Is the rodent a valuable model system for studying invariant visual object recognition?

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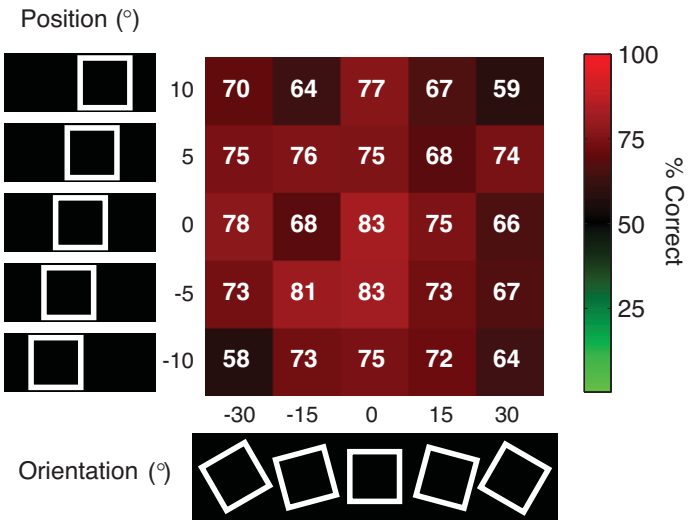
Despite the many advantages rodents offer in terms of experimental accessibility, they have never been extensively used as models to investigate the neuronal processing of visual objects. A crucial step in establishing whether rodents are suitable models for the study of object vision, is to assess if they are capable of invariant object recognition – i.e., recognition of visual objects across the range of transformations that they typically undergo during natural vision (e.g., changes in position and size).

In this study, we tested rats (Long-Evans) capability to discriminate between two geometrical shapes (square and triangle) presented at different sizes, positions and orientations. In each trial, a single shape was presented on a computer monitor and the animal had to report its identity. The experiment consisted of three phases. In phase I, each animal learned to discriminate between the two shapes presented at fixed size (40° of visual angle), position (center of the monitor), and orientation. Naïve rats typically achieved > 70% correct performance in 2-3 weeks of training. In phase II, the animals were trained to perform the task while either the size, the horizontal position, or the orientation of the shapes was separately varied. Rats readily acquired this task (> 70% correct performance) across sizes ranging from 40° to 10°, positions spanning ±12°, and orientations spanning ±40°. During phase III of the experiment, we asked if rats could generalize to novel combinations of size, position, and orientation (a total of 100 transformations of each target shape were tested). Performance was typically > 70% correct for nearly all of these previously unseen transformations (performance of one rat over a subset of the tested conditions is shown in the figure) and even for a fraction of transformations for which feedback was withheld.

These results show that rats can readily learn to: 1) discriminate between simple visual shapes; 2) disregard variations in their position, size and orientation; and 3) generalize to novel views. This suggests that the rat visual system contains the fundamental mechanisms that support object recognition. Therefore, given the broad ranges of experimental approaches available in rats, they may be a powerful new model system to study the neuronal basis of invariant object recognition.



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