cluster of phonemes, as in ‘flow snakes’ for ‘snow flakes’; a syllabic level, as in ‘sig the packarettes’ for ‘pack the cigarettes; a word level, as in ‘literature’ for ‘temperature’; and even at a phrasal level, as in ‘I would not buy kids for the macadamia nuts’ for ‘I would not buy macadamia nuts for the kids’ (Fromkin, 1973; 2002; Harley, 2006). The focus of this paper is the word level, which is a less common type of errors, but also less studied as earlier research focused on lower levels (Nooteboom, 1973; Fromkin, 2002).

Word level substitutions can be divided into different types: 1) semantically related words where the target (the intended word) and the error (uttered word) share semantic features, as in ‘pass me the sugar’ instead of ‘salt’; (2) phonologically related words where the words sound similar but are not related semantically as in ‘literature’ instead of ‘temperature’; and 3) blends where the error is a new word that blends two existing words, as in ‘don't shell’ (a blend of shout and yell) so loud’ (Nooteboom, 1973; Fromkin, 2002; Harley, 2006). The second type of word

substitution errors is generally known as malapropisms. Nonce words are not covered by this term, but we include them in this study. We will show that these errors reveal important aspects about the phonological structure of the mental lexicon and representation of words in Arabic.

Analyzing slips of the tongue is invaluable as they help better understand how language is processed in the mind, which in turn contributes to evaluating language production theories and ultimately build a model of speech production (e.g., Fromkin, 2002; Dell & Reich, 1980, see *Background* Section for more on the importance of studying them). Motivation for this paper comes particularly from the fact that most studies on slips targeted Indo-European languages, especially Germanic languages, and only a few focused on other language families (Jaeger, 2005; Wells-Jensen, 2007; Wan & Allassonnière-Tang, 2021; Alderete, 2022). This means that the findings of such research could fit well with Indo-European languages, which could result in what is known as Galton's problem where there is a bias in favor of Indo-European languages (Aitchison, 1994; Wan & Allassonnière-Tang, 2021). Previous research findings need to be verified by examining other languages to better understand the universal features of the mental lexicon and discern those that arise from the structure of the language in question (Aitchison, 1994; Alderete, 2022).

In addition, we have noticed that stress plays a major role in malapropisms made by Arab speakers. This is unexpected given that stress in Arabic is fully predictable and non-phonemic (Watson, 2011; Abu Guba, 2018; Mashaqba & Huneety, 2018; Al-Huneety et al., 2023). Its predictability and non-phonemicity were the reasons behind its neglect, together with the syllable, by early Arab scholars. Even now, Arab scholars not working on the Western tradition do not pay attention to these phonological aspects; in fact, some deny the existence of stress in Arabic at all (personal experience). Moreover, the rhythm of Standard Arabic and Eastern dialects (e.g., Jordanian Arabic) is more syllable-timed than stress-timed (Ghazali et al., 2007; Abu Guba, Fareh, et al, 2023; Abu Guba, Mashaqba, & Huneety, 2023), which suggests that stress in Arabic is not as important as stress in stress-timed languages such as Germanic languages. In this study, we provide evidence for the major role of stress and prosodic structure in Arabic phonology.

In the remainder of this paper, we review related literature in *Background* Section. Then we lay out the methods used to collect the data in *Methods* Section. In *Results and Discussion* Section, we analyze and discuss the collected malapropisms. We conclude with some implications in *Conclusion*.

Background

The study of speech errors in Indo-European languages has received considerable attention for their role in understanding the mechanisms of speech production (e.g., Fromkin, 1973; 2002; Garrett, 2002; Shattuck-Hufnagel, 2002). Slips usually occur when a malfunction happens at a certain stage in language production and therefore analyzing these slips will throw light on the mechanisms involved in processing language (Fromkin, 1973).

Two speech models dominated the study of the slips of the tongue: The Spreading Activation Theory (see Dell, 1986) and Modular Theory (e.g., Levelt, 1989; 1999). The latter is more detailed and more accepted in the literature (Jaeger, 2005; Kormos, 2006), and thus our study will be couched within it. According to Levelt's (1989; 1999) Modular Theory, in the first phase of speech production (the conceptual planning), a speaker plans what and how to convey a message. This results in a preverbal plan that contains all the information needed to convert meaning into language. This will be the input to the second phase (grammatical encoding) where lexical units and syntactic encoding are selected. Here the speakers retrieve lexical entries that contain lemmas (abstract lexical units) with their syntactic information and lexemes (word forms). In this phase, a speaker activates a lemma with the best match of the intended message. The lemma activates syntactic slots/phrases. This output constitutes the surface structure to the morpho-phonological encoding phase where the word's morphological and metrical structure and segments are retrieved. (We assume that lexical substitution errors occur in this phase). The output of this phase is the phonological score (=internal speech). Following that in the phonetic encoding phase, a speaker selects the articulatory gestures yielding an articulatory score that is converted into speech in the articulation phase. A monitor that inspects the output at different phases is postulated, and errors occur if the monitor fails to detect them; self-correction means that the monitor detected the error at the last stage (see Levelt, 1999 for details).

