

Rapid invariant view learning of novel objects in the inferior temporal cortex (IT) of macaques.

Nikolaos C. Aggelopoulos and Edmund T. Rolls, University of Oxford, Department of Experimental Psychology, Oxford OX1 3UD, UK

Weiskrantz & Saunders (1984) have shown that monkeys with bilateral lesions of the inferior temporal cortex (IT) are impaired in tasks that require the identification of an object when it has been transformed in size or orientation. Subsequent research (eg. Logothetis et al, 1995) has shown that view-invariant representations can be set up in IT neurons after extensive training.

We tested the hypothesis that macaques can learn view invariant recognition of novel objects in short periods of time. The responses of single neurons in the IT to four digitised views of the object were tested before and after the object was shown continuously transforming between different views for periods of 30 s to 30 min. The training period included manipulation of the object by the monkey as a result of which the monkey saw the object from different views. A novel control object was also included in the design, but in the “training” period only the four fixed views were shown, with no continuous transform between views.

Of the 103 neurons tested, 5 showed a significant change in their responses to the test object without any change in their responses to the control object (with interaction terms in a two-way ANOVA significant in the range $p < 0.001$ to $p < 0.05$ for different neurons). These changes were apparent after test periods of 5-20 mins. We also calculated an “invariance index” defined as the variance of the neuronal responses between views normalised over the mean firing rate. For the tested objects, the mean invariance index over these 5 neurons changed from 3.07 to 1.40, indicating a more similar neuronal response to the different views after training, whereas there was no significant change for the control object.

Thus some neurons in the IT have the ability to learn quickly (in less than 20 min) view invariant representations of novel objects.

REFERENCES

- Logothetis N et al (1995) *Current Biology* 5:552-563
Weiskrantz L & Saunders RC (1984) *Brain* 107:1033-1072