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Supplemental Information

Detecting Changes in Scenes: The Hippocampus Is Critical for Strength-Based Perception

Mariam Aly, Charan Ranganath, and Andrew P. Yonelinas

Inventory of Supplemental Information

Table S1 shows response time data for Experiment 1.

Figure S1 shows the behavioral paradigm and behavioral data for Experiment 2 (fMRI study). fMRI data are shown in Figure 3 and Figure S2.

Figure S2 shows fMRI data for the left and right parahippocampal cortices (data reported in the main text). It is related to Figure 3.

Supplemental Text. Supplemental analyses for Experiment 1 (Analyses S1 and S2).

Supplemental Table

	Different						Same					
	1	2	3	4	5	6	1	2	3	4	5	6
Patients	1436 (253)	2146 (164)	2890 (194)	3242 (442)	2193 (181)	2071 (524)	1854 (498)	2112 (269)	2750 (385)	3527 (426)	2278 (226)	1571 (190)
Controls	984 (112)	1854 (245)	2518 (295)	2563 (358)	2158 (423)	1682 (200)	1278 (181)	2041 (349)	2723 (553)	2735 (445)	2134 (349)	1477 (194)

Table S1. Average response times for patients and controls (Experiment 1). Response times are shown separately for 'different' and 'same' trials, split by confidence response. Standard error of the mean is shown in parentheses. See data in Figure 2.

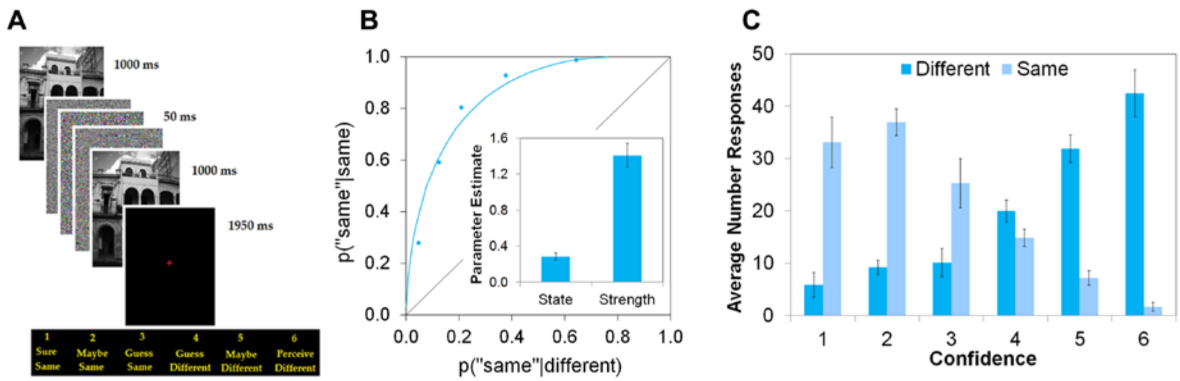

Figure S1. Paradigm and behavioral results for the fMRI experiment (Experiment 2). (A) Trial procedure for the scene perception task. A scene was presented for 1s, followed by a dynamic noise mask for 50 ms, then the corresponding 'same' or 'different' scene was presented for 1s. Individuals made same/different judgments on a confidence scale, either while the second scene was on the screen or in the blank period after that. (B) Aggregate ROCs and parameter estimates of state- and strength-based perception (inset) on this task. The pattern replicates the patient study and previous behavioral studies, showing that performance reflects a combination of state-based (upper x-intercept) and strength-based (curvilinearity) perception. Note that state- and strength-based perception are on different scales (probability for state-based perception, and *d*' for strength-based perception), so the magnitude of the estimates for state- and strength-based perception are not comparable. (C) Average number of responses in each of the 6 confidence bins for 'same' and 'different' trials. Error bars depict +/- 1 SEM. See fMRI data in Figure 3 and Figure S2.