More specifically, at the lexical selection stage, evidence shows that lexicalization involves two stages (Fay & Cutler, 1977; Garrett, 1980; Harley, 2006). In the first stage, a lemma that dictates its syntactic structure is selected and semantically related errors occur here. In the second stage, the abstract lemma is mapped into a phonological word form (phonological encoding) and malapropisms (which are less common than semantically related errors (Jaeger, 2005)) happen at this stage (Dell et al., 2014).

The numerous studies on speech errors, mainly in Indo-European languages, brought evidence on several linguistic issues and established the psychological reality of phonological aspects such as phonetic features, segments, syllables, and stress (e.g., Boomer & Laver, 1973; Fromkin, 1973; 2002; Garrett, 1980; Cutler, 1982; Frisch, 2006; Harley, 2006). Below we present the most agreed-upon findings from studies on speech errors.

Sentence processing spans more than a word as errors can appear early in an utterance (Shattuck-Hufnagel, 2002). Speech errors suggest that linguistic units (features, segments, words, and phrases) are planned and conceptualized well before being uttered; this is confirmed by the fact that the intonation contour of utterances does not change even when transpositions occur (Fromkin et al., 2013).

Errors target phonemes, which are usually similar phonetically, more than any other phonological unit including features (e.g., Wells-Jensen, 2007; Alderete, 2022). Consonants are more vulnerable to errors than vowels, with no consonants substituting vowels or vice versa. Errors do not violate the phonotactics of the language in question (Fromkin, 1973; 2002; Cutler, 1982, among others). Note here that Alderete (2022) reports that a few do violate Cantonese phonotactics, most

probably due to L2 effect. Syllabic position is also important in that onsets replace onsets and codas substitute for codas (this was not true for Arabic though (see findings from Arabic studies below)) besides word-initial phonemes have more importance than other phonemes.

Likewise, evidence has been established for the reality of phonological and morphophonemic rules where allophony rules are not violated. For example, in [ˈblʌdəntˈstjuːdiz] for 'bloody students' (Fromkin, 2002), the phonetic realization of the plural marker /s/ changes to /z/ to fit into the new phonetic environment. Likewise, the indefinite article 'an' changes to 'a' when transpositions occur, as in 'a kice ream cone' for 'an ice cream cone'. Such errors show that morphophonemic rules are separate from phonological rules (Fromkin, 1973; 2002).

Findings also suggest that the mental lexicon stores stems, affixes, whole words, idioms, and compounds separately (Fromkin, 2002; Levelt, 1999). Stems never transpose with affixes and vice versa (Fromkin, 2002) and errors substitute words but leave behind their inflectional morphemes, which means that affixes and stems are processed at different levels (Garrett, 1980; Cutler, 1982). It has also been established that function words and content words are represented and processed at separate levels/stages as errors exchanging these two types of words never occurred, meaning that they are not activated at the same time or level (an error is supposed to happen when both are simultaneously active (Garrett, 1980; Fromkin, 2002; Harley, 2006).

Syntactic categories are almost always unviolated. Nouns substitute nouns, verbs replace other verbs and so on. This suggests that words are tagged with their grammatical category in the mind and the syntactic properties of the phrase dictate the selection of the grammatical category of the word; that is, errors need to fit into the syntactic slots in the pre-specified lexical category (e.g., Garrett, 1980; Hotopf, 1980; Levelt, 1989; Fromkin, 2002; Jaeger, 2005). Whole-word substitutions suggest that the mental lexicon is organized according to semantic fields as well as phonological similarity, i.e., lemmas and phonological forms are represented separately in the mind (Levelt, 1989; Bock & Huitema, 1999; Fromkin, 2002; Jaeger, 2005; Harley, 2006; Wan & Allassonnière-Tang, 2021).

Concerning phonologically related errors (the focus of this paper), Fay and Cutler (1977), Laubstein (1987), and Jaeger (2005) found that almost all phonological errors honored the syllable structure of the words, with the number of syllables having more importance than the internal structure of syllables (which was found to be similar in over 80% of the cases though). They also found that even semantically related substitutions honor syllable structure in over two-thirds of the cases, which suggests that syllable structure plays a major role in the mental representation of words.

Regarding stress, earlier research on Indo-European languages found conclusive evidence for the importance of stress in language processing and production. Stressed syllables tend to be more involved than weak syllables in errors; syllables involved in the slips are metrically similar, with stressed syllables substituting stressed ones and weak syllables substituting weak ones (Boomer & Laver, 1968; Nooteboom, 1973;

Fromkin, 2002; Garrett, 2002). For example, Fay and Cutler (1977) reported that malapropisms had the same stress pattern in 98% of the cases. They argued that this constitutes evidence for the representation of stress in the lexical entry of English words, a similar conclusion reached by Jaeger (2005). In this paper we will find out whether this applies to Arabic where stress is fully predictable and non-phonemic.

