Supplementary Material for:

“Online evaluation of novel choices by simultaneous representation of multiple memories”

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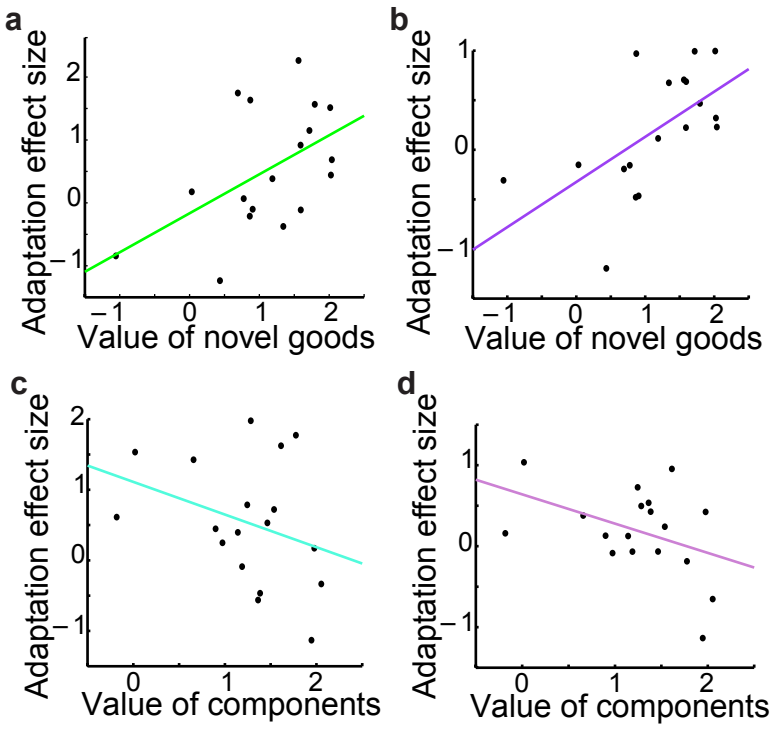
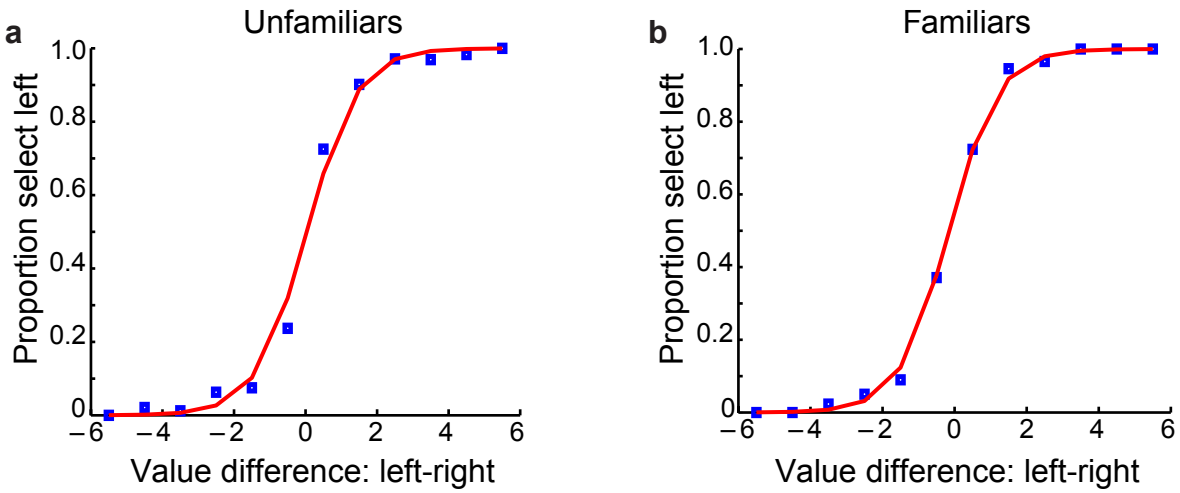
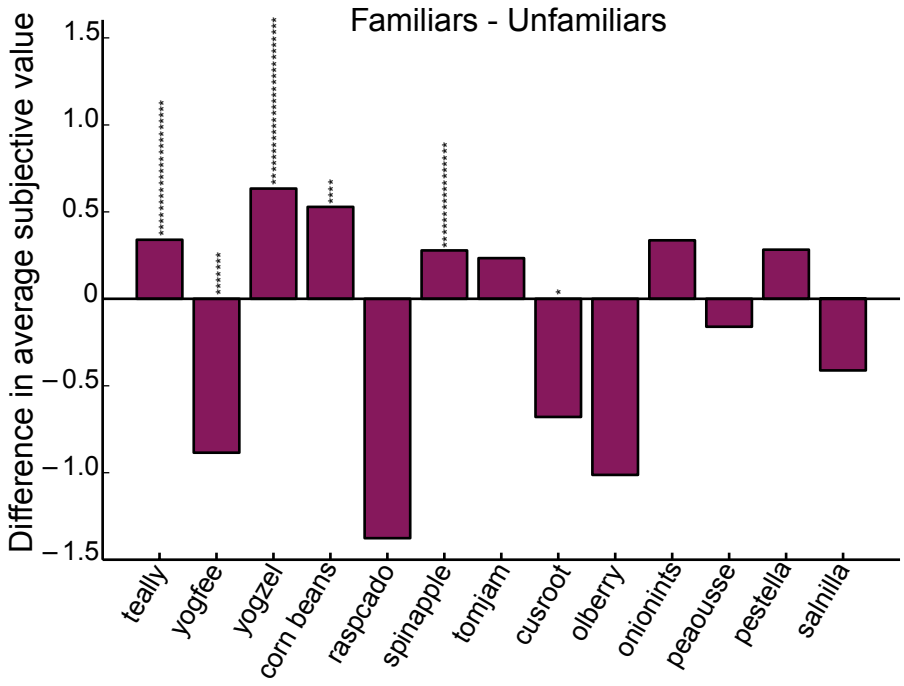


