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Systematic Thinking of Human Intelligence †

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Abstract: This paper expounds the great significance of human intelligence research from the height of the wisdom age. We should understand what it is to be a human being and what are the mechanisms of this intelligence. The author advocates that systematic science should be involved in such research. Methodology, especially oriental holistic thinking, is important. We put out the idea of "Education Engineer", first try to do theoretical research, focus a concept System Quotient, then to build a model. To establish such a system, we undertake several decades of exploration according to the thought of Xuesen Qian's "Dacheng Wisdom" and the fruits of information science and intelligence science. The concepts of "Human intelligence system" and "System Quotient "(SQ) are proposed, developed completely and applied in the classroom. A "teaching information feedback system" has been created. It contains a "classroom informatization" and a "Playing with Science" system.

Keywords: system science; models of human intelligent systems; "Dacheng Wisdom"; intellectual engineering; SQ (System Quotient)

1. The Call of Times for Human Intelligence Research

We are living in an era of unprecedented great changes. Real research topics should answer the questions and express the spirit of The Times. This is the true proposition and true knowledge. The study of human intelligence is a true proposition with a great significance for the times.

Human intelligence is broad, profound, vast and incomparable. Over its long history countless pioneers have carried out hard exploration, but in information, knowledge, thinking, inspiration, intelligence, ability, wisdom, innovation—such a series of issues—there is still lots of ambiguity, and even confusion, which has left a huge space for us to explore. Methodological thinking is necessary first. We should absorb nutrition from scientific progress, seek enlightenment and direction, this is contemporary system science.

The surging tide of wisdom has gone out of control and opened a new era of wisdom revolution. This is a time of uncertainty, opportunity and challenge, of hope and disappointment. We strongly feel the call of the "intelligent human" and intelligent science in a new "intelligent age" [1].

2. Methodological Thinking of Human Intelligence Research

What is most lacking in the storehouse of human knowledge is knowledge of man himself. That it is to know thyself that is the eternal philosophical proposition.

Intelligence research should be, first of all, a methodological revolution. Because the development of modern science has entered a new era of multiplicity, temporality, and complexity, and our view of nature is undergoing a fundamental change.

The key is to introduce methodological thinking so that we can look beyond, so that we can see what we cannot see but must see. Methodological research is crucial for any science. Pavlov said, "Science advances continuously with methodological achievements. Every step forward in methodological research, we seem to step up a ladder, and then we

expand a broader horizon and see things we have never seen before". Pavlov added: "The effectiveness of our research depends on the perfection of the method. It is the method that controls the fate of the research".

With the profound "eyes" that linear science cannot possess, contemporary systems science explores the fields that previous science cannot touch and reveals a broader and more real phenomenon world. Systems science has a strong methodological color, one which not only forms unique research methods and means that are different from traditional science but should be a powerful weapon to explore complex systems.

The origin of Chinese culture and science is an ancient wisdom crystallization to study wholeness, evolution and complexity. Ancient Chinese science contains wisdom and abundant resources that are seldom known today. Chinese culture provides a source of wisdom for us to have a deeper understanding of systems science [2].

Prigozin has stressed many times: "We believe that we are moving towards a new synthesis, towards a new naturalism, and that maybe we can finally combine the western tradition (with its emphasis on experimentation and quantitative representation) with the Chinese tradition (with its spontaneous, self-organizing worldview)". To grasp the structure and mechanism of human intelligence and the law of talent growth involves the exploration of a complex science and the development of a subject science.

Human intelligence is not isolated from the outside world. We must place the study of human intelligence in the giant system of nature and society, organically and comprehensively integrate human and environment. Pay attention to the macro grasp, to see the overall picture of human intelligence.

3. Human Intelligence System Model

"Wisdom" is mainly seen in the understanding of the world, "energy" is mainly seen in the transformation of the world, the unity of "wisdom" and "energy" is a complete process, only "wisdom" cannot see "energy"; Or to define "intelligence" as "energy", the definition of "energy" as "intelligence" is one-sided and defective. Without the drive of a dynamical system, without coordination of mouth and hand, without the support of emotion and will, without social interaction and social practice, can human intelligence be created? The evolution of the brain nervous system, the evolution of natural intelligence caught in the chicken-egg or egg-chicken paradox. Did the evolution of the brain nervous system lead to the evolution of natural intelligence or the human–environment interaction lead to the evolution of the brain nervous system and intelligence? I think the environment should be introduced into the study of human intelligence, that we should integrate "intelligence" and "energy" into the human intelligence system in order to grasp the overall picture and essential characteristics of human intelligence as a whole.

There are also complex relationships between subsystems. These subsystems include: input system, processing system, storage system, and output system. The most important thing is the dynamic system and control system. As shown in the Figure 1.

The input system is the gateway to human intelligence. Without the absorption of external information, human intelligence becomes a tree without roots and water without source. Prigaozin pointed out: to progress and develop, any organic system must exchange material, information and energy with the outside world, to keep the system open.