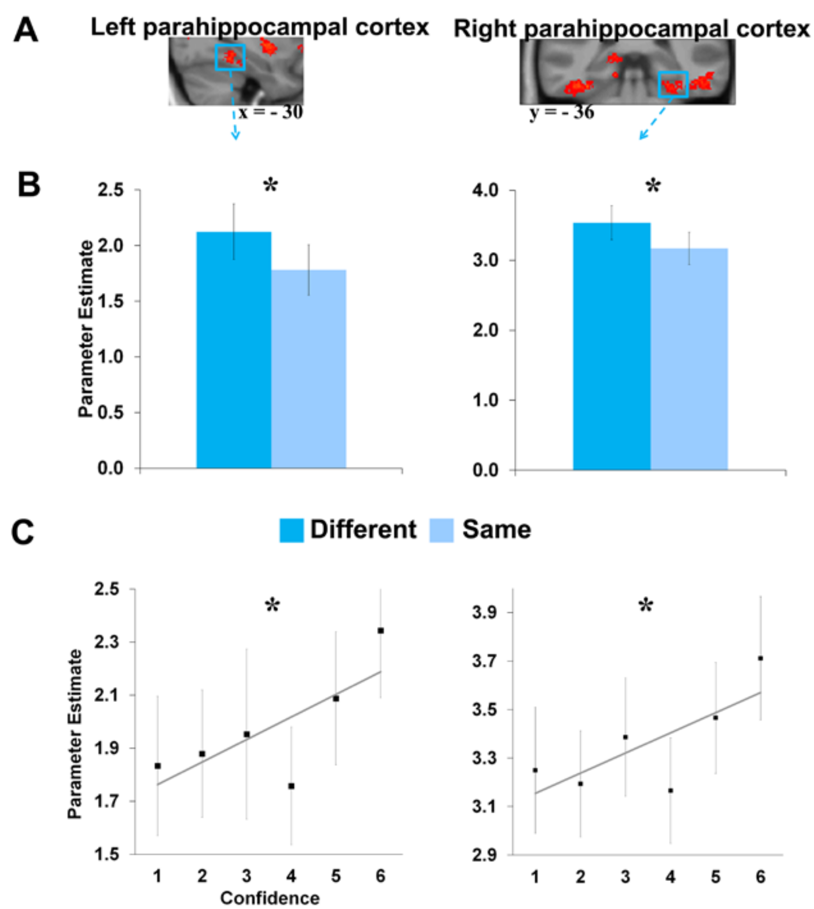

Figure S2. The parahippocampal cortex tracks the strength of perception. The left and right parahippocampal cortices (A) were more active when individuals correctly identified 'different' scenes, compared to when they correctly identified 'same' scenes (B). Parameter estimates showed that activation tracks the strength of evidence, with increasing activation with increased confidence in difference (C). The linear trend was statistically significant [left parahippocampal cortex: $t(17)=3.46$, $p=.003$; right parahippocampal cortex: $t(17)=3.39$, $p=.003$]. The MNI coordinates for the peak voxels are -33, -46, -13 for the left parahippocampal cortex and 33, -41, -19 for the right parahippocampal cortex. Error bars depict +/- 1 SEM. See also Figure 3.

Supplemental Text

Supplemental Analysis S1 – Patient Study

Effects of age

It is important to ensure that age is not a factor in producing the differences between patients and controls. For strength-based perception, there was no significant correlation between age and performance for the controls (p=.30) or the patients (p=.66). Similarly, there was no significant correlation between age and state-based perception for the controls (p=.14) or the patients (p=.91).

Given the small sample size, the correlations may not have reached statistical significance even if age is a factor in performance. We therefore ran a 2 (group: patient or control) x 2 (perception: state or strength) mixed-model analysis of variance, with age as a covariate. There was no main effect of age [$F(1,12) = 1.63$, p=.23], and no perception by age interaction [$F<1$]. The only significant effects were the main effect of group [$F(1,12)=6.21$, p=.028] and the perception by group interaction [$F(1,12)=7.85$, p=.016]. The latter interaction arises because the patients are significantly impaired at strength-based perception but are not different from controls (in fact, numerically higher) in state-based perception. Thus, even when controlling for age, the pattern of results remains consistent with our interpretation that only one type of perception (strength-based) is impaired in the patients.

These findings do not rule out a correlation between age and state- and strength-based perception in the population, but they do suggest that in our current sample, age was not a strong predictor of performance.

Supplemental Analysis S2 – Patient Study

Alternative models

To evaluate the robustness of the ROC dissociation that we observed in the parameter estimates, we fit the unequal-variance signal detection (UVSD) model, rather than our state-strength model, to the data (Swets, 1973). According to the UVSD model, the underlying parameters that describe ROC shape are variance ratio and strength/discriminability. Variance ratio reflects the variance of strength for same compared to different items, and strength reflects the discriminability of same and different items. The results from fitting this model were consistent with the conclusions from state-strength theory: the patients were selectively impaired in one component of perception, namely, strength [Patients: M=0.65, SD=0.26; Controls: M=0.92, SD=0.20; $t(13)$=2.21, p=.023], and were spared in the other component, namely, variance ratio [Patients: M=0.79, SD=0.18; Controls: M=0.81, SD=0.14; t<1].

Supplemental References

Swets, J.A. (1973). The relative operating characteristic in psychology. *Science* 182, 990-1000.