

Visual thinking is an old art. One tries to represent and manipulate concepts, relations, inferences, to see the proper shape of a question and the outline of an answer, or to model a possible explanation. Plato was a visual master, as his many analogies attest. Aristotle had a knack for diagrams. The Cartesian coordinates remain a crucial revolution in data representation, although they reduced geometry to algebra.

The crisis of Euclidean geometry in the nineteenth century, however, badly shook philosophers' confidence in their "visions". Russell was an algebraic thinker who mistrusted even Venn's diagrams. Letters and numbers, not diagrams or pictures, dominate in the *Principia*, whose fourth volume on geometry never appeared. Truth tables, with their familiar shape and mechanism were, introduced by Wittgenstein, a thinker more at home with architectural and engineering design. He and Frege were "visionaries" for whom the iconographic side of thought was neither frivolous nor misleading, but a key aid to the intuition. Indeed, one might recast the analytic vs. continental divide in terms of philosophers who seek to see things clearly and distinctly and philosophers who hear voices. Nietzsche and Heidegger had a bent for the oral tradition, the spoken logos and its fluid, uncontrollable flow.

From truth tables to derivation trees (tableaux) there is a clear line of development: thinking is easier if one can see and handle inferences geometrically and continuously rather than algebraically and discretely. Paradoxically, we owe to Einstein both the last blow to our everyday faith in the Euclidean description of the universe, and one of the strongest statements in favour of mental visualization and its heuristic power. In a famous letter to Jacques Hadamard, he wrote that "The words or the language, as they are written or spoken, do not seem to play any role in my mechanism of thought. The psychical entities which seem to serve as elements in thought are certain signs and more or less clear images which can be 'voluntarily' reproduced and combined [...] this combinatory play seems to be the essential feature in productive thought before there is any connection with logical construction in words or other kinds of signs which can be communicated to others". Feynman had a similar approach. Unsurprisingly, he devised a now standard diagrammatic system to deal with complex calculations in quantum physics.

Today, the computer revolution has finally reconciled the algebraic, digital tradition with the geometrical, analogue one. Two interesting books that well explain this transition and how computers are modifying our ways of visualising and manipulating information are *Modelling Reality - How Computers Mirror Life* by Iwo and Iwona Bialynicki-Birula (OUP 2005) and *The Philosophical Computer*, by Patrick Grim, Gary Mar and Paul St Denis (MIT 1998).

*Modelling Reality* is a fascinating and accessible introduction to computer modelling. It discusses cellular automata, Shannon's information, deterministic chaos, fractals, game theory, neural networks, genetic algorithms, Turing machines and many other topics. It comes with a CD full of applications to experiment with the processes and theories discussed.

*The Philosophical Computer* contains several exploratory essays in philosophical modelling. It shows how computers can help to tackle a variety of issues in philosophy and in logic, including self-reference, fuzzy logic, epistemic chaos, and cellular automata in game theory. This book too comes with a CD containing the source code of all major programs to facilitate further research.

Visual thinking has been externalized to the screen, where it is now refinable and intersubjective. And because of its interactive nature, the new alliance between computational modelling and visual thinking is promoting the revival of a Baconian-Kantian approach to knowledge. Forget Plato's philosopher, who allegedly knows the vase better than its maker: one really knows and understands something only when one can build and repair it. Knowledge is a way of making and handling, closer to cooking and knitting rather than to watching TV or listening to an iPod. After all, both Descartes and Wittgenstein were engineers.