Serial memory strategies in macaque monkeys: behavioral and theoretical aspects

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Abstract:

Serial memory is the ability to encode and retrieve a list of items in their correct temporal order. To study nonverbal strategies involved in serial memory, we trained four macaque monkeys on a novel delayed sequence-recall task and analysed the mechanisms underlying their performance in terms of a neural network model. Thirty fractal images, divided into 10 triplets, were presented repeatedly in fixed temporal order. On each trial the monkeys viewed three sequentially presented sample images, followed by a test stimulus consisting of the same triplet of images and a distractor image (chosen randomly from the remaining 27). The task was to touch the three images in their original order, avoiding the distractor. The monkeys' most common error was touching the distractor when it had the same ordinal position (in its own triplet) as the correct image. This finding suggests that monkeys naturally categorize images by their ordinal number. Additional, secondary strategies were eventually used to avoid distractor images. These include memory of the sample images (working memory) and associations between triplet members. Further direct evidence for ordinal number categorization was provided by a transfer of learning to untrained images of the same ordinal category, following reassignment of image categories within each triplet. We propose a generic three-tier neuronal framework that can explain the components and complex set of characteristics of the observed behavior. This framework, with its intermediate level representing ordinal categories, can also explain the transfer of learning following category reassignment.

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