DOES THE META-NARRATIVE OF THINGS *REALLY* EXIST?

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BOOK REVIEW

A NEW KIND OF SCIENCE

Stephen Wolfram
Wolfram Media Inc., 2002
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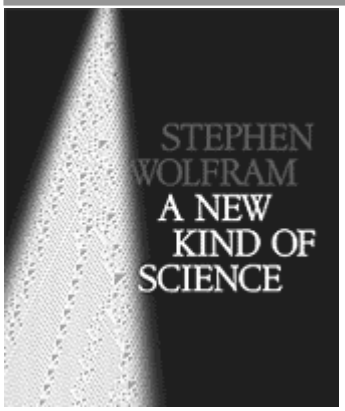
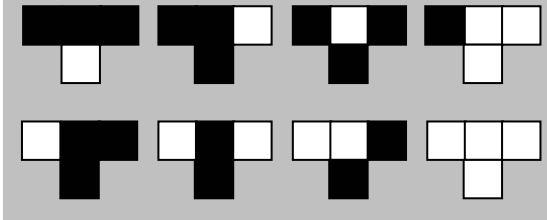


I must admit that the review of this giant book in this journal is a little bit of late. There have been plenty of comments about the thick book (about 1,280 pages), but certainly not because the thickness. Plenty of responses to the book because it was written by the Stephen Wolfram, probably the most excited scientist in the world campaigning for cellular automata all at once making fortune from it. One of Wolfram's great contributions to science is developing practical symbolic computer algebra and wide spreading for the first time, the software MATHEMATICA. The other thing for so many people talk about the book is because somehow, it brings some controversies in the society of advanced science in the world of complexity science.

However, the Journal Of Social Complexity will a little bit different on reviewing the book as the focus of the journal is the social phenomena theoretically and methodologically. An important note in the beginning of this article is that I will never be able describing the content of the book in some pages of paper, henceforth the reader is strongly recommended reading the book herself. Here we will only discuss some important point from the book that came to be the caveat of the development of complexity science especially when it is implanted to the social sciences.

CA is a very nice tool to use for analyzing many things, but I don't think that CA itself the new model for explaining the world. CA has been formulated since the original works of John Von Neumann, and there has been so many development and improvement of the CA since the vast technology of microcomputer recently. Furthermore, I don't think the label of "A New Kind of Science" is not very nice for the ideas representing by the book, as if the book is just the same level with historically the revolutionary works by Emmanuel Kant, Isaac Newton, Ferdinand de Saussure, or even Galileo.

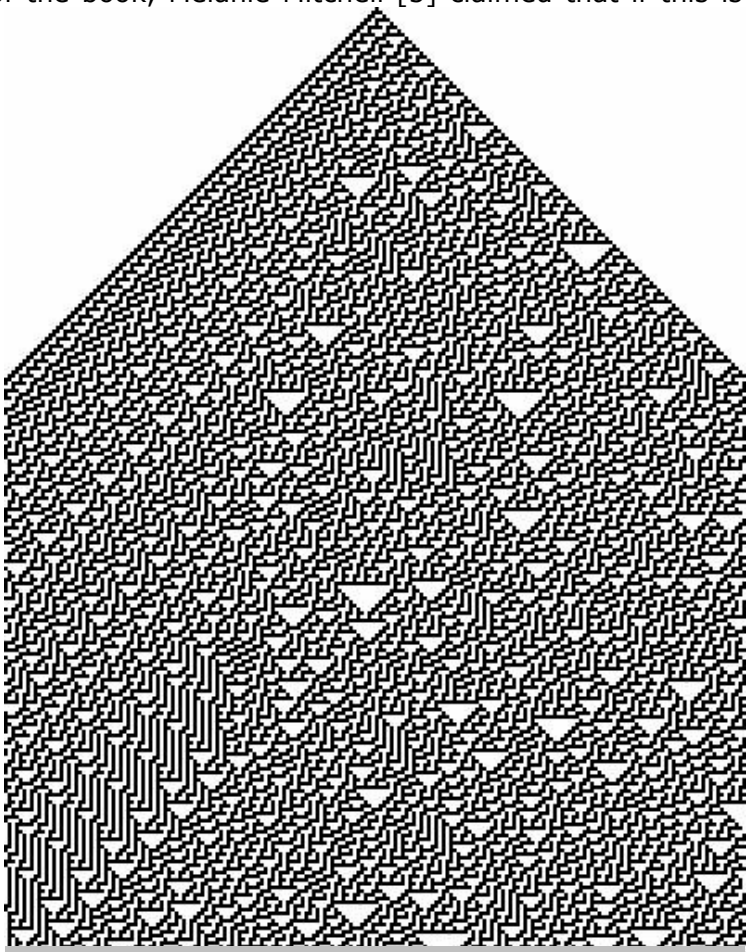


The interesting rule number 110, a rule that if we labeled the cells as p, q, and r, can be written as *Mod[(1+p)qr+q+r,2]*. Wolfram contended that the rule is a universal computer and in a sense capable of arbitrarily complex behavior.

The most interesting part of the book is that the book is full of beautiful pictures of the cellular automata. As we know, Cellular Automata (CA) is the spatially and discrete computational device that initially begins with extremely simple rules but creates interesting images which show some even more interesting behaviors. These one dimensional cellular automata images are a bunch of black and white pixels that are built from the top down, where each scan-line is based on the color of

the pixels on the scan-line above it. More specifically, the pixels immediately above it, above it and to the left, and above it and to the right. So each pixel's color is determined by three other pixels [4].

