

Bounded Rationality Based Algorithms of the Mind Construction

—Situated Cognition as Calculating Media

Qianzheng Zhao

Beijing Normal University, Beijing, China

Email: zhaopianzhen@163.com

How to cite this paper: Zhao, Q.Z. (2018) Bounded Rationality Based Algorithms of the Mind Construction. *Open Journal of Social Sciences*, 6, 275-281.
<https://doi.org/10.4236/jss.2018.64023>

Received: April 2, 2018

Accepted: April 27, 2018

Published: April 30, 2018

Copyright © 2018 by author and Scientific Research Publishing Inc. This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

The solvability of algorithms of the mind is a study that has been discussed through the whole development process of Cognitive Science Philosophy. When the dichotomy theory for the study of mind algorithms went into a dilemma, a new research approach appeared. This new approach is constructed on the basis of situated cognition and analyzed through the bounded rationality perspective, *i.e.* the mind algorithms formula is symbolized through formalized, logically demonstrated, and representative situated cognition. This method realizes a formulation of human mind algorithms which is the rational reflection of the organic and co-existence of the mind, body and the external world.

Keywords

Algorithms of the Mind, Bounded Rationality, Situated Cognition, Embodied Cognition, Emergence

1. Introduction

Studies on solvability of algorithms of mind are various in different schools, where many scholars had discussed and analyzed the topic from different perspective. Algorithms of the mind refers to the inner working mechanism of the brain and the mind in the process of cognition in the outside world. It is a part of the study of Cognitive Science Philosophy. This paper firstly analyzes the development direction of algorithms of the mind related theories, then analyzes and compares the representative theories about algorithms of the mind in history, and points out its problems. Furthermore, a new research route is proposed, which is different from the previous theories about algorithms of the mind un-

der the theories of computations, monism and dualism. This paper hopes to solve the difficulties of computational, monism and dualism in the theory of algorithms of the mind through the above research ideas and ideas, and to break the rigid research ideas of this research problem. Constructing the algorithms of the mind program is on the basis of situated cognition and the perspective of bounded rationality. So they provide more possibilities for the development of cognitive science and artificial intelligence. Based on the thorough understanding of the former studies, and the deep understanding of the subject, there is a bold proposition promoted: The algorithms of mind shall be conducted from the boundary rationality perspective and at the same time uses the situated cognition to logically demonstrated such algorithms within the finitary limits of the rational boundary. As it is known to all that the study and development of Philosophy has gone through three stages (turns)—Ontology to Epistemology, Epistemology to Practice, and Practice to linguistic. These changes in study approach are the evidence of problem-solving and philosophical thinking progress. The study trend concerning the algorithms of the mind, as it is been observed, is to follow the same rule.

Firstly, just as the study of general issues in Philosophy, scholars tend to establish a macro solution and definition for the algorithms of the mind, hoping that a logical, effective and self-evident formulaic sequences can be formulated. This approach intends to find a solution through Algorithmism—to establish a algorithms formula which is representational, logical and deductive. (“Representation is the way which information is presented in the brain.” [1]). This, however, scholars always encountered many obstacles as either philosophers or scientists realize that the finitary limits of human cognition poses limits on the logical display of the infinite issues of such algorithms. For this regard, scholars turn to try it in different way: since it can not be explained and solved comprehensively, it might be better to find the solution through human application and perception process of algorithms. This change on study direction is exactly identical to the similar change in Philosophy. At the earlier formulation stage of Philosophical Thinking, main focus was laid on studying the essence of the world. Philosophers studied the causes and rules of the objective world and at the same time examined the causes and connotation of humankind as part of the objective world or as an independent subject. The bottleneck they met in such study pushed forward the first turn in Philosophy—the Epistemology turn *i.e.* a study that focuses on reliability and internal causality of human cognition, and the refinement and classification of human perception and application of cognition. This same process is also recognizable in the solvability study of algorithms, *i.e.* from pursuit of macro solution to the seek of solvability through human application and perception on such algorithms.

