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Editorial Introduction

Yun Hariadi
Dept. Dynamical System Modeling, Bandung Fe Institute
Jl Cemara 63 Bandung, Indonesia
yh@dynsys.bandungfe.net

Logic is idiosyncratically releated to rigor or strength, for mathematics, scientific methods, and then computation. But it contains a weakness too: the paradoxes, as in propositions that are true and false. Not that this is a matter of novelty if we just remember that people started to cast doubts on logic since the day a Cretan said that 'All Cretans are liars', thousands of years ago.

More than daily usage of the term - that is often synonymous to 'rationality' as much as on the opposite to 'emotionality', all scientific methods we today know are built upon it. Deduction follows. We can recall at least as far as to Euclid's *Element*, probably the first modern work on geometry. It was purely built on an axiomatic system that contains only definite axioms from which every truth value in it will follow.

A century ago, Euclid inspired David Hilbert of a machine able to present truth value of every proposition. Hilbert's Program on formal axiomatic system must end up in a full completeness and consistency. Hilbert's legacy brings a touchstone for another achievement on logic of the last century, that is, Bertrand Russell and Alfred Whitehead's *Principia Mathematica*, a work primarily on arithmetic with a hope that through this work, all mathematical statements will become provable deductively with only a tiny bundle of axioms on hand.

It was only twenty years later, Kurt Gödel published the monumental 'On Formally Undecidable Propositions of Principia Mathematica and Related Systems 1', another phenomenal work showing that every formal axiomatic system on Hilbert's mind cannot escape incompleteness or inconsistency. In the paper, what Gödel does is creating Gödel's numbers, natural numbers coded from existing symbols and propositions. Gödel then formally defines what undecidable proposition is, that is, proposition and its negation that are both true or false at the same time. Liar's paradox, 'This statement is false,' is a good example. In Gödel's hand, the sentence is modified to: 'This statement is unprovable', due to the fact that for logicians, truth value of a proposition is closely related but not necessarily complimentary to the proof of it, attained deductively from finite set of axioms.

He comes up with two theorems, one is about inconsistency, the other is incompleteness. Hilbert's dream becomes impossible, and it takes more than just hard work to solve Hilbert's 23 Problems (after his famous lecture in 1900). In other and much simpler words, logic is limited. And this is the motive behind the last three papers in the journal now you are holding. The forth article which I myself wrote tries to again, capture a particular way to modify liar's paradox in a fuzzy logic setting. With the help of computer simulation, some graphical results do have interesting features, and it is through this small preliminary work that I hope, another advancement on the family of modal logic will appear in the future.

The fifth and sixth articles give us other viewpoints when logic is really put to work, one is about social sytem, the other is cognitive, but both pay special attention to computation. As we shall see, the end of Hilbert's dream is also viewable through computation. In somehow different fashion, Alan Turing came up with similar result, that there is no algorithm able to decide whether any other algorithm will halt or not, definitely contrary to Hilbert's machine. With the help of Cantor's diagonalization,

this is famously known as 'halting problem'.

Hence, unlike old wisdom in classical logic, no guarantee that every truth has proof. Consequently, Greg Chaitin treated mathematics very much the same with physics, that there is experiment in mathematics too, as seen in Mandelbrot sets or Julia sets, or in various phenomena of chaos brought by nonlinear models. Even in a formal axomatic system with only finite axioms, the theorems are random and unpredictable.

This is the main idea behind the fifth article by Hokky Situngkir. As we shall see, there is an endeavor on applying the algorithmic information-theoretic computational complexity to meta-social-sciences. The paper uses the binary string as the model of social phenomena to gain understanding on some problems faced in the philosophy of social sciences or some traps in sociological theories. The paper ends up showing the great opportunity in recent social researches and some boundaries that limit them.

The sixth article by Rendra Suroso relates old idea of Computational Theory of Mind (CTM) in cognitive sciences to the phenomenon of emergence, such that through the same old formal axiomatic system, but arranged in many levels, unpredictability can become a methodological solution to undecidability, such that it will encourage us to see that understanding mind through computer is after all not impossible, contrary to some philosophical traits.

The first to third articles, although beyond the incomputability or undecidability issue, are also found to be valuable and interesting in their own ways.

The first paper by Akira Namatame presents the issue realizing efficient and equitable utilization of limited resources by collective decision of interacting heterogeneous agents. Through agent-based computation, it explores a new approach for designing desirable collective of interacting agents. There are two closely related issues concerning collective, the forward problem and the inverse problem, that are one way or another, similar to upward and downward causation also found in the sixth article, two keywords so popular in complexity sciences.

The second paper by Hokky Situngkir presents the formal definition of meme in the terms of equivalence between memetics and the theory of cultural evolution. Still through a computational model and simulation in advance, it is presented that the selfish meme is power-law distributed. The simulation result shows that the contagion of meme as well as cultural evolution is a complex adaptive system. Memetics is the system and a state of the art of importing genetics to social sciences.

The third paper by Edil Torres Rivera presents a research model and analysis of group process. Incorporation of theoretical concepts from chaos and mathematical theory to group process with time-series data collected from group variables gives us another way to look at group process, presented in terms of mathematical derivatives and functions, phase space portraits, bifurcations and attractors, close return and Poincaré maps, and power spectrum analysis and histograms.

Last two articles are two book reviews on econophysics. The first is merely about crash in financial markets and the second is an incorporating work of many levels in the field.

Lastly I need to pinpoint that, it is strange too to see that Gödel is almost unknown in academic society, except for logicians, philosophers, and perhaps computer scientists. For some reason, this is probably to do with the lack of logical rigorousness in social sciences as shown in the fifth article. For other reasons, probably the oddity of logic Gödel presents us in spite of it being for a long time a building block for scientific explanation that makes people not fond of it.

Gödel is irony. Sciences all of a sudden becomes less immune to paradox than ever before. Since Gödel, need we not only to redefine the concept of truth, but also the truthfulness of our scientific knowledge. That is exactly another point why we always have to keep our eyes open and just never to give up.

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