The idea that the digital computer will someday match or exceed the intellectual abilities of human beings has been put forward repeatedly ever since the computer was invented. In the early days of computing the assertion was without an empirical basis: the programs of the computer could no more be expected to reason, plan, learn, sense, formulate concepts, use language or think creatively than could their mechanical predecessors in the art of simulation: the puppet, the windup toy soldier and the music box. Moreover, the idea that intelligence itself might require a theoretical framework for its explanation was scarcely acknowledged. Intelligence was considered a transparent concept, and if it were to be recognized in a machine, the intellectual powers of the machine would have to be almost indistinguishable from those of a human being. Thus early computers were called electronic brains, and John von Neumann, one of the architects of the kind of computer in commonest use today, formulated explicit analogies between the computer and the brain. Many people still associate data with human knowledge, the operation of a program with decision making, the trace or ongoing record of the program's operation with the stream of consciousness and the acquisition of data with learning.

In the past 20 or 25 years the new discipline of artificial intelligence has put to rest some of the more naive analogies between the computer and the brain and has begun the task of placing the concept of intelligence on a theoretical footing. For the practitioners of the discipline the computer is a laboratory in which to develop new ways of thinking about thinking. Computer programs written by investigators in artificial intelligence have demonstrated conclusively that in certain activities (including activities most people would say require intelligence, such as playing games) the computer can outperform a human being. Recent programs have demonstrated that the computer can even develop elaborate theories about a limited domain such as arithmetic from a few simple axioms. At the same time the understanding of various features of human intelligence has been considerably enriched by the attempt to describe analogues of those features in the detail necessary

for writing a program. As a result the analogy relating the performance of the computer to that of human intelligence has broadened and matured.