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What Makes an Attractive Face? A Neurological Perspective

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We have heard two fascinating reports on groups of people who viewed computer-drawn images of faces and then were asked which image was the most "attractive." There were clear consistencies of choice within the groups with people generally preferring such things as smooth rather than wrinkled skin, greater rather than lesser bilateral symmetry, lesser rather than greater signs of sexual dimorphism, and so on. The question then raised by the presenters is what, if anything, these preferences have to do with mate choice?

The reality of deciding that another individual is an attractive potential mate is multidimensional. Visual attributes of physical attractiveness involve not simply the frontal image of a person's face, but their body shape and size, their movements, the dynamics of their expression of emotions, their head and body viewed from different angles, and so on. Attractiveness depends also on information derived from other senses including spoken communication and smell, and the unconscious expression of emotions, as well as on shared cultural background, status, and other societal factors.

We have regions of our brains which are specialized for the recognition of faces. The fact that these regions are so prominent in both humans and monkeys makes it likely that they are the result of strong evolutionary selection. It is clearly important for primates to be able to recognize and distinguish particular individuals by their facial characteristics. Does recognition of faces depend absolutely on visual learning, or are we born with innate preferences? Are there universals within facial characters that distinguish desirable mates? To what extent is facial attractiveness a key element in human mate choice?

The Neurological Background

The visual system operates by deconstructing information from the eyes into components which include contrast boundaries, orientation of edges, wavelength, texture, movement, and stereopsis. Each of these *visual primitives* is processed in a different cortical area and information from these areas converges on two main centers for object recognition, one based on color and contrast boundaries, and the other on movement and stereopsis.

The integrity of a region in the fusiform gyrus is critical for recognition of faces (Kanwisher et al. 1997). There are at least two cortical regions, amygdala and cingulate gyrus, which become active in response to emotional signals in a visual image. Evocation of visual memory, including the recognition of faces, activates large regions of prefrontal cortex (Scalaidhe et al. 1999). There is a region of dorsolateral frontal cortex that is specifically activated in response to incongruity in an image, for example an inappropriately colored or asymmetrical face (Zeki & Marini 1998); the unconditioned emotional response to activity in this center is aversion.

Object recognition has the property of *constancy*: we can recognize that something is the same object when it is illuminated in light with different wavelength components; when it is presented at different angles and at different distances; and whether it is moving or still. Neurons involved in object recognition respond to *key features* in the image. In a face, for example, these include the eyes, nose, mouth, and hair. Key features can be studied in pure form by microelectrode recordings from single neurons with 'elaborate' receptive fields, in monkey inferior temporal cortex. Action potential frequency reflects the appropriateness of key features in an image. A neuron might respond with moderate frequency to a frontal view of a face and then increase its firing frequency on the addition of ears to the image. Whether, in a conscious person, an increase in action potential frequency is correlated with preference for a particular image is unknown.

Object recognition is principally a learned cognitive function. Training a monkey to recognize an abstract image results in the appearance of neurons which respond to that image; neurons with similar receptive fields cannot be found in control animals. A young baby will initially smile in response to any vaguely face-shaped object that has eyes and a smiling mouth; it rapidly learns to recognize its mother and to respond to any other face with fear. We need only consider fashion to accept that our appreciation of facial beauty has a strong cultural background, reflecting learning and experience.

With this background, neurological investigation of what makes works of art or other objects attractive has come to three main conclusions (Goguen et al. 1999; Zeki 1999). First, the image of a person is most attractive when it exhibits universality, usually portrayed as ambiguity. For example it might not be clear whether a woman is happy, sad, generating erotic signals, or concealing a secret emotion. Second, effective images are comprised of elements that strongly activate visual primitives. Third, exaggeration of key features can make an image appear more attractive. For images of people this may be analyzed and illustrated by the works of cartoonists or the techniques for applying cosmetics. From this work we are led to question whether an image of a face is chosen as the most "attractive" simply because it is the one most easily distinguished as being a face, or because it includes some higher order feature relevant to mate choice?

Facial Images and Mate Choice

Neurological and ethological investigations do not support the concept of an innate ability to recognize particular visual objects. On the other hand, there is a genetic background to being able to learn to distinguish key features, as when a baby first learns to recognize its mother's face. The fact that young animals can become imprinted on human surrogates dispels any possibility of rigid predetermination in object discrimination.

Language acquisition offers a useful basis for comparison. Young children learning to speak have an innate capacity to impose grammatical structure on their words. In immigrant societies with polyglot adult languages this is demonstrated by the development of creoles, which spontaneously evolve into new grammatically consistent languages. But there is no genetically based universal language. Similarly, in the development of vision, we learn to distinguish objects by using their key features, a form of visual grammar. A king of France is said to have raised a small group of children in isolation so they would speak the language used by Adam and Eve. If this had worked, might they also have described Eve's face?

Any fundamental hypothesis of visually mediated mate choice must rest on the premise that preferences in facial recognition derive from culture and environment. Apparent commonalties between different cultures reflect either the pervasiveness of modern world culture, or the physiology of recognition of key features. Thus an 'average' face, the weighted mean of key features for face recognition, is likely to be preferred to an extreme.