Secondly, with further development of the study and philosophical thinking, there is an awareness that the study scope of the algorithms of the mind has to be further narrowed, so as to guide the study into right direction and to find the right point to make breakthrough. This process again resembles the second turn

in Philosophic thinking—from Epistemology to Practice. Calculationism used to think that “the mind is a computing machine” [2]. As the previous thoughts and studies on the running mode and perceptive mode of such algorithms were somewhat abstract and lack of representation, there is an awareness that only by establishing a specific algorithms of external practice that a rational analysis and solution of mind algorithms can be achieved. As algorithms of the mind of congenital property is beyond human recognition, the representation of such algorithms has to be established on the interaction of the mind and the external practice. Through such interaction, we are able to acquire the denotation of such algorithms, by which the connotation of the algorithms can be abstracted and acquired. Finally, the algorithms of the mind formula is able to be achieved through representation. Either the deduction of the algorithms of the mind, or the physiological properties of human body, or the natural object can only be acquired through the interaction of mind with the external practice, in a top-down, partial recognized and gradual acknowledgement manner.

Lastly, the study approach of algorithms of the mind may also go through a third turn, which resembles the third turn in Philosophy—the linguistic turn. Linguistic Philosophy indicates that the essence of the philosophy is language. Language, according to this theory, is a media which human thoughts are expressed and a reflection of the interaction with the external world. Therefore, Ontology, Epistemology and Practice issues are finally falls into seeking answers through language study—to examine meta issues through a deconstruction and reconstruction process. This turn marks the new direction for future development and breakthrough in modern Philosophy. Currently, the algorithms of the mind in Cognitive Science are facing the same problems in traditional philosophy—Either the philosophic thinking in Ontology or Epistemology has not yet provided an answer to those meta issues in Philosophy. To accurately and systematically symbolize the algorithms of the mind, it is inevitable that the study of the algorithms of the mind shall take the same linguistic turn in Philosophy. *i.e.* to break the limits of the Computationalism and Representationalism and turn to use the rationally bounded situated cognition as the material or object to embody the environmental language of the algorithms of the mind. By this approach, a dynamic representation mechanism is established to satisfy the evolution property of the algorithms of the mind.

2. The Dilemma of Dichotomy

Cognitivism at the beginning defined the algorithm of the mind as the symbolic algorithm of the brain and took the symbolic representation as the semantic explanation of mind events and mind computation. However, either the original or the well-developed cognitivism encountered a bottleneck in dualism. The connotation of the dualism is to distinguish between the consciousness of the mind and the symbol representation in the brain. In dichotomy theory, algorithm is borderless and exceeds the range of rational cognition. Eventually, it falls into a irrational solution. “The basic idea of computationalism is that mental state,

mental activity and psychological process are computational states, computational activities, and computational processes” [3]. Zenon W. Pylyshyn, [4] a scholar of Computationism applied the representation to connect symbolic algorithm of the brain to human body and mind. This approach itself is based on the premise of binary separation of mind consciousness and symbolic representation of brain. It has a fatal problem: it rejects the consciousness and the experience of consciousness, which isolate the subjective mental state from the human entity. The symbolic algorithm of brain, in this regard, is an isolated form and has no connection to the mind. This binary separation also faces many troubles. For one hand, human brain serves only as the mechanical carrier of symbolic algorithm and it has no function of acquiring the material of thinking. As human consciousness is excluded in such computation, the mechanical computation of brain is meaningless. On the other hand, factors such as human idea of experience, external dynamic situation and evolution of the cognition subject, due to its subjective property, are all lack of representation in mind computation, which can not be expressed by fixed formula or can be revealed any suitable calculation results. Human experience of consciousness and external situated cognition are two key factors which can not be ignored and bypassed during mind computation. Beside the radical separation of dichotomy, there also exists an theory of obscure dualism. M.R. Bennett and P. M. S. Hacker [5] held that psychological attributes are originated from certain brain area, which equals to thinking ability and cognitive ability. They believe that the psychological attributes, rather than being an independent or virtual existence, is the function of certain brain areas. This theory, however, can not provide the evidence of the respective correspondence between psychological attributes and particular brain area or cranial nerves. This obscure dualism is the isolation of mind consciousness in specific areas of the human brain. It is also essentially a binary distinction between the brain and the mind. Either the traditional Dichotomy and Obscure Dichotomy, the experience of consciousness is considered as an isolated factor—the former take it as an independent existence outside brain and the later holds that it is an isolation form within the brain. These binary separation, without question, denies the identity of human cognition and mind computation. it seems that they are intend to decompose the problems of mind computation, it is actually denies the identity of the two. The inter-connection of mind and brain, however, is already proved in neuroscience—there is no such existence of a world that cannot be perceived by mind and brain and vice versa.

