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Decomposition in Arabic spoken word recognition

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Abstract

Previous research has shown that when a wordlikeness task is used, native Arabic speakers rate spoken nonwords with real roots more Arabic like than nonwords with pseudo roots. That is, they showed an ability to decompose the nonword and identify the embedded root. However, since the wordlikeness task is offline affording subjects unlimited processing time, and other studies used some online tasks that might be confounded, the question remains whether this is the result of a mere conscious process or a part of automatic natural spoken language processing. We investigate this question by comparing the processing time and accuracy rates between nonwords with real roots and nonwords with pseudo roots in an auditory lexical decision task. Native Arabic speakers were slower and less accurate in rejecting nonword with real roots. These findings suggest that automatic morphological decomposition in Arabic spoken word recognition precedes full lexical identification.

Keywords: Morphological processing; auditory lexical decision

الملخص

أظهرت الدراسات السابقة قدرة المتحدثين العرب على تمييز الكلمات غير الحقيقية التي تحوي جذورا حقيقية عن الكلمات غير الحقيقية التي لاتحوي جذورا حقيقية عندما يطلب منهم تقييم مدى تشابه هذه الكلمات غير الحقيقية مع كلمات حقيقية من اللغة العربية. وهذا يدل على ملاحظتهم لوجود الجذر والاعتماد عليه في تقييم الكلمة. ولكن بما أن تجربة تقييم الكلمات هي تجربة تمنح الكثير من الوقت فهي لا تظهر ما إذا كانت هذه القدرة هي عملية تحليل واعية للالفاظ أو جزءا من العملية الطبيعية التلقائية لإدراك الكلمة المنطوقة. يتم التحقق من هذا السؤال في البحث الحالي عن طريق قياس الوقت اللازم (و هو ما يقاس بالجزء من الألف من الثانية) والدقة؛ لاتخاذ قرار حيال كون اللفظ المسموع هو كلمة حقيقة أو غير حقيقية. وجدت الدراسة أن سرعة اتخاذ القرار ودقته يعتمدان على وجود جذر حقيقي في اللفظ المسموع؛ مما يدل على أن تحليل الكلمة والتعرف على الجذرهما عمليتان طبيعيتان تلقائيتان في معالجة اللغة العربية تسبقان التعرف الكامل على الكلمة.

الكلمات المفتاحية: المعالجة الصرفية، تصنيف اللفظ المسموع

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1. Introduction

Arabic morphology is non-concatenative in that words are mainly derived by mapping consonantal roots into vowel patterns (Holes, 1995). For example, the word for "worked" in Arabic is derived by mapping the root consonants /ʕML/ into the vowel pattern /-a-i-/ resulting in the word /ʕamil/. To derive the word "worker", however, the same root is mapped into a different pattern (i.e., /faːʕil/)[1] resulting in the word /ʕaːmil/. Alternatively, instead of transforming the stem internally as in the case with Arabic words, affixation is the main method of word derivation in morphologically concatenative languages such as English. For example, the word "worker" is derived in a concatenative manner by adding the suffix "er" to the stem "work".

However, a question that has been debated is how cognitively relevant are the morphological units (i.e., root and pattern) in the representation of the Arabic mental lexicon. Two main theories of Arabic morphology and lexical processing have been proposed. The first assumption put forward was that non-concatenative morphology is morpheme-based in that the root and pattern are represented and accessed during lexical processing (see McCarthy (1981) for the prosodic account of the morpheme-based theory). Alternatively, the opposing theory asserts that lexical processing in non-concatenative languages is stem-based (Benmamoun, 1999, 2003). The latter argument is that an Arabic word such as *muqaddim* "presenter" is not the result of mapping the root [qdm] into the pattern [mufaʕʕil] but rather the result of adding the prefix mu- to the imperative stem *qaddim*.

