courses. The architects are taught through a series of design studies and receive criticism about the solution they come up with rather than the method. They are not asked to understand problems or analyse situations. As in the real professional world the solution is everything and the process is not examined! By comparison scientists are taught theoretically. They are taught that science proceeds through a method which is made explicit and which can be replicated by others. Psychologists, in particular, because of the rather 'soft' nature of their science are taught to be very careful indeed over their methodology.

However, this is perhaps too simple an explanation. Although their performance was no better overall, both groups of design students showed greater skill than their peers in actually forming the three-dimensional solutions. They appeared to have greater spatial ability and to be more interested in simply playing around with the blocks. Is it possible that the respective educational systems used for science and architecture simply reinforce an interest in the abstract or the concrete? These experiments do not enable us to answer this question. However, they are also very limited in their ability to model the actual design process so for further progress we need to turn to more realistic investigations.

The results of this experiment also further question the division between analysis and synthesis seen in the maps of design earlier in this chapter. What is clear from this data, is that the more experienced final year architecture students consistently used a strategy of analysis through synthesis. They learned about the problem through attempts to create solutions rather than through deliberate and separate study of the problem itself.

Some more realistic experiments

In a slightly more realistic experiment, experienced designers were asked to redesign a bathroom for speculatively built houses (Eastman 1970). The subjects here were allowed to draw and talk about what they were doing and all this data was recorded and analysed. From these protocols Eastman showed how the designers explored the problem through a series of attempts to create solutions. There is no meaningful division to be found between analysis and synthesis in these protocols but rather a simultaneous learning about the nature of the problem and the range of possible solutions. The designers were supplied with an existing bathroom

design together with some potential clients' criticisms of the apparent waste of space. Thus some parts of the problem, such as the need to reorganise the facilities so as to give a greater feeling of spaciousness and luxury, were quite clearly stated. However the designers discovered much more about the problem as they critically evaluated their own solutions. One of Eastman's protocols shows how a designer came to identify the problem of shielding the toilet from the bath for reasons of privacy. Later this becomes part of a much more subtle requirement as he decided that the client would not like one of his designs which seems deliberately to hide the toilet, the toilet then was to be shielded but not hidden. This subtle requirement was not thought out in the abstract and stated in advance of synthesis but discovered as a result of manipulating solutions.

Using a similar approach, Akin asked architects to design rather more complex buildings than Eastman's bathroom. He observed and recorded the subjects' comments in a series of protocols (Akin 1986). In fact, Akin specifically set out to 'disaggregate' the design process, or break it down into its constituent parts. Even given this interventionist attack on the problem, Akin failed to identify analysis and synthesis as meaningfully discrete components of design. Akin actually found that his designers were constantly both generating new goals and redefining constraints. Thus, for Akin, analysis is a part of all phases of design and synthesis begins very early in the process.

Interviews with designers

So far we have looked at the results of experiments in which designers are asked to design under experimental conditions. These conditions can never actually model the real design studio, so an alternative research method of interviewing designers about their methods allows them to describe how they work under normal conditions. Of course this research method is also flawed since we are dependent on the designers actually telling the truth! Whilst it is quite unlikely that they would deliberately mislead us, nevertheless memory can easily play tricks and designers may well convince themselves in retrospect that their process was more logical and efficient than was actually the case. One of the advantages of the interview is that we can sometimes persuade very good designers to allow us to interview them whereas, sadly, many of