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Book review

4 **Computable Economics: the Arne Ryde Memorial Lecture Series**

5 Kumaraswamy Velupillai (Ed.), Oxford University Press, Oxford, Vol. xiii, 2000, 222 pp.,
6 Index

7 Professor Velupillai has been striving to get the economics profession to take the mathe-
8 matics of formal computation theory more seriously for over a decade, so one looks forward
9 with pleasure to a synthetic statement of his position occasioned by the Arne Ryde lectures.
10 He has been one of the very few to realize that neoclassical economics has not so much
11 been driven by the smooth development of generic mathematical 'tools' as the historical
12 fact, it took a concerted turn immediately following WWII in what one might characterize
13 as a 'Bourbakist' direction, to the neglect of an alternative path marked out by recursive
14 function theory and effectively calculable mathematics. (Wolfram (2002) hints economics
15 was not alone in this detour.) As usual, when being reminded of the road not taken, the au-
16 dience looks for a combination of historical narrative which tries to contextualize the wrong
17 turning, along with some weighing up of the analytical pros and cons of the two paths. Un-
18 fortunately, perhaps due to the lecture format, that is not what we get here. Instead, what we
19 are proffered is a list of precursors, the sketch of an argument that preference orderings are
20 not generally Turing computable, a brief description of neural nets as a model of adaptive
21 behavior, some observations on machine learning and induction, a series of reflections on
22 Rabin's (1957) paper on effective play of arithmetical games, and some disjoint observa-
23 tions on some scattered selected economic models. The threads that connect these chapters
24 (beyond repeated appeal to computation) are frequently left for the reader to work out for
25 herself. None of these are presented in sufficiently elementary form to serve as a primer for
26 someone unfamiliar with the literatures cited, nor are proofs fully written out, although the
27 book does come equipped with a brief explanation of Turing computability in an appendix.
28 The lectures certainly start out by asking the right questions: Is there a computability
29 property distinctly characteristic of the economy per se? Should we treat all knowledge as
30 algorithmic? What, if any, is the formal relationship between rationality and computation?
31 Is there some special role for mechanical induction in the economy? But more often than
32 not, Velupillai treats their answers as obvious to all right-thinking economists, even while
33 admitting that much of his approach will be rejected out of hand by orthodoxy. The incon-
34 gruity of this veil drawn over what one by all rights would expect would be an impassioned
35 expression of faith in the computational approach derives, I suspect, from a fundamental am-
36 bivalence which lies at the heart of the book: if indeed neoclassical theory is uncomputable
37 'all the way down' to the primitive concept of the preference ordering (a result dating back

38 to Kramer (1967) and Lewis (1985)), and back upwards through optimal choice, rational
 39 expectations, the calculation of equilibria, effective play of games (and so on), then what
 40 should be the role of the theory of computation in economic theory? Furthermore, what
 41 could be the most major transformation in the neoclassical program in the 20th century—
 42 namely, the shift away from dependence upon static allocation models and towards treating
 43 the economic agent as information processor—portend, if it were predicated upon a severe
 44 misunderstanding of the imperatives of real computers? Some (and von Neumann (1966)
 45 was among them) would respond: so much the worse for neoclassical theory; just start over
 46 with the computer as the theoretical template for economic organizations such as the market
 47 and the firm. Simon (1982) (someone often misleadingly treated as precursor by Velupillai)
 48 would also say ditch the neoclassical model, but replace it with computer simulations of
 49 various modular algorithms characteristic of specialized human problem solving or simu-
 50 lations of organizational structures which resemble program flow-charts; fundamentally, he
 51 would reject the quest for a general architecture of the mind.

52 Velupillai does not even entertain these options; rather, possibly with a view to main-
 53 tenance of peace with orthodoxy, he opts for an entirely different principle: “I think it is
 54 imperative that we model the agent in its full complexity, i.e. as a Turing machine. It is
 55 the collective (of agents) that is simplistic and may fail to have the capacity of universal
 56 computation” (p. 64). Although he nowhere states it directly, the argument seems to be that
 57 since the neoclassical orthodoxy persists in treating the agent in a sloppy and unrigorous
 58 way as a utility computer, why not go the whole 9 yards and render the agent a formal ab-
 59 stract computer? von Neumann’s transcendence of individualism and Simon’s promiscuous
 60 modularity of algorithms then go by the boards. The promissory note, never fully cashed
 61 out in the lectures, is that the neoclassical orthodoxy might then be able to do much, if not
 62 all, of everything it already does, now admirably bound by the discipline of true Turing
 63 computability (e.g. pp. 100, 114, 179), much like Ulysses and the Sirens.

64 I think the reader may be forgiven if she wonders whether many of the formal results
 65 cited in the book do not so much support this position as undermine it. For instance, the
 66 non-computability of preference orderings might be circumvented by rendering the com-
 67 modities and their power sets finite, but at the expense of losing many of the most vaunted
 68 results of postwar neoclassical theory, such as the existence proofs, the welfare theorems,
 69 and so on (Richter and Wong (1999)). If market pricing is rendered computationally effec-
 70 tive, then one rapidly discovers that the conviction that there is a unique generic Walrasian
 71 market process looks very odd indeed. If one opts for the Kolmogorov definition of random-
 72 ness, then one is brought up starkly against the consequence that the attendant probabilities
 73 may themselves be non-computable. So it is not at all clear just which parts of neoclassical
 74 economics, if anything, are left standing tall and proud after the computational critique. But
 75 there is a deeper problem with the lectures: Velupillai never justifies *why* we should make the
 76 basic commitment to the model of the agent as Turing machine. This is a subject of protracted
 77 and heated controversy amongst philosophers (Searle’s Chinese Room argument is an old
 78 chestnut in this literature); and economists have been notoriously fickle about commitment
 79 to any specific school of actual human psychology (the modern ‘behavioral’ movement
 80 included). Very few cognitive scientists have been willing to subscribe to the principle that
 81 the Turing machine is an adequate model of the brain, which renders Velupillai’s reference
 82 to neural networks all the more awkward.

83 Much of this goes to show that, when contemplating large-scale intellectual trends in
84 the sciences like the impact of the computer on economics (just as on physics, or biology,
85 or psychology), mathematics plays an important subsidiary role, but cannot explain *why*
86 certain positions are adopted and other, beyond all logical imperative, are left to languish.
87 Indeed, the pressure for a self-conscious computational economics will continue to be felt
88 with increasing urgency by economists, for reasons ranging from the continuing diffusion
89 of the computer into all corners of life to the dominance of computational themes in the
90 natural sciences, but the forms their reactions will assume in economics cannot be a simple
91 function of the mathematical theorems one finds being taught in departments of computer
92 science. The question remains: Is there a computability property *uniquely characteristic* of
93 the economy?

94 **Uncited reference**

95 Searle (1980).

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