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Book Review

Computation, Information, Cognition: The Nexus and the Liminal

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Computation, Information, Cognition: The Nexus and the Liminal. Edited by Susan Stuart and Gordana Dodig-Crnkovic. Cambridge Scholars Publishing, Newcastle, 2007, 340pp. ISBN: 9781847180902, £39.99, $79.99.

Are you a computer? Is your cat a computer? A single biological cell in your stomach, perhaps? And your desk? You don't think so? Well, the authors of this book suggest that you think again. They propose a computational turn, a turn towards computational explanation and towards the explanation of computation itself. The explanation of computation is the core of the present volume, but the computational turn to regard a wide variety of systems as computational is a potentially very wide-ranging project.

We have had computational machines at least since Pascal's and Leibniz' calculators, perhaps even since 1st Century BC, when the *antikithera mechanism* was built to predict lunar eclipses. However, it is only since the invention of the universal digital computer in the early 1940s and especially the spread of the Personal Computer in the 1980s that these machines have become commonplace and that their mechanism, computation, has gained more general attention beyond the confines of mathematical theory. For example, it is presently the standard assumption of cognitive science that the human mind is an computational information processor, an assumption shared by the proponents of artificial intelligence who hope that artificial computers may achieve the dizzying heights of human intelligence. Having said that, it is essential to the comprehension of the present volume that computation is not necessarily something that takes place inside certain machines that we call computers, and not even what a mathematician is doing with a pencil on a piece of paper. Computation is rather thought to be a mechanism that can be found in many systems, natural and artificial—or at least usefully postulated in the analysis and explanation of these systems. This approach has its roots in physics, but it has spread to the understanding of living systems (e.g., cells), partially incorporating earlier research programs like cybernetics and semiotics. In this sense, the presumed computation in the human mind is just one sub-system in a larger computational universe.

The papers of this volume have grown out of selected presentations at the European Computing and Philosophy conference, E-CAP, held at Mälardalen University, Sweden (http://www.idt.mdh.se/ECAP-2005/). Those papers not selected

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for this volume have been published in the web journal *TripleC*, issue ii, November 2006 (http://triplec.uti.at/). The event was the third in an annual sequence of E-CAP conferences, organized each year by the European Organisation for Computing and Philosophy, which in turn is part of the International Organisation for Computing and Philosophy—an organisation that also organizes annual conferences in the US (NA-CAP) and in Asia (AP-CAP) (see http://ia-cap.org/). Volumes with selected papers from E-CAP 2007 and AP-CAP 2007 are also forthcoming. In 2008, the E-CAP meeting will take place in Montpellier in June and the NA-CAP meeting in July in Bloomington, Indiana.

Before we take a closer look at the the excellent content, allow me to mention that it is a great pity that Cambridge Scholars Publishing have done a shoddy job with the volume—or rather no job at all. The book has evidently never seen the care of a copy editor or anyone else who knows the basics of typesetting. Apart from that, the paper and binding are cheap and the printing on the dust jacket rubs off after carrying the book around in a bag for a little while—though the jacket is nicely embellished by a painting of one of the editors, Dodig-Crnkovic. Last but not least, I am told that Cambridge Scholars Publishing did not provide a copy of the finished book to each contributor—though they did provide one to this reviewer.

Evidently, in a selection such as this, there is no overall argument or thesis that can be discussed here. I will try to give a flavor of the papers and then see whether one can detect an overall direction of the exercise, perhaps even indicate some evaluation of that direction.

As the editors point out in their useful introduction, the aims of the Computing and Philosophy conferences have shifted somewhat from the use of computers in the teaching of philosophy to many other philosophical issues that arise in connection with computers, from computer modeling of the mind, to artificial intelligence and various ethical challenges posed by the growing relevance of computers in human daily life. The editors provide one-paragraph summaries of each paper in their introduction, and they organize the papers under six headings: 1. Information, 2. Ontology, 3. Bioinformation and Biosemantics, 4. Cognitive Science and Philosophy, 5. Computational Linguistics, and 6. Ethics and Education.

As mentioned above, one radical attempt at broadening the import of analysis in computational terms is to say that everything is somehow computation. One of the keynote speakers, Gregory Chatin, calls this a *digital philosophy* or *digital physics*, a neo-Pythagorean theory which says that "everything is made out of 0/1 bits, everything is digital software, and God is a computer programmer, not a mathematician!" (p. 3). This digital philosophy is proposed prominently by Edward Fredkin and Stephen Wolfram (in his book *A New Kind of Science*) and developed in Chatin's book *Meta Math!*, of which this paper is an overview. This suggestion that the world is at bottom digital is interestingly contrasted with another paper, by Pietarinen, who proposes that we need a logic of iconic (i.e. non-digital) representation. The papers by Floridi and Allo attempt to capture both digital and analog representations under the notion of *information* and to develop a (pluralistic)

logic of its dynamics. These papers deal with what I take to be a central question, if not the central question: "What is computing?" and they suggest that this notion must be understood much more widely than traditionally assumed. The traditional notion described by Turing with the help of what is now called the *Turing machine* restricts computing to algorithmic processes that proceed step by step to a particular final state, taken as output. Here, computing may not be algorithmic, or even digital; in particular it will concern entities other than mere symbols.

The papers in section 2, "Ontology" seem somewhat old-fashioned in this context, in their focus on ontologies within computational systems in the conventional sense. The computationalist programme is much more at home in sections 3 to 5 where biological, cognitive and linguistic systems, respectively, are analyzed as computational ones—or where this analysis is challenged (e.g., by Miłkowski). This analysis has been commonplace in the cognitive sciences for a long time, at least in the sense of computation as information processing (and assuming that all such processing is computational). Without the cognitive baggage it has a long and successful history in the rule-fixated discipline of linguistics and it is interesting to see that it can be transferred with relative ease to biology where the notion of information appears especially useful in the explanation of functionally directed processes. Perhaps I am a computer in more than one sense, after all.

Section 6 on "Ethics and Education" is really *practical philosophy*, and even though its importance is evident (in fact more evident than that of the other directions), it is really a quite separate concern. No wonder that the impact and use of computers for teaching and ethics has inspired separate conferences, associations, and so forth.

As indicated, I see significant potential for the computational analysis of various phenomena, but if the movement wants to be one of the kind that propose an analysis that "Everything is x, at bottom," then we need to know more about that x. The widening of computation often goes together with a rejection of Turing's notion of computation. Fine, but if we do not want that old-fashioned notion, what will it be?

It emerges that these papers offer much more than just *something about philosophy and computing*, indeed they went well beyond a philosophy of computation (or, worse, a philosophy of computers) into an overarching research programme of a computational philosophy of the world. This programme is a promising one and how far reaching it will be cannot be seen at the moment. Indeed, I would expect that computational analyses are on their way toward becoming mainstream and will soon be so common that we will hardly notice them at all.