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Extended Abstract

The Law of Information Conversion and Intelligence Creation

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Introduction

Due to the high importance of information theory to human kinds and the un-satisfaction toward the Shannon Theory of Information, there have been hot discussions during the past decades over the subject of what information and information science should be. Numerals of forum, workshop, and conference have been organized and thousands of paper, journal and book published whereas the feeling of un-satisfaction is not decreasing yet.

Having recognized the positive contributions from the discussions during the past, we have also noticed the following lessons associated with the discussions that need necessarily be overcome and improved, in the information studies to come.

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Lesson 1: Background Issue
Different researchers may have different backgrounds, and thus different viewpoints, for their studies of information science. So, when speaking of the same term 'information', they may mean different things. This leads to difficulties in mutual understanding among discussants.

Lesson 2: Issue of concepts confused
There are two categories of fundamental concepts in information studies. One is the ontological information and the other is epistemological information. When talking about information, some ones may refer to ontological one while others to epistemological one. This also makes difficult for achieving agreements.

Lesson 3: Methodological Issue
More importantly, the methodology feature with "divide and conquer" has been widely employed in information studies, making the research being diversified.

As is well known, some authoritative scholar had once made comments on information science studies, by saying that *information science is not yet qualified to be called 'a science' as it has not invented any laws concerning with the nature and/or society*.

Taking in mind the lessons, we have made continuous efforts for decades in information studies and have achieved a number of progresses among which the most significant one is the discovery of the "law of information conversion and intelligence creation" through the employment of the new methodology. In what follows we would share with the readers the new results.

Methods

What we want to strongly emphasize here is the fundamental issues, i.e., the view angle and the methodology that we employ in information studies.

(1) The view angle for information studies should be global and panoramic though the background of research may be in local area such as communication, computing, biology, physics, psychology, physiology, astronomy, or art, etc.

(2) Information can be generated not only by object but also by subject. The information processes covering the interaction between the subject and the object should receive the most attention.

(3) For the object-subject interaction, the information generated by object plays the function of stimulus whereas the subject's reactions are the ecological product of the stimulus.

(4) The methodology employed in information studies should hence take the view of information, the view of system, the view of ecology and the view of interaction between subject and object.

Taking into consideration the view angle and the methodology mentioned above, a general model for information studies is shown in Fig.1 below, in which the information generated by the object in environment is termed the ontological information.

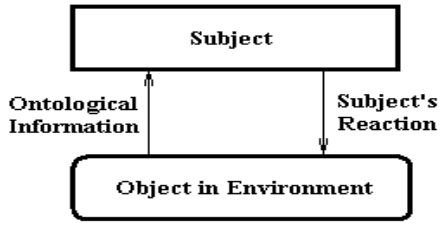

Fig.1 General Model for Information Studies

The general model for information studies expressed in Fig.1 can be applicable for all fields of information studies. In fact, the subject in the model in Fig.1 can be human beings, animals, plants, or any kinds of living beings like bacteria, as well as artificial intelligent systems, and so on.

For studying in depth the information processes shown in the general model, taking **human subject** as the **subject** in Fig.1 would be necessary and meaningful. This is because of the fact that humans are the most complex one among all kinds of subject and the human subject-object interaction is thus the most typical and representative. The general model in Fig.1 is therefore detailed into the model expressed in Fig.2.

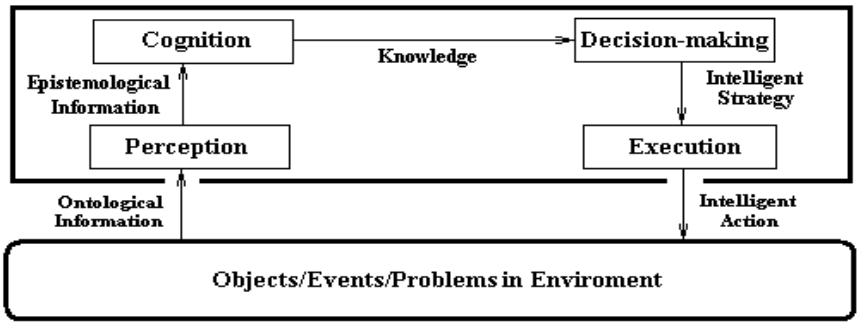

Fig.2 Typical Model for Information Studies

As is seen from the model in Fig.2, the upper part is the human subject. The ecological products of the ontological information in this case are including the epistemological information, knowledge and intelligence (intelligent strategy and intelligent action).

The function of interaction between human subject and the object in environment is performed through the following information processes as can be seen in Fig.2.

