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Short English summary and table of contents of Il computer di Platone (Bari, Dedalo, 2005) and Il computer di Ockham (Bari, Dedalo, 2010)

Il computer di Platone and *Il computer di Ockham* (and a third volume that, I hope, will follow them) could be considered a ‘natural history of the signs’, and, at the same time, an ‘anthropology and cognitive history of mathematics, logic and computing’.

The basic idea is that the modern computer is not only a wonderful device with a relatively short history. It is easy to realize that an almost historyless technological account of the computer conceals some deep aspects of our age. Actually, if we read the history of computing since the Second World War, we see something astonishing. On the one hand we find bewildering continuous technological change (somebody said that every five years the computer becomes ten times cheaper, ten times more powerful, ten times smaller), and on this basis we count its ‘generations’ (from relays to microchips). On the other hand, if we consider its logic architecture, we realize that it has never actually changed since von Neumann’s first computer, notwithstanding the huge research investments. The computers’ logical nature does not change because it continues to implement the *universal Turing machine*, and computes the whole ‘computable’, i.e. the set of all the possible algorithms: ‘all that can be done by manipulating signs according to rules’, an ‘absolute’ concept, something that does not depend on anything and something that cannot change.

According to this view the modern computer is the technological emergence of such a logical architecture, the result of a long evolution whose roots can be found in Greek civilization, that is in the ancient idea that there is a natural correspondence between language and reality, between a world of signs and a world of things. We can call it the ‘syntactic paradigm’: a brilliant and usually agreed to (but not so obvious) idea, and the computer is the ‘absolute’ syntactic machine that crowns this long lasting insight [first and second chapter of the first book].

The emergence of the syntactic paradigm can be found in ancient Greece, intertwined with the development of alphabetic writing that built up a world of ‘signs’ (words) which had to *mimè* another world of ‘things’ (the real objects). This idea of *syntactic representation* was the basis of the parallel genesis of Greek philosophy and mathematics, but ever since this beginning it was clear that, inside this relationship between those two worlds, there was a deep ‘preestablished disharmony’: words and things were not alike, neither in their being nor in their becoming, some words (being, not, true, equality) did not represent any ‘thing’, a part of a word did not represent a part of the represented thing, language represented diachronically a synchronical reality. This disharmony grounded many formal paradoxes that endure up to the present time, first and foremost ‘the liar’ [3rd and 4th chapters].

Moreover this relationship between language and reality was the core of Aristotelean logic (the founding of the ideas of syllogisms, axioms and formal principles [5th chapter]), the new theoretical Greek geometry (the founding of the ideas of demonstration and equality [6th and 7th chapters]), and Greek natural philosophy (the founding of the ideas of form, causality, infinity and continuity [9th and 10th chapters]).

Greek mathematics was, in particular, strictly embedded in the Greek language and this gives us the rationale for its oddest features: zero did not exist, one was not a number, numbers and magnitudes were two sharply opposite worlds, mathematics could not be applied to physics

[8th chapter]. Beyond language, music also played a role in the development of Greek mathematics (even the discovery of incommensurability probably had its beginning in the musical problem of the tone dichotomy), an involvement that lasted until the 17th century: afterward, mathematically there will only be ‘sound’, and musical harmony will become something belonging only to the irrational realm of ‘beauty’ [11th chapter].

At the end of the first book two chapters deal with the connection between the syntactic paradigm and the evolution of the idea of *soul* [12th chapter] and with a comparison to the ancient Chinese view on these themes, analysed according to the characters of Chinese writing [13th chapter].

The second book (*Il computer di Ockham*) begins analysing how, at the end of antiquity, first Christianity and then the breakdown of the Western Roman Empire bore a brand new world: the ‘dark’ centuries of the Middle Ages were the real cradle of modern Europe. Greek civilization was monolingual, in the Middle Ages the world became multilingual, and was able to create new formal idioms: algebra, calculus, logic, programming languages [the first two chapters].

In the Middle Ages, the object of the representation was no longer ‘nature’, but the ‘book’, the *Bible*, and so its logic became a linguistic logic intertwined with medieval Latin grammar: the medieval university became the cradle of this ‘scholastic’ culture [3rd and 4th chapter]. Christian culture was the background of a cognitive change that made possible the emergence of a new concept of science. Syntactic algebra emerged in the Islamic world, and afterward in Europe it became a real *language*, the first human artificial language, and ultimately the ‘language of science’, because scholastic philosophy in the medieval universities paved the way for a new connection between mathematics and physics, the track of an idea of science as a ‘deep’ linguistic structure, the secret engine of the new science in the 17th century [5th, 6th and 7th chapter]. Actually the core of the Scientific Revolution was the new ‘place’ of mathematics, no longer a fragment of natural language, it was a set of real attributes (numbers, figures) drawn from real things, but a brand new language (derivatives, integrals, series, real numbers, algebraic signs) to deal with a deeper reality, attainable not by qualitative, natural, common experiences but by quantitative, artificial, laboratory experiments [8th, 9th and 10th chapter].

Last but not least: where does the ‘syntactic paradigm’ come from? And how and why does it change? It is difficult to see it as a ‘hardware’ effect of the brain working, for the evolution of the brain can be measured in very long periods, whereas the times of the signs’ ‘career’ seem evident already in centuries or even in decades. Nor can we see the signs as sorts of ‘ideas’, the ‘software’ of the brain: signs seem to involve deeper cognitive processes, not as volatile as ideas, but we could say they are substantially a sort of *history-sensitive apriori*.

And it is known from neuropsychology that there is also a ‘middleware’ of the brain, i.e. its connectionist architecture, which takes its shape in the earlier years of life due to the plasticity of the synaptic connections. To this account we can also remember that dealing with the signs is the most relevant feature of the left hemisphere of the brain. Therefore, following this line of thought, the evolution of the syntactic paradigm could be intertwined with the changing of the brain lateralization [Conclusions of the second book].

The main thesis of these books is that it is difficult to understand the modern world if we look at the signs as simple scrawls, marks left on the paper (or bits in the memory of a computer). The growing role of the signs, since their beginning with alphabetic technology, is the actual thread of the European civilization.

If we change our mind and ‘take the signs seriously’, we realize that, beneath the technological aspects, the computer is the track of an anthropological change, perhaps ruled by

the brain lateralization and connected to other anthropological aspects (language, religion, music, etc.). The syntactic paradigm is not a sort of ‘idea’, but actually the deep structure of our cognition, the grounding of our science, our economy and our culture, whose development can be followed through the millennia until today. Its triumph in the 20th century allows us to call our age the ‘realm of signs’, and gives us the rationale for the pervasiveness and wide spread use of the computer in our world.

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(Dedalo, Bari, 2005). ISBN: 88-220-0227-X

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Ockham’s computer

(Dedalo, Bari, 2010). ISBN: 88-220-0247-1

Foreword.

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