Video Article

Using T- or Y-mazes to measure working and reference memory in mice

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Abstract

Mice and rats typically choose to consecutively enter different goal arms when repeatedly placed in a T- or Y-maze. This reflects their natural exploratory behaviour in the wild. This "spontaneous alternation" behaviour has been used for decades by experimental psychologists to measure rodent working memory, i.e. memory for what the animal has just done. This is distinct from reference memory, where the solution is always the same, e.g. "always go left; always choose the white box not the black". Although spontaneous alternation has been used for many years to study rodent behaviour, typical alternation rates reported in the literature for discrete-trial designs are only around 75%, and alternation is regarded as rather unreliable by some researchers. We report here that rates of 90% or higher are achievable if the animals are prevented from sampling cues from the arm not visited. Manipulations that affect spontaneous alternation in rodents almost always affect memory for recent events in humans, unlike many other rodent cognitive tests. This suggests that alternation is one of the best, certainly most simple and accessible (in terms of apparatus and experimenter time, especially if automated versions are employed) tests of episodic memory. It therefore has great potential in the search for treatments for dementia such as Alzheimer's disease. Reference memory can also be studied in a T-maze. The more cues that are provided, the faster learning will be. We have successfully used a fixed body turn response (e.g. a particular mouse always has to turn right for the reward) combined with distinctive goal arms decorated with different objects and paint schemes (e.g. the mouse is always rewarded for choosing the right arm with nails on the floor and a chequered black-white right wall, never the left arm with small stones on the floor and a black left wall. A Y-maze is useful for studying "procedural" learning. Each mouse is allocated a direction in which to turn, whichever arm of the maze it is placed into. So, for example, to reach the reward, a particular mouse always has to turn left, whether placed in arm A, B or C. The arms of the maze are all identical and undecorated. Mice with complete lesions of the hippocampus perform normally on such Y-maze procedural learning, which compares favourably with their chance performance on alternation tasks.

Disclosures

No conflicts of interest declared.

