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NEURAL PROCESSING OF REPEATED SEARCH TARGETS: HOW ARE PREVIOUSLY ENCOUNTERED TARGETS REPRESENTED IN MEMORY?

Alexis Torres (Dr. Trafton Drew and Lauren Williams)
Department of Psychology

As part of our daily routines, we spend a vast amount of time searching for objects in our environment. In an everyday context, we may search for car keys in the morning. In a more specialized context, a radiologist searches for a fracture in a medical image. To search for and locate a novel object, it is thought that we hold a mental representation of it in visual working memory in order to guide attention to target-relevant features in our environment.

Two neural correlates of mental activity that are used to study memory and attention were utilized in this study, the contralateral delay activity (CDA) and N2pc. The CDA informs us about whether an item is being held in visual working memory (VWM). Specifically, the CDA is an indicator of VWM load, such that it is larger when VWM load is larger (Vogel & Machizawa, 2004). N2pc informs us about attentional allocation to target features, such that it is larger when a target object in our visual field is attended (Luck & Hillyard, 2004).

When we get ready to search for a novel object, the representation of that item is housed in VWM—producing a larger CDA (Kappenman & Luck, 2012). When an object is repeatedly presented, the representation of that object is transferred into long-term memory (LTM)—producing a smaller CDA (Carlisle, et al., 2011). In contrast to simple laboratory stimuli, repeated real-world objects result in a larger N2pc wave, suggesting attentional allocation to real-world objects may benefit from LTM representations (Jones, et al., 2018). However, stimulus type does not affect rate of transfer out of VWM.

For this pilot study, we measured CDA and N2pc amplitude using EEG to investigate whether real-world objects that have been presented repeatedly, then reintroduced after an extended period, are treated as new (represented in VWM) or old (represented in LTM). This was tested by having participants complete two sessions of a search task. In the training session, participants were cued to attend to a target object. After a retention period, participants searched for and indicated whether their target was among an array of distractor objects. Targets were repeated once or six consecutive times. For the testing session, participants were cued to attend to a target object (which was previously encountered or brand new). After a retention period, participants searched for and indicated whether their target was among an array of distractor objects. N2pc was measured at 200-300 ms and CDA is measured at 300-1000 ms.

We predict that individuals will be faster and more accurate when searching for real-world objects that have been presented repeatedly as compared to items that have only been presented once or are brand new. We expect that presentation of novel objects will produce a smaller N2pc and larger CDA wave; whereas, repeated objects will produce a larger N2pc and smaller CDA wave. By investigating how repeated objects are represented in memory, we hope to gain an understanding about the conditions under which items in visual working memory are transferred into long-term memory.

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