The processing system is the core of human intelligence. The subject of mind science is the information that a person obtains from the outside world through eyes, ears, nose, tongue and body and then enters brain for processing. There is nothing but the unity of opposites. The existence of opposites is the essence of the universe. There are two distinct types of certainty and uncertainty in the universe. In the process of interacting with nature and society, the human brain has formed two hemispheres of left and right during hundreds of millions of years evolution. The left hemispheres process certain information to form the logical thinking function, while the right hemispheres process uncertain information to form the non-logical thinking of the right one. The duality of imprecise processing and precise processing is formed in human processing system, logical processing and non-

logical processing are completely different. Human thinking is the result of the integration of imprecise and precise processing. Logic is synonymous with "quantitative intelligence", and non-logic is synonymous with "qualitative intelligence". These are still not the whole of the intelligent system. Thinking cannot be equivalent to intelligence.
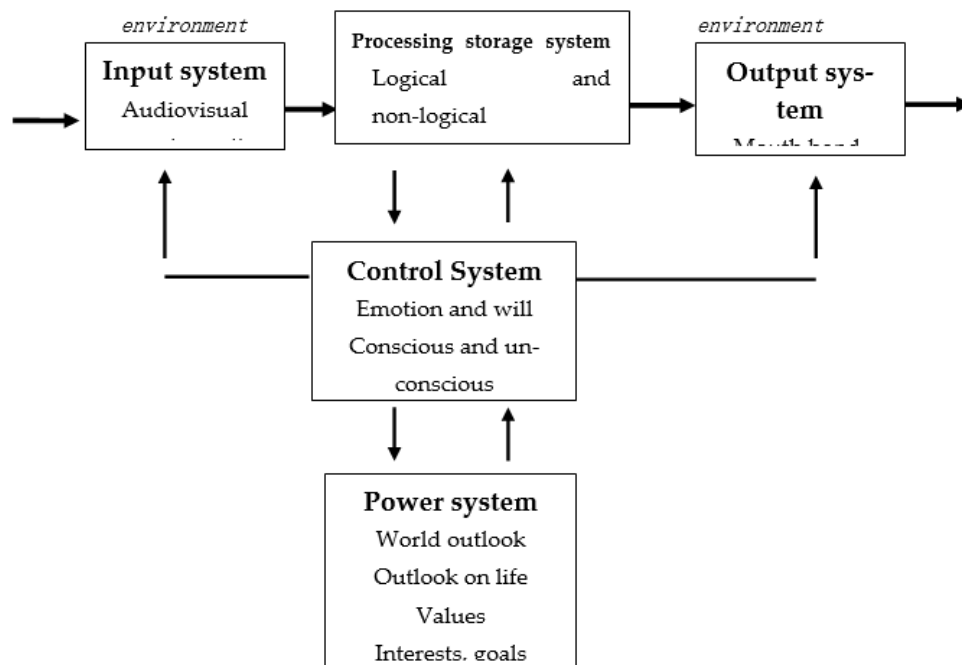

Figure 1. Human intelligence system model.

The output system is the home of human intelligence. Human intelligence develops according to how man has changed the natural world. The hand and mouth are both organs of human intelligence and are heavily represented in the cerebral cortex. The appearance of the hand is one of the main signs that distinguishes man from the ape. He is playing a huge role in the process of understanding and transforming the world. It is the hand that teaches the brain. It is practice brings the human understanding of the truth of the objective world.

Control systems are the backbone of human intelligence. Because any creation is inseparable from a great emotional impulse, no success can be achieved without strong will. The emergence of the concept of "emotional intelligence" (EQ) is evidence of this fact. Emotion or lack of emotion can lead to thinking dysfunction. Albert Einstein once said, "emotion and desire are the driving force behind all human effort and creation".

Dynamic system is the source of human intelligence and the key to distinguish animals and machines. The great significance of world outlook, outlook on life and values, should be put forward in the dynamic system. In the face of the vast information world, people's intelligent activities are firstly screened, positioned and guided by their world outlook, outlook on life and values, then driven by dynamic system to the whole intelligent system.

The above is just a reflection triggered by the static description of the intelligent system. Human intelligence is a dynamic development process of self-organization and gradual construction from chaos to order in the interaction between environment and human subsystems in a large open system. The self-organization of human intelligence system and the growth and development of talents are full of uncertainties. The mechanism of the self-organization of talents is extremely complex. What is the order parameter that constitutes a human intelligence system, the demon of wisdom, what is the invisible hand [3]?

We propose the concept of "System Quotient" (SQ), which integrates "EQ" and "IQ" into "SQ". "IQ" and "EQ" can only be a part of human intelligence system. "System business"-"SQ" covers the whole of the human intelligence system, including the whole of the input, processing, output, control and power systems, so as to avoid many disadvan-

tages. The concept of human intelligence system and system business SQ is the inevitable result of the synthesis and innovation of human intelligence research. China is a great nation with 5000 years of fine civilization. Holistic thinking is a strength and good of Oriental thinking. From IQ–EQ–SQ, this is the inevitable development of the process to understand human intelligence, the inevitable development of science, and the inevitable choice of oriental nations also.