Each of these claims is congruent with a separate hypothesis of lexical representation and lexical processing. On the one hand, the morpheme-based theory is in the line with the decompositional hypothesis (Taft & Forster, 1975). This hypothesis suggests that words, particularly complex ones, are represented and accessed as separate morphemes. On the other hand, the full-listing hypothesis (Butterworth, 1983) lays the theoretical background for the stem-based theory. It adopts the view that words are not accessed or represented as separate morphemes but rather as whole units.

Several attempts have been made to provide evidence for morpheme-based lexical processing in Arabic. Pivotal work by Boudellaa and Marslen-Wilson merits review. For example, using the incremental masked priming task, Boudellaa and Marslen-Wilson (2005) set out to explore the time course of the availability of different types of processing information during lexical access in Arabic. Specifically, by manipulating Stimulus Onset Asynchronies (SOA), they wanted to learn if morphological (root and pattern) effects in Arabic emerge earlier than semantic or orthographic effects in visual word recognition. Their results suggested that both root and pattern effects were separable and preceded semantic and orthographic effects. However, the root effect was stronger than the pattern effect at all SOAs.

If lexical processing in Arabic is truly root-based then it stands that root productivity (family size) should have an effect on pattern processing. Boudellaa and Marslen-Wilson (2011) explored this assumption using masked and cross modal priming experiments. They found out that pattern priming was only successful in the context of a productive root.

Moreover, given the diglossic situation in Arabic, Boudelaa and Marslen-Wilson (Boudelaa & Marslen-Wilson, 2013) investigated whether the root effects still stand in dialectal Arabic as compared to standard Arabic. Using an auditory priming task, they demonstrated that both standard Arabic and dialectal Arabic show root and pattern effects.

Findings of the studies reviewed above were interpreted as good evidence that lexical processing in Arabic is morpheme-based with the root playing the central role. However, a closer look may suggest that this evidence may not be conclusive particularly for spoken word recognition. First, most of the studies investigating morphological processing in Arabic used priming tasks where both the prime and target are visually presented. These may not provide comparable information about the root effect in spoken word recognition. That is, the ability to recognize and decompose the consonant root letters in a written word may not be replicated in the less reliable linear auditory signal. Similarly, even when cross-modal priming is used the target is still presented visually after an auditory prime.

Moreover, using auditory- auditory priming is not without problems as words sharing the root are typically related in meaning. Therefore, semantic priming may confound morphological priming. Attempting to tease apart, morphological effects from semantic ones Boudellaa and Marslen-Wilson (2013) compared priming in a condition where there was a transparent semantic relationship between the two words in the prime and target that share the same root (e.g. the root /ʃHD/ in the word /ʃaːhidun/ “witness” and the word /ʃahaːdatun/ “testimony”) to another condition where there was an opaque semantic relationship between the two words sharing the root (e.g. the root /ɣRB/ in the word /ɣuruːbun/ “sunset” and the word /ɣariːbun/ “foreign”). Priming was comparable in both conditions. Boudellaa and Marslen-Wilson (2013) took the overt root priming effects in the absence of a transparent semantic relationship as evidence that priming effect in their study were purely morphological and root-based (see also Geary and Ussishkin (2019) for a similar attempt to isolate morphological priming effects from semantic effects in Hebrew). However, this is inconsistent with evidence from a distributed connectionist model (Plaut & Gonnerman, 2000). Plaut and Gonnerman (2000) conducted a simulation to compare the effect of semantic transparency on processing in a morphologically rich language that simulates Hebrew and a morphologically impoverished language that simulates English. In the network, priming of semantically opaque words was only observed in the morphologically rich language. However, in both languages semantic transparency resulted in more priming indicating to the unavoidable semantic confound. Besides, priming in the absence of semantic transparency cannot be categorically taken as evidence of morpheme-based processing in Semitic languages as compared to word-based processing in Indo-European languages. That is, although behavioural evidence on some Indo-European languages such as English and French show lack of priming in the absence of semantic transparency, research on German, another Indo-European stem-based language, revealed similar findings to Semitic languages. That is, similar to findings in Arabic and Hebrew morphological priming does show regardless of semantic relatedness (Baayen & Smolka, 2020; Smolka, Komlósi, & Rösler, 2009).