Very few studies tackled slips in Arabic. Abd-El-Jawad and Abu-Salim (1987) analyzed 911 slips of the tongue in Jordanian Arabic involving segment and whole-word substitutions. Most of their corpus involved segmental substitutions within and across words; some related to word transpositions and only 11 involved whole-word substitutions that were not semantically related (the focus of this paper). Note that errors involving vowels were very infrequent. In word substitutions, the words almost always belonged to the same grammatical category, with nouns representing 79% and verbs 7% of the errors. They also found that bound morphemes were not affected in errors involving word transpositions, as in *biiʕ ʔil-qamħ fii ħaql-u* 'sell the wheat in his field' > *biiʔ ʕil-ħaqil fii qamħ-u* 'sell the field in his wheat'. This is similar to the world literature and agrees with Fromkin's (2002) conclusion that words are tagged with their syntactic labels in the mind. Also, the inflectional morphemes left behind changed to suit the new lexical items, as in *ʔalwaan ʔil-ʕalam* 'the colours of the flag' > *ʔaʕlaam ʔil-lawn* 'the flags of the colour', which shows that grammatical morphemes and morphophonemic rules are independent. The researchers also found strong evidence for the underlying representation of morphemes in Semitic languages where consonants and vowels are represented on different tiers. For example, in the error *kalaam-ha sˁaħiiħ* 'her speech is right' > *sˁaħaaħ-ha kaliim,* the vocalic pattern did not change. They also found evidence for phonological features, which agrees with findings on Germanic languages. They found that 74% of segmental errors differ in only one phonetic feature. Finally, they reported that most whole-word substitutions were semantically related; they were either antonyms, co-hyponyms, or hyponyms. Their study covered many phonological aspects in Arabic and yielded interesting results; however, it did not address malapropisms adequately.

Safi-Stagni (1990; 1994) analyzed slips of the tongue in Hijazi Arabic in Saud Arabia and reached similar conclusions. Her studies were based on approximately a hundred slips in each study focusing on segmental errors, with only six slips relating to whole-word phonologically related substitutions. This means that a more comprehensive study with a larger corpus is needed. In another study, Berg and Abd-El-Jawad (1996) compared Arabic and Germanic (English and German) slips of the tongue and concluded that syllable structure tends to have a flat representation, unlike German or English that has a hierarchical structure. Unlike errors in Germanic, errors in Arabic occurred equally in initial and final positions with no constraints on the interaction between phonemes in these positions. They argued that this means that Arabic onset and coda consonants have equal status, but Germanic ones do not. Additionally, they found more errors involving the rime in English and German than in Arabic, which they interpreted as evidence to the claim that Arabic has a flat structure. However, the fact that Arabic stress assignment is sensitive to the rime weight made them assume that a hierarchical structure is constructed at a later stage

in the derivation. In our study, we will report evidence against this proposal and show that the rime is very crucial in Arabic phonology.

To summarize, although slips of the tongue have been well studied in Indo-European languages, very few studies tackled speech errors in Arabic. Moreover, the few studies on Arabic focused on segmental errors and did not address the role of suprasegmentals in whole-word substitutions. This study attempts to fill this gap and find whether the phonological findings concerning suprasegmental aspects from previous studies in the world literature hold true for Arabic even though stress in Arabic is non-phonemic and fully predictable.

Methods

A total of 2000 slips representing all types of errors, with a focus on whole-word substitutions, was collected. Data was collected by the researchers over the past three years from many naturally occurring resources: live TV and radio programs, and everyday speech by Arab speakers, mainly in Jordan. Some colleagues also sent the researchers videos containing slips of the tongue. Errors were detected based on speakers' correcting themselves by saying the target word. All errors that did not relate to whole-word substitutions were excluded. Word substitutions that were triggered by the context or collocations, e.g., *kaff ʕadas* 'a handful of lentils' for *fatt ʕadas* 'lentil porridge' were also excluded. These two words are strong collocates of the word *ʕadas* in Arabic, so we cannot be certain that the error was triggered by the phonological form of the word, although it is probable. Note also that exchanges involving segmental substitutions from surrounding words were excluded even if they resulted in a whole word, as in *dawa gaħħa* > *gawa daħħa* 'cough medicine'. This is because such errors are segmental substitutions triggered by other segments in the words. Also excluded were substitutions that represent metathesis within the word, e.g., *dʒakaara* > *dʒaraaka* 'teasing'. Here the two consonants 'k' and 'r' swap their positions and it is possible that the error occurred at the articulation level due to a malfunction of the motor commands to the muscles, not at the phonological encoding level. Only errors that represented true malapropisms were used in this study; their total was 200. These were transcribed by the first author in IPA symbols and grouped according to their parts of speech and number of syllables. Blind to the original transcriptions, the second researcher verified a sample of 50 examples for reliability. Transcriptions were compared, and agreement of 100% was reached. It is worth mentioning that the distinction between semantically related and phonologically related errors is not always a clear-cut one.

Results and Discussion

First, we present the malapropisms in terms of grammatical characteristics and then we analyze them according to their phonological properties.

Grammatical characteristics

Each error and its corresponding target word belonged to the same grammatical category, and all of them belonged to content words. No errors involved the substitution of a content word for a function word or vice versa. This is similar to errors in other languages (e.g., Fromkin, 2002; Harley, 2006; Wells-Jensen, 2007). This shows that in Arabic, like in other languages, the syntactic structure is generated in the mind before phonological encoding.

68% of the errors related to nouns, 20% to verbs, and 12% to adjectives. The percentage of verbs here is unlike that in Indo-European languages where errors in verbs account for less than 10% (Fromkin, 1973; 2002; Hotopf, 1980; Harley, 2006). Our findings in this concern seem to be similar to Wan and Allassonnière-Tang's (2021) findings where a third of errors belonged to verbs. This can be attributed to the importance of verbs in Arabic. It is well known that Arabic is a verb-subject-object and a subject-verb-object language with the former being more common than the latter; besides, all words in Arabic are derived from verbal roots (Holes, 2004). Note that no violations of grammatical inflections such as number, gender or definiteness were attested in the corpus. This finding means that grammatical information is encoded earlier at the syntactic level and gender seems to be encoded in the lemma (Kormos, 2006).

