Cognitive and Neurobiological Approaches to Learning and Memory in Nonhuman Animals

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Pigeons responded to three individually illuminated spatial locations, left, center, and right in a serial reaction time task similar to one used with humans by Nissen and Bullemer (1987). The structured condition involved a nine-item repeating sequence of left, left, left, center, right, center, right, center, and right. The unstructured condition involved random locations. Nissen and Bullemer found faster reaction times in the structured condition compared to the unstructured condition, implying that the subjects in some sense remembered the list. The present study clarified what a participant learned and remembered about the list. Specifically, responding to a location was facilitated when that location could be better predicted based on the previous one or two items, i.e., on first- and second-order likelihoods. Furthermore, responses to successive locations within a two- or three-location repeated pattern, or chunk, were progressively faster, implying that pigeons learned to unitize several successive locations into a single chunk.

Tasks were also run with rats the CA1, CA3, and dentate gyrus subregions of the hippocampus in the learning and memory of spatial location. The end of each arm of the maze was baited with a hidden Froot Loop. In each trial the rat ran down one arm to eat the Froot Loop, and after 10 seconds it was given the choice of the arm it had visited previously and a new unvisited arm. To measure for impairments in learning and memory of spatial location, the number of mistakes and length of time taken to respond were recorded both before and following lesioning of one of the three subregions. It so far has been found that when the CA3 subregion was lesioned, rats made more mistakes and were slower than controls. Rats with CA1 and dentate gyrus lesions did not show any significant changes compared to controls.