Taken together, it is apparent that one cannot solely rely on the priming task to specify structural roles for morphemes in the processing of spoken words in Semitic languages. In other words, most priming studies conducted to investigate morphological effects in Arabic were visual-visual in both the prime and target or auditory in the prime and the target is visual (see also Khateb, Asadi, Habashi, and Korinth (2022) for the role of the root in visual word recognition in Arabic using the eye-tracking task). These do not tap into morphological effects in spoken word recognition. In addition, even when only auditory stimuli is used (Boudelaa & Marslen-Wilson, 2013) the very nature of the priming task cannot totally exclude semantic confounds.

Recently, other paradigms have been used to investigate the role of the root morpheme in Arabic spoken language processing. For example, Aldholmi and Pycha (2023) used the silence replacement paradigm in two experiments to examine the role played by consonants and vowels in sentence processing in Arabic. Subjects were asked to listen to spoken sentences and repeat them. They found out that replacing consonants with silence inhibited recognition more than replacing vowels with silence. They also found that recognition increases when the stimuli has a high ratio of consonants to vowels. The authors interpreted their findings as good evidence that speech processing in Arabic is mainly dependent on root consonants. These results showed clear influence for root consonants. However, since the silence placement paradigm involves a production task one may not accurately specify the locus of the root consonants' effect in this study. In other words, the root effect in the silence replacement on spoken word recognition cannot be isolated from its effect on any of the processes involved in speech production (Levelt, 1989; Levelt, Roelfs, & Meyer, 1999).

Alamri (2017) used the visual word paradigm with eye-tracking to investigate the effect of the root morpheme in Arabic spoken word recognition. In this paradigm, subjects listen to spoken words and selects the target word by clicking on one of two or more pictures that are presented on a computer screen. Fixation location and duration are measured. Using two experiments, Alamri tried to isolate root effects from phonological and semantic effects by manipulating morphological, semantic and phonological relatedness of the competing pictures to the spoken word. The findings were mixed. That is, in the context of prefixed target words (e.g., /masbaħ/ "swimming pool") it was found that root effects were independent of semantic effects. However, in the context of non-affixed words (e.g., /farʃah/ "rug") their results were similar to those obtained in the connectionist simulation by Plaut and Gonnerman (2000) discussed above. That is, there was "a graded activation of morphologically relatives as a function of semantic transparency" (Alamri, 2017, p. 163)

Taken together, the evidence suggests that when real words are used it proves difficult to fully dissociate morphological effect from semantic ones. In addition, other lexical effects (e.g., neighbourhood density) may be stronger in word processing as compared to nonword processing. To eradicate these problems a task is needed that a) exclusively taps into the lexical processing involved in spoken rather than visual word recognition b) rules out semantic effects and strong lexical effects involved in real word processing c) and at the same time, similar to the priming task, examines online (automatic) not offline processing.

Using an auditory lexical decision ALD task (Goldinger, 1996) with nonword stimuli meets these conditions. The ALD task has the potential of showing if native Arabic speakers can decompose a nonword utterance into root and pattern online similar to priming tasks but without any semantic cues. Such findings will provide more reliable evidence whether morphological processing in Arabic is root-based or stem-based and whether an obligatory decomposition takes place prior to lexical access. Using nonwords has two advantages. First, it eradicates the problems of semantic priming. Second, even if we take for granted the validity of priming task in confining effects to morphological ones, the current study will show if root effects can be replicated in other tasks especially those in which sublexical level representation (using nonwords rather than lexical representation using real words) dominates (Vitevitch & Luce, 1998, 1999). Vitevitch and Luce maintain that lexical competition is only partially involved when processing nonwords because they do not initiate "direct contact with a single lexical unit" (Vitevitch & Luce, 1999, p. 376). Following this proposal, it is assumed here that using nonword stimuli will show that root effects are not merely the byproduct of semantic or lexical effects but rather the result of decomposing the nonwords into their constituent morphemes early in the course of recognition (Boudelaa, 2014)

