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Research article

Description, Understanding, and Explanation: How Scientific Interpretation Gave Birth to Modern Molecular Biology

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Abstract

This paper illustrates the role and position of hermeneutics methods in science and technology through the analysis of a scientific case, namely the generation of modern molecular biology, and the difference, connection, and mutual transformation of “description-text,” “understanding-text,” and “explanation-text” in the process of scientific research. The results show that the interpretation and transformation of scientific text often needs a certain cultural fulcrum and that it works by means of analogy. This is complemented through natural language. The complexity and richness of language transformations allow for scientific discovery and technological innovation to break through the limitations of objective conditions. A theory of complex thinking systems illustrates these results relatively well. Through the analysis of hierarchical levels of thought, two ways are revealed for transforming things and reducing them understandability. Mediated by natural language, these two ways involve the transformation and recovery, firstly, of abstract concepts in different layers, and secondly, of intuitive images in different layers. The results all provide support for the ontological and methodological foundation of scientific interpretation methods. Science and technology are facing more and more complex objects, and mathematical induction and deduction may become more and more difficult. Therefore, scientific interpretation may become an essential way to expand new fields of science and technological innovation.

Keywords: Hermeneutics; Genetic information interpretation; Text transformation; Thinking system; Understanding

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Научная статья

Описание, понимание и объяснение: Как научная интерпретация породила современную молекулярную биологию

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Аннотация

Данная статья иллюстрирует роль и положение методов герменевтики в науке и технике через анализ научного случая, а именно зарождения современной молекулярной биологии, а также различия, связи и взаимной трансформации “текста- описания”, “текста-понимания”, и “текста-объяснения” в процессе научного исследования. Результаты показывают, что интерпретация и трансформация научного текста часто нуждаются в определенной культурной опоре, что работает посредством аналогии. Это дополняется естественным языком. Сложность и богатство языковых трансформаций позволяют научным открытиям и технологическим инновациям преодолевать ограничения объективных условий. Теория сложных систем мышления относительно хорошо иллюстрирует эти результаты. Через анализ иерархических уровней мышления выявляются два пути преобразования вещей и уменьшения их понятности. Опосредованные естественным языком, эти два пути предполагают трансформацию и восстановление, во-первых, абстрактных понятий в разных слоях, во-вторых, интуитивных образов в разных слоях. Все результаты обеспечивают поддержку онтологической и методологической основы методов научной интерпретации. Наука и техника сталкиваются со все более сложными объектами, а математическая индукция и дедукция могут становиться все более и более трудными. Таким образом, научная интерпретация может стать важным способом расширения новых областей науки и технологических инноваций.

Ключевые слова: Герменевтика; Интерпретация генетической информации; Преобразование текста; Система мышления; Понимание

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INTRODUCTION

Hans Georg Gadamer once interpreted hermeneutics as an activity generally mediated by “natural language.” Interpretation is a method through which we can analyze and solve problems from a rational standpoint, clearly explain the meaning of all aspects of things, and obtain the meaning of truth.

Since the hermeneutic approach was transplanted from theology and the humanities to the field of scientific and technological activities, scientific interpretation has gained increasing attention. However, there is still a lack of specific examination and discussion about the application and function of the interpretation method in the process of scientific cognition, especially the analysis and textual research based on specific scientific cases. The discussion of the scientific interpretation method remains to fully appreciate its importance.

Hermeneutic approaches are very important for scientific research and technological innovation – there is no doubt about this, as evidenced in the works of Patrick Heelan, Joseph Kockelmans and others (Crease, 1997). But I argue that the analysis of specific applications is more important. In my opinion, without the basis of specific case analysis, a new method is difficult to be popularized, and effectively applied. The value of the method can only be found through specific case analysis.