In modern study, there appeared a front and revolutionary theory in Philosophy of Cognition—“4E+S”theory [6]. “4E” refers to four theories of cognition, namely the embodied cognition, embedded cognition, enacted cognition and extended cognition. “S” refers to the theory of situated cognition. Although “4E” and “S” are five different theories, the core idea of the them are in common—instead of merely discussing the relationship of brain and mind, the study is tend to base their analysis on specific examination of five aspects in “4E+s” model, which also marked the preliminary solution of dichotomy dilemma.

3. A Trial of Mind Algorithms Solution Based on Bounded Rationality Theory

Compared with the radical change of traditional Cognitive Science, Clark [7], in accordance with certain facts of embodiment and environmental embedding, separated the embodied cognition into two states: simple embodiment and radical embodiment. "The concept of simple embodiment at its earliest stage was appeared in visual study. For instance, Ballard in his animate vision study believed that the visual processing is a dynamic changing process, in which the responding reaction can only be conducted if the visual environment is stable enough". [8] Scholars pros to radical embodiment indicated that the representation concept in Cognitive Science is neither correct nor is specifically illustrated its denotation. "In order to avoid the difficulty of formalizing the objective world, cognitive scientists turned to formalize the information processing function of brain to seek the solvability of algorithms of the mind". [5] This, however, is still unable to solve many subjective issues, namely, the description of brain function, connection and identity of brain and thought, the original mechanic of brain which formulates the information process mode, the internal brain processing formula and its external reaction etc.

Considering the above analysis, it is conclusive that the solution of algorithms of the mind shall be based on situated cognition *i.e.* to use situated cognition to modify the asymmetry state between brain and mind, tackle representation issues between brain and mind and establish a logical and objective connection between the two. "Through symbolic situated cognition, the algorithms of the mind is able to function as the real time reflection of the interaction between the internal organism and the external environment driven by designated target". [9] The embodied cognition applied in the algorithms of the mind focuses on the interaction of the organism and its external environment, and aims to formulate a formula that reflect the interaction of the mind, brain and the external world. By doing this, a describable inter-theory frame is thus formulated. Cognition shall be embodied in a certain situation and pre-determined by that situation. All the reaction under the situation cast their instant effect to body and brain. And the formulaic reaction of body and brain (subjective and objective) as well as the responding calculation, in return, serve as the premise of cognition. The whole series of process formulate the factors and basis for algorithms of the mind. In addition, the cognition object and human mind is under constant revolution, which will result in formula change both internally and externally. Embodied programs of situated cognition will be re-organized and new situated cognition of the mind, body and the external world will then generate. New social and cultural situation will thus be gradually formulated, which in return cast influence on the situated cognition. This process further indicates the co-existence and co-relation between the cognition subject of human being and the external world. It also distinctly lines out the study direction of embodied cognition based algorithms of the mind. "Embodiment is the property by which

we are able to interact with the world and make the cognition meaningful. Beside being involved in situation, embodiment interaction is the way we create meaning, manipulate and change such meaning”. [10] As we break the limitations of computationism and seek a situated cognition based study approach, distinct factors in human situated cognition and mind algorithms formula, *i.e.* the emergencies occurred during the interaction of mind algorithms and its external environment also plays major role in algorithms of the mind, which need to be highly valued.