Recently, Aljasser (2020) used nonword stimuli to explore whether Arabic speakers' processing of nonwords is root-based. However, the nonword stimuli were presented in a rating task. In their rating task subjects were asked to rate the nonwords based on their wordlikeness in Arabic. Although their result showed that subjects were sensitive to the root in nonwords the rating task falls short of providing evidence that this sensitivity can be applied automatically and used effectively in spoken word recognition. It is probable that while Arabic speakers are already able to identify the underlying morphemes in the nonwords, their parsing efforts may not be fully automatized in natural online spoken word recognition.

The difference between offline and online processing has long been pointed out in the field of L2 acquisition. However, we borrow this distinction in our current investigation of L1 morphological processing because we are targeting an L1 linguistic question that has been disputed. Notably, a distinction has been made in the L2 acquisition literature between the two types of linguistic representations the L2 learner possesses which can reflect integrated and non-integrated knowledge (Jiang, 2000). The nature of the former representation is believed to be “unanalysed/automatic” and the latter to be “analysed/non-automatic” (Ellis, 1984). L1 processing, on the other hand, is assumed to always be characterized by the former representation (i.e., unanalysed/automatic). Therefore, we hypothesized here that if the root and pattern morphemes in L1 Arabic govern the spoken word recognition process, then access to their representations should be automatic. Specifically, we investigate the following research question:

Do Arabic speakers automatically decompose spoken nonwords into morphological constituents and use the root morpheme representation as the main unit of processing?

2. The current study

So far, we have argued that previous studies revealing root-based lexical processing in Arabic have certain limitations that can either confound their results (e.g., semantic confounds), or used an offline task (i.e., nonword rating) that affords subjects unlimited processing time and therefore does not tap into unanalyzed automatic lexical representation and processing. To investigate whether the root morpheme is independently represented and accessed automatically during spoken word recognition in Arabic, one has to investigate this question with a task that avoids these pitfalls. One such task is the ALD task (Goldinger, 1996).

2.1 Method

Here, we predict that if L1 Arabic spoken word recognition is governed by the root morpheme then L1 Arabic speakers will show unanalysed automatic lexical processing and decomposition process as reflected in the ALD task. In this task, subjects listen to a stimulus item and their task is to judge as quickly and as accurately as possible if the item is a real word in the target language or a nonsense word (nonword). Root-based lexical processing should show in the form of longer reaction times and more error rates when rejecting nonwords with real roots compared to nonwords with pseudoroots. If this does not show however, it should be good evidence that findings of previous studies were inconclusive. As mentioned above, the argument here is that neither previous task using real words nor nonword rating allow us to fully tap into morphological representation in spoken word recognition. On the one hand, the online tasks discussed above may be confounded with semantic effects. On the other hand, the offline nonword rating task may have been only tapping into an analysed, non-integrated and consequently non-automatic lexical representation and processing. Therefore, the ALD task allows more unequivocal interpretations of its results and helps us establish if Arabic native speakers use the root as the processing unit in online naturalistic spoken word recognition.

2.2 Participants

Thirty one native Arabic speakers, all students in the department of English language and translation, Qassim university, took part voluntarily in the experiment. Participants were all male. None of the participants reported a history of speech or hearing problems. Their age ranged from 19 to 21 years and their mean age was 20 years old.

