

In essence the behaviourist view is that it is unnecessary to hypothesise a complex mental mechanism where behaviour can be explained without one. This follows the sound scientific principle of not inventing complex theories when simple ones will do, but can the behaviourists adequately explain intelligent thought? Their theories have appeared most successful in explaining behaviour such as learning and the acquisition of physical skills. The rat in the psychologist's maze can be seen as learning to associate the response 'left' or 'right' with the stimulus of each junction. Thorndike expanded this simple idea by placing cats in puzzle boxes where a variety of bolts or catches needed to be released to open the cage. The cats escaped by trial and error and thus apparently learned to solve a problem. Behaviourists have thus tended to explain problem-solving or goal-directed thinking in terms of successive mental trial and error. Actually the associationist model of thought seems more applicable to imaginative thought or day-dreaming. Here the thinker is not wilfully controlling direction but, rather, is allowing the thought stream to wander. However this must wait until the next chapter.

The Gestalt school

However satisfactory or not their theories may be the behaviourists have contributed little which may be used by designers wishing to improve their thinking skills. It was not until the arrival of the Gestalt school of psychology that we begin to find material useful for explaining design thinking. The Gestalt school established a tradition of studying problem-solving which is continued today by such writers as Edward de Bono. Gestalt theories of thinking concentrate on processes and organisation rather than mechanisms. Wertheimer (1959) saw problem-solving as grasping the structural relationships of a situation and reorganising them until a way to the solution is perceived. This already begins to sound more like designing than Thorndike's cats, but Wertheimer went even further. He maintained that this mental reorganisation of the situation is achieved by applying various mental modes of attack which still persist today in creativity tools such as those advocated by populist writers. These mental tricks include trying to redescribe the problem in another way and the use of analogy as a way of shifting the mental paradigm. As we shall see later this forms the basis of a number of quite recently proposed design techniques. Whereas

the behaviourists used animals to explain thought, the Gestaltists used animals to show the absence of human-like thought. The Gestaltists were also very interested in perception and, therefore, stressed the importance of context in thought. De Groot's use of words in describing Kohler's experiments with apes is most revealing:

We humans are struck by the inability of these otherwise quite intelligent animals to take a ring off a nail; a possibility that we immediately see. Due to our experience with nails and rings and their usage, we see the situation in a totally different way than the ape does. Similar examples can be given touching upon the relation between adults and children.

(De Groot 1965)

Thus for De Groot thinking depends upon acquiring the ability to recognise relationships, patterns and complete situations. In his study of chess De Groot shows how experienced chess players 'read' situations rather than 'reason them out' as do the less experienced. Thus chess masters can play so many games simultaneously simply because each time they see a board they are able to recognise the pattern of the game. This 'schooled and highly specific way of perceiving' combined with a 'system of reproductively available methods in memory' (De Groot 1965) produces a rapid and inscrutable response which, to the uninitiated observer, looks like an intuitive flash of genius. Paradoxically, chess masters may also spend far longer examining a situation than their less experienced counterparts simply because they can see more problems, perhaps further ahead, than the average player. Anyone who has watched an experienced designer at work will recognise this description. The designer may appear to be drawing in a very natural and relaxed manner as if no effort were involved at all. As Bruner puts it the designer must 'go beyond the information given' and see possibilities which others may fail to discover for themselves but still recognise as useful, appropriate and beautiful when they are presented.

Markus listed four basic sources of information available in a design decision-making situation: the designer's own experience, others' experience, existing research and new research (Markus 1969a). It is perhaps the inevitable mixing of these sources which contributes to designers' seemingly random behaviour, sometimes apparently intuitively leaping to conclusions whilst at other times making very slow progress.

The Gestalt psychologists paid particular attention to the way we represent the external world inside our heads. Most notably Bartlett in his now classical studies of thinking (Bartlett 1958) and