Lexical retrieval after Arabic aphasia: Syntactic access and predictors of spoken naming

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Abstract

Research into anomia has been carried out in English and many Indo-European languages extensively, but not in Arabic. Previous studies have investigated predictors of successful lexical retrieval after anomia, and access to syntax during lexical retrieval. The aim of the current study is to examine impaired lexical retrieval in Arabic at two levels: predictors of lexical retrieval, and access to syntax during lexical retrieval, via checking whether syntactic cueing (using the definite article al-‘the’ prior to nouns) facilitates noun retrieval in Arabic aphasia, with regard to naming speed and accuracy, and establishing the determinants of aphasic noun retrieval in Arabic. Three participants with anomia following CVA named 186 pictures from a published Arabic database in two conditions: bare noun condition, and determiner + noun condition. Participants’ accuracy and reaction times were compared in both conditions. Furthermore, a multiple regression analysis was carried out to test the effect of psycholinguistic variables (visual complexity, name agreement, age of acquisition, imageability and other intrinsic variables) on successful lexical retrieval to determine predictors of Arabic noun retrieval after anomia. The production of the determiner + noun in picture naming facilitated spoken naming in all three participants. Nouns produced with the determiner were produced faster and more accurately than their counterparts produced without the determiner. The two participants with agrammatism produced morpho-syntactic errors in the bare noun condition, but not in the determiner + noun condition, suggesting that the determiner sets up a noun phrase frame with a slot for the noun to be filled, resulting in responses that are faster and more accurate. Age of acquisition and imageability were the only two variables that had influence across the participants. These results have theoretical and clinical implications for lexical retrieval models.

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1. Introduction

Anomia is the inability to retrieve words after an injury to the language areas in the brain. It can be caused by a deficit in the mental representation of semantics, syntax or phonology. Additional causes of anomia could be weakening or blocking of the links between representations at different levels (Laine & Martin, 2006). Studies investigating lexical retrieval following anomia have looked into what psycholinguistic factors influence successful lexical retrieval. Studies on anomia have also

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investigated the effect of semantic and phonological cueing on lexical retrieval facilitation (e.g. Nickels & Best, 1996). More recently, a number of studies have investigated the role of syntax in lexical retrieval through syntactic cueing methods (e.g. Gregory, Herbert, & Varley, 2010; Herbert & Best, 2010; Ritschel, 2009). This has yielded a vast body of data from Indo-European languages, with clinical and theoretical implications beneficial to speakers of those languages and the overall anomia research body. Previous studies in the current line of research have looked into accuracy of aphasic responses, while reaction times/response latencies have not been used as a measurement of lexical retrieval, based on the assumption that reaction time data may be an unreliable indicator of performance in patients with aphasia due to the heterogeneous nature aphasic reaction times. The current study investigates lexical processing in Arabic, in service of its speakers and the wider body of literature. Moreover, reaction times are used as a measurement of successful lexical retrieval.

1.1. Access to syntax during lexical retrieval

Semantic and phonological cueing methods have been used to facilitate retrieval, and have been shown to improve the lexical retrieval process (e.g. Boyle & Coelho, 1995; Howard, Patterson, Franklin, Orchard-Lisle, & Morton, 1985; Law, Wong, Sung, & Hon, 2006). Furthermore, activation of semantics and phonology during lexical retrieval has been found to be robust and non-arguable (Caramazza, 1997; Dell, Schwartz, Martin, Saffran, & Gagnon, 1997; Levelt, Roelofs, & Meyer, 1999; Patterson & Shewell, 1987). Activation of syntax during lexical retrieval has been a matter of dispute among scholars. While Dell et al. (1997) and Levelt et al. (1999) maintain that syntax is central to lexical retrieval, Caramazza (1997) questions whether access to syntax during lexical retrieval is needed.

According to Levelt et al.’s (1999) Weaver ++ model, lexical retrieval starts with the conceptual preparation stage which is followed by the lexical selection (lemma). After the lexical selection stage, morphological and phonological encoding takes place and finally phonetic encoding and articulation occurs. Levelt et al. (1999) maintain that during the lexical selection stage activation is spread to the target word’s lemma node, at which the syntax of the target word becomes available for grammatical encoding, by creating the suitable syntactic environment for the target word. Information such as number and gender for nouns, and argument structure, tense, mood, person and number for verbs are encoded at this level, allowing speakers to combine words to form sentences (e.g. Cleland & Pickering, 2003). The Weaver ++ model is based on the assumption that these levels of processing are independent from each other, activation is feed-forward; once a lexical node is selected at a certain level, it has no influence on previous levels.

Dell et al.’s (1997) Interactive 2-step model proposes three layers of processing; semantic, word (lemma), and phoneme (phonology). The ‘word layer’ at which syntactic information of the target word is retrieved. This level is responsible for grammatical encoding which in turn determines the most appropriate syntactic environment for the word in question (Dell et al., 1997). According to Dell et al. (1997), after semantic nodes for a given noun are activated, the activation spreads to the word or syntactic level which mediates between semantics and phonology. This activates all possible syntactic environments that are relevant to the target noun. The 2-step Interactive model suggests that while levels of processing are represented independently, they influence each other and overlap in time. Once lexical nodes are selected, they send activation back to nodes at preceding levels. Then, they spread activation forward to nodes at the next levels.

In contrast with the models presented above, Caramazza’s (1997) Independent Network (IN) model proposes a dual-stage model in which an activation of semantic features is followed by parallel and independent activation of syntactic features and phonological form, suggesting that access to syntax and phonology occur independently and in parallel in single word production. Caramazza (1997) questions whether the lemma level is necessary in lexical retrieval, citing evidence from brain-damaged patients with selective grammatical class impairments restricted to either oral or written production, including a disadvantage in verb production either orally or in writing but not in both. This dissociation argues against an amodal lemma level. The Independent Network is a forward activation model, like the Weaver ++. However, Caramazza (1997) maintains that the activation from lexical-semantic representations to lexical-syntactic representations and the word-form networks spreads simultaneously and independently, which is unlike the Weaver ++ and the 2-step Interactive models.

1.2. Neuropsychological and experimental evidence

Investigations of both views have been undertaken in healthy participants (e.g. Miozzo and Caramazza, 1999; Vigliocco, Antonini, & Garrett, 1997) and participants with aphasia (e.g. Friedmann & Biran, 2003; Herbert & Best, 2010). Findings from these studies varied depending on the methodological used and different populations of participants. Some studies were in support of the view that access to the lemma is necessary during lexical retrieval, while others maintained it is optional.

Miozzo and Caramazza (1999) asked their healthy Italian-speaking participants to recognize the initial phoneme, grammatical gender and the final phoneme of unavailable words during tip-of-the-tongue state. The results showed higher accuracy in grammatical gender recognition than phonemic recognition of target words. This led the authors to suggest that there is no correlation between syntactic and phonological information, which is incompatible with the Weaver ++ and the Interactive 2-step models.

Recent evidence from Herbert, Anderson, Best, & Gregory (2014) was in support of Caramazza’s (1997) IN model. The authors investigated syntactic processing in fourteen healthy controls and thirteen speakers with aphasia through naming mass and count nouns, and completing a noun syntax judgment task. The results suggest a lack of relationship between naming accuracy and syntax as evident from the error analysis. Participants’ semantic errors were best explained within the
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