2.3 Stimuli

The stimuli consisted of 60 nonwords and 60 real word fillers. The nonwords varied in their root status and were divided in two conditions. In the real root (RR) condition, forty of these nonwords had real roots (e.g., /taʕalmum/, /taʕamlul/). In the pseudo root (PR) condition 20 nonwords had pseudo (nonexistent) roots (e.g., /taʕalzuz/, /taʕamzuz/). The pseudo roots were mainly created by replacing the last consonant of the real roots (e.g., /ʕLM/→/ʕLZ/). The tri-consonantal real roots and pseudo roots in both groups of nonwords were embedded in the same pattern (i.e., {ta-a- -u-}). According to derivational rules of Arabic the derivation of the word /taʕallum/ "learning" is achieved through mapping the root /ʕLM/ into the four consonant's slots in the pattern by repeating the second root consonant /l/ so that it occupies consonant slot number 2 and number 3. The creation of the nonwords, however, was the result of illegal mapping of the three root consonants in the four consonant's slots in the pattern by repeating the third (not second) root consonant. For example, using this method, the three consonants of the real root /ʕLM/ were mapped resulting in the nonword /taʕalmum/. Similarly, the mapping of the pseudo root consonant /ʕLZ/ resulted in the nonword /taʕalzuz/.

Using this method of nonword stimuli creation has several advantages. First, and most importantly, it allowed the control of the nonword point. This is the point at which the nonword deviates from all real words and it has been shown to affect reaction time (Marslen-Wilson, 1984). If nonword rejection starts at this point then it is critical to control this point across conditions. In both conditions, the RR condition (e.g., /taʕalmum/) and the PR (e.g., /taʕalzuz/) the nonword point is phoneme number six (i.e., /m/ and /z/, respectively). Additionally, adopting this design allowed the balance of a number of important independent variables across conditions. To avoid confounding effects of word length, all nonwords were balanced for number of phonemes and syllables. This also allowed the control of the nonword initial phonemes. That is, all items began with /ta-/ which has an important role in activating the word's cohort during recognition (Marslen-Wilson & Welsh, 1978)

Every single stimuli item was spoken in isolation and recorded by a male native Arabic speaker using a high-quality microphone on to digital-audio-tape at a sampling rate of 44.1 kHz. The recordings were then saved as digital 16- bit files on a computer disk. The duration of the initial silence was fixed to 50ms in all stimuli items' files.

2.4 Procedure

A PC running E-prime (Schenider, Eschman, & Zuccolotto, 2002) was used for the experiment presentation and data collection. E-prime is a software used to design, generate, and run computerized behavioural experiments. Participants were tested individually and one at a time. Each participant was seated in front of a computer desk equipped with a set of Beyerdynamic DT-100 headphones. Prior to running the experiment, the instructions appeared on the computer screen in Arabic. Participants were instructed that they will listen to stimuli items and that their task is to judge which ones are real Arabic words and which ones are nonwords by pressing the relevant button on the keyboard. All participants' inquiries were answered prior to the start of the experiment.

Prior to the experimental trials, each participant received 12 practice trials. Half of these trials were real words and the other half were nonword. These trials were used to familiarize the participants with the task and were not included in the final data analysis. The participants were then presented with one of the randomly selected stimuli at a comfortable listening level over the headphones. The P button on the Keyboard (with a sticker indicating "nonword" in Arabic to remind subjects what the relevant button is) was for nonword selection and the W button (with a sticker indicating "real word" in Arabic) was for word selection. The participants responded as quickly and accurately as possible by pushing the appropriate labelled button. After each response, 1500 ms elapsed before the next token was played. RT was measured from the onset of the stimulus file to the onset of the response.

3. Results

Recall that we are interested in comparing reaction times and accuracy rates between the RR and PR conditions when subjects are selecting nonwords. Eprime data file was scored by assigning the value 1 to each correct response and the value 0 to each incorrect response. The correct response was when the subjects decided that a nonword was a nonword. The incorrect response was when the subjects decided that the nonword was a real word. The sum of these scores for each nonword was then divided by the number of subjects in each condition to calculate the mean correct response for each nonword. Overall mean correct response in the RR condition was (.896) and overall mean correct response in the PR condition was (.973). Mean RTs in ms and percentage correct with standard deviation (SD) for each of the two conditions are shown in Table 1.

