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# Definition and Essence of Information

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**Abstract:** It is 60 years since essential attributes of information were explored in the field of philosophy, resulting in contention of a hundred schools of thought and wide division of opinions so far. Some scholars at home and abroad have been trying to build a new system of information philosophy from the angle of ontology so as to explain the world. However, this paper puts forward a definition of information and its mathematical expressions, and points out that information is the collection of three kinds of attributes of things, which is proved perfect after testing. It is found on analysis that the essence of information people refer to nowadays is just the interaction of matters, and the representation of the law of causality in philosophy. The paper also suggests that information is only a noun that people have customarily used and confused. Eventually, the induction, differentiation and utilization of conventionally-stated information should be applied into studying matters themselves.

**Key words:** information, attribute, interaction, causality, Wiener

In 1948 Wiener, founder of cybernetics, said: “Information is information, not matter or energy. No materialism which does not admit this can survive at the present day.” Thus, he introduced the concept of information in the theory of communication to philosophy. Consequently, professionals of philosophy have got involved in the research into defining the connotation of information for 60 years. Statistics shows, there were about 130 definitions of information until 1980. And Shannon (C·E·Shannon 1916-2001), founder of information theory, also issued a statement: it is almost impossible to count on a sole concept about information being satisfactorily responsible for every possible application in general fields.<sup>1</sup> So the paper puts forward a definition of customarily-named information and its mathematical expressions, hoping it is helpful to end the philosophical exploration

for the concept of information

## 1. Definition of information and its mathematical expressions

The habitually-called information is the collection of three kinds of attributes of things: things themselves (including cause or effect formed through their interactions), the attributes of things that someone thinks and simulates, and the attributes of tools he uses when he himself considers, or expresses, or simulates something. The first kind of attributes of things is based on facts, for example, the three states of water. The physical, chemical, biological, social and other properties of things have nothing to do with any expressive way used by him (such as: languages, words, music and pictures). The second kind is his inner thoughts, or expressions through languages, or words or bit in computers. namely, some attributes of things that he considers, or attributes of things simulates according to science and technology, some are very true to the facts, but some are incompletely, while others are not in any way. The third kind is the attributes of tools used by him when he himself thinks , or expresses, or simulates

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<sup>1</sup> Peter F. Drucker. Knowledge Work and Knowledge Society: Transformations of this Century [DB/OL]. Homepage by Adriane Kaufmann, e-mail: Kaufmann@ksgl.harvard.edu Last Modified September 27, 1995. 转引自: 刘钢. 信息哲学探源[M]. 北京: 金城出版社, 2007. 70.

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something, ie. the state of brain neuron when he thinks, the line trend of words when he uses, the vibration frequency and intensity of sound when he speaks, or the state of languages or electric circuit devices in a computer, or models of devices used in an experiment, etc.. If the sign  $X$  expresses the first kind of attributes,  $X'$  is the second, and  $X_{tlw}$  the third, and info is for information, we can simply express customarily-named information as follows:

$$\text{info} = X + X' + X_{tlw} \quad (\text{see Appendix})$$

For instance, the moon and a fresh flower have their respective quantity of physical, chemical, mathematical and other properties. There are footsteps if someone steps on the surface of the moon in the sky, whereas there are no footsteps if one steps on the reflection of the moon in the water. A lily smells sweet while a flower in the mirror is not fragrant. They are different because in the two cases, both the true moon and the true flower are cause, and both their images are effect. So each has its own  $X$ . Man's knowledge about the moon is still in its infancy. Then the quantity of the attribute of the moon thought by man is  $X'$ , which does not completely correspond to its  $X$ . And the quality of tools used to express the quantity of the moon's attribute is  $X_{tlw}$ .

More example: the ingredients indicated in the instruction to a fake product are identical with those printed in the instruction to a famous-brand product. Thus, the audience unaware of the truth would think that the two instructions correspond to the same product. In fact, the information about the physical, chemical, biological, social and other properties of the fake product is entirely different from that of the brand-name product. Although the instructions are all the same, the  $X$  of the former product differs entirely from the  $X$  of the latter. However, the  $X'$  got by the

audience is alike to the  $X_{tlw}$  of the expression  $X'$ .