Phonological properties

Malapropisms involved monosyllabic and especially polysyllabic words, with 98% of the malapropisms targeting polysyllabic words. This may be attributed to processing load where polysyllabic words require more processing and therefore are more vulnerable to errors. Moreover, the percentages of polysyllabic words might be related to the frequency of these words in Arabic, which still needs to be established. Interestingly, 98% of the errors respected the number of syllables in that both the error and the target had the same number of syllables. Table 1 shows the distribution of malapropisms according to the number of syllables.

Table 1
Distribution of malapropisms according to number of syllables

	Percentage	Examples
Monosyllabic	2%	band 'rim' > xadd 'cheeck', hoon 'here' > ʕoon 'aid', xeer 'bounty' > keer 'care'
Disyllabic	48%	naadat 'she called' > maatat 'she died', swaaga 'driving' > xyaatˁa 'tailoring', ʔanfaaq 'tunnels' > ʔaaxaaq 'nonsense word', kaasteen 'two cups' > ħusˁteen 'two shares'
Trisyllabic	36%	ʔalħisˁaan 'the horse'> ʔaθθimaar 'the fruits', xubaraaʔ 'experts'> fuqaraaʔ 'poor people',

Quadrisyllabic and above	14%	juqaddim ‘he presents’ > juʕaððib ‘he tortures’ ʔalmaħallaat ‘the stores’ > ʔalmatˁaaraat ‘the airports’, ʔarraziina ‘the sober’> ʔarraðiila ‘the vice’, ʔannaaziħa ’the displaced’ > ʔalmaaziʕa ‘the tearing’, ʔattaʕaawun ‘cooperation’> ʔattaʔaamur ‘conspiring’

The only four words where the number of syllables was not retained are given in (1). (Where relevant, stress is indicated by the vertical stroke ˈ, and syllable boundary by a dot.)

(1) Words violating the number of syllables
ʔas.ˈsaa.ri.ja ‘communicable’ > ʔas.si.jaa.ˈsij.ja ‘political’
ʔi.ˈsal.mak ‘keeping you healthy’ > ʔi.ˈsam.mi.mak ‘poisoning you’
ˈtuu.nis ‘Tunisia’ > bag.ˈdoo.nis ‘parsley’
ʔal.ʔis.laa.ˈmij.ja ‘the Islamic’ > ʔal.ʔis.raa.ʔii.ˈlij.ja ‘the Israeli’

In the four words, a new syllable was added, rather than deleted. Besides, the primary stress (except for one) and the rime (the vowel and the coda) were intact, which increases the similarity between the error and the target word. Note that the last example could have been triggered by the broader context due to the famous Israeli-Arab conflict, although the error was not present in the immediate context.

Regarding stress, in 99% of the errors, the place and weight of the stressed syllable were intact. Some examples are given in (2) below. Only two malapropisms had stress on a different syllable, namely *ˈħaa.wi* ‘proper noun’ > *ħaj.ˈwaan* ‘animal’, and *ʔas.ˈsaa.ri.ja* ‘communicable’ > *ʔas.si.jaa.ˈsij.ja* ‘political’, where the addition of the new syllable shifted the stress rightward. This is in harmony with the fact that right-orientedness of stress in Arabic phonology is well-established (Abu Guba, 2018; 2021).

(2) Faithful mapping of stress
taʕˈliim ‘teaching’ > tanˈʕiim ‘softening’
ˈtusˁrux ‘cry’ > ˈtugsˁuf ‘bombard’
juˈqaddim ‘present’ > juˈʕaððib ‘punish’
musˁˈtawsˁaf ‘clinic’ > musˈtawdaʕ ‘store’
ʔalmaˈðalla ‘infliction’> ʔalbaˈzella ‘peas’
ʔattaˈʕaawun ‘cooperation’ > ʔattaˈʔaamur ‘conspiring’

The rhythmic pattern of the errors was similar to the target in 96% of the cases. The rhythmic pattern of the word refers to the alternation of weak and strong syllables within a word (Aitchison, 1994). Some examples are given in (3).

(3) Rhythmic pattern mapping
a) hoon ‘here’ > ʕoon ‘aid’
b) niiˈsaan ‘April’ > riiˈħaan ‘basil’
c) ˈnaadat ‘she called’ > ˈmaatat ‘she died’

d) maˈxaawfak 'your fears' > maˈwaagfak 'your attitudes'
e) maxˈbazna 'our bakery' > maxˈfarna 'our police station'
f) ʔilʕirˈsaan 'the grooms' > ʔisˤsˤiiˈsˤaan 'the chicks'
g) ʔalqaaˈnuun 'the law' > ʔalmaʕˈluum 'the known thing'

In all these examples, the target and the error have the same rhythmic pattern. In the first example, it is a heavy (bimoraic) syllable in both the error and the target. In example (3b), both words have two heavy syllables and in (3c), a heavy syllable is followed by a light syllable (the last consonant does not contribute weight in Arabic (Abu Guba, 2018). In (3d), the pattern is a light syllable +extra-heavy syllable +light syllable in both words. Likewise, in (3e), two heavy syllables are followed by a light syllable and finally in (3f-g), a heavy syllable is followed by two heavy syllables. Note that the second syllable in the target word in (3f) has a short vowel and a coda (ʕir = a bimoraic syllable), and in the error the second syllable has a long vowel (sˤii), which is metrically equivalent to a short vowel and a coda. The opposite occurs in the last example where /qaa/ is metrically equal to /maʕ/.