For this purpose, I choose modern molecular biology as the object of analysis which I think is a typical case of applying and reflecting the value of the interpretation method. The methodology followed in this case is unconventional, revealing the existence of genetic information through an analogy in the medium of natural language. The discovery process is the creation and interpretation of a series of texts, that is, the transformation and recovery of natural language, including abstract concepts and intuitive images. By deciphering description-texts, understanding-texts and explanation-texts, hermeneutics gave birth to modern molecular biology.

The text transformation first involves the understanding of the text. Therefore, at the end of this paper, a discussion of “understanding” is highlighted. Why can people understand? Einstein argued that this is the hardest thing to comprehend in the world (Vallentin, 1954, p. 24). I found that if the mechanism of “understanding” is placed within the framework of modern hierarchy theory or the hypothesis of complex systems, there will be a more reasonable explanation: The coordination between the hierarchical discontinuities (emergent or emerging) in the thinking system is realized through transformation and recovery within the conscious layers mediated by natural language. “Understanding” is based on the instinctual ability to transform language, and language naturally has the characteristics of human culture, and this explains why the application of hermeneutic methods revolves around a certain cultural element.



ONTOLOGY AND EPISTEMOLOGY OF THE INTERPRETATION OF TEXT

Scientific research is also a hermeneutic process, and scientific discovery and technological innovation are realized in the process of continuous interpretation of text. Scientific knowledge activities can be mainly divided into three steps: description, understanding, and explanation, there are accordingly the “description-text”, the “understanding-text,” and the “explanation-text”. In a certain sense, scientific research is the interpretation of these three texts. Before formally entering the specific case analysis, it is necessary to first clarify the ontological and methodological basis of the interpretation of text.

(1) Description-texts

The empirical statements of the experimental process and results about objective object (usually using empirical vocabulary) form the original text of scientific interpretation, namely the “first text”. The original text is a text formed by a simple description, and so it is defined as a “description-text.” Although there are many different statements for the same object, the same process, and even the same result because of the different backgrounds of the researchers, after many observations and experiments by many people, these empirical statements eventually tend to become consistent and become recognized as empirical facts. Therefore, the description text can also be called the empirical fact text (simply the “empirical text”).

To admit that the text can transmit the experience of empirical facts is to admit that the text has a certain capacity to represent reality: The description-text composed of empirical language represents existence. It is in this context that Gianni Vattimo wrote that: “the question concerning a rationally grounded understanding of texts has progressively tended towards the thinking of a general ontology” (Vattimo, 2015, p. 721). The interpretation of empirical texts will eventually involve ontologies and epistemology, because experience about existence is always based on epistemological foundations.

(2) Understanding-texts

The interpretation of a description-text is “understanding,” and the text produced through understanding is an understanding-text. If the description-text represents the facts, the understanding of the description-text is also the understanding of the objective object. There is an essential difference between understanding and simple descriptive empirical statements, and understanding is a deep rational activity. As will shown below, the rational state of so-called reason is a state in which all layers of the human thinking system are coordinated. Understanding-text is a new text produced through language transformation in the state of reason, representing “theoretical facts,” so it is also called “theoretical fact text” (“theoretical text” for short) which is the “second text” of scientific interpretation.



The physiological mechanism of understanding is far beyond the level of modern science, and the hardest thing in the world to understand is human understanding itself. Up to now the most advanced AI has not reached this level of understanding, or even the ability to understand in general. The reason, I speculate, is that understanding is not a step-by-step programming or statistical probability analysis. In terms of the external form of understanding, namely language transformation, AI can imitate only one part, or even a small part of it. Even the analysis of “artificial text,” that is, the text generated by AI technology, needs to rely in the end on hermeneutics methods, that is, on the transformation and recovery mediated by natural language.

The text generated by understanding is usually composed of theoretical words (the division of empirical words and theoretical words, although not very strict, is meaningful) and more strict grammatical rules. Although understanding is a very personal matter, each researcher has a different background and forms different understanding texts. By verbal communication and mutual interpretation the researchers will produce relatively consistent theoretical statements and form consistent theoretical texts, such as textbooks. Natural language is a talent of human beings which is rooted in human social culture. Therefore, in the interpretation process of transformation and recovery mediated by natural language, it shows its powerful ontological and epistemological functions.