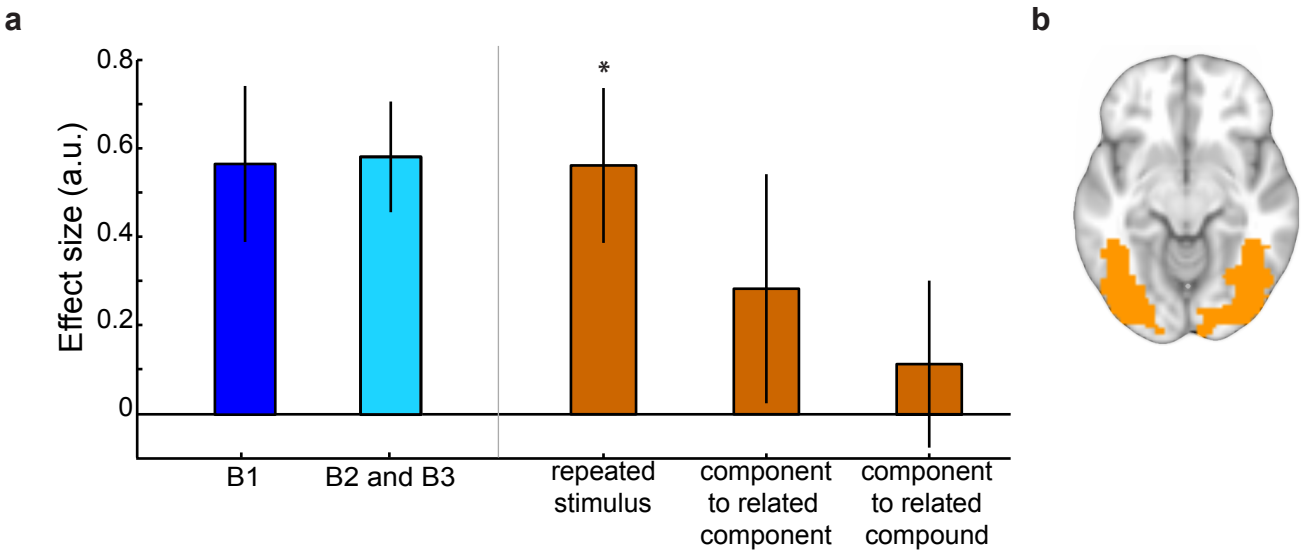
Supplementary Figure 1: Partial correlations between novel and component values and adaptation between related components in the unfamiliar group. (**a**)(**b**) As shown in Fig. 2d and 2e, after removing signal attributable to the average value of the component items, there was a significant correlation between the average value of the novel items and the extent to which individual participants showed adaptation between related components across all blocks in both mPFC, ($r = 0.51$, $p = 0.015$, **a**), and hippocampus ($r = 0.60$, $p = 0.004$, **b**). (**c**)(**d**) There was also a negative effect of the component values on the same signal after variance associated with the novel compounds had been removed, in both mPFC (trend, $r = -0.32$, $p = 0.096$, **c**), and hippocampus ($r = -0.42$, $p = 0.042$, **d**). Notably, this effect, **c** and **d**, cannot be simply due to the valuation of the currently displayed component item, as the contrast in question contains each item positively and negatively equally often. Instead, one possible implication of this finding is that the plasticity between component items does not only depend on the constructed value of the novel good, but that it may be particularly prominent if the value of the novel good is surprisingly high due to the low values of the components. If it is assumed that an initial prediction of the value of the novel good is the average value of the components, then the plasticity effect is best correlated with the error between the constructed value and this prediction.



