Perception and Recognition of Faces - Human Capacities of Possible Relevance for Artificial Systems

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Abstract

Faces are one of the most frequently looked at objects in our environment. Our eyes scan faces for myriad reasons, to assess identity, health, moods, intentions, imminent actions, to name a few. As such, it should not be surprising that face processing is a well developed function in the human brain with the likelihood of dedicated hardware. We take as a working hypothesis that the processing of faces is unique, that it is qualitatively different from the processing of other objects.

We have examined this idea using a variety of methods, including fMRI, magnetoencephalography as well testing visual capacities using psychological and psychophysical methods. We have concentrated on two different groups, normal observers and those suffering from prosopagnosia. This latter group is of great interest because of their selective deficiency in face recognition. We document this by showing that these individuals are very poor at remembering faces but that they can recognize other objects normally. A fraction of these individuals show abnormal neural responses to faces.

We also show that in normal observers, the human face recognition system is selectively sensitive to small facial features, approximately on a scale of 0.5 centimeters on the face, that the processing of upright faces is holistic whereas upside down faces and all other objects are encoded in a piecemeal fashion. These findings reinforce the idea that the recognition of faces is qualitatively different from that of objects.

We also show that face recognition is not easily degraded by affine image transformations, suggesting that for purposes of recognition, faces can be regarded as flat two dimensional objects.