Four of the errors that violated rhythmic pattern underwent syllable addition, as in *ʔasˈsaarija > ʔassijaaˈsijja, ʔiˈsalmak > ʔiˈsammimak, ˈtuunis > bagˈdoonis, and ʔalʔislaaˈmijja > ʔalʔisraaʔiiˈlijja* (a translation is already given above). Four had the same number of syllables, namely *ħajisˈtardʒi* 'will have the courage' > *ħajisˈtadridʒ* 'will pull someone's leg', *bitˈsˤalli* 'she is praying' > *bitˈsˤawwir* 'she is taking a photo, *ʔalˈkaariθa 'the disaster'* > *ʔalˈkamira* 'the camera' and *ˈħaawi* 'proper noun' > *ħajˈwaan* 'animal'. No syllable deletion was attested. Note that it can be argued that the metrical pattern in *ħajistardʒi/ħajistadridʒ and bitsˤalli/bitsˤawwir* is the same as final consonants in Arabic are extrametrical, i.e., they are weightless.

The high percentages of the faithful mapping of stressed syllables, number of syllables, and rhythmic pattern lend support to the supremacy of these phonological aspects in language processing (Aitchison, 1994). Although the stress and syllable have been neglected in traditional Arabic phonology and the former is fully predictable and non-phonemic, they were almost always mapped faithfully. This suggests that these suprasegmental features play a major role in language processing and mental representation in Arabic.

Turning to the segmental level, word-initial and final segments were preserved most of the time, while middle segments were not. Errors and targets had the same word-initial consonant in 65% of the cases, the same rime in 75% of the cases and both the first consonant and rime in 39% of the cases. Both tend to be the same more in longer words, which means a greater similarity is required to fool the speech monitor. Some examples are *ʔalmaħallaat* 'the stores' > *ʔalmatˤaaraat* 'the airports' and *maxaawfak* > *mawaagfak*.

Additionally, when the target and the error did not share the same initial and/or final segments, the segments tended to be phonetically similar in many cases. This agrees with Aitchison's (1994) findings for English malapropisms. For example, in

ʔalħisʿaan 'the horse' > *ʔaθθimaar* 'the fruits', both /n/ and /r/ are alveolar sonorants, and in *ʔarraʔiis* 'the president' > *ʔarraxiisʿ* 'the cheap one', /sˤ/ is the emphatic counterpart of /s/; all other features are the same. Likewise, in *naadat* > *maatat*, the initial segments are nasals.

Note that when the words differed on the rime, the other factors (number of syllables, other consonants and vowels in the word) tended to be the same, e.g., *ʃibak* 'fence' > *ʃibil* 'cub', and *ʔazzawaal* 'noon time' > *ʔazzawaadʒ* 'marriage'. This increases the phonological affinity between the target and the error; hence the malapropism occurs.

These findings at the segmental level support the bathtub effect, which refers to the tendency among people to remember the beginnings of words more than the ends which are remembered more than the middles (Aitchison, 1994, p. 134). However, in our corpus, the rime was found to be slightly more important than the beginning, a finding that is not in line with results obtained from other languages (e.g., Fromkin, 1973; 2002; Fay & Cuttler, 1977; Aitchison, 1994). More importantly, the finding that the rime was very crucial does not agree with Berg and Abd-El-Jawad's (1996) claim that Arabic has a flat structure. In addition to the fact that stress assignment is governed by the rime weight, this finding seems to refute the earlier claim that Arabic has a flat structure.

The results pertaining to the segmental and suprasegmental aspects suggest that the segmental structure of the word is less important than the suprasegmental one. Some evidence for this comes from findings in first and second language phonology that show that suprasegmentals are more important than segmental aspects in language processing and production (Munro & Derwing, 1995; Celce-Murcia et al., 2010).

These results are similar to stress-timed languages where the number of syllables, rhythmic pattern and primary stress were the most retained features in malapropisms followed by word-initial and final consonants (Fay & Cutler, 1977; Aitchison, 1994; Fromkin, 2002; Jaeger, 2005). Additionally, these results resemble those in tone languages such as Mandarin where the word-initial consonants, the same rime and/or the same tone in the first syllable played the major role in determining similarity (Wan & Allassonnière-Tang, 2021). Taken together, the results from the three types of language rhythms suggest that the organization of words in the mind according to the formal similarity that is based on the syllabic and metrical structure is a language universal. These parameters seem to play a great role in the arrangement of the mental lexicon (cf. Fay & Cutler, 1977). It could be the case that words are sublisted according to the number of syllables, rhythmic pattern, stress, initial segments and rimes, and retrieval works in parallel to access these sublists, besides other sublists, e.g., a list according to word class, as evidenced from findings in the world literature (see *Background* Section). In addition, it seems that words are stored according to their orthographic forms among literate people as reported in earlier research (Jaeger, 2005).