Table 1. Mean RTs in ms and % correct by Condition

	Mean RT in ms (SD)	*% correct* (SD)
RR	1405 (68)	89.6 (7.6)
PR	1345 (67)	97.3 (2.9)

Table 1 shows that subjects responded to nonword in the RR condition slower than those in the PR condition and that they made more errors in the RR condition. Two separate t-tests were conducted on RTs and correct response. The first t-test showed that RTs in the RR condition were very significantly higher than those in the PR condition *t*.stat = 3.2, *p* = .0022, *t*(58.0.05) = 2.002.

Similarly, the other t-test showed that mean correct responses in the RR condition were extremely significantly lower than those in the PR condition *t*.stat = 4.3, *p* = .00007, *t*(58.0.05) = 2.002.

4. Discussion

The current study aimed to examine the robustness and automaticity of morphological decomposition in Arabic obtained in other studies. Previous studies used either potentially semantically confounded tasks or offline tasks that do not tap into automatic speech processing. Therefore, we attempted to answer the question whether Arabic native speakers automatically extract the discontinuous root consonants embedded in spoken nonword stimuli when no other semantic cues may be used. To answer this question an ALD task was employed in order to solely tap into auditory rather than visual recognition and at the same time, similar to other online tasks examine online not offline processing. The ALD task affords us this possibility by allowing the investigation of automatic sensitivity to morphological structure embedded in nonword stimuli.

The current findings are straightforward. Native Arabic speakers were slower and less accurate to reject nonwords with real roots than nonwords with pseudo roots. Recall that all nonwords in contrasting conditions were embedded in the same types of patterns. As a result, confounding variables such as initial phonemes, number of phonemes, number of syllables and position of the nonword point were all controlled. Therefore, this processing cost as manifested in slower RTs and more decision errors appears to be the result of activating the root morpheme representation after obligatory decomposition. This activation has a temporal cost associated with it and therefore made rejecting nonwords with real roots slower and less accurate. These findings contribute to the Arabic morphological processing debate in a number of ways. First, the present finding that Arabic speakers showed online automatic decomposition of the nonword stimuli and extraction of real roots is in line with the model that Arabic language is morpheme-based, the processing of which entails an obligatory decomposition (Boudelaa, 2014; Taft, 2004).

On the other hand, our findings diverge from the stem-based full-listing model (Butterworth, 1983) which posits that words are not accessed or represented as separate morphemes but rather as whole units. In other words, if the root morpheme is only accessed via a whole word representation, how would the root morpheme be accessed automatically when it is embedded in a nonword as in the current study? In contrast, given that nonwords were used in the present experiment, the current findings suggest that decomposition and activation of the root morpheme precedes lexical access. An attempt to account for decomposition in nonwords has been made by the Augmented Addressed Morphology Model (AAM) (Caramazza, Laudanna, & Romani, 1988). In this dual rout model, it is assumed that whole-word route and root morpheme route are used in parallel. When the complex word is familiar it activates the whole-word representation. However, when it is novel, which is claimed to apply to nonwords, morphological decomposition and activation of the root morpheme takes place. A similar model of processing was posited for a non-concatenative language, namely Hebrew; but see Boudelaa (2014) for a critical review and the positing of the obligatory decomposition model for Arabic.