In order to make clear the above described conception of information, the expressions of information, which is a natural phenomena and is based on facts, are listed below:

$$\text{info} = X$$

But the expression of absolutely lying information should be as follows:

$$\text{info} = X' + X_{tlw}$$

The information, in words for the illiterate and abstract art and animals' sound for the vast majority, is expressed here:

$$\text{info} = X_{tlw}$$

Or words, abstract art and animals' sound can be shown as:

$$\text{info} = X$$

If we admit the above expressions, we can get out of tight spot to define information in philosophy.

## 2. Several wordings worth discussion

2.1 Some scholars hold that it is necessary to distinguish "information in the sense of ontology" from "information in a sense of theory of knowledge"<sup>2</sup>.

If it comes into the domain of philosophy, information need not and should not have two definitions with different meanings, namely, definition in the sense of ontology and definition in a sense of theory of knowledge. If you admit that information is a confusedly-used term, you will not attempt to treat it in terms of the philosophical category. Consequently you will accept the above mathematical expressions of information.

2.2 Some scholar said, Information is a domain of philosophy indicating indirect existence, which is the self manifestation of matter's existing method (direct existence)

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<sup>2</sup> 钟义信. 信息科学原理(第三版) [M] 北京 北京邮电大学出版社, 2002.50

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and state. <sup>3</sup>It is not effective.

If information is just “indicating indirect existence” and “being self manifestation”, Why can information produce strong material force? And why does the power of information vary from person to person, and have connection with its objects? And why do people often fail to distinguish true information from false information and be deceived?

2.3 Some foreign scholar puts forward that information has thus arisen as a concept as fundamental and important as “being”, “knowledge”, “life”, “intelligence”, “meaning” or “good and evil”. <sup>4</sup>

Body, being, substance, are but different terms for the same reality. It is impossible to separate thought from matter that thinks. This matter is the substratum of all changes going on in the world. <sup>5</sup> There is an inclination of dualism in the author’s viewpoint, which we do not agree with. Such an account cannot explain why there exists a great deal of insignificant and boring junk messages.

### 3. Essence of information and correct research direction

Languages we can understand (including words we can read) have conveyed information. But we can not say languages we cannot follow (including words we cannot read) have conveyed the same information, and that the interpretations of such languages haven’t conveyed the same information. Therefore, there is different interpreted information when we can know a language or not.

When reading, seeing a movie, attending a lecture, or listening to music,

someone may be moved or stirred. Then you cannot say he does not communicate information with words, pictures and languages. When you get deeply into the substances of words, pictures and languages, you may be aware that this is the changes between man and nature, and the communication between man and his social activities, but not the exchange of information between the lines of words, the vibration frequency and intensity of sound in a language. If the contents of same matters are referred to with expressions of strange words and languages, and so-called aliens’ art which man does not know, nobody is certainly moved or inspired.

Hence, we can infer a conclusion: the conventionally-named information is in fact the interaction among man, other beings and various matters. When they interact, different things have different information.

Information can be both material and mental, existing or conscious, produced or received, true or false, real or fictitious, right or wrong, remembered or forgot, known or unknown; it can exist objectively but cannot be perceived subjectively, or vice versa; and it can be powerful or weak, has tangible or intangible values, and so on. The true information is mingled with the false, and sometimes it appears while sometimes it disappears. So here is another conclusion: the connotation of habitually-named information has self-contrary connotation, which is a self-contradicted, interwoven concept.

Wiener introduced the concept of information in the theory of communication to philosophy, which seems a breakthrough. However, he failed to predict that, with complicated new ideas and techniques emerging one after another in today’s society, a lot of new contents have been infiltrating into information. His idea of information has

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<sup>3</sup> 郭焜. 信息哲学——理论、体系、方法 [M]. 北京: 商务印书馆, 2005. 45.

<sup>4</sup> 弗洛里迪. 什么是信息哲学? [J]. 世界哲学, 2002, (4). 73.

