A revolution or self indulgent hype? How top scientists view Wolfram

SO IS this a scientific revolution? We asked three leading British scientists for their first impression of *A New Kind of Science*. They are intrigued but sceptical that Wolfram's view of the universe is anything like as new as he thinks. Are they right or is this another example of a revolution being hard to discern in terms of conventional thinking?

Prof Sir Michael Berry, Bristol University

Stephen Wolfram has been an energetic explorer of this branch of (largely) experimental mathematics. His detailed, powerful and original account of cellular automata bristles with erudition as he engages some of the deepest ideas in logic and physical, biological and cognitive science to support his central claim that complexity and randomness in life, the universe and everything are the outcome of simple programs.

I remain unpersuaded. Real snowflakes rarely have the perfect hexagonal symmetry of these model automata; pigmentation patterns of leopards and zebras, and the shapes of leaves, seashells and snails can equally be simulated by old-fashioned continuous mathematics. Elaborate contrivances reproduce some aspects of Einstein's relativity theory, but not (yet) gravity and quantum mechanics.

He encourages us to rely on our eyes for immediate intuitions of complexity, arguing that formal definitions and measures of complexity may not easily capture this elusive quality. But to my eyes his automata are poor reflections of the abundance and variety of nature's forms.

He deliberately distances his ideas from others by labelling previous work "traditional science", not citing (or, in the main text, even naming) other scientists, and endlessly repeating "my discoveries". "I"s abound. He thinks modesty might inhibit clarity, but the logic escapes me. The irony is that Wolfram has indeed created "a new kind of science" – not through cellular automata but with his computer language Mathematica, which has enriched the working practices of thousands of scientists, including me.

Dr John Ellis, Theory Division, CERN

Stephen Wolfram cannot be accused of lacking audacity. More than three centuries ago, Galileo and Newton provided humankind with a new and powerful way of interpreting the universe, based quantitatively on mathematical equations.

In this provocative book, Wolfram seeks to convince us to change our world view again, and re-interpret the universe through computer programs and cellular automata. His rallying cry is the search for the emergence of complexity from simple underlying principles. How successful is this venture?

I am not competent to assess his insights into the dazzlingly broad range of subjects discussed by Wolfram in this book. As a theoretical physicist, I was most interested in the 10th chapter, where he addresses fundamental physics. Wolfram certainly has an original way of looking at the basic problems in this subject, but he does not provide new results sufficient to loosen my personal embrace of the Galilean and Newtonian mathematical approach. I remain to be convinced that Wolfram reproduces the successes of the traditional approach, such as relativity and quantum mechanics, let alone provides new insights into the puzzles of particle physics. In their absence, after a while I began to tire of all the computer outputs and petty numerology infesting the text.

This disappointment does not mean that I cannot recommend this book. The general reader will surely find much of it fascinating, and it may contain valuable insights into other sciences. It is also possible that my failure to appreciate its contributions to fundamental physics marks me as a scientific dinosaur – history will judge. Anybody interested in scientific originality is invited to join the jury by reading this book.

Prof David Deutsch, University of Oxford

This fascinating book, full of refreshing insights, diversions and speculations, merits careful reading. So far, I have merely skimmed it. But I have been asked for "first impressions", so here goes.

It reminds me of Douglas Hofstadter's masterpiece *Gödel, Esher Bach*, addressing similar issues. But where Hofstadter describes problems, Wolfram also claims to have far-reaching solutions – or at least, solutions-in-waiting. This gives the book an intriguing "plot", but I fear it is far too optimistic.

Wolfram seems to share a fundamental mistake with the majority of mathematicians and computer scientists, namely the belief that "simplicity" can be defined independently of the laws of physics. This tempts one to see computer programs "underlying" physical processes instead of *vice-versa*, and so to misconstrue the relationship between computation and physics.

I was disappointed that there is only the barest mention of quantum computation. If computation-based ideas really are going to play a fundamental role in physics, it will have to be through the quantum theory of computation – which is now "the" theory of computation – not the classical one that this book is based on.

Hence my first impression is that the book's central thesis is false: I do not think that the sciences (and beyond) will be revolutionised by reinterpreting nature in terms of simple computational rules rather than simple equations. It's an interesting perspective, and may become valuable. But I see no revolutionary change in scientific theory or methodology in prospect here – no whole new kind of science.