

To be, or not to be, remembered: Patterns of memorability in the medial temporal lobe

Wilma A. Bainbridge (1), Daniel D. Dilks (2), Aude Oliva (3)

1 – Department of Brain and Cognitive Science, MIT

2 – Department of Psychology, Emory University

3 – Computer Science and Artificial Intelligence Laboratory, MIT

We are constantly encoding the world around us into memory, but remembering only some images of faces or places, while forgetting others. These images differ in their *memorability* – a predictive value of whether a novel stimulus will be remembered or forgotten that is highly consistent across observers (Bainbridge et al, 2013; Isola et al, 2011). The current study investigates how memorability is represented in a classic memory-related cortical region, the medial temporal lobe. In an fMRI study, human observers (N=16) viewed images of faces and scenes that were determined *a priori* as being highly memorable or highly forgettable, and viewed them only once each. While in the scanner, participants performed an orthogonal categorization task (i.e., male/female for faces; indoor/outdoor for scenes). Participants were not aware of any memory-related nature to the study, and completed a post-scan memory test. Stimuli were controlled for both low-level image statistics (i.e., spatial frequency, color), as well as higher-level attribute information (i.e., gender, race, attractiveness, and emotion for faces, and indoor/outdoor, natural/manmade, and no faces or animals for scenes). Despite these tightly controlled visual and semantic attributes, significant differences in BOLD activity were found between memorable versus forgettable images in regions of the medial temporal lobe: the amygdala (for faces only), perirhinal cortex, and parahippocampal cortex. In addition, multivoxel pattern analyses found significantly high pattern classification accuracy for memorable images versus forgettable images in the hippocampus, perirhinal cortex, and parahippocampal cortex. Neither univariate nor multivariate effects of memorability were found in the entorhinal cortex. These results indicate that i) even when an image is first perceived, the medial temporal lobe is distinguishing images that should be later remembered versus forgotten, and ii) image memorability can be utilized as a general image attribute that is linked to stereotyped cortical activity.

Funded by the DoD NDSEG Program to W.A.B. Thanks to the Athinoula A. Martinos Imaging Center at the McGovern Institute for Brain Research, MIT.