

THE OUTLINE OF A NEUROPHYSIOLOGICAL THEORY DESIGNED TO ACCOUNT FOR MENTAL PHENOMENA AS DESCRIBED IN ORDINARY LANGUAGE IN WHICH IS AS FAR AS POSSIBLE CONSISTENT WITH CURRENT PHYSIOLOGICAL AND PSYCHOLOGICAL EVIDENCE (1969).

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Stimuli (physical energy) impinge on the sense (receptor) organs and generate a sensory input (afferent neural discharge). As Broadbent (1958) has suggested a significant part of the total sensory input at any one time is either wholly or partially filtered out, probably by the action of the reticular activating system so that only a limited part of the total input is available for processing by the higher centres. If a particular input has a high signal/noise ratio either in relation to the immediately preceding input pattern or in relation to the remainder of the current input, it will tend to activate the reticular filter system so as to facilitate its own transmission to the higher centres at the expense of other inputs, i.e. the individual's attention will be held or caught by it. That part of the sensory input that passes through the filter is transmitted to the higher centres, presumably in the cortex, where it generates *a conscious experience*. Experiences in this sense are of two kinds, *sensations* and *mental images*. The boundary between sensations and mental images is not sharply defined, as is shown by the cases where the two are confused. A hallucination in the psychiatric sense is an image mistaken for or misinterpreted as a sensation. An example of a sensation mistaken for an image is given in an experiment by Perky (1910) in which the subject was told to form a visual image of a banana on a screen onto which, unbeknown to him, a faint image of a banana was projected. Under these conditions a perfect agreement was found between the reported location and orientation of the putative mental image and that of the real, but otherwise sub-threshold, image projected onto the screen.

The fact that such confusions are possible suggests that mental images are formed by the same process as that involved in the production of sensations, that is by filtering out certain components of a sensory input, in this case, presumably, a sensory input that is weakly structured, i.e. one where there is no clear intrinsic signal/noise differentiation, e.g. the random afferent activity in the optic nerve when the eyes

are closed. In this way a pattern of excitation is transmitted to the higher centres which generates an experience which is functionally equivalent to that generated by the physical stimulus situation it is said to resemble.

An experience, whether it be a sensation or a mental image, both selects and, through feed-back activity, is modified by what is variously described as an 'interpretation', 'meaning', 'concept', 'construct', 'cognition', 'schema' or whatever. This interpretation or meaning-assignment suggested by a sensation or used in the formation of a mental image is explained on the present hypothesis in terms of a high-level switching-in and switching-out of various output and feed-back circuits within the brain. It may be compared to the operation and locking in for a short period of time of an electro-magnetic relay which operates a number of make, break and changeover contacts. If by virtue of a subsequent input, e.g. on being asked a question, a verbal behaviour output circuit is energised, the contacts on the relay that are open and closed will determine the content of the resultant utterance, i.e. the subject will describe the situation confronting him *as he interprets it*. If the subsequent input requires performatory (i.e. non-verbal) behaviour, the nature of this will also be determined by the individual's interpretation of the situation, i.e. by the contacts that are closed or open on the relay.

Other effects of an interpretation are produced automatically, and do not depend upon subsequent input in this way. These are said to be 'involuntary.' They consist mainly in the operation of feed-back circuits which affect the subsequent events within the control system itself. The two most important of these are (1) the direct feed-back to the input filter mechanism which predisposes the system to filter in the kind of input whose occurrence is *predicted* or *expected* by virtue of the interpretation given to the previous input, and (2) the *emotional* feed-back effect. Emotional phenomena may be thought of as resulting from the operation of a *servo mechanism* whose function is to facilitate or inhibit the activity of other parts of the system. These servo effects are of two kinds general and selective. The *general* effects either increase the level of activity or *arousal* of the system as a whole, as in excitement, or reduce it as in depression or relaxation. The *specific* effects are either *redintegrative*, i.e. tending to maintain the current activity of the system and leading to its reinstatement on subsequent occasions (as in the case of *pleasant* emotions), or

disintegrative, i.e. tending to disrupt the current activity of the system and promote its replacement with alternative patterns activity (as in the case of *unpleasant* emotions).

The phenomena of *memory*, including the acquisition of beliefs and specific emotional dispositions (motives), are construed in terms of this theoretical model, not in terms of the storage of information, but rather in terms of the selective facilitation and inhibition of certain pathways through the system. A pathway in this sense should not be interpreted as implying a very specific anatomical route through the system involving certain particular neurons and only those neurons. Although there is some degree of specificity in the route through the brain involved in different behavioural functions, facilitation and inhibition of different pathways through the system is almost certainly to be conceived in terms of a process whereby certain patterns of activity widely distributed within the nervous system acquire the tendency to elicit or inhibit other patterns of activity widely distributed through some anatomically distinct, though possibly overlapping, part of the system.

REFERENCES:

1. Broadbent, D.E. (1958) *Perception and Communication*. Oxford: Pergamon.
2. Perky. C. W. (1910) *American Journal of Psychology*, **21**, 422-452.

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