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Multimodal conceptual knowledge influences lexical retrieval speed: evidence from object-naming and word-reading in healthy adults

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Getting from a concept to a spoken word relies on access to specific neural systems that support different knowledge domains (Caramazza & Mahon, 2006; Mahon & Caramazza, 2009). For example, a concept's visual form, diagnostic colour, manner of motion, or action it may invoke. It is proposed that modality-specific knowledge converges in the anterior temporal lobes (aTLs) to form a multimodal or unique representation (Lambon Ralph et al., 2015). This knowledge can be accessed in many different ways. For example, thinking of a concept, seeing a visual image, or reading a written word. All concepts are multimodal but some are more strongly associated with sensory and functional modalities than others. Experiencing the smell of a pineapple may invoke its unique taste, visual appearance, and texture. A table, however, is not strongly associated with such rich qualities. This multimodal convergence may assist lexical retrieval, but does it facilitate processing speed?
The aim of the current study was to examine if multimodal information facilitates lexical retrieval. No predictions were made; however, it was hypothesised that there would be an effect of multimodality on reaction time in object-naming and word-reading tasks.
Using 160 words (Cree & McRae, 2003) rated for different modality attributes (e.g., visual, olfactory, auditory: Hoffman & Lambon Ralph, 2013) word-reading and object-naming tasks were designed. For object-naming, 143 words were substituted for corresponding line drawings; 17 were omitted because they were likely to induce coordinate semantic errors. Means were calculated for items across each attribute and categorised as low (M= 3.07, SD=.35) or high (M=4.11, SD=44) using a median split ($p<.001$). Tasks were administered separately via E-prime 2. Items were presented centrally for an unlimited duration following a 500ms fixation cross. Participants were seated 50cm from the screen and instructed to respond quickly and accurately.
For object-naming, ANOVA revealed a significant effect of multimodality ($F(1, 14)=29.68$, $p<.001$) reflecting the fact that RTs were faster for high multimodal stimuli (high: M=1087.08; SD =228.03, low: M=935.32; SD=172.23). The same pattern was found for reading ($F(1, 14)=5.24$, $p<.04$), although the differences were much smaller (high: M=549.98; SD=89.33, low: M=527.30; SD=68.36). Results suggest a processing advantage for items with rich multimodal representations, perhaps because a wider neural network is optimised to support rapid lexical retrieval following visual input. This pattern was also observed for reading, albeit to a lesser extent. By virtue of their visual appearance, words carry fewer features that may provoke the multimodal processing advantage. This finding is consistent with the proposal that reading does not require access to semanticsv (Coltheart et al., 2001). Further analysis with a larger sample aims to establish whether particular attributes (e.g., colour) are predictive of a processing advantage in object-naming and reading.

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Keywords: Object knowledge, Semantic Representation, multisensory processing, lexical retrieval, Conceptual representation

Conference: Academy of Aphasia 56th Annual Meeting, Montreal, Canada, 21 Oct – 23 Oct, 2018. **Presentation Type:** poster presentation

Topic: Eligible for a student award

Citation: Mackenzie-Phelan R and Roberts DJ (2018). Multimodal conceptual knowledge influences lexical retrieval speed: evidence from object-naming and word-reading in healthy adults. *Front. Hum. Neurosci. Conference Abstract: Academy of Aphasia 56th Annual Meeting.* doi: 10.3389/conf.fnhum.2018.228.00107

Received: 30 Apr 2018; **Published Online:** 14 Dec 2018.

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