Another piece of evidence for the great role of these suprasegmental features comes from the 'tip of the tongue' phenomenon where speakers can recall the number

of syllables in a word, its stress pattern and its first phoneme (Fromkin, 2002; Jaeger, 2006). That is, the lexical entry of a word could include these phonological aspects and is not worked out during phonological processing (Jaeger, 2005). Our results also receive evidence from Abd El-Jawad and Abu Salim's (1987) word substitutions in Arabic that were triggered by the context such as *ʔaʕtˁiini siigaara* 'give me a cigarette' > *gusˁsˁilli siigaara* 'cut me a cigarette'. Although the error was trigged by context as the speaker was talking about hair cutting, the two words were phonologically similar.

It remains to be answered why and how these errors occur. The above substitutions are supposed to occur when the wrong phonological form is activated and retrieved from the phonological lexicon. This may be attributed to the phonological similarity that is so high that it escapes the monitor. After selecting the appropriate lemma, the speaker starts searching for the word form corresponding to the target lemma. Word forms that are similar phonologically are also activated. Mis-selection happens when these erroneous forms receive higher levels of activation. The fact that the errors share the same metrical structure (in terms of number of syllables, rhythmic pattern, and stress position), and to a lesser degree their initial consonants and rimes, suggest that words in the mind are stored and retrieved according to these phonological properties at the phonological level.

Conclusion

Findings show that the syntactic category of substituted words are never violated. This suggests that words in the mind are organized according to their part of speech. In addition, results suggest the phonological properties of words, namely primary stress, rhythmic pattern and number of syllables, and to a lesser degree, word-initial consonants and rime, play a major role in their mental representation and processing in Arabic. This is similar to earlier findings on other languages (cf. *Background* Section). That is, the phonological organization of words in the mind accords a great role to these phonological aspects regardless of stress phonemicity and predictability in the language, and the look-up of words is partly phonological. It seems this type of organization is a language universal, which receives further evidence from the tip of the tongue phenomenon.

Disclosure Statement

No potential conflict of interest was reported by the authors.

References

Abd-El-Jawad, H., & Abu-Salim, I. (1987). Slips of the tongue in Arabic and their theoretical implications. *Language Sciences, 9*(2), 145-171.

Abu Guba, M.N. (2018). Stress assignment in polysyllabic words in Levantine Arabic: An Optimality-Theoretic analysis. *Lingua Posnaniensis*, *60*(2), 7–24. https://doi.org/10.2478/linpo-2018-0009

Abu Guba, M.N. (2021). Gemination within English loanwords in Ammani Arabic: An Optimality-theoretic analysis. *Journal of Linguistics, 57*(1), 3-40. http://dx.doi.org/10.1017/S0022226720000183

Abu Guba, M. N., Fareh, S., & Yagi, S. (2023). English and Arabic speech rhythms: A contrastive review. *International Journal of Arabic-English Studies, 23*(1), 183-202. https://doi.org/10.33806/ijaes2000.23.1.10

Abu Guba, M. N., Mashaqba, B., & Huneety, A.. (2023). Polysyllabic shortening in Modern Standard Arabic. *Journal of Semitic Studies*. https://doi.org/10.1093/jss/fgac030

Abu Guba, M., Mashaqba, B., Jarbou, S., & Al-Haj Eid, O. (2023). Production of vowel reduction by Jordanian–Arabic speakers of English: an acoustic study. *Poznan Studies in Contemporary Linguistics, 59*(1), 1-25. https://doi.org/10.1515/psicl-2022-2011

Aitchison, J. (1994). Words in the mind: An introduction to the mental lexicon. (2nd ed). Blackwell.

Alderete, J. (2022). Cross-Linguistic trends in speech errors: An analysis of sub-lexical errors in Cantonese. *Language and Speech, 66*(1), 79-104. https://doi.org/10.1177/00238309211071045

Al-Huneety, A., Mashaqba, B., Alhala, M. A., Abu Guba, M. N., & Al-Shdifat, K. G. (2023). Acquisition of stress in the speech of Ammani Arabic-speaking children. *Ampersand*, 10, 100094. https://doi.org/10.1016/j.amper.2022.100094

Berg, T., & Abd-El-Jawad, H. (1996). The unfolding of suprasegmental representations: A cross-linguistic perspective. *Journal of Linguistics, 32*(2), 291-324.

Bock, J. K., & Huitema, J. (1999). Language production. In Garrod, S., & Pickering, M. (Eds.), *Language processing* (pp. 363-388). Psychology Press.

Boomer, D. S., & Laver, J. D. M. (1968). Slips of the tongue. *British Journal of Disorders of Communication, 3,* 1-12.

Celce-Murcia, M, Brinton, D., & Goodwin, J. (2010). *Teaching pronunciation*. Cambridge University Press.

Cutler, A. (1982). The reliability of speech error data. In A. Cutler (Ed.), *Slips of the tongue and language production* (pp.7-28). Mouton.

Dell, G. S. (1986). A spreading activation theory of retrieval in sentence production. *Psychological Review, 93,* 283-321.

Dell, G. S., & Reich, P. A. (1980). Slips of the tongue: The facts and a stratificational model. *Rice Institute Pamphlet – Rice University Studies, 66*(2).

