Why is it so Difficult to Recognize Faces Differing Only Moderately in Orientation in Depth? (Changed Title)

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Two Minimal Match-to-Sample Trials: Which one of the lower two test faces is an exact match to the sample (upper face)?

Orientation Disparity Between Sample and Test Faces

The 20° orientation disparity between matching and sample faces imposes a massive 350 msec cost in matching!

Why such massive costs from such a modest disparity in orientation?

The Representation of Faces (But not Blobs) Is Highly Sensitive to the Spatial (i.e., Gabor/Fourier-Like) Composition of Images

Each member of a complementary pair of images contains all scales and orientations but different specific combinations from the other member. A complementary pair of images of the face of a person: a) appears to be faces of different people, as evidenced by the difficulty in different specific combinations from the other member. A complementary pair of images of faces contains all scales and orientations but does not activate FFA.

Scaling Face Similarity by the Gabor Jet Model

We scaled face similarity to assess:

a) the effects of orientation disparity on matching and sample faces
b) the variation over 20 different pairs of matching and foil faces

Table: Orientation Disparity Between Sample and Test Faces

The model predicts the psychophysical similarity of matching and foil faces perfectly (Yue et al., 2012).

Could the reduced Gabor-similarity of images at different orientations account for the massive costs of orientation disparity?

Normalization Gabor Dissimilarity between Matching and Foil Face

A rotation disparity of as little as 13° between sample and matching faces increases normalized dissimilarity to above 5.

References


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Conclusions

1. The substantial cost on matching faces from even modest disparities in orientation can be attributed to the high dissimilarities of Matching and Sample faces as scaled by a model of V1 simple cell filtering.

2. The success of Gabor scaling to account for both the massive costs of orientation disparity and the psychophysical similarity of matching and face purposes provides further support for Yue et al.’s (2006) finding that faces retain aspects of the spatial, Gabor-like coding characteristic of early visual stages.