<sup>5</sup> 马克思恩格斯全集: 第 2 卷 [M]. 北京: 人民出版社, 1965. 164.

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changed into a maze because people have been using the word at will, which placed them into a dilemma. They are as perplexed as they were when they were seeking the media for propagation of electromagnetic waves and testing the “ether” hypothesis at the end of 19th century. The academic community has kept on arguing the definition of information for decades.

Focusing on the attributes of things (including beings), we are able to solve the perplexity resulted from the self-contrary information, and distinguish customarily-named, self-contrary information from the entirely different attributes of things. For example, the instruction of a fake product is as same as that of a real brand-name product, but the function of the fake product is definitely not the same as the real brand-name product.

The present fact is: the concept of information has become a self-contradictory and common term used confusedly, universally. At present someone will surely get into trouble if he tries to give information a philosophical or scientific definition. It is impossible to state the precise ontological meaning for “information”, just as one language, English or Esperanto, is unable to unify 4300 languages in the world.

Pondering over any piece of information, we can find out, accustomed-stated information is essentially the most ancient interaction in nature, so interaction is “the real ultimate cause of matters.”<sup>6</sup> And interactions happen only between attributes of things.

Languages and words are tools to know things themselves or connections between them. Customarily-stated information which languages and words convey lags behind the attributes of things which result in

accustomed stated information. Matter is cause whereas language is effect. Viewed from causality, effect certainly lags behind cause, too. When someone speaks, his sound is not the matters it expresses or describes. Language has the function to express matters only when it forms the corresponding mechanism in man’s brain. “ Language is not only a kind of symbols which exist in the objective world and organized in a special way, but also the embodiment of the symbols and the regulations which decide the combinations of symbols in the brain. Brain expresses language with the same organs which express other objective existence. Neurologists began to know the neural basis of objects and incidents, and their connections presenting in brain. At the same time they will surely come to the further knowledge about the presentation of language in the brain and the structure connecting language and the brain.”<sup>7</sup>

All in all, there is only the interaction between (attributes of) things. Information is just a noun people have customarily used and abused. Eventually, the induction, differentiation and utilization of conventionally-named information will be applied into studying things themselves. The sole criterion for testing truth is practice.

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<sup>6</sup> 黑格尔 .逻辑学下卷 [M].北京 :商务印书馆 ,1976.203-223.

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<sup>7</sup> 达玛西奥 .大脑与语言 [A].王文清主编 .脑与意识 [C].科学文献技术出版社 ,1999.74.

*Appendix*

The following arrays can formulate the aforementioned customarily-stated information:

$$\text{info}_1 = \begin{pmatrix} P_{11} & P_{12} & L & P_{1n} & P'_{11} & P'_{12} & L & P'_{1n} & P_{tlw11} & P_{tlw12} & L & P_{tlw1n} \\ C_{11} & C_{12} & L & C_{1n} & C'_{11} & C'_{12} & L & C'_{1n} & C_{tlw11} & C_{tlw12} & L & C_{tlw1n} \\ B_{11} & B_{12} & L & B_{1n} & B'_{11} & B'_{12} & L & B'_{1n} & B_{tlw11} & B_{tlw12} & L & B_{tlw1n} \\ L & L & L & L & L & L & L & L & L & L & L & L \\ S_{11} & S_{12} & L & S_{1n} & S'_{11} & S'_{12} & L & S'_{1n} & S_{tlw11} & S_{tlw12} & L & S_{tlw1n} \end{pmatrix}$$

$$\text{info}_2 = \begin{pmatrix} P_{21} & P_{22} & L & P_{2n} & P'_{21} & P'_{22} & L & P'_{2n} & P_{tlw21} & P_{tlw22} & L & P_{tlw2n} \\ C_{21} & C_{22} & L & C_{2n} & C'_{21} & C'_{22} & L & C'_{2n} & C_{tlw21} & C_{tlw22} & L & C_{tlw2n} \\ B_{21} & B_{22} & L & B_{2n} & B'_{21} & B'_{22} & L & B'_{2n} & B_{tlw21} & B_{tlw22} & L & B_{tlw2n} \\ L & L & L & L & L & L & L & L & L & L & L & L \\ S_{21} & S_{22} & L & S_{2n} & S'_{21} & S'_{22} & L & S'_{2n} & S_{tlw21} & S_{tlw22} & L & S_{tlw2n} \end{pmatrix}$$