Dell, G. S., Nozari, N., & Oppenheim, G. M. (2014). Word production: Behavioral and computational considerations. In M. Goldrick, V. Ferreira, & M. Miozzo (Eds.). *The Oxford handbook of language production* (pp. 88-104). Oxford University Press.

Fay, D., & Cutler, A. (1977). Malapropisms and the structure of the mental lexicon. *Linguistic Inquiry, 8,* 505-520.

Frisch, S. A. (2006). Speech errors as evidence in phonology. In K. Brown (Ed.), The encyclopedia of language and linguistics (2nd ed., Vol. 11). (pp. 736-739). Elsevier.

Fromkin, V. A. (1973). *Speech errors as linguistic evidence.* Mouton.

Fromkin, V. A. (2002). The non-anomalous nature of anomalous utterances. In G. Altmann (Ed.), *Psycholinguistics: Critical concepts in psychology* (pp. 3-33). Routledge.

Fromkin, V., Rodman, R., & Hyams N. (2013). An introduction to language (10th Ed.). Cengage Learning.

Garrett, M. F. (2002). The analysis of sentence production. In G. Altmann (Ed.), *Psycholinguistics: Critical concepts in psychology* (pp. 34-72). Routledge.

Garrett, M. F. (1980). Levels of processing in sentence production. In B. Butterworth (Ed.), *Language production* (pp.177-220). Academic Press.

Ghazali, S., Hamdi, R., & Knis, K. (2007). Intonational and rhythmic patterns across the Arabic dialect continuum. In E. Benmamoun (Ed.), *Perspectives on Arabic Linguistics: Papers from the Annual Symposium on Arabic linguistics* (pp. 97-121). John Benjamins.

Harley, T. (2006). Speech errors: Psycholinguistic approach. Invited entry. In K. Brown (Ed.), *The encyclopedia of language and linguistics* (2nd ed., Vol. 11). (pp. 739-744). Elsevier.

Holes, C. (2004). *Modern Arabic: Structures, functions, and varieties.* Georgetown University Press.

Hotopf, W. (1980). Semantic similarity as a factor in whole-word slips of the tongue. In V. Fromkin (Ed.), *Errors in linguistic performance: Slips of the tongue, ear, pen, and hand* (pp.97-109). Academic Press.

Jaeger, J. (2005). *Kids' slips: What young children's slips of the tongue reveal about language development.* Lawrence Erlbaum Associates.

Kormos, J. (2006). *Speech production and second language acquisition.* Routledge.

Laubstein, A. S. (1987). Syllable structure: The speech error evidence. *Canadian Journal of Linguistics, 32*, 339-363.

Levelt, W. J. (1989). *Speaking: From intention to articulation.* MIT Press.

Levelt, W. J. (1999). Language production: A blueprint of the speaker. In C. V. Brown & P. Hagoort (Eds.), *The neurocognition of language* (pp. 83-122). Oxford University Press.

Mashaqba, B., & Huneety, A. (2018). Emergence of iambs in Eastern Arabic: Metrical iambicity dominating optimal nonfinality. *SKASE Journal of Theoretical Linguistics*, 15(3). 15-36.

Munro, M., & Derwing, T. (1995). Foreign accent, comprehensibility, and intelligibility in the speech of second language learners. *Language Learning, 45*(1), 73–97.

Nooteboom, S. G. (1973). The tongue slips into patterns. In V. Fromkin (Ed.), Speech errors as linguistic evidence (pp. 87-95). Mouton.

Safi-Stagni, S. (1990). Slips of the tongue in Arabic. In E. Mushira (Ed.) *Perspectives on Arabic Linguistics.* (Vol. I). John Benjamins.

Safi-Stagni, S. (1994). Arabic segmental errors and segmental phonology. In E. Mushira, V. Cantarino, & K. Walters (Eds.), Perspectives on Arabic linguistics. (Vol. VI). (169-184). John Benjamins.

Shattuck-Hufnagel, S. (2002). Speech errors as evidence for a serial ordering mechanism in sentence production. In G. Altmann (Ed.), *Psycholinguistics: Critical concepts in psychology* (pp. 73-120). Routledge.

Wan, I. P., & Allassonnière-Tang, M. (2021). A corpus study of lexical speech errors in Mandarin. *Taiwan Journal of Linguistics, 19*(2), 87-120.

Watson, J. C. E. (2011). Word stress in Arabic. In M. van Oostendorp, C. J. Ewen, E. V. Hume, & K. Rice (Eds.), *The Blackwell companion to phonology* (pp. 2990–3018). Wiley-Blackwell

Wells-Jensen, S. (2007). A cross-linguistic speech error investigation of functional complexity. *Journal of Psycholinguist Research, 36,* 107–157. https://doi.org/10.1007/s10936-006-9036-5

Appendix

A partial list of errors (ordered according to number of syllables and alphabetically)

Target word	Error	Target word	Error
1. band	xadd	51. ˈdʒaaʔiħa	ˈdʒaamiʕa
2. hoon	ʕoon	52. faˈlaafil	dʒaˈlaadʒil
3. xeer	keer	53. haˈdijja	ʕiˈdijja
4. ʔalf	ʔalb	54. magaˈdiir	makaˈtiib
5. ˈbaaʔat	ˈbaaʕat	55. maljuˈneen	daktuˈreen
6. ˈbaħdˤar	ˈbadˤħak	56. mahˈbuule	maħˈbuube
7. ˈdʒamiʕ	ˈmaniʕ	57. maˈxaawfak	maˈwaagfak
8. ˈħaawi	ħajwaan	58. maxˈfarna	maxˈbazna