(3) Explanation-texts

A so-called “explanation” is the interpretation of the understanding text and the text generated through explanation is the “explanation-text” which is the third text of scientific interpretation. Since understanding is the understanding of empirical text, then explanation is the explanation of the empirical text. Due to the complexity and richness of the transformation and recovery mediated by natural language, through the interpretation of a theoretical factual text, we can obtain many explanatory texts and produce a new series of observable statements, which are not included in the already known facts, except from the original empirical facts. So, the explanation-text is likely to point to new facts that are yet to be recognized as objective or instead as illusions or artefacts of the language games. However, scientific discovery and technological innovation happen precisely because the same empirical or theoretical text can produce many explanatory texts, a new explanatory text may lead to a new scientific discovery or new technology.

(4) Brief sum-up

The analysis of text transformation and recovery mediated by natural language runs through the process of description, understanding and explanation of scientific research. As a scientific and technological research method, scientific interpretation has long been overlooked, but its functions and affordances are becoming increasingly recognised for their importance. As Joseph Kockelmans, a founder of scientific hermeneutics, pointed out, when people look back at the history of science and technology they find, that natural



science is born with hermeneutics, and evolved alongside hermeneutics in every aspect (Crease, 1997, p. 264). Scientific interpretation combines scientific practice with language analysis, and with the help of the cultural characteristics of natural language itself it grants to the subjective active role in scientific and technological research the basis of philosophical ontology and epistemology.

Based on the above cognizance, a typical case in biological science will be examined below to further demonstrate the interrelationship of description, understanding, and explanation, and the role of textual analysis.

THE TRANSMISSION MODE OF HUMAN CULTURE GIVING RISE TO MODERN MOLECULAR BIOLOGY

In natural science research the concept of information first started in biology, or rather, in molecular biological genetics. Before the birth of molecular biology, biological science – as opposed to the natural history of biology – set the relationship between the biological parts according to the traditional idea of physics and chemistry based on the notion of reduction. In addition to the physical and chemical concepts of interaction, some biologists have imagined “organic forces,” such as “affinity,” “vitality,” and even “willpower,” but there is no way to describe them scientifically. The biotic and abiotic could neither be distinguished nor be connected, only described, neither understood nor explained, until the molecular genetic mechanisms of organisms were revealed and interpreted as information, the results of which show us that organisms are both material and informational. Let's take a look at the process of discovering information in biological genetics.

Information Interpretation of Biological Genetics

(1) From the description-text to the understanding-text

In 1953, James D. Watson and Francis Crick discovered DNA's double-helix structure and a special relationship between the nucleotides forming DNA molecules and amino acids of protein molecules, a relationship that cannot be explained by traditional physicochemical interactions. (The famous biologist Jacques Monod has carefully examined and discussed this matter, see Monod, 1971). Scientists explain this particular interrelationship in respect to “natural language” by using the characteristics of human cultural transmission, interpreting it as a similar text communication coding relationship (see Figure 1). A set of cryptographic books used by the whole organic world was then discovered. Thus, from an incomprehensible description text, through scientific interpretation to an understandable text, the theory of biological genetic information was finally established.

