Figures and figure supplements

Successful retrieval of competing spatial environments in humans involves hippocampal pattern separation mechanisms

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Figure 1. Experimental design and performance. (a) Depiction of contextual modifications between environments. Each colored box represents a different target store. Cities 1 & 2 (similar cities) are identical aside from swapped position of stores (purple and teal). City 3 (interference city) shares the same stores as similar cities but in a novel layout. City 4 (distinct city) has a novel layout and stores. (b) During encoding participants completed 4 rounds of navigation and map drawing of each city. (c) Retrieval consisted of 8 blocks of city-specific distance judgments. (d) Retrieval accuracy demonstrates lower performance on city 3. **p<0.01
DOI: http://dx.doi.org/10.7554/eLife.10499.003
Figure 1—figure supplement 1. Map drawing learning curves.
DOI: http://dx.doi.org/10.7554/eLife.10499.004
Figure 1—figure supplement 2. City transition map scores.
DOI: http://dx.doi.org/10.7554/eLife.10499.005
Figure 2. Analysis methods. (a) Single trial parameter estimates were generated by building a single model with a separate regressor for each trial. (b) Subfields were demarcated manually to create separate ROIs for CA3/DG, CA1, Subiculum, and PHG. (c) The searchlight classifier was trained using single trial estimates from half of the retrieval blocks and tested on the remaining retrieval data. Training/testing was repeated for all searchlight spheres in each subject's MTLs, creating subject specific statistical maps. (d) Within-city similarity was assessed for each ROI by extracting the trial parameter estimates from the subfields and correlating between matched trials of a city's "A" and "B" retrieval blocks. (e) Between-city similarity was calculated consistent with within-city similarity. DOI: http://dx.doi.org/10.7554/eLife.10499.006
Figure 2—figure supplement 1. Snapshot of virtual environment.
DOI: http://dx.doi.org/10.7554/eLife.10499.007
Figure 3. Environment classification. (a) City classification searchlight revealed a cluster of above chance classification performance throughout much of left CA3/DG and CA1. (b) Pie chart of distribution of voxels in the searchlight showing their predominance in CA3/DG and CA1. (c) Classifier performance of each city revealed above chance performance on cities 1, 2, and 4 and below chance performance on city 3. Further analysis of city 3 classification performance revealed above-chance misclassification of city 3 trials as cities 1 & 2. (d) City 3 (interference city) retrieval performance and city 3 classifier performance were positively correlated. *p<0.05, **p<0.01.

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Figure 3—figure supplement 1. Classifier trained with matched number of trials from each city.
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Figure 3—figure supplement 2. City 1 & 2 classification results broken down by correctly classified and incorrectly classified as each city.

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Figure 4. Multivariate pattern similarity analysis (MPS) of environment similarity during retrieval. (a) Similarity matrix of all pairwise city MPS conditions in CA3/DG. Diagonal depicts within-city and off-diagonal depicts between city MPS conditions. (b) Same as (a) for CA1. (c) Voxel remapping index for CA3/DG (green) and CA1 (blue). Remapping index for each city was the z-transformed contrast between within city and average between cities MPS (see legend below). Left CA3/DG showed overall more remapping than CA1, with significant remapping for Cities 1 & 2 and marginally significant remapping for City 4. Left CA1 showed significant remapping only for City 4. *p<0.05.

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Figure 4—figure supplement 1. Cortical region MPS analysis.
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Figure 5. Analysis of incorrect and correct interference city trials. (a) Analysis of interference city trials reveals higher similarity between incorrect city 3 (interfering city) and correct city 1 or 2 trials than between correct city 3 and correct cities 1 and 2 trials in CA3/DG. Control comparisons suggest that this effect could be attributed to interference from cities 1 & 2. Left bar greater than all other bars t(18)>2.2, p<0.04. (b) CA1 did not exhibit similar behavior for incorrect vs correct between-city 3 comparisons. *p<0.05, **p<0.01. DOI: http://dx.doi.org/10.7554/eLife.10499.013
Figure 5—figure supplement 1. Right hemisphere hippocampal interference city MPS analysis. DOI: http://dx.doi.org/10.7554/eLife.10499.014
Figure 5—figure supplement 2. Empirical HRF plotted beside Canonical HRF convolved with 4 s boxcar function (average response time was 3.8 s).

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