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A resource model of phonological working memory

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Abstract

Classic models of working memory (WM) place an upper bound on the number of items that can be retained at a given time. These models predict perfect recall precision up to capacity and a sharp drop in precision past the capacity limit. Recently, an alternative “resource” model has been proposed for visual WM, which views WM as a resource divided between any number of representations to be held in memory. Recall precision thus decreases monotonically as the number of items increases. A prominent advantage of the resource model is its biological plausibility: Activity in a neural population encoding a certain item is divided by the sum of the activities of neurons in all populations encoding items, thus the larger the number of items, the lower the activity (gain) of the population encoding each item. A second advantage of the resource model is that it posits a direct link between attention and working memory, by proposing that division of resources between items is driven by attention, such that attended items receive more resources at the cost of the unattended.

In two experiments, we tested the predictions of the resource model for phonological WM when participants rated syllables on a continuum (1-100) between phoneme pairs (e.g., most /kA/ like to most /gA/ like) that differed in a single feature. Experiment 1 manipulated the set size (1, 2, 4), while Experiment 2 manipulated attention by cueing items that had a higher likelihood of being probed. Precision was measured as the reciprocal of the variance around the median rating for each stimulus.

As predicted by the resource model, precision decreased monotonically as set size increased, even from 1 to 2, and for uncued items in favor of cued. Collectively, these results support a flexible resource model of phonological WM, similar to visual WM.