

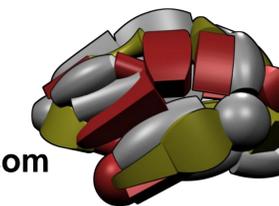
# A neurocomputational account of the magnitude of the face offset effect

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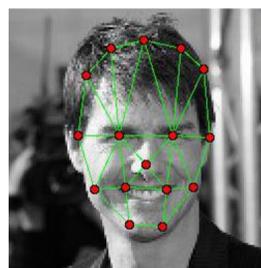
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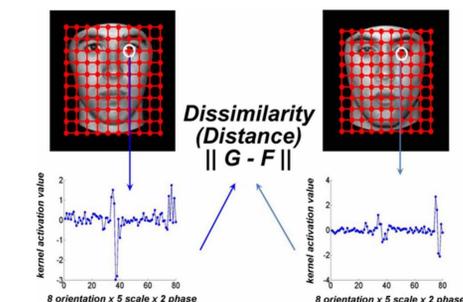
## Gabor Jet Model: Large Receptive Fields produce the "Action at a Distance" characteristic of Face Configural Effects

**Version 1.** Illustration of the computation of dissimilarity for a corresponding pair of jets (modeling the multiscale, multiorientation filtering of V1 hypercolumns) positioned at nodes in a rectangular grid for a pair of face images.

**Version 2.** Fiducial point version of the Gabor-jet model. Particular jets automatically center themselves on landmark features of a face like the pupil of the right eye.



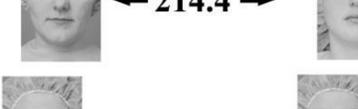
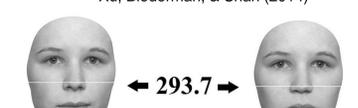
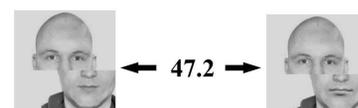
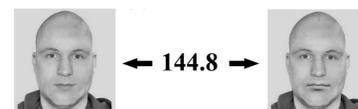
**Below Left:** Illustration of a Gabor "jet" with five scales and eight orientations. Overlap of medium-sized receptor fields of two jets. A single face region acts on multiple distant, large receptive fields producing the configural effect.



This measure of face dissimilarity predicts psychophysical performance in discriminating faces almost perfectly! (Yue et al., 2012)

## Illustration of Fiducial Point Model predicting the face offset effect

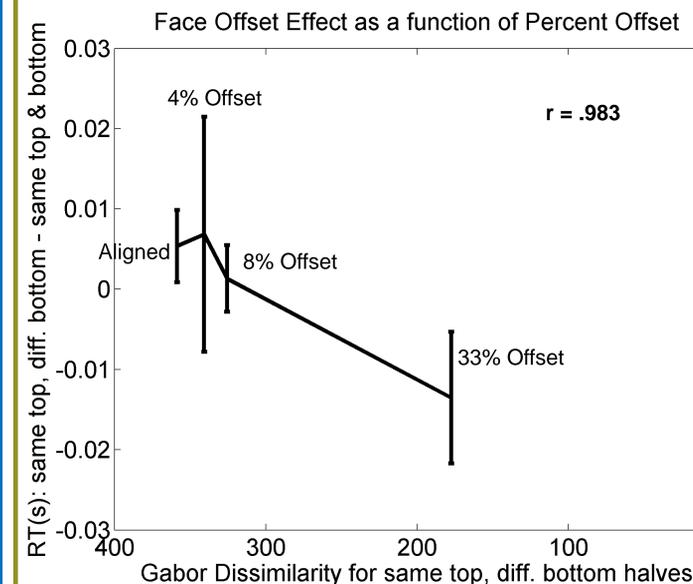
**Gabor Dissimilarity of identical top face halves**



Subjects judge whether the top halves of two faces are the same or different when the bottom halves might be different. With same top halves and different bottom halves, judgments are slower and less accurate when the halves are aligned than offset.

