

It cannot be too strongly emphasized that this investigation is still at an extremely primitive stage and hence gives but some dim and shadowy picture of the amazing intricacy of pattern woven in space and time by the sequential activation of neurones in multi-lane traffic over the ten thousand million components in the cortical slab of cells. It has been surmised that many millions of cells take part in the simplest cortical response. We can further speculate that the human cerebral cortex surpasses that of all other animals in its potentiality to develop subtle and complex neuronal patterns of the utmost variety, for from this would stem the richness of human performance as compared with even the most intelligent animal.

Physiological investigation reveals that all perception depends on very complex processes of detection by sense organs and of transmission of signals (nerve impulses) in a coded pattern thence to the brain. There is much neurophysiological evidence that a conscious experience arises only when there is some specific cerebral activity. For every experience we would postulate that there is a specific spatio-temporal pattern of neuronal activity in the brain. Thus with perception the sequence of events is that some stimulus to a sense organ causes the discharge of impulses along afferent nerve-fibres, which, after various synaptic relays, eventually evoke specific spatio-temporal patterns of impulses in the neuronal network of the cerebral cortex. The transmission from sense organ to cerebral cortex is by a coded pattern of nerve impulses that is quite unlike the original stimulus to that organ, and the spatio-temporal pattern of neuronal activity that is evoked in the cerebral cortex would be again different. Yet, as a consequence of these cerebral patterns of activity, I experience sensations (more properly the complex constructs called percepts) which in my private perceptual world are "projected" to somewhere outside the cortex; it may be to the surface of the body or even within it, or, as with sight, hearing or smell, to the outside world. However, as succinctly expressed by Russell Brain:

"the only necessary condition of the observer's seeing colours, hearing sounds, and experiencing his own body is that the appropriate physiological events shall occur in the appropriate areas of the brain".

This direct relationship of brain activity to perception was first clearly seen by Descartes. It is immaterial whether these events are caused by local stimulation of the cerebral cortex or of some part of the afferent nervous pathway, or whether they are, as is usual, generated by impulses discharged by sense organs. However, electrical stimuli applied to the sensory zones of the cerebral cortex evoke only chaotic sensations: tingling or numbness in the skin zones; lights and colours in the visual zone; noises in the auditory zone. Such chaotic responses are to be expected since electrical stimulation of the cortex must directly excite tens of thousands of neurones regardless of their functional relationships, and so initiate a widely spreading amorphous field of neuronal activation quite unlike the fine and specific patterns that must be set up by the input to the cortex from the sense organs. A familiar chaotic sensation, involving elements of touch, heat, cold and pain, arises from similar reasons when a sensory nerve is directly stimulated, as when the ulnar nerve in the elbow (the "funny bone") is mechanically stimulated.

In response to sensory stimulation, I experience a private perceptual world which is an interpretation of specific events in my brain. Hence I am confronted by the problem: how can this cerebral pattern of activity give me a valid picture of the external world? Usually this problem is discussed in relation to visual perception. There seems to be an extraordinary problem in explaining how impulses from the retina when relayed to the cerebral cortex give rise to a picture of the external world with all its various objects in three dimensional array and endowed with brightness and colour. However, this epistemological problem has led to much