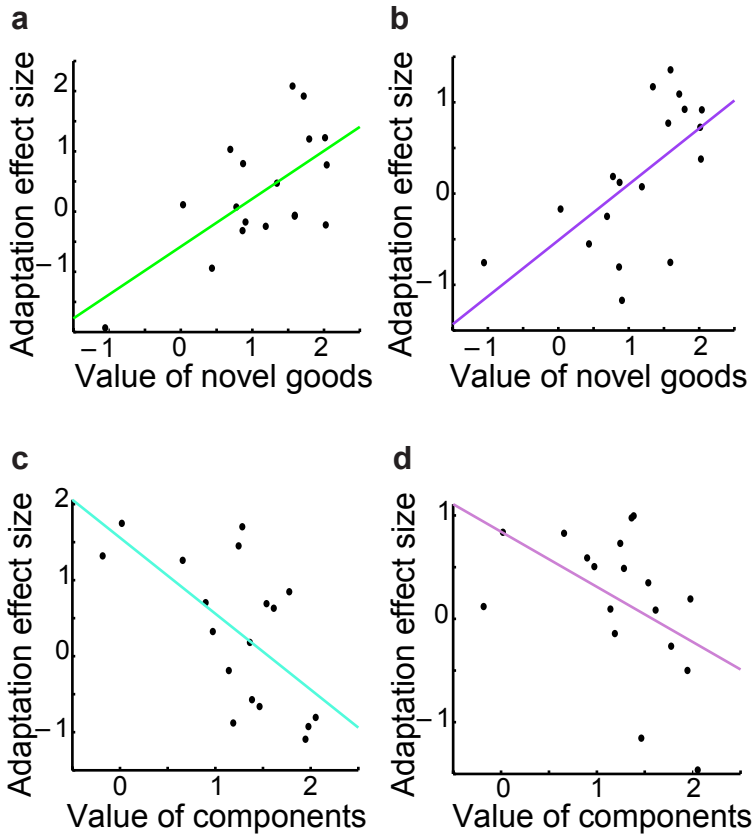
Supplementary Figure 2: Consistency of choices on the decision making task. These logistic regressions show how the difference in value between the left and right option predicted choice during the decision phase of the experiment. The consistency of choices made by the unfamiliar group (**a**) was comparable to that of the familiar group (**b**), with no significant difference between the two groups (beta values: 1.42 for unfamiliars, 1.46 for familiars; one-tailed Mann-Whitney U-test: p = 0.182).



Supplementary Figure 3: Group comparison: average value assigned to the 13 novel food items. The average difference in value assigned to each novel good by the familiar and unfamiliar groups. The stars on each bar indicate the number of participants assigned to each of the goods in the repetition suppression experiment, and out of those assigned there was no significant difference in valuation between the groups.



Supplementary Figure 4: Adaptation effects in visual regions of the unfamiliar group (**a**) Left side: Between early and late blocks, there was not a significant reduction in the adaptation effect size of visual regions to repeated stimulus presentation (one-tailed t-test: $t(18) = 0.50$, $p = 0.312$, parameter estimates extracted from unfamiliar group within the ROI shown in (**b**), see Methods for details). This suggests that across the duration of the experiment sensitivity to adaptation effects was maintained. Right side: Whilst there was significant adaptation to repeated stimulus presentation in visual regions (one-tailed t-test: $t(18) = 3.22$, $p = 0.002$), there was no evidence for adaptation between either related components (one-tailed t-test: $t(18) = 1.10$, $p = 0.144$) or between compounds and their related components (one-tailed t-test: $t(18) = 0.60$, $p = 0.278$) (block 1 only, ROI shown in (**b**)). Thus, repetition suppression in visual brain regions was not specific to the construction of a novel good.



Supplementary Figure 5: Partial correlations between the value of food items and adaptation between related component items in blocks 2 and 3 of the unfamiliar group. Partial correlations are shown as in Supplementary Fig. 1, but now show effects in blocks 2 and 3 only, with the positive correlations between compound value and adaptation between related component items (mPFC: r = 0.64, p = 0.002, **a**; and hippocampus: r = 0.63, p = 0.003, **b**; as shown in Fig. 6b and 6d respectively), and negative correlations between component value and adaptation between related component items (mPFC: r = -0.63, p = 0.003, **c**; hippocampus: r = -0.47, p = 0.024, **d**).

	Mean Accuracy (%)		Reaction Time (ms)	
	Components	Compounds	Components	Compounds
Unfamiliar group	98.4	97.4	803.1	821.4
Familiar group	97.1	98.3	848.0	908.1
Group difference: p value (two-sample t-test)	0.43	0.18	0.43	0.63

Supplementary Table 1: Accuracy and reaction time on stimulus-item learning task
There was no significant difference between groups in the average accuracy or reaction time during the last block of trials of the stimulus-item learning task. This suggests that, on average, participants in the unfamiliar and familiar groups learnt the stimulus-item pairings equally well.