Algorithmic Economics

Li, Bin

University of North Carolina at Chapel Hill

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I. Introduction

Originally, “Algorithmic Economics” refers to the economic analysis of the design of a specific computer system by computer experts. Bin Li, an independent Chinese scholar, alleges that the ideas and principles in it can be expanded into, or re-interpreted as, the basic principles of a unified economics -- and a unified social science. The relevant books and papers of Bin Li have published in Chinese or English, see the "Webpages and References" section of this entry.

II. Basic Philosophical Thoughts

The design of a computer system has to be economically analyzed, which is ascribed to the limited computational power and limited resources that do not permit extravagance. This premise is contrary to the basic assumption of mainstream neoclassical economics that ignores the time and cost of calculation. It is further interpreted to mean that thinking activity must be treated as that similar to physical actions. Secondly, since the computer is run with the mode of "instruction + information", Bin Li proposes that instructions can be regarded as the innate universal thinking tools hinted by Kant's philosophy, conditioning and enabling economic analysis applicative to thinking activities like to those physical productions.

III. Algorithm Framework Theory

Thinking = computation = (Instruction + information) × speed × time

This is the Algorithmic Framework Theory (AFT), a theory of how the mind works. Verbally, it means that human think is to use the innate, finite, universal, and constant Instructions in the brain serially, alternately, selectively, and repetitively processing information from the outside world. The "Instruction" is defined as any computer instruction or any "Artificial Instruction" in the human brain that computers cannot yet imitate. An Artificial Instruction can be identified by analyzing human thinking processes or the natural languages (especially verbs that refer to thinking actions). This hypothesis is used to mitigate the doubts of readers on the viability of computationalism as an imitation of human thinking. Thereafter, a person is assumed in principle to think in the way like a computer, thus is called the “Algorithmic Person”.

IV. Extensions and Inferences

An Instruction can process no more than two data for an operation and produce no more than one result. This is called Meta-Computation, the smallest unit of thinking activities. Many Meta-Computations are arranged in a sequence as a "program" to carry out a task over time, where the method of selecting Instructions and information to compile the program is called "Algorithm". AFT is interpreted as the Roundabout Method of Production of thoughts as

knowledge stocks. The stocks of knowledge, as the screened and retained computing results, grow and improve historically.

The next inference is that the knowledge of actors involving in computing must be limited, hence it is impossible for actors to plan computations precisely, thus they must try or experiment from time to time, blindly. This factor is emphasized and incorporated into the reasoning process. And, the fact that decisions are often time-limited and urgent is alleged to force the actors to tradeoff between computing time and the resultant quality[1], even to prefer computing speed to the quality, which is called the "Forced Closure" of computations. Further, Forced Closure leads actors to adopt various subjective Algorithms ("Alternative Algorithms") other than the deductive method, such as Induction, Association, Assumption, Approximation, Analogy, Imitation, Randomization, Adventure, Evolution, Negotiation, Enforcement and so on. This is called the "Subjective Turn" of computations, or "Mental Distortion". Any existing knowledge is in principle regarded as resulted from Forced Closure, Subjective Turn, or Mental Distortions that make conclusions or decisions arbitrarily, regardless of other possibilities in the future or elsewhere. Thus, knowledge is seen as some frozen, imperfect patterns that are used to stratify computational operations as "some variables assigned by patterns + the rested variables on one's discretion".

Mental Distortions cause mistakes, then embed innovations. Innovations thus are divided into two types: the "Information-Driven" and the "Algorithm-Improved", which respectively refer to the innovations caused by introduction of new information and the innovations caused by improved Algorithms. The combinations composed of Instructions and information can increase in number rapidly over time, or along with extending the computing sequences, until it soon approaches infinity, which is what "Combinatorial Explosion" means. Combinatorial explosion is used to demonstrate the unlimited potential of knowledge development or innovation. This is considered the decisive way out of the neoclassical general equilibrium paradigm. The convergent processes toward equilibria and the divergent processes breaking equilibria are interwoven in this "Algorithmic World", resulting in contradiction, conflicts, plurality, and mixedness.

These inferences are collectively called the "Thinking - Knowledge - Conflict - Innovation Quaternity", the major derivative from AFT. The logic in the above reasoning is called, extendedly, the "Algorithmic Logic", a higher-order logic or meta-logic that economically analyzes, compares, selects, re-constructs, combines other logical operations, and arranges their sequences.

