Semitic root facilitation in picture-word-interference: Evidence from Arabic

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In the picture-word-interference (PWI) paradigm, participants name pictures (i.e. target words) while ignoring distractor words. Studies on Indo-European languages reported several experimental effects, including semantic interference (slower naming times for target – distractor pairs belonging to the same semantic category, e.g., *cow-sheep* than for unrelated pairs e.g., *cow-table*), semantic facilitation (shorter naming times for pairs involved in other semantic relationships, e.g*., glove-hand,* than for unrelated pairs), and phonological facilitation (shorter naming times when pairs overlap in their phonology, e.g., *carrot-castle*).

A few studies used the PWI paradigm to investigate word production in Hebrew, a Semitic language. Words in Semitic languages are composed of two non-concatenated units; vocalic patterns, predominantly made of vowels, and roots, typically made of three consonants (i.e. [**k**-**t**-**b**] 'to write'). Roots provide information on the semantic field, and can be shared between several derived forms (i.e. /**k**i**t**a**b**/ 'book', /ma**kt**a**b**a/ 'library', /**k**a**t**e**b**/ 'writer'). Consequently, words sharing the same root are phonologically similar, and semantically related. Three studies reported root facilitation effects (shorter naming latencies when target and distractor words shared the same root than for unrelated pairs) in Hebrew (Deutsch & Meir, 2011; Deutsch, 2016 & Kolan, Leikin & Zwitserlood, 2011). The authors concluded that roots are represented in the mental lexicon and accessed as independent morphological units during word production tasks. Crucially however, because words sharing roots also share phonological and semantic information, this conclusion is only warranted if it can be shown that the root facilitation effect is not driven by the semantic and/or phonological relationship between the two words. Studies on Hebrew tested for phonological and semantic relatedness effects, but reported heterogeneous results. Kolan et al. (2011) reported no effect of semantic interference, but Deutsch & Meir (2011) did report an interference effect in their semantic condition. Similarly, Deutsch & Meir reported phonological facilitation in their phonological condition, but Deutsch (2016) and Kolan et al. (2011) reported no effect of phonological overlap.

The first aim of the present study is to replicate the root facilitation effect in another Semitic language, Arabic. The second aim is to determine whether phonological facilitation can be obtained from distractors that do not share the root but overlap in phonology, in a non-concatenated manner that mimics the phonological overlap of pairs sharing the same root. The third aim of the present study is to examine whether the semantic interference effect can be observed in Arabic. This effect is central to models of lexical access in word production. It remains an open question whether these models also apply to other language families.

Native speakers of Arabic (N = 45) performed a PWI task. Target and written distractor words were combined to form six conditions (see Table 1 for examples). In the Root-related condition, the two words shared the root. In the Phonological condition, words shared letters/phonemes in a non-concatenative fashion. In the Semantic-related condition, pairs belonged to the same semantic category. Each condition was compared to an unrelated condition.

In line with previous studies, the root-related condition led to shorter naming latencies compared to the unrelated condition (108ms, *SE*= 13.69). Moreover, naming latencies in the phonological condition were shorter compared to the unrelated condition (38ms, *SE*= 13.67). Finally, we observed slower naming times for semantically related than unrelated pairs (64ms, *SE*= 13.89). Facilitation in the phonological condition suggests that at least part of the root facilitation effect is driven by phonological similarity. Studies are now needed to determine if part of the root facilitation effect can be associated with morphological processing or can be explained by phonological and semantic facilitation alone. Finally, the semantic interference effect suggests that at least some features of models of lexical access built for Indo-European languages also apply to Semitic languages.

Table 1. Examples of targets and distractors in the root-related condition, semantically-related condition, and phonologically/orthographically related condition.

Target	Root-related distractor	Semantically-related distractor	Phonologically/orthographically related distractor
/**k**i**t**aa**b**/ 'book'	/ma**kt**a**b**a/ 'library'	/daftar/ 'notebook	/kanab/ 'sofa'
/me**dx**a**n**a/ 'chimney'	/**d**e**x**a**n**/ 'smoke'	/mukayef/ 'air conditioner'	/maxama/ 'broom'
/mu**ɣ**a**ni**/ 'singer'	/u**ɣni**ya/ 'song'	/ʕaazef/ 'instrument player'	/ma**ɣ**nat^{ʕ}is^{ʕ}/ 'magnet'
/ma**sdʒid**/ 'mosque'	/**s**u**dʒ**uu**d**/ 'prostration'	/kanisa/ 'church'	/mudʒassam/ 'figure'

References

Deutsch, A., & Meir, A. (2011). The role of the root morpheme in mediating word production in Hebrew. *Language and Cognitive Processes*, 26(4-6), 716-744.

Deutsch, A. (2016). The separability of morphological processes from semantic meaning and syntactic class in production of single words: Evidence from the Hebrew root morpheme. Journal of psycholinguistic research, 45(1), 1-28

Holes, C. (1995). Community, dialect and urbanization in the Arabic-speaking Middle East. *Bulletin of the school of oriental and African studies*, 58(2), 270-287.

Kolan, L., Leikin, M., & Zwitserlood, P. (2011). Morphological processing and lexical access in speech production in Hebrew: Evidence from picture–word interference. *Journal of Memory and Language*, 65(3), 286-298.

McCarthy, J. J. (1981). A prosodic theory of non-concatenative morphology. *Linguistic Inquiry,* 12, 373–418.

The formation of Semitic words

Semitic languages like Hebrew and Arabic greatly differ from the more widely studied Indo-European languages in terms of their morphological structure (Holes, 1995; McCarthy, 1981). In English, morphemes concatenate together in a linear fashion to produce a morphologically complex word, such as “books” (i.e. “book” + “s”). By contrast, Semitic words are made of two bound morphemes which are combined through a non-linear system. The first morpheme is the root (henceforth formatted in bold), which has been described to act as a content morpheme that carries semantic meaning. Roots are made of strings of non-concatenative consonants, and each root represents a particular semantic field (i.e. Arabic roots [**k-t-b**] ‘to write’, [**l-ʕ-b**] ‘to play’, [**r-s-m**] ‘to draw’). The second morpheme is the vocalic pattern, which is pre-dominantly made of vowels (e.g., (i.e. [_i_a_]). Vocalic patterns determine grammatical features such as gender and number in nouns, and tense and aspect in verbs. Roots and vocalic patterns are combined in a non-concatenative way to create surface word forms. For example, combining the root [**k-t-b**] ‘to write’ with the vocalic pattern [_i_a_] ‘denoting noun (n.), masculine (m.), singular (s.)’, results in the surface word form /**k**i**t**a**b**/ ‘book’. Similarly, when the same root [**k-t-b**] ‘to write’ is combined with the vocalic pattern [ma_ _ a_ a] ‘denoting place noun (p.n), feminine (f.), singular (s.)’, it results in the surface word form /ma**kt**a**b**a/ ‘library’.

Therefore, words sharing the same vocalic pattern denote the same grammatical features, whereas words sharing the same root typically denote the same semantic field, although there are a restricted number of cases in Semitic languages where the same root can indicate different meanings (i.e. Hebrew root [**n-ʕ-l**] in /**n**a**ʕ**a**l**/ ‘shoe’ and /ma**nʕ**u**l**/ ‘a lock’).