Notwithstanding, decomposition accounts were posited mainly based on evidence from visual word recognition. These do not necessarily resemble the processes involved in spoken word recognition (Marslen-Wilson, 1984). In the current findings from spoken language processing, however, an interesting question is raised. That is, how can decomposition and extraction of the root morpheme take place automatically given the non-concatenative structure of Arabic language? Unlike written words the acoustic signal is linear. As a result, an emphasis on the Uniqueness Point (UP) has been made by initial models of spoken word recognition (e.g., Marslen-Wilson & Welsh, 1978). The UP refers to the point at which the word deviates from all other words in the listener's lexicon. (e.g., the phoneme /z/ in "thousand"). It was argued that spoken word recognition takes place exactly at this point regardless of internal morphological structure of the word. Main support of this position came from findings that when RTs were measured from the nonword deviation point, they were comparable regardless of the location of the deviation point in the nonword; that is, nonwords were rejected at their nonword point (Marslen-Wilson, 1984). The current findings diverge from this proposal in that reaction times were not constant from the nonword point.[2] In fact, our subjects needed significantly more time to monitor the input past the UP. This time was longer for nonwords with the real roots than nonwords with pseudo roots.

Clearly, continuous non-decompositional models of spoken word recognition which rely on linear recognition and assume that the lexical representations are structured in terms of whole words rather than morphological units cannot account for our findings. In fact, the current findings are more plausibly explained in terms of an automatic decomposition and activation of the morphemic representation which precedes lexical access. This, however, does not rule out the possibility that under some conditions Arabic speakers may use a dual route model to process some words in Arabic. Indeed, some recent evidence suggests they do (Alamri, 2017; Wray, 2016)

Given the non-concatenative nature of the root consonants, pronounceability seems to be peripheral to the representation and recognition of these morphemic units. Indeed, we agree with the mechanism of auditory representation and recognition which is elegantly captured by Gwilliams and Marantz (2015) based on their neural evidence of auditory decomposition in Arabic. They state that:

"Our results support the existence of a mechanism that is able to extract each component (in this case, consonant) of the root morpheme from the whole word, and set up a comparison between (1) the sensory evidence and (2) possible realisations of the root and their relative likelihood of occurrence. Incoming phonemes would presumably have to be separated into morphemic categories as they materialise over the speech stream, and recognised relative to mental representations of possible roots."(Gwilliams & Marantz, 2015, p. 10).

5. Conclusion

The current study has provided evidence that, even when hearing nonwords, processing in Arabic undergoes an automatic and unconscious decomposition to extract the root morpheme and use it as the main unit of processing. These findings have both theoretical and pedagogical implications. On the one hand, they provide support to theories of morpheme (root) based processing in Arabic (e.g. McCarthy, 1981) and the decompositional hypothesis of lexical processing (Taft & Forster, 1975). On the other hand, our results have important pedagogical implications for the teaching of Arabic as a second or foreign language. Morphological processing activities may need to be an integral part of Arabic teaching courses. Indeed, morphological processing training has been found to be as effective as phonological processing in teaching spelling to Arabic speaking children (Taha & Saiegh-Haddad, 2016). Future research should seek to explore the mechanism underlying lexical processing of Arabic as a second language and whether morphological processing intervention can accelerate the acquisition of the decomposition-based lexical processing which native Arabic speakers adopt.

Endnotes

[1] The three consonants [fʕl] in the pattern are used as place holders for root consonants.
[2] Although RTs in the current study were measured from the beginning of the nonword, not the nonword point, the stimuli prior to the nonword point including initial silence was balanced across items making auditory stimuli duration up to the nonword point comparable.

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معلومات عن الباحث

د. فيصل الجاسر، أستاذ مشارك (اللغويات التطبيقية) في (قسم اللغة الانجليزية والترجمة) (كلية اللغة العربية والدراسات الاجتماعية) في جامعة القصيم (المملكة العربية السعودية). حاصل على درجة الدكتوراه في اللغويات التطبيقة من جامعة نيوكاسل عام 2008. تدور اهتماماته البحثية حول علم اللغة النفسي خصوصًا ما يتعلق بفهم وإدراك ونطق اللغة العربية كلغة أولى ولغة ثانية.

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