(1) Information generated from the object in environment is termed the **ontological information**.
(2) Via human perception, the ontological information is conversed to the **epistemological one**.
(3) The epistemological information is conversed to **knowledge** via human cognition.
(4) Based on the above results, the decision-making is able to produce the **intelligent strategy**.
(5) The intelligent strategy is conversed to the **intelligent action** and is reacted on the object.

The information processes expressed in Fig.2 is the most essential activity for humans. The process can be abstracted as the information-knowledge-intelligence conversion, reflecting **the law of Information Conversion and Intelligence Creation** where the information conversions play the role of means while the intelligence creation is the goal for conversions.

It is obvious that, to implement the "information conversion and intelligence creation" process, one needs the support, on one hand, from the theory of information, the theory of knowledge, and the theory of intelligence and on the other hand, the corresponding conversion algorithms.

Viewing the current literature one can find that, however, all the three categories of the theory, as well as the conversion algorithms, are far from sufficient for the needs of the law establishment up to now. Therefore, it is obligatory for researchers to re-create the theories and the algorithms. Fortunately, what we have completed during the past decades meet the needs.

Nevertheless, due to the limitation of the space, the new theories for information, knowledge, and intelligence, and the conversion algorithms can merely be reported here in brevity. Only the conclusive results can be introduced. For those, who have special interests in the theories, can find the details from the references [2,6,9,10].

Results and Discussion (M_Heading1)

The Theory of Information

Shannon theory has been essentially extended to epistemological information theory, also called comprehensive information theory, which is the trinity of syntactic, semantic, and pragmatic information.

The Theory of Knowledge

In addition to the general theory of knowledge, it is discovered that innate knowledge - empirical knowledge – regular knowledge – commonsense knowledge forms the internal ecological systems of knowledge whereas epistemological information – knowledge – intelligence forms the external ecological system of knowledge. The latter is termed information-knowledge-intelligence conversion, or more concisely information conversion.

The Theory of Artificial Intelligence

Due to the employment of "divide and conquer" methodology, artificial intelligence has been divided into three schools, structure simulated artificial neural networks, function simulated physical symbol systems, and behavior simulated sensor-motor systems. They are independent to each other.

By employing the new methodology stated above, the mechanism of intelligence growth is discovered as the information conversion. As consequence, the new approach to the simulation of intelligence, the mechanism simulated approach, or the information-knowledge-intelligence conversion, has been successfully established [9].

The Information Conversions

Having had the three categories of theory needed for the mainstays of the law, what we have to do the next is to find the conversion algorithms for linking the information theory, knowledge theory, and intelligence theory and for implementing the framework of the law.

As results, the three classes of conversions have been established, including the first class of information conversion that converses ontological information to epistemological information, the second class of information conversion that converses epistemological information to knowledge, and the third class of information conversion that converses epistemological information, knowledge and the goal to intelligence.

Conclusions

Referring back to the typical model for information studies shown in Fig.2, one can see that the three categories of theory, i.e., the comprehensive information theory, the knowledge ecology, and the unified intelligence theory on one hand and, on the other hand, the three classes of information conversion, i.e., the conversion of ontological information to comprehensive information, the conversion of comprehensive information to knowledge, and the conversion of knowledge to intelligence, have all been settled down in principle. Therefore, the establishment of the law of information conversion and intelligence creation has now been completed.

The law of information conversion and intelligence creation clearly reveals the secret of how the intelligent strategy, thus the intelligent action, can successfully be created in humans when the subject faces the stimulus from an object in the outside word. This result is really meaningful for the understanding of the human intelligence. Main text paragraph (M_Text).

It is worth of pointing out that the law of information conversion and intelligence creation not only reveals the secret of human intelligence but, more importantly, also gives the inspiration on how the intelligent strategy, thus the intelligent action, can successfully be created in machine. This is also meaningful for understanding the information science and artificial intelligence.

Furthermore, the law of information conversion and intelligence creation can provide instructions to the studies for other kinds of subjects, even like bacteria. In these cases, the epistemological information and the knowledge as well as intelligence can be simplified to certain extent while the principles are still valid.

Comparing with the law of energy conversion and conservation in physics, the law of information conversion and intelligence creation will play a role much more significant. This is because of the fact that any effective energy processes, and mass processes, all need be instructed and controlled by using intelligent strategy that can only be resulted from information conversion.

The law of information conversion and intelligence creation has great significance not only for science and technology but, more importantly, also for economy and human society because there would be much too many activities that need intelligent strategy and intelligent action to deal with the problem solving in economic progress and social development.

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