4. On Human Intelligence

"Wisdom", namely "great wisdom", comes from insight into the most general objective, the most general rules, and insight is to know these rules and use these rules to transform the objective world. Xueshen Qian believed wisdom is synonymous with creative thinking which can "perceive" and "apply", covering the whole process of the human intelligence system. It is the overall operation of the long chain of input, processing and output under the control of emotion and will, guided by value, driven by goals, and under the control of emotion and will, and it is the best state in which all subsystems work together so as to achieve the realm of "enlightenment". It is the ultimate realm of intelligence which suddenly reveals itself and penetrates everything. Wisdom is the emergence and mutation of intelligent system, and the transition, promotion, leap and mutation from low level to high level produced when all subsystems of intelligence work together in the best state. Emergence is the non-additive attribute of the system. Emergence refers to those attributes, features, behaviors and functions that exist at a high level but no longer exist at a low level. It is the peak state of higher-order intelligence. The difference between the whole and the parts such as "the whole is greater than the sum of its parts" and "the whole is less than the sum of its parts" is emergence. It is "out of thin air", "unique" original work, so called "innovation", "wisdom" is the top of intelligence [4].

5. Exploration of Intellectual Engineering

"Intelligence project" originates from the reflection of education reform caused by many contradictions and troubles in education practice and learning. Qian Xuesen pointed out: "The most difficult and core problem in education science is the basic theory of education science. How do people acquire knowledge and the ability to apply knowledge? If we solve this core problem, all other disciplines of education science and other branches of education science will have a foundation and a basis. Without this theoretical foundation, it is hard to say whether any other disciplines will be accurate." Education is facing a revolution of values and methodology [5].

In our decades teaching practice, we experienced a common phenomenon thousands of times: after each test, teachers suddenly realized that what they had taught students so many times that they should have mastered it, in fact many students did not understand, almost became the "mystery of the classroom". How to solve this "mystery"? The object of education is human beings and a group of human beings. To train human being effectively, we must study human being. The fundamental way out lies in exploring the law of thinking, opening the forbidden area of the brain, exploring the structure and mechanism of human intelligence, learning and talent growth.

5.1. Proposed the Idea of Intelligence Engineering

Education should become a complex interdisciplinary science, comprehensive science and even frontier science. The "systematic science" and "Dacheng wisdom" advocated by Xueshen Qian are highest level of great wisdom of the Chinese culture. In 1983 we proposed the concept of "intelligence engineering", looking at education from the perspective of engineering. We took these methods and technologies of natural science into the field of education, so as to establish a cross science and comprehensive science.

5.2. Technical Development—The Development of Teaching Feedback Predictive Test Analysis System

Based on the theorem science of 1985, with the help of modern high technology and the support of schools, we started to build a "teaching information real-time processing system". The main object of the students in the learning process are exposure of habitual thinking to research the rules of mistakes, to guide teaching reform, to explore the use of modern educational technology to improve teaching efficiency and reduce students' burden. In 1999, cooperation with related units developed into a "teaching feedback evaluation system", the original "system" has a new breakthrough as "domestic leading". The "system" consists of hardware and software. In 1995, Teaching Feedback and Test Analysis was published by the Electronics Industry Press.

5.3. Application Research

The proposal of intelligence engineering provides a new idea for the research of intelligence science. Starting from the application research and taking the school as the base and the students as the main object, from the macro experimental research of the input and output of teaching information, the development law of human intelligence is summarized and undertakes intelligent science studies. Bohr's atomic micro shell structure model is proposed. Similarly, we can also explore the operating mechanism of brain, study the microscopic structure of thinking and analyze a macroscopic "cognition map" [6].

5.3.1. Study

The higher level of pursuit is to use the computer to deal with a lot of information quickly, take schools as the base, take students as the main object. From the students in the teaching processes of a large number of thinking phenomena, and in particular the habitual mistakes in the study of their mode of thinking, we can guide teaching reform. At the same time, this is also a different thinking on the research of human intelligence: the fundamental problem of the current predicament of artificial intelligence is that artificial intelligence lacks the support of intelligence theory, especially the support of a human intelligence mechanism.

5.3.2. The Theorem and Practice on Education for Children

Education for children must be supported by scientific experiments. It is natural to develop a series of scientific games. After more than 100 section-one classroom teaching practices and many hands-on training seminars, at the end of 2009 we started to write transparent, hands-on and fun science and explored the science "teaching cases". The content of teaching-resource development and science sought to allow children to play together in the writing of the manuscript. "Play science", in the form that children love to see, with bottles and cans to do experiments, lets children approach science. "Playing science" does not indoctrinate, does not preach.

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