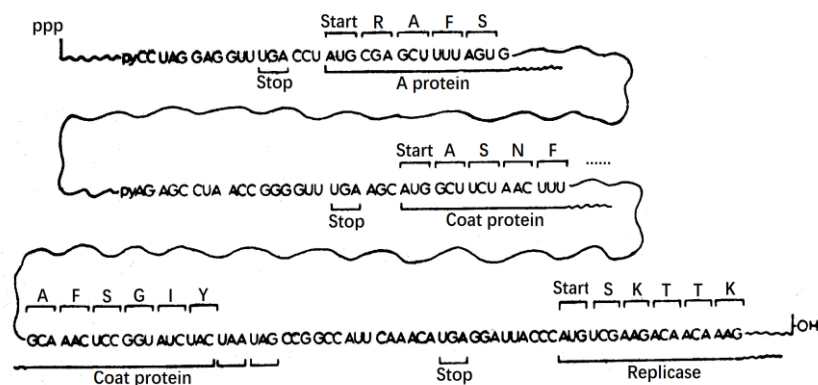


Figure 1. The understanding-text interpreted from the description text: The nucleotide program and corresponding proteins of the mRNA molecule of phage R17 (Sheng, 1976, p. 39).

A bioinformation interpretation is based on a human cultural information model. The genetic characteristics of organisms are recorded in an encoded form, similar to a string of characters in human culture that is both material and informational.

The bacteriophage R17 is a relatively simple organism consisting of three proteins: a protein, coat protein, and replicase. Figure 1 illustrates the nucleotide sequence of the mRNA molecules of bacteriophage R17 and their corresponding proteins. Note that it is the product of the scientific interpretation by way of a hermeneutic method. Formally, this is similar to a language that is part of human culture: There are letters (A, G, C, U being the four nucleotides), words composed of letters (triplet codons corresponding to the different amino acids: R, S, N, F...), sentences composed of words (determining the amino acid sequence of a protein), paragraphs (determining the amino acid sequence of multiple proteins), and specialized starting and terminating symbols between sentences and paragraphs. The relationship between the structure of a phage mRNA molecule and the overall function of the phage is understood only by human intelligence because it is both material and informational. The origin of the special coding form of biological genetic information is still a mystery today, but it is an indisputable fact that biological heredity (or the continuation of life) can be understood and recognized only on the terms of an interaction of information.

Therefore, by way of interpretation based on the way of human cultural communication, the scientific vision really enters the information world, starting with the biological system.

(2) From the understanding-text to the explanation-text

Figure 2 shows a text that is the biological genetic code book deciphered from the above understanding-text. This text enables a full explanation of the coding relationship of genetic material and genetic information, and shows the relationship between nucleotides and amino acids at a glance – which are connected not by mechanical and



statistical decisions, but by passwords. This explanation-text not only fully explains the genetic mechanism (understanding-text), but also fully explains the genetic phenomenon (description-text).

	U	C	A	G	
U	Phe/F (UUU) Phe/F (UUC) Leu/L (UUA) Leu/L (UUG)	Ser/S (UCU) Ser/S (UCC) Ser/S (UCA) Ser/S (UCG)	Tyr/Y (UAU) Tyr/Y (UAC) 【Stop】 (UAA) 【Stop】 (UAG)	Cys/C (UGU) Cys/C (UGC) 【Stop】 (UGA) Tyr/W (UGG)	U C A G
C	Leu/L (CUU) Leu/L (CUC) Leu/L (CUA) Leu/L (CUG)	Pro/P (CCU) Pro/P (CCC) Pro/P (CCA) Pro/P (CCG)	His/H (CAU) His/H (CAC) Gln/Q (CAA) Gln/Q (CAG)	Arg/R (CGU) Arg/R (CGC) Arg/R (CGA) Arg/R (CGG)	U C A G
A	Ile/I (AUU) Ile/I (AUC) Ile/I (AUA) M【Start】 (AUG)	Thr/T (ACU) Thr/T (ACC) Thr/T (ACA) Thr/T (ACG)	Asn/N (AAU) Asn/N (AAC) Lys/K (AAA) Lys/K (AAG)	Ser/S (AGU) Ser/S (AGC) Arg/R (AGA) Arg/R (AGG)	U C A G
G	Val/V (GUU) Val/V (GUC) Val/V (GUA) Val/V (GUG)	Ala/A (GCU) Ala/A (GCC) Ala/A (GCA) Ala/A (GCG)	Asp/D (GAU) Asp/D (GAC) Glu/E (GAA) Glu/E (GAG)	Gly/G (GGU) Gly/G (GGC) Gly/G (GGA) Gly/G (GGG)	U C A G

