To begin with, however, we need to study thinking itself and, in the next chapter, that precious and wonderful phenomenon of creativity which is so central to design. The history of cognitive psychology reveals many conflicting views about the nature of thought and the thought process from the most mechanistic to the most mythical. We begin with a problem familiar to those who study design. The word 'thinking', like the word 'design', is used in so many ways in everyday language that we need to specify exactly which versions of it we are examining.

There is the sort of thinking we do when we say are trying to think where we left something. This is essentially remembering and is obviously vital to design but again not the central task. There is the use of the word 'think' which we apply to the act of concentrating or simply paying attention, as when we say 'think what you are doing'. There is the use of the word to mean belief as when someone says what they 'think'. There is the thinking which psychologists would label 'autistic' but which ordinary people might describe as day-dreaming. This leads to a sort of uncontrolled stream of consciousness which in itself can be useful to designers but is certainly not their main tool. There is the sort of imaginative thinking we do which might be described as fantasy anchored in reality. Here we might 'think' through some scenario which is possible but not actual. Clearly this is very much what designers do. Finally there is the sort of thinking which we might call 'reasoning'. This is self-consciously done with a deliberate attempt to control the direction of thought towards some intended end product but where some obstacles have to be overcome. This is reflective thought and problem-solving.

In Chapter 9 we explore creative and imaginative thinking, but it is the last of these many forms of thinking that we are primarily studying here. The great British philosopher and student of thought, Ryle (1949) described even this last version of thinking as being 'polymorphous'. Just as two farmers might do quite different things, with one rearing sheep and another reaping crops, Ryle famously explained, we still recognise them both as farmers. So it is with thinking.

Theories of thinking

This subject is not an easy one since it takes us quickly into the psychology of thinking and to some extent of feeling and emotion. So much has been written about the phenomenon of thought and

the business of thinking by philosophers and psychologists that we cannot possibly do justice to the subject here. However, this chapter attempts the almost impossible, which is a brief survey and summary of the key points from these debates which seem important to the study of design.

Cognitive psychology is one of the most problematic fields of science since it involves investigation of something we cannot see, hear or touch. We know it is going on, and we all think throughout our lives without worrying about it too much, but thinking about thinking is another matter. In terms of modern western psychology, the earliest theories of thinking were very basic indeed. In fact the 'behaviourist' theories of thinking hardly admitted that thinking was any more than very mechanistic behaviour which just happened to go inside the head. The Gestalt psychologists were more interested in how we solved problems, and more recently the cognitive science approach has tried to study humans as information processors.

The behaviourists

The behaviourist Thorndike (1911) believed that human intelligence comprises only one basic process, the formation of associations. In fact the behaviourists were reluctant to admit that humans could be distinguished from other species by our abilities to think at a high level. Following Thorndike's early writings many behaviourist psychologists tried to explain thinking purely in terms of direct associative links between stimuli and responses. They even went so far as to argue that thinking is really only sub-vocal speech or 'talking to ourselves'. Indeed some experimenters found evidence of peripheral muscular activity during thinking but, of course, they failed to show that this was actually the thinking itself. Eventually the idea was modified suggesting that the muscular activity was so small as to have no effect save to act as feedback to the thinker. The idea behind such an apparently curious notion was that in this associationist model of thought, each of our responses could be fed back to act as another stimulus eliciting yet a further response. Writers such as Osgood and Berlyne eventually abandoned the search for 'muscular thought' and introduced the notion of purely cortical responses. For Berlyne (1965), patterns of thought result from us choosing from a variety of responses which we associate with each stimulus. The choice is made simply by selecting the strongest associative link although these links can be strengthened or weakened by our experience of life.