In some animal species, female choice of a male partner is stimulated by sexual display. Key features of the sexual display are then selected by evolution, resulting in phenotypes such as peacock's tails or bird of paradise plumes. There are some suggestions that human evolution may have included selection for protruding female buttocks or breasts, but I am not aware of suggestions that facial characteristics such as enlarged eyes or lips have undergone any similar selection. A universal key feature of faces involved in mate choice would inevitably have been selected and accentuated by the normal processes of evolution.

Facial Attractiveness and Key Features for Facial Recognition

We have neurons in primary visual cortex which respond specifically to texture. These are instrumental in vision of leaves in a forest or pebbles on a beach, where there are more objects than there are photoreceptors in our eyes yet we "see" all the leaves on the trees. In a face, we respond positively to absence of texture, as in classical Japanese paintings of plain white faces, against which lips, nose, eyes, and hair stand out dramatically.

Key features in facial recognition include eyes, nose, mouth, and hair. Artists and beauticians can make faces more attractive by exaggerating these features. Comic book art is a valuable source of empirically derived images of attractive faces, including symbolic representation of key features for distinguishing between male and female faces. Some of the best

stereotypes of male beauty come from homosexual artists, for example Michelangelo's sculpture of the 'dying' slave, who looks as if he is enjoying the petit mort rather than the grand. Human faces are never perfectly symmetrical, but any substantial deviation from symmetry about a vertical line drawn through the nose is perceived as atypical and hence less attractive.

We need only look at fashion to accept that our concepts of facial beauty have a strong cultural background, which varies over time. Short hair-long hair, prominent bright lips-pale lips, white skin-brown skin, etc. There is a contrast between Melanesian and Polynesian societies in their appreciation of facial attractiveness. In Melanesia, tribal groups have frequent regional changes in physiognomy and language, whereas Polynesians, even separated by space and time, retain considerable homogeneity. Jared Diamond comments in his studies of communities in the New Guinea Central Valley that each village had its own standards of facial beauty and if asked, would explain how beautiful their women were, and how ugly were the women in neighboring villages.

In assessing the relevance to mate choice of selecting between images of faces we have to ask whether their attractiveness results from their containing an optimal assortment of the key features necessary to distinguish a face from another form of object? In other words, is the test no different from counting action potentials when recording from a visual neuron with an elaborate receptive field? Or does its result reflect the presence of key features critical for mate choice which lead to activation of regions of frontal cortex responsible for planning future actions?

Conclusions

I suggest that there are no genetically based standards of facial attractiveness, but only learnt and culturally derived standards. Common agreement between individuals is based first on the clarity of key features which permit facial recognition, and second on experience and culture. Our speakers presented evidence to support both these views. Images of faces with little asymmetry were more attractive than those with extreme asymmetry or no asymmetry. Children raised by older parents were more attracted by images of faces of older people than were children raised by young parents. The observation that images of people who appear unhealthy are less attractive than healthy ones depends in part on our cultural perception of healthy. In most modern societies extremely obese people are perceived as unattractive and are victims of prejudice, whereas in societies recently emerged from a stone age culture the opposite can be true. Images of seriously deformed or textured faces present atypical key features and hence may be aversive. Finally, childhood programming to avoid people who are unclean or unhealthy has a powerful influence on adult attitudes, without any need to hypothesize the presence of innate or universal preferences.

The challenge for research into the visual basis of mate choice is to demonstrate the

extent to which it occurs. Whether real choice of a mate was or is possible in historic or modern societies is not clear; there may be wide gaps between desire and outcome. Also, the place of facial preference among other parameters such as age, wealth, power, level of education, body shape, strength, verbal ability, parental direction, or simple availability, needs to be clarified with respect to each different culture. At this meeting we heard from Professor Kawai (Kawai 2000) that in Japanese culture a man might first make love with a woman without ever having seen her face, and he proposed that this reflects a major difference between Japanese and European cultures and ideas of romantic love.

This morning's presentations offer many challenges. The technology for combining and morphing images provides a powerful research tool. The results of the surveys give much interesting information on the key features for visual recognition of faces, and have provoked all of us to think more deeply about whether or not genetically based universals underlie our perceptions and influence our interactions with other people and our choice of mates.

References

Goguen, J. A., Ramachandran, V. S., Humphrey, N., & Harth, E.
1999. *Art and the Brain.* San Diego: Academic Press.

Kanwisher, N., McDermott, J., & Chun, M. M.
1997. The fusiform face area: A module in human extrastriate cortex specialized for face perception. *J. Neurosci* 17: 4302-4311.

Kawai, H.
2000. The world of *The Tale of Genji* seen in visual images. Kyoto Conference on Human Mate Choice and Prehistoric Marital Networks.

Scalaidhe, S. P., Wilson, F. A, & Goldman-Rakic, P. S.
1999. Face-selective neurons during passive viewing and working memory performance of rhesus monkeys: Evidence for intrinsic specialization of neuronal coding. *Cereb Cortex* 9: 459-475.

Zeki, S.
1999. *Inner Vision.* Oxford: Oxford University Press.

Zeki, S. & Marini, L.
1998. Three cortical stages of colour processing in the human brain. *Brain* 121: 1669-1685.