9.	ħiˈwaar	ħiˈmaar	59. musˈtawdaʕ	musˁˈtawsˁaf
10.	ˈħurra	ˈħilwa	60. ʃaˈraaʔiʕ	ʃaˈwariʕ
11.	kaasˈteen	ħusˁˈteen	61. skaaˈlooni	skooˈlaari
12.	ˈmaadʒid	ˈmaaxið	62. waˈgitha	waˈragha
13.	mabˈruur	manˈsˁuur	63. ˈħadˁanit	ˈfataħit
14.	mabˈħuuħ	mafˈtuuħ	64. muˈnaafasa	muˈnaasaba
15.	ˈmaðˁhar	ˈzamhar	65. xubaˈraaʔ	fuqaˈraaʔ
16.	maħˈðuuf	maxˈtˁuuf	66. xuˈraafi	xaˈraaʔi
17.	maˈliik	ʃaˈriik	67. jalbiˈsuun	jalʕaˈbuun
18.	miˈθaal	xaˈjaal	68. ˈjirħamu	ˈjirdʒumu
19.	miħˈtaadʒ	miʃˈtaag	69. juˈqaddim	juˈʕaððib
20.	ˈmiʃi	ˈnisi	70. ˈʕaafija	ˈjaaʔisa
21.	ˈnaadat	ˈmaatat	71. ʔalħiˈsˁaan	ʔaθθiˈmaar
22.	niiˈsaan	riiˈħaan	72. ʔalqaaˈnuun	ʔalmaʕˈluum
23.	xaˈbiir	faˈgiir	73. ʔarraˈʔiis	ʔarraˈxiisˁ
24.	raˈʔuuf	xaˈruuf	74. ʔalwaˈlaaʔ	ʔalbaˈlaaʔ
25.	ˈʃibak	ˈʃibil	75. ʔazzaˈwaal	ʔazzaˈwaadʒ
26.	ˈswaaga	ˈxjaatˁa	76. ʕaˈwaanis	ʕaˈwaaridˁ
27.	ˈtamir	ˈgamar	77. ʕaˈwaazil	faˈlaafil
28.	taˈʕliim	tanˈʕiim	78. ʔaˈʕlaamu	ʔaʕˈʃaabu
29.	ˈtiħni	ˈtimʃi	79. ʔiktiˈʔaab	ʔibtiˈlaaʔ
30.	ˈtusˁrux	ˈtugsˁuf	80. ʔilʕiˈrssan	ʔisˁsˁiiˈsˁaan
31.	ˈtuunis	bagˈdoonis	81. ʔistiqˈtˁaab	ʔistixˈdaam
32.	walˈhaan	ʕatˁˈʃaan	82. ʔistirˈxaaʔ	ʔistifˈtaaʔ
33.	ˈwahim	ˈzaʕal	83. ʔiˈsalmak	ʔiˈsammimak
34.	ˈxaadim	ˈħaamil	84. ʔuˈbaama	ʔuˈsaama
35.	ˈxutˁwa	ˈxutˁba	85. ʔaˈxaana	gaˈfaana
36.	ʔafˈlaadʒ	ʔamˈlaaħ	86. ħajisˈtardʒi	ħajisˈtadridʒ
37.	ʔalˈxubθ	ʔalˈxubz	87. jatˈtahimu	janˈfadʒiru
38.	ˈʔanðar	ˈbaʕtar	88. ʔalˈkaariθa	ʔalˈkamira
39.	ʔanˈfaaq	ʔaaˈxaaq	89. ʔalmaˈðalla	ʔalbaˈzella
40.	ʔaˈsiir	tˁaˈwiil	90. ʔalmaħalˈlaat	ʔalmatˁaaˈraat
41.	ˈʕasal	ˈʕadas	91. ʔanˈnaaziħa	ʔalˈmaaziʕa
42.	ˈʕawra	ˈħamra	92. ʔalqaraˈwijja	ʔalqalaˈwijja
43.	ʕaˈzaaʔ	ʕaˈʃaaʔ	93. ʔarraˈziina	ʔarraˈðiila
44.	ˈʔaʕðar	ˈzaʕtar	94. ʔalxaˈbaaʔiθ	ʔalxaˈbaaʔiz
45.	ʔidˁˈjuuf	ʔinˈdˁuuf	95. ʔalʔintiqaaˈlijja	ʔalʔintiqaaˈmijja
46.	ˈʕilka	ˈʕutˁla	96. ʔalʔislaaˈmijja	ʔalʔisraaʔiiˈlijja
47.	ˈʕizwa	ˈʕadʒwa	97. ʔasˈsaarija	ʔassijaaˈsijja
48.	bitˈsˁalli	bitˈsˁawwir	98. ʔattaˈwaasˁul	ʔattaˈfaasˁul
49.	ðaaˈtijja	saaˈmijja	99. ʔattaˈʕaawun	ʔattaˈʔaamur
50.	daˈxalni	daˈfaʕni	100. ʔilˈbaraka	ʔilˈbagara