Figure 2. The explanation-text interpreted from the understanding-text. The triplet genetic code book of one amino acid is determined by three nucleotides (Sheng, 1976, p. 18)

Information Interpretation of the Biological Variation

(1) The description-text

Geneticists have observed that the phenotypic differences between two generations cannot be explained through an interaction at the same layer, i.e., the idea of acquired inheritance is untenable, which leads to the theory of the separation of germplasm and constitutions. The germplasm determines the basic characteristics of an organism in future development, equivalent to a set of instruction vectors. Evidently, this process is closer to the category of “information” than that of “pre-formation”. Just as a book is the product of human culture, so germplasm and similar variation mechanisms have the function of storing information. The concept of germplasm indicates that the notion of information has entered the vision of scientists, and the objective reality of the information became accepted.

Then came the question. On one side, experiments in genetics arrived at the following statement: The change of constitution does not lead to a corresponding change in germplasm. This was shown by Weismann’s experiment of repeatedly cutting off the tails of several generations of multiple white mouse specimen where none of the newborn animals showed a reduction (or elongation) in their tails. Hence, it was shown that a phenotypic change does not produce a genotypic change, and the acquisition cannot be inherited. But, on the other side, the archaeological study of fossils arrives at the statement Over a long course of time some species disappear, some new species are produced, and other species have been evolving. If we assume that we have no further empirical statements to settle the dispute, then we are facing a stalemate. What makes the genetic information change?



(2) The understanding-text

By the interpretation method an understanding-text was given, based on the “support” of characteristics that are shared with the mode of dissemination of human cultural information. The characteristic of human cultural information transmission is 1) that the information content depends on the composition and order of letters, words (punctuation), phrases, sentences and paragraphs in the information carrier (language), and 2) that it can only be changed by modifying the structure and order of words. Applying these same features to evolutionary biology we arrive at a new text. The content of the new text is that the changes of a genetic material carrier in the natural environment lead directly to changes of genetic information content, then to changes in genetic traits. It is also that the changes in phenotypic shape, though they are determined by genetic information, synchronized with the changes of natural environment, do not lead to changes in the content of genetic information and therefore do not alter genotypic shape.

(3) The explanation-text

From the interpretation of the understanding-text, scientists (physiologists and physicists) interpret different explanation-texts through the mediation of natural language. One of them is that biological genetic variation is the change of different material layers of macro and micro, and the change of different material layers has their own causes. The change of genetic material plays a decisive role in genetic trait variation, with the change of genetic material happening in the same material layer. This explanation-text provides an observable statement: energy radiation leads to genetic variation, and specific energy radiation can lead to specific genetic variation.

(4) The validation to the observable statements of the explanation-text

The exchange between DNA molecular bonds is the most fundamental change in genetic material, and the bond energy structure is an important component of the structure of the molecular energy field. Each bond in each biomolecule, whose energy state is different, has its own intrinsic vibrational frequency. Due to quantization, the interaction between the energy fields is highly selective, i.e., the bonds with a certain intrinsic vibrational frequency can only interact with the corresponding radiation energy field that almost has no influence on other bonds. Therefore, if this energy field is large enough, the resonance (activation speed) of the bond will greatly exceed the thermal speed of the molecule to release the stored energy. The energy state of the whole molecule will change and jump into another steady state, and then isomerism of the base molecules occurs, which leads to new sequencing of the DNA (Pullman & Pullman, 1963, p. 209).

Scientists have noticed that the genetic effects of radiation biological mutagenesis come not from direct physical interactions but from information interactions caused by physical interactions. Evidently, the same radiation energy has different effects on the germplasm and constitution of an organism, and heredity and variation can only be explained by information interactions. Experiments show that far-infrared laser radiation



can lead to the generation of consistent genetic variation within populations (Wang & Wang, 1999, p. 1011-1013).

