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Phenomenal competition for poses of the human head

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Abstract. We show a cylindrical projection of the human head. This projection is ambiguous with respect to head pose. Viewing such a projection produces perceptual competition for a few discrete views.

In a number of studies it is suggested that the brain may represent head pose in terms of a discrete set of preferred views. Exactly what these views are and how their representations enable visual face recognition and pose estimation is not entirely clear. On the one hand, it is easier to find neurons in the primate inferotemporal cortex that are more selective for head-on, profile, or back views than other angles (Perrett et al 1991). On the other hand, psychophysical studies have shown that human face recognition generalizes better from a learned view near 45° about the vertical axis than from other views (Bruce and Valentine 1987; Troje and Bülthoff, in press). This latter observation is consistent with theoretical predictions based on virtual views for symmetric objects (Vetter et al 1993). In either case, one might expect that if an image of a human head is presented in such a way as to make pose assignment ambiguous, we might visually experience a competition for preferred poses. Figure 1 shows a picture in which the pose for any given patch of the image is ambiguous (a color version of the figure can be viewed on the Perception Web site at http://www.pion.co.uk/perception/perc0396/kersten.html). The figure displays a cylindrical projection of a human head produced with a Cyberware scanner. The cylindrical projection is shown flattened, so that all views of the head—from 0° to 360° about a vertical axis through the head center—are available on a single flat sheet of paper.

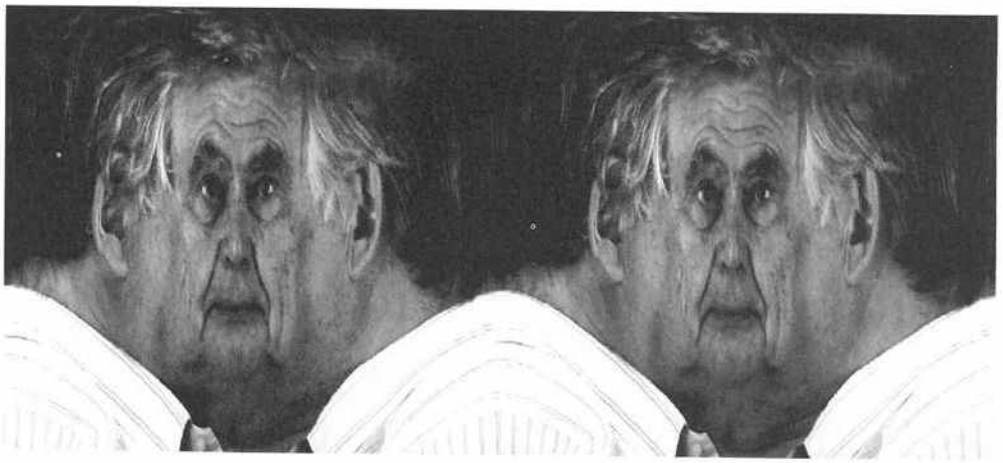

Figure 1. Cylindrical projection of a human head (for color version see http://www.pion.co.uk/perception/perc0396/kersten.html)

In order to reduce the effects of the left and right image boundaries, we have adjoined two copies; thus any given patch of the head is represented twice.

If readers view this face for a few moments, they should notice patches of the image which seem to organize themselves perceptually into a coherent view of part of a head. There is a phenomenal competition between several of these patches, each of which captures a quasi-stable preferred view or pose of the head for that region. Most observers experience only a few stable views (eg frontal, three-quarter, profile, or back view), even though in principle all views from 0° to 360° are possible. The lack of a visible occluding contour down the midline of the face no doubt makes it more difficult to see the profile view near the nose, whereas symmetry seems to contribute to the stability of the frontal view. It is conceivable that neurons tuned to particular poses of the head (Perrett et al 1991) enhance the perception of stable views. Of course, we are able to recognize a person from nonpreferred views under normal conditions. Logothetis et al (1994) discuss an interpolation network for recognition based on tuned neurons. In a multistable display, however, these interpolated views cannot compete with the 'tuned views'.

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