According to the G-j model, offsetting the lower half places it beyond the r.f.s of the upper half, thus reducing its influence on the perception of the top half (reducing the Gabor dissimilarity produced from different bottom halves) and rendering it easier to judge that the tops are identical in the presence of different bottom halves.

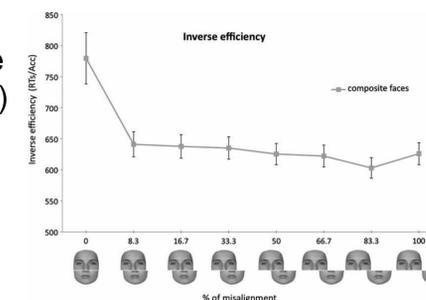
## Experiment: Fiducial Point Model predicts the magnitude of the face offset effect



Stimuli and paradigm from Rossion (2013).

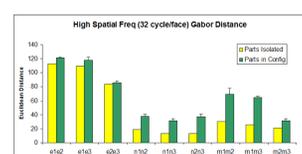
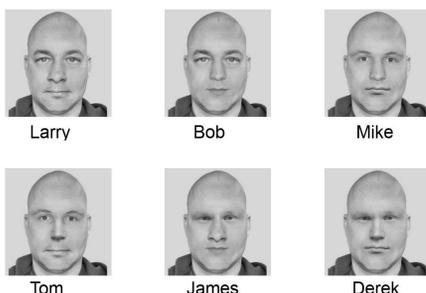
**Left:** Mean reaction times for 0, 4, 8, and 33 percent offset. RTs were normalized to remove subject variance and top face variance. The greater the percent offset, the smaller the Gabor dissimilarity (between the identical upper halves) and the faster the reaction times.

**Right:** Laguesse & Rossion (2011) found a small offset facilitated the entire face offset effect.

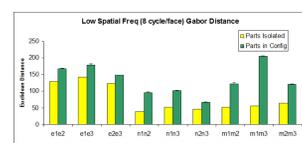


## Face Configural Effect

Learn faces and names



**High s.f.**  
 $r = 0.51, p < 0.03$   
26% of Variance



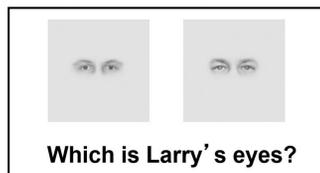
**Low s.f.**  
 $r = 0.66, p < 0.003$   
44% of Variance

No effect of spatial frequency on magnitude of the configural effect with filtered faces. Effect is all from large r.f.s.

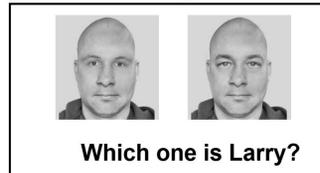
Test yourself

Condition: Parts in isolation

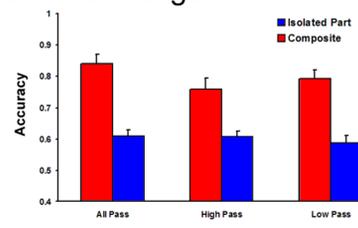
Condition: Parts in configuration



Which is Larry's eyes?



Which one is Larry?



**Explanation:** Faces differing only in the shape of a single part look more dissimilar than the parts in isolation.

Xu et al. (2014) showed that this configural effect can be accounted for by a spatial model with large, overlapping receptive fields.

## Conclusions

1. Face individuation may be achieved through a representation that preserves aspects of the original spatial filtering, allowing fine metric discriminations between similar faces. [Yue, Tjan, & Biederman (2006): What makes faces special?; Yue et al. (2012)]
2. Configural effects, including the face offset effect, can be produced by the coding of Gabors with large receptive fields that span much of a face. [Xu et al. (2014)]
3. Attention cues provided by offsetting upper and lower face halves may allow face cells to shrinkwrap (Moran & Desimone, 1985) onto the top half of the face. However, given that the magnitude of the offset effect can be largely predicted by Gabor similarity, this attentional contribution of shrinkwrapping may be modest.

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"Geon-Brain" logo of the Image Understanding Lab (top right) was the work of Mark Lescoart.