In the first chapters, Wolfram gives an idea on the construction of the elementary cellular automata consisting four cells as a rule – he stated the elementary rule will be 2^8 or 256 rule modes of them because it consists of 4 cells with 2 colors each cell. It should be noted that Wolfram studies 1-dimensional CA, a CA with 2 states and 2 neighborhoods per cell. The idea was that the simplest program could result such a complex patterns. He numbered the 256 modes, and interestingly noted that the mode number 110, a CA whose behavior becomes partitioned into a complex mixture of regular and irregular parts. Quoting Wolfram, "it is unique among the 256 rules considered here: of the four cases, in which such behavior is seen, all are equivalent if one just interchanges the roles of left and right or black and white". This is a interesting and impressive result, as he stated that the CA #110 is a kind of universal computer. Surprisingly, in the book Wolfram contend that this is become the logical consequences that the universality is ubiquitous throughout the nature – a statement that followed the claim that CA rule 110 is the universal computer. However, this is very naïve, as Wolfram admitted by himself that it sounds odd, but he is still stand aside the contention. In his review of the book, Melanie Mitchell [5] claimed that if this is the universal computer, then many other things in computational researches is also universal. For example the Conway's Game of Life (2D CA), that has become the model of the primary living cells in the improvement. Or probably become the inspirational aspects in the development of the Agent-Based Modeling in social researches. This is a very sharp criticism to Wolfram claiming his universal computer. Another example is the Lindemayer's invention on the structures of fractal seeming to be likely the way living plants grow.



Examples of the 1-D CA of rule #30 in Wolfram's book. The really suprising rules are those that create complex randomness. Ones that don't follow any discernable pattern, and display an extremely complex design

A universal computer is a computer that can compute anything that computable. This has been stated by Alan Turing some decades ago, and one of Turing's valuable merit is some problems that usual computer cannot compute. Probably you can see the difference of my above opinion with Wolfram said about the principle of computational universality, that almost any dynamical system that does not lead to random or transparently fixed

or oscillatory behavior is likely to be a universal computer. A rude statement and any theses shall prove it.

In the last chapter of the book, Wolfram stated that Gödel theorem has showed us some problems that cannot be solved with normal axioms of arithmetic, henceforth he stated the Principle of Computational Equivalence that he hoped and suspicious about the possibility to complete the "incompleteness" of Gödel. Perhaps, this can be the step further of Roger Penrose did [6], that in his book, *Shadows of the Mind* (1995) offer a challenge of a new kind of physics to solve problems about the consciousness and human thought – a book that responded badly also by the Artificial Intelligence scientists. But in the other case, Wolfram's book can also become against Penrose's, because somehow what Wolfram did is just to make any translation on some arithmetical symbols to the level where computers can compute. This is not "a new", as a matter of fact, because it is useless while Penrose invaded the arithmetical level of mathematics by the Gödelian theorem [1].

Another claims of Wolfram in the book inviting so many criticism is that when he saw the complex patterns of his CA, he claims that all of the pattern is as universal as how the nature behave on pigmentation. This invited biologist's criticism, as there is no further researches on it. It is a computational simulation of the nature and the simulations shall use some reductionism methodologically while Wolfram talk in epistemologically speaking [3].

Another criticism shall be posted is the usage of the "emergence" terminologies that is not clearly showed in the entirely book. The emergent phenomena are the most important characteristic in the complexity science that is originally discovered when we interact with the conditions in the "edge of chaos". Nonetheless, the CA is one kind of model that showed such phenomena. This factor has changed many of our perspectives on gazing the world and reality including in seeing the social phenomena.

In general, I think what Wolfram did do too many generalizations without further researches on how his mighty theoretical aspects will be seen in other spaces of sciences. I believe that Wolfram will find some useful resources in the works of Saussurian [7], [2], analysis of symbols to construct his claim of arithmetical symbols expressing the real world, especially when he jump into to the world of social analysis – one thing that even in general physicist never do, as far as I know. His claim on his suspicion on the general theory of everything with his researches in CA is seemingly too absurd. We are living in the world of symbols, and the world of symbols is bounded in the intertextuality, and what we can do is just to manipulate the signs as reality becomes the simulacrum of living. And this is a criticism to the spirit of universality of the Wolfram's jargon. The only possible thing is just the universal sign that perhaps satisfied us but certainly not the general explaining for all of things (meta-narratives). This is probably also a caveat to all of the physicists that think that mathematically we can explain everything in the positivistic aura.

However, the book is very valuable on giving any explanation on the possibility of using CA explaining our world. As we know Wolfram did many researches on how to explain very hard things such as the thermodynamics law in CA-style, a very superbly incredible thing to do. The book should be read but not only this book, I concur, as the book is look too egocentric without the bibliographical references acknowledge. However, in the web-site of the book (http://www.wolframscience.com) some noted for suggested reading is submitted.

Last but not least, it has to be acknowledged that the book will give a fresh air to the traditional scientists with traditional methods and paradigms - a book challenging the natural scientists and opening the eyes of the social scientists on the contemporary usage and articulation of signs. Again I strongly suggest you to read it and surf in the web-site prepared for it as you will find

many interesting and inspiring ideas on how we will shape the world of civilization.

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