Is LOC responsive to object familiarity?
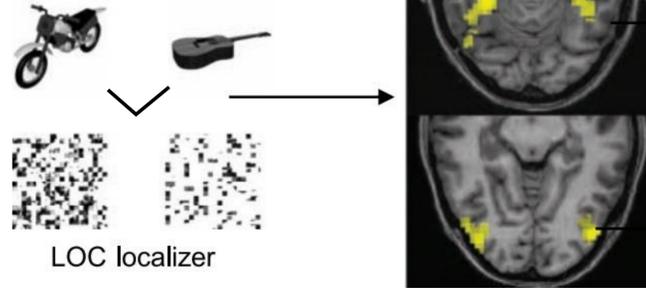
Manan P. Shah[1], Irving Biederman[1,2], Bosco Tjan[1,2], Brenton Keller[2], Rorry Brenner[2], Bryan Shilowich[2]

Department of Neuroscience[1], Department of Psychology[2], University of Southern California

Image Understanding Lab

http://geon.usc.edu/

LOC Localizer

Malach et al. (1995) reported that the Lateral Occipital Cortex and the Posterior Fusiform, an area he termed the Lateral Occipital Complex (LOC), responded more to intact objects than their scrambled versions (resembling texture).

Fmri activation obtained from the contrast of objects (top) minus scrambled (bottom)

LOC localizer

Eger et al. 2008

Malach's Test for Familiarity

Malach et al. compared LOC activation of common familiar objects with Henry Moore sculptures, which were unfamiliar to the subjects.

Henry Moore Sculptures

Results
The Moore sculptures, like the familiar objects, also produced strong activation of LOC relative to their scrambled versions. However, without control for the physical characteristics of the stimuli, it is possible that a familiarity effect was present but the uncontrolled stimulus differences obscured such an effect.

Experiment

There is strong evidence (Hayworth & Biederman, 2006) that LOC is sensitive to the parts composition of an object. To control for part composition and a host of other stimulus parameters, 72 Familiar objects were modeled (using Blender) as an arrangement of geons. Novel (unfamiliar) Objects were created from the Familiar objects by rearranging their parts so the same parts were present in both Familiar and Novel Objects.
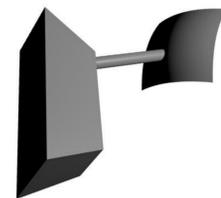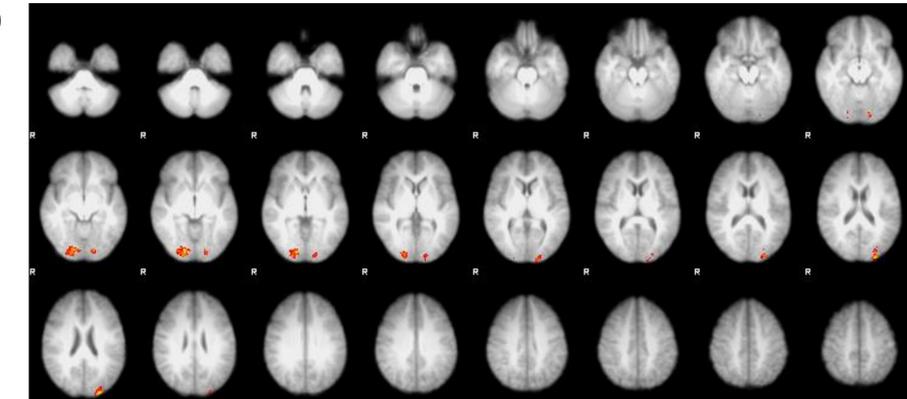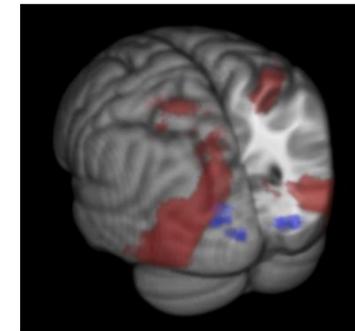
Familiar	**Novel**	**Scrambled**

Subjects performed an orthogonal task (detecting the color change of a frame surrounding the objects), while they viewed blocks of Familiar, Novel (Unfamiliar), and Scrambled images of objects.

Results

- LOC was well defined by the contrast of [Familiar + Novel] minus Scrambled (red).
- Occipital pole activation was observed in the contrast of Novel minus Familiar (blue)

- There was no difference in LOC activation of Familiar vs. Novel objects. Contrast of Familiar minus Novel showed no significant activation. Contrast of Novel minus Familiar (below) yielded bilateral occipital pole activation.

New Question

Is it the loss of part shape or the loss of relations between parts (or both) that results in reduced LOC activation from scrambled images?
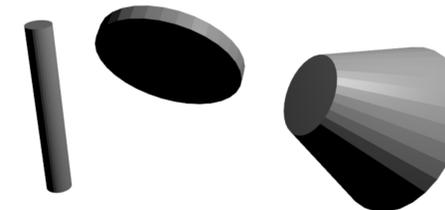
Test LOC Activation
If Novel > Scattered = Scrambled, then the loss of *interpart relations* is the critical variable.
If Novel = Scattered > Scrambled, then the loss of *part shape i*s the critical variable.
If Novel > Scatter > Scrambled, then the loss of *both* interpart relations and part shape is critical.

Conclusions

- We confirmed Malach et al.'s (1995) contention that LOC does not evidence a familiarity effect.
- The lack of an effect of familiarity is consistent with Kim et al.'s (2009) finding that the release from adaptation in LOC between object images is unaffected by whether the second image is in the same or different basic level category. Thus viewing Dog1 followed by Monkey 1 does not lead to a greater release from adaption compared to Dog1 → Monkey 1.
- Therefore LOC is the region where a physical representation of an object is defined independent of its semantic associations.

References
Hayworth, K. J., & Biederman, I. (2006). Neural evidence for intermediate representations in object recognition. *Vision Research*, 46, 4024-4031.
Malach, R. et al. (1995). Object-related activity revealed by functional magnetic resonance imaging in human occipital cortex. *Proceedings of the National Academy of Sciences, USA*, 90, 8135-8139
Kim, J., Biederman, I., Lescroart, M. D., & Hayworth, K. J. (2009). Adaptation to objects in the lateral occipital complex (LOC): Shape or semantics? *Vision Research*, 49, 2297-2305.