

Structure-level lexical interactions in memory search across multiple domains: A case study of normal hearing individuals and those with cochlear implants

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What does it mean to search through one's memory? What kind of individual differences affect the memory search process? This work investigates such inquiries in the specific context of responses to a verbal fluency task (VFT), where a participant is given a limited amount of time (e.g., 1 minute) to generate as many words as possible that meet a specific criterion or category (e.g., animals). Searching through one's memory involves both the navigation of internal structural representations and the processes that impact those structural representations (Kumar et al., 2024). In order to differentiate the contributions of underlying structural representations from the processes that act upon them, this project's sample includes prelingually deaf individuals, who do not have access to abundant speech and phonological information during the development of early language. Therefore, a comparison between prelingually deaf individuals with cochlear implants and normal hearing individuals has the capability to reveal the role that speech and phonological information play in language development and whether that vehicle of development affects memory search and retrieval processes.

Speech acts as a multimodal vehicle by which meaning can be conveyed. When paired with appropriate prosody, speech offers components that enhance meaning, such as intonation, emotion, rhythm, and cadence. This listening experience is therefore more complex and informative than the reading experience of simply interacting with written text. With those fundamental differences between speech and written language in mind, the motivating questions of this research were as follows: is the process of semantic search significantly different across hearing groups as a result of the modality of language development? Are those differences consistent across categorical domains?

VFT responses for *animals* and *foods* from normal hearing individuals and prelingually deaf individuals were examined. The *foods* sample included 44 total individuals, 25 of which were normal hearing individuals (NHs), 18 of which were prelingually deaf individuals with cochlear implants (CIs), and one individual whose hearing status was recorded as n/a. The *animals* sample included 64 total individuals, 31 NHs, 29 CIs, and four n/a individuals. Individual's responses to the VFT were run through a Python package called *forager* in order to evaluate lexical patterns, using Universal Sentence Encoder (USE) as a baseline lexical model, and were analyzed on measures of semantic similarity, phonological similarity, word frequency, and number of valid items generated (Kumar et al., 2023).

I conducted a repeated measures ANOVA using 41 individuals who completed the *foods* and *animals* VFTs. While results indicated that mean semantic similarity and mean phonological similarity did not differ between NHs and CIs within any domain, a main effect of group was found in regard to mean frequency value in response to the *animals* VFT. A main effect of domain was found across all lexical patterns (mean semantic similarity, mean phonological similarity, mean frequency value). For example, both groups used significantly lower frequency items in response to the *foods* VFT compared to the *animals* VFT. However, this work assumes that both hearing groups are using the same underlying semantic representations (USE). Future work will examine whether some of these differences are obscured as a result of this assumption and will pursue analyses to illuminate such differences.

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