Chapter 17

Cerebral Cortex as Model Builder

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17.1 Introduction

The cerebral cortex is supposed to be responsible for humanity's dominance of the natural world, and in particular for the intellectual pre-eminence that underlies this position. With the hope that the function of the whole cortex may illuminate the role of the parts devoted to vision and vice versa, I have asked the following five questions:

- Why does the cortex everywhere possess a similar structure?
- What sort of new behavior does cortex make possible?
- What types of operation are required for such new behavior?
- Do neurons in visual cortex perform such operations?
- Can we suggest how the cortex does it?

In this chapter, I attempt to give the simplest and most straightforward answer to each question in turn, and a unified view emerges which makes sense of a wide assortment of facts about the cortex.
17.2 Why does the cortex everywhere possess a similar structure?

The simplest answer is that it performs the same operation everywhere, but the input upon which this operation is performed varies in different cortical areas according to the origin of the input fibers, and the effects of the operation also vary according to the destinations of the output fibers. The principal regional differences that one has to account for are those between the primordial areas, which include the sensory projection areas and the motor area, and the other areas. This distinction was originally made by Flechsig1 in 1901 on the basis of the earlier myelinization of the tracts associated with the primordial areas, and it is possible that their most important characteristic is simply that they become functional at an earlier age. Other local variations could result from differences in the number, size, origin, and destination of the fibers entering and leaving; regional differences of structure are interesting and important, but they do not violate the hypothesis that the cortex performs a uniform operation throughout.

17.3 What sort of new behavior does cortex make possible?

Early comparative anatomists such as Elliot-Smith2 answered this by saying that animals with well-developed cortices had greater flexibility of response and were able to modify genetically determined behavior patterns in different circumstances. This required the ability to detect types of association that an animal with a less developed cortex would be unable to use.

Unfortunately, this qualitative insight has not been confirmed and extended by modern behavioral psychologists. Macphail for instance,3 could not find any evidence for improved learning ability correlated with greater cortical development. This was based on a review of laboratory studies,

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