Information Interpretation of the Organism Survival and Growth

(1) The description-text

The properties and states of all layers in an active organism must be coordinated and unified; they can be adjusted at any time as the environment changes. Organisms have the invariable ability to maintain their own form and function for a period of time in the process of material metabolism and energy metabolism, while non-living things that follow traditional physical and chemical laws have no such ability.

(2) The understanding-text

How does one layer change its state of time and space according to the change of another layer? If the question is expressed in an anthropomorphic way, that is, how does one layer get to know the changes of some other layer, simultaneously reacting accordingly? In human society this is effected by one layer sending messengers to those other different layers. Based on the interpretation of human social and cultural characteristics, the description-text is transformed into an understanding text: there is information communication between different layers and cross layers of the organism.

(3) The explanation-text

All layers and parts of the organism can be coordinated in the process of survival, because they establish informational communication connections. This explanation-text presents the observable statement that various layers and parts of the organism exchange their messengers.

The results of further analysis on higher organisms suggest that there is indeed such a way of communication in living organisms. Take humans as an example, it has been found that the three messengers delivering life information between the layers of the human body are: hormones, prostaglandins (local hormones), and adenosine cyclic phosphates (cAMP). They work together to complete the task of delivering life-sustaining information in a relay way which is really similar to human communication. Hormones are the first messengers of endocrine glands directly secreted into the blood to transmit life information and instructions, such as insulin and pituitary hormones. Prostaglandins are a group of unsaturated fatty acids synthesized on a variety of cell membranes in the human body. The cAMP is a special type of nucleotide that regulates the physiological activities of cells and substance metabolism.

The main sites of human hormone production are: the pituitary gland, thyroid gland, parathyroid gland, pancreatic islets, adrenal gland and gonads, which can be compared to outposts at the highest layer of the human body, and they all activate under the coordinated control of the hypothalamus. All kinds of hormones are distributed throughout the body, although the ones that have extensive contact with tissue cells can



only act on tissue cells that recognize donor information. For example, hormones bind to receptors on the target cells to promote prostaglandin synthesis on the cell membrane, then the prostaglandin activates intracellular adenylyl cyclase, converting the intracellular energy storage material adenosine triphosphate (ATP) into cAMP with the participation of magnesium. cAMP activates protein kinases within cells, producing a series of enzymatic reactions that allow cells to produce specific physiological effects. The prostate numbers and cAMP not only perform the mission of delivering hormonal information, but also constitute a tertiary amplification system of this information, making the processed information expand ten thousand times so that the hormones of several molecules can make the cell have significant physiological effects.

The role of the messengers is to convey information between the qualitative material layers in the organisms, adjusting the spatial and temporal relations of various layers. The messengers are not the independent material layers in the biological system, and the information they carry is not enough to establish a new derivative layer, but if such a communication system established by messengers were to be lost, the organism would not be able to survive in the unpredictability of the environment (Wang, 1993, p. 123-124).

(4) Brief sum-up

Since Schrödinger (1944) boldly proposed cryptological determinism, a complete biological genetic code book was deciphered in the 1960s. From that moment, biologists have used a set of concepts similar to human cultural communication to describe, understand, and explain the variation, survival, development and evolution of organisms, such as: information, vector, replication, transmission, conversion, transcription, translation, recognition, and expression. And molecular biologists have also created a set of terms of corresponding materialization mechanisms: codons, anticodons, insertions, transposons, introns, exons and operons (see Figure 3).

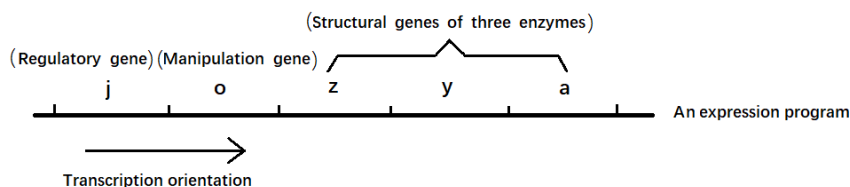


Figure 3. An understanding-text about developmental control (The “operon” model created by Jacob & Monod, 1961).