V. Applications: The Grand Synthesis of Economics & Social Sciences

From the above "Algorithmic" perspective, the mathematical deductive reasoning in mainstream neoclassical economics should be deconstructed, and the optimal calculations or computations should be combination of deductions and various Alternative Algorithms, or mixture of various different short chains of thinking activities. Various types of information or

[1] Cherniak, Christopher (1986). Minimal Rationality. Cambridge, MA: MIT Press.

data should also be mixed to use. Price and transaction are effective only locally, rather than ubiquitously or conclusively as the summary or “representation” of all other kinds of information or of all other kinds of behaviors. This is the Algorithmic way of deconstructing neoclassical economics.

Since knowledge itself is regarded as fixed patterns, the psychological objects such as emotions, instincts, impulses and desires can be further regarded as something similar to, instead of disparate from, knowledge. In turn, these "irrationalities" are interpreted as a specific type of knowledge, the "hard software": inherited biologically, it cannot be modified directly by the inheritors, but only be input data and used. Because newborns don't have enough time or ability to learn or generate the knowledge in the hard-software, the off-the-shelf knowledge can help enable them to survive roughly after birth. Such reasoning is used to explain that many phenomena emphasized by psychologists and behavioral economics are actually rational.

Institutions, as the knowledge on interpersonal relationship, are taken as a typical example to illustrate knowledge patterns. Institutions used to regulate behaviors remain rigidly fixed when behaving, rather than flexible or contingent on the behaviors. This rigidity reduces the variables that would have to be assigned otherwise in current decision-making, making it easier. This effect is used to further explain the imperfection of knowledge stocks. Knowledge including science, engineering, ideology, law, religion, mythology, ethics, culture, and common sense are all viewed from this angle.

This relatively chaotic, "Algorithmical" social state is seen as a prerequisite for organization. Generated within a certain scope and in some specific ways, an organization is interpreted as the measure to build more interpersonal consistencies among conflicts, to avoid the waste caused by the conflicts to a certain extent, and hence to obtain additional benefits. However, due to finite computational power of organizers, the establishment of interpersonal consistency is thought to require instant or realtime command among people on the spot of work, in addition to the rules established before work. The emergence of hierarchy and the "power" is thus explained.

The above logical processes that endogenize institutions and organizations are further extended to the endogenesis of governments and political activities. The stratified operational mode of current computations is used to explain the division of labor and the collaboration between legislative, judicial and administrative departments of a government, as well as the mixed existence of government and market. Markets are described as the way in which a large number of individuals or organizations interact: they collect and cite each other's computational results to undertake enormous amounts of tasks; and, they tentatively innovate and compete, but repetitions and failures occur as well. Continuous and endless growth and development are seen as the prominent features of an economic system. The behavioral results of actors from finite computational power both reinforce and hedge each other, thus explaining the birth of macroeconomic phenomena, and hence of the macroeconomic policies.

The embodiment or concretization of thought is related to money. The endogenesis, properties and laws of money are therefore explained.

The arguments about the limitations of transaction, price and money become a preparation for moving out of economics and into the social sciences (and the humanities). In the social sciences, various non-economic phenomena are analyzed and studied with various economic or non-economic methods. AFT and its inferences are used as their common basis.

Finally, the concept of "Higher-Order Consistency" is introduced, which emphasizes that the diversity, pluralism, or mixedness in the Algorithmic world are not absolute generally, but are defined in specific spatiotemporal environments by actors or observers with limited knowledge. Along with knowledge development, the consistent or conflictive relationships will change from time to time in the subjective or objective side, but will remain coexistent in this common environmental world. Higher-Order Consistency is conceived as a complementary concept to achieve the grand synthesis (or unification).

VI. Applications: The Methodology

AFT is considered so compatible with diversity that the following methodological stance is proposed: the real world can in principle be seen as the synthetic result of behaviors of ancient or contemporary Algorithmic people as the actors, hence should both as the object of research and as a collection of the pre-theoretical theories that the actors made before, where the researchers only marginally modify and develop the theories as common sense. Researchers should regard themselves as both Algorithmic persons and a special type of actors, who compete or cooperate with common people, or trade with them based on the division of labor.

AFT holds that the methods of researchers can be not completely different from those methods adopted already by actors, but only technically or stylistically different. Any approach alone should be not effective enough. A desirable theory usually has simple forms and wide applicability, thus highly economical in computations. However, the marginal returns of theoretical approach will eventually decline and hence give way to empirical approaches (the "Theory-Experience Shift").

AFT uses a variety of approaches to overturn the mainstream position of mathematical methods in economic theory, and advocates computer simulation as a new formal method to replace mathematics.

VII. Websites and References

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https://www.researchgate.net/profile/Bin-Li-121

Chinese site: http://blog.sina.com.cn/libinw

Weibo: “算法经济学者李斌”

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