Recognition memory: Opposite effects of hippocampal damage on recollection and familiarity

Magdalena M. Sauvage, Norbert J. Fortin, Cullen B. Owens, Andrew P. Yonelinas and Howard Eichenbaum

Supplementary material:

Methods

Adult Long Evans male rats (225-250g) were maintained under reverse light/dark cycle (6 a.m. light off, 6 p.m. light on), food deprived to 85% of their body weight and received water *ad libitum.* Testing took place during the day in the home cage. During shaping, rats learned to retrieve 1/4 Froot Loop cereal buried in each unscented medium contained in a 125 ml plastic cup (NALGENE). Subsequently, a pool of eleven media and ten odors was used, allowing the creation of 110 distinct odor-medium pairings. Ten original (old) and ten rearranged (new) pairs of odor-medium were chosen randomly for each daily session (5 sessions/week). Rats were trained on a delay non-matching to sample task in which a single stimulus pair baited with 1/4 Froot Loop was presented, then after a 1 min delay, the old pair and a new pair were presented sequentially. To ensure that rats could not solve the task using olfactory cues, both cups were baited but the bait in the original pair was made inaccessible. As animals acquired the task (80% correct over 3 consecutive 10 trial sessions), the number of original pairs increased from 1 to 10 and the delay between initial presentations and testing increased from 1 min to 30 min. Rats were trained to the same criterion then over-trained for 10 additional sessions. Subsequently, 5 response criteria were generated by varying the size of the cup and the amount of reward. Once probabilities for hit and false alarms were within a range of 0.2 for each bias over three consecutive sessions, data were collected for 2 additional sessions for each bias and subjects were divided into two groups of equivalent performance in d' and Ro and surgeries for sham or hippocampal lesions were performed. Following two weeks of recovery, rats received six testing sessions per bias and the five last sessions were averaged and used to construct the ROC curves (fig.2a).

R^2_{quadr} and R^2_{lin} were obtained by fitting polynomial and linear regression lines to each individual data set. Unpaired *t*-tests were used to compare Ro, d' (fig.2c) and percent correct scores. To directly compare scores on recollection and familiarity, Ro and d' scores of each subject were normalized as standard deviations from the average for the same variable and a two-way ANOVA was performed with Ro and d' as parameters followed by unpaired *t*-tests.

Generating ROC and z-transformed ROC functions, Ro and d' estimates

ROC functions were generated for each animal by plotting the hit rate against false alarm rate in each response bias condition. ROCs were quantified further by taking the z-scores of the hits and false alarms and plotting the ROCs in z-space. A least squares algorithm (Yonelinas et al., 1997) was used to estimate the intercept and the degree of curvilinearity observed in each ROC, which reflects recollection (Ro) and familiarity (d'), respectively. Because lure items could be recollected as having been recombined, an additional recollection parameter was included for the lure items (Rn), but this parameter was close to zero and is not discussed further. The model equation, $P('old'|old) = P('old'|new) + Ro + (1 - Ro)\,\Phi(d'/2 - c_i) - (1-Rn)\,\Phi(-d'/2 - c_i)$, assumes that recognition reflects the contribution of recollection process and a signal detection based familiarity process. The variable d' reflects the distance between two equal-variance Gaussian strength distributions, c_i reflects the response criterion at point i, and Φ is the cumulative normal response function.

Yonelinas AP. *Mem Cognit*.**25** **(**6):747-63 (1997)