4. Conclusion

The external situated cognition serves as the material and logical basis for the construction of brain working formula. Without this basis, the establishment of algorithms of the mind is not complete if merely by examining the internal practice of the brain. Similarly, chemistry and biology are not complete enough to explain the function of the brain. Through the above argumentation, this paper solves the bottleneck problem in the development of algorithms of the mind theory, and puts forward a new research direction, which is to construct a comprehensive algorithms of the mind program with situated cognition as the starting point of bounded rationality. “It shall also be involved in the interaction of subjective intention and external cognition environment, the interaction of which manages the activation pattern of neurons in each cerebral hemisphere”. [11] The research idea on situated cognition, embodied cognition, and emergence of situated cognition and algorithms of the mind, in essence, are the revolutionary rectification of the traditional computational metaphor. Surely different study approaches, parallel and non-contradict or contradict approaches are co-existed. The existence of these approaches, however, will not influence the seek of new study direction for the solution of algorithms of the mind. The linguistic turn in modern Philosophy proved such inevitable progress in study approach. Linguistic Philosophy indicates that the essence of the philosophy is language. Language, according to this theory, is a media through which human thoughts are expressed and is also the reflection of the interaction with the external world. Therefore, Ontology, Epistemology and Practice issues are finally explored through language study—to examine meta issues through deconstruction and reconstruction process. This turn marks the new direction for future development and breakthrough in modern Philosophy, and also is the case in the study of the solution for the algorithms of the mind. The modern study of the solution for the algorithms of the mind shall be conducted within certain situation environment. Specifically, it shall use the describable and formalized situation to symbolize the organic formula of the algorithms of the mind. Through this representation, an organic formula reflecting human mind, body and the external world is able to be established. Hence there is no doubt that the construction of such algorithms and its process of description are based on the dynamic interaction of mind, body and the external world (active or passive, subjective or objective), the solutions based on boundary rationality for the algo-

rithms of mind shall be conducted on the basis of situated cognition. By this approach, the rules, demonstration and representation of the algorithms of the mind are able to be examined and realized. However, there are still some areas where the study needs to be discussed with more scholars. For example, the specific rules of construction needed to be explored, and the forms of communication between the situated cognition and the inner mind needed to be clarified, and so on. But it can be believed that this paper constructs a new algorithms of the mind program, which can provide more theoretical support for cognitive science, artificial intelligence and other fields.

References

- [1] Liao, Q.Y. and Xu, S.H. (2012) How the Mind Calculates Metaphor. *Journal of Foreign Languages*, **35**, 46-52.
- [2] Ian Ravenscroft (2005) *Philosophy of Mind*. Oxford University Press, 81.
- [3] Cheng, L. (2007) What Is Computationalism? *Science & Culture Review*, **4**, 5-16.
- [4] Zenon, W.P., Ren, X.M. and Wang, Z.L. (2007) *Computation and Cognition: Toward a Foundation for Cognitive Science*. China Renmin University Press, 26-30.
- [5] Kotchoubey, B., Bennett, M.R. and Hacker, P.M.S. (2005) Philosophical Foundations of Neuroscience. *Philosophical Investigations*, **28**, 193-196.
<https://doi.org/10.1111/j.1467-9205.2005.00251.x>
- [6] Li, J.H. and Yu, X.J. (2014) “4e+s”: A New Revolution in Cognitive Science? *Philosophical Researches*, No. 1, 96-101.
- [7] Clark, A. (1999) An Embodied Cognitive Science? *Trends in Cognitive Sciences*, **3**, 345. [https://doi.org/10.1016/S1364-6613\(99\)01361-3](https://doi.org/10.1016/S1364-6613(99)01361-3)
- [8] Ballard, D.H. (1991) Animate Vision. *Artificial Intelligence*, **48**, 57-86.
[https://doi.org/10.1016/0004-3702\(91\)90080-4](https://doi.org/10.1016/0004-3702(91)90080-4)
- [9] Liu, X.L. (2005) Interaction Metaphor and Embodied Philosophy—The Philosophical Foundation of Some New Approach to Cognitive Science. *Philosophical Researches*, 73-80.
- [10] Dourish, P. (2001) *Where the Action Is: The Foundations of Embodied Interaction*. MIT Press, Cambridge, 216.
- [11] Roger, W.S. and Zhang, M.W. (2004) Search for Beliefs by Consistent with Science. *Science & Culture Review*, **1**, 99-113.