THE UNDERSTANDING OF “UNDERSTANDING”

Albert Einstein once said, “the most incomprehensible thing about the world is that it is at all comprehensible” (Vallentin, 1954, p. 24). Really, the most difficult question in



the world to understand is why people can understand. “Understanding” is in the middle position between description and explanation, and is a key feature of cognition. If the description-text cannot be understood, there cannot be an explanation of the things described, and thus predictive statements cannot be obtained. As I mentioned earlier, “understanding” is a strictly individual event. What individuals do in their rational state is something that we do not clearly understand in terms of their physiological mechanism. However, I argue that “understanding” itself can also be understood through hermeneutics. I propose to treat this question in the framework of a „thinking system,“ a proposal that proves to be productive.

The hierarchy and complexity of the thinking system

We can build the administrative-levels mode of the thinking system. It is organized by consciousness with many layers: direct perception / indirect perception / rational faculty / worldview / consciousness / the subconscious / top-consciousness. The existence of top-consciousness requires special emphasis. It is an as yet unclear and unconfirmed part of consciousness as it relates to the physical mechanism (Wang, 1993, p. 139). Of course, such a division of consciousness is not strict and needs to be further explored, but it seems evident that consciousness is layered hierarchically (see Figure 4).

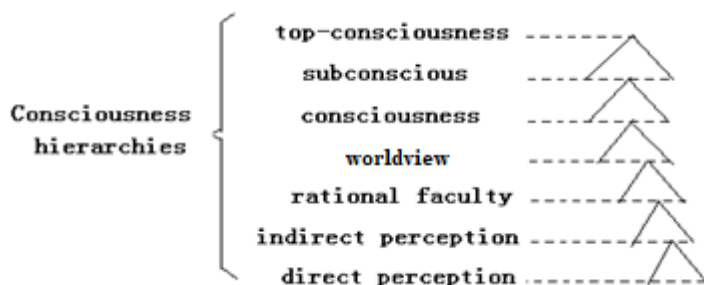


Figure 4. Hierarchical structure of the thinking system (Wang, 2006, p. 255).

The illustration about the layered structure of the thinking system is absolutely necessary to understand the completeness, creativity, and mechanisms of cognition. It reveals that human understanding, or cognition, is not a linear process, nor is it merely a leap through perception and rationality. During the process of actual thinking or cognition, many layers work together. They are conceptually distinct and can be considered independently even though they contain, restrain and influence each other, forming complex interacting relationships. This process follows a creative trajectory and its creativity comes from the complex interactions between the layers. Thinking systems have standards of values and psychology besides the general characteristics of complex systems, such as mutation, restriction, coding, and organization.

In the human thinking system, each consciousness-layer has its own substance with special form, that comes from abduction of higher layers and abstraction from lower



layers, and by influence from outside the system. As in any natural hierarchy, a functioning consciousness hierarchy cannot be reduced. All layers of consciousness work together and support each other, none of them work alone. During thinking they all play a supporting role. Cognition is a complex event worked on by the whole brain (consciousness). It is unnecessary to refer to a presupposed basis or foundation of rationality. The rationality of knowledge can only be found when thinking is considered as multi-layered complex system, and when the content of one layer is supposed to be the foundation of others, and if a traversal across layers is defined as the organization of a new idea.

To Understand “Understanding” from a Hermeneutic Perspective

From the above analysis, it is not difficult to see that “understanding” is realized through complex interactions between the layers of thinking systems. The hierarchical theory of thinking provides a new perspective on “understanding.” Through this new perspective, we find two patterns or ways of “understanding”: in different layers and across layers, the transformation and recovery between abstract concepts, and that between intuitive images. The understanding-text is the result of successful transformation and recovery.

