Response of Units in Striate Cortex of Squirrel Monkeys to Visual and Electrical Stimuli

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THE MANNER IN WHICH single units of the primate striate cortex respond to natural, visual stimuli has been described both for anesthetized (17, 26) and unanesthetized preparations (12, 30, 36, 44). Only Poggio (36), however, has examined the foveal representation in unanesthetized, painlessly immobilized monkeys where full control of visual stimulation could be maintained. His analysis concentrated on the spatial properties of the effective stimuli. Several units were found to change their characteristics during the course of analysis, thus raising the possibility that the processes of "feature extraction," if they in fact exist, may be more dynamic than they appear to be under anesthesia.

Using a preparation similar to Poggio's, we have looked at this system in a somewhat different manner. First, besides determining the effective spatial properties of the stimulus, whenever possible we have also determined the latency of response to stroboscopic flashes and to electrical stimulation of optic tract (OT) or optic radiation (OR). We hoped thereby to assess to some degree the directness of the afferent access to different classes of units. Second, we have examined the response to diffuse illumination at various intensities. This has revealed a type of unit heretofore unrecognized in striate cortex of any species and which, surprisingly, constituted more than one-third of the units in the foveal representation in striate cortex of the unanesthetized squirrel monkey. We have termed this new class of units "luxotonic"[1] to reflect the fact that they discharge continuously at a rate dependent on level of illumination. Combining these analyses of latencies and of the responses to the intensive as well as the geometric properties of the stimulus, it can be concluded that many units participate in more than one stage or type of analysis of the visual input. In other words, feature extraction for spatial information may proceed through the same units that respond to the nonspatial, intensive features of the stimulus or its background conditions. While this possibility has long been appreciated, it has seldom received the attention it deserves.

Finally, as detailed in the succeeding article (4), we have examined the influence which stimulation of the mesencephalic reticular formation can exert on units in striate cortex, in this regard probably touching on the source of some of the lability observed by Poggio (36).

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[1] While this neologism mixes Latin and Greek origins and fails to conform to proper Latin derivation (lucitonic), it has the dual advantage that it avoids confusion with preexisting usage (phototonic, photopic) and that its sense is, according to cursory testing, often (in contrast to lucitonic) immediately apprehended by American colleagues.

METHODS

General preparation

Data were collected from 28 squirrel monkeys (*Saimiri sciureus*), weighing 0.3–1.2 kg. Under secobarbital anesthesia, using sterile technique, pairs of 0.2-mm diameter, gold-plated nichrome electrodes with 1—2 mm tip separation were implanted in the right optic tract (OT) and optic radiation (OR). The OT electrodes were placed in accordance with responses elicited by stroboscopic flashes. The OT was then stimulated with 0.1-ms pulses, 1—2 mA, while recording electrodes were positioned in OR for maximal response. In some cases OR electrodes were placed instead by stimulating through them to elicit maximal response at striate cortex.

For future access with microelectrodes, a