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Nature Reviews Neuroscience 2, 81 (2001)**COGNITION****Knowing your onions****Peter Collins**

Categorization is the fundamental ability that underlies the allocation of stimuli into useful classes such as animal, vegetable and mineral. Without this ability, perceptual input would make little sense. Although we are beginning to understand the complex processes leading to perception, we know very little about the neural basis of categorization. Now, writing in *Science*, David Freedman and colleagues describe an experimental protocol that might lead to an improvement in this situation in the coming years.

Freedman and colleagues used a three-dimensional morphing system to generate images that reflected linear combinations of three different species of prototype dogs and three different species of prototype cats. By blending different amounts of dog and cat together, they were able to produce a set of stimuli that continuously varied in shape between prototype dogs and cats. Importantly, the set contained a precisely defined category boundary such that stimuli that were near to, but on opposite sides of, the boundary appeared similar, whereas stimuli that were on the same side of the boundary



but were far apart could appear to be dissimilar. This type of sharp boundary is a classic feature of perceptual categorization and allows for the dissociation of physical similarity and category membership. Two monkeys were trained to categorize the stimuli set as either cat or dog. Freedman *et al.* then looked for neurons that reflected the different categories.

A population of neurons in the lateral prefrontal cortex reflected the category of the visual stimuli. A typical neuron was more active in response to one of the categories (for example, dog) and responded similarly to each of the stimuli from that category irrespective of the amount of dog in the stimulus. Further analysis of the response properties revealed that the typical neuron was more sensitive to category than identity. Finally, the monkeys could be trained with stimuli that were assigned to a new category, illustrating the plasticity of this system.

The authors were careful to note that the prefrontal cortex is unlikely to be the only area of the brain involved in perceptual categorization. The development of approaches such as this suggest that it may not be long before we have definitive evidence on this point.

References and links**ORIGINAL RESEARCH PAPER**

Freedman, D. J. *et al.* Categorical representation of visual stimuli in the primate prefrontal cortex. *Science* **291**, 312–316 (2001)

FURTHER READING

Miller, E.K. The prefrontal cortex and cognitive control. *Nature Rev. Neurosci.* **1**, 59–65 (2000)

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