(1) Understanding through the transformation and recovery of and among abstract concepts

The concept is the core element of the thinking system, formed through the process of abstraction. Different layers of consciousness hold concepts with varying degrees of abstraction. These are expressed externally in form of words, which consequently possess a hierarchy. The interrelationship among them mirrors the interconnection between concepts.

In essence, “understanding” refers to the continuous generation of new connections among the concepts of each thinking layer (see Figure 5). This dynamic process ultimately leads to a state of mutual support and coordination, which can be described as a state of understanding, or a rational state.

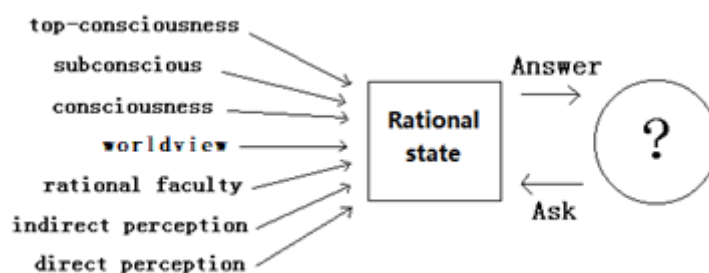


Figure 5. Understanding in the rational state.



(2) Understanding through conversion and recovery among intuitive images

In the absence of concepts or with unclear concepts, the brain's understanding of things depends on the conversion and recovery between intuitive images (intuitive models) at different layers of consciousness (see Figure 6). The visual images support each other, thus achieving an understanding of things. There are jumps and discontinuities between the intuitive models at each layer, and the connection to them depends on the intuitive experience of each person. I speculate that this is the human ability to understand instinctively.

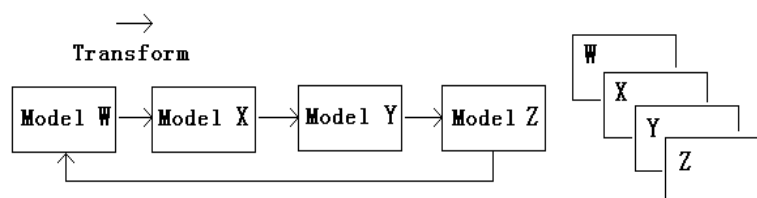


Figure 6. Understanding through different layers of intuitive image conversion (Wang, 2007, p. 267).

Understanding by conversion and recovery among intuitive images at different levels is mediated by human intuitive experience; as in the case of conceptual understanding, this kind of understanding is also characteristic of human culture. Any understanding has a certain cultural background, which was confirmed in the previous case analysis of modern molecular biology.

The hierarchical structure of the thinking system and its complexity are an important theoretical framework for us to understand “understanding.”

CONCLUSION

From the analysis of the case of the birth of modern molecular biology, we can see that the hermeneutic method mediated by natural language and intuitive experience runs through the interpretive process of description, understanding, and explanation in scientific cognition. Scientific knowledge is a process of the transformation and reductive recovery of text. The mutual support and validation of “describing text,” “understanding text,” and “explaining text” are the most basic requirements for the interpretation of text. The interpretation of information based on human cultural exchange patterns has led to modern molecular biology, as well as many other scientific discoveries and technological innovations, such as Information Science and Artificial Intelligence (Wang, 2022, pp. 183-190). The cultural elements in natural language and intuitive experience make the hermeneutic method rely on ontology and methodology. The application of hermeneutic



methods often requires a cultural moment as a fulcrum, which can be anything that the researcher has understood. With the theory of a complex hierarchical system one can obtain a clearer understanding of human “understanding.” Scientific interpretation will become an increasingly important method in scientific research, because science is facing more and more complex objects, and mathematical induction and deduction may become more and more difficult. Therefore, scientific interpretation may become an essential way to expand new fields of science and technological innovation.

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