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$$\text{info}_m = \begin{pmatrix} P_{m1} & P_{m2} & L & P_{mn} & P'_{m1} & P'_{m2} & L & P'_{mn} & P_{tlwm1} & P_{tlwm2} & L & P_{tlwmn} \\ C_{m1} & C_{m2} & L & C_{mn} & C'_{m1} & C'_{m2} & L & C'_{mn} & C_{tlwm1} & C_{tlwm2} & L & C_{tlwmn} \\ B_{m1} & B_{m2} & L & B_{mn} & B'_{m1} & B'_{m2} & L & B'_{mn} & B_{tlwm1} & B_{tlwm2} & L & B_{tlwmn} \\ L & L & L & L & L & L & L & L & L & L & L & L \\ S_{m1} & S_{m2} & L & S_{mn} & S'_{m1} & S'_{m2} & L & S'_{mn} & S_{tlwm1} & S_{tlwm2} & L & S_{tlwmn} \end{pmatrix}$$

In the equations, P is for physical quality, C — chemical quality, B — biological quality, ... and S — social quality, etc., instead of part of X, the attributes mentioned in the paper. What's more, m is the number of various subsystems in a system, m=1, 2, 3, ... ; n is the number of different properties in every subsystem, n=1, 2, 3, ...

In order to make clear the related conception of information, here are arrays of absolutely-natural and based-on-fact information:

$$\text{info}_m = \begin{pmatrix} P_{m1} & P_{m2} & P_{m3} & L & L & L & L & L & L & P_{mn} \\ C_{m1} & C_{m2} & C_{m3} & L & L & L & L & L & L & C_{mn} \\ B_{m1} & B_{m2} & B_{m3} & L & L & L & L & L & L & B_{mn} \\ L & L & L & L & L & L & L & L & L & L \\ 0 & 0 & 0 & L & L & L & L & L & L & 0 \end{pmatrix}$$

Arrays of absolutely-lying information should be shown as:

$$\text{info}_m = \begin{pmatrix} P'_{m1} & P'_{m2} & L & P'_{mn} & P_{tlwm1} & P_{tlwm2} & L & L & L & P_{tlwmn} \\ C'_{m1} & C'_{m2} & L & C'_{mn} & C_{tlwm1} & C_{tlwm2} & L & L & L & C_{tlwmn} \\ B'_{m1} & B'_{m2} & L & B'_{mn} & B_{tlwm1} & B_{tlwm2} & L & L & L & B_{tlwmn} \\ L & L & L & L & L & L & L & L & L & L \\ S'_{m1} & S'_{m2} & L & S'_{mn} & 0 & 0 & L & L & L & 0 \end{pmatrix}$$

The equations of information of words for the illiterate, abstract art and animals' sound for the vast majority, are as follows:

$$\text{info}_m = \begin{pmatrix} 0 & 0 & L & 0 & 0 & 0 & L & 0 & P_{tlwm1} & P_{tlwm2} & L & P_{tlwmn} \\ 0 & 0 & L & 0 & 0 & 0 & L & 0 & C_{tlwm1} & C_{tlwm2} & L & C_{tlwmn} \\ 0 & 0 & L & 0 & 0 & 0 & L & 0 & B_{tlwm1} & B_{tlwm2} & L & B_{tlwmn} \\ L & L & L & L & L & L & L & L & L & L & L & L \\ 0 & 0 & L & 0 & 0 & 0 & L & 0 & 0 & 0 & L & 0 \end{pmatrix}$$

Or words, abstract art and animals' sound themselves are expressed below:

$$\text{info}_m = \begin{pmatrix} P_{m1} & P_{m2} & L & P_{mn} & 0 & 0 & L & 0 & 0 & 0 & L & 0 \\ C_{m1} & C_{m2} & L & C_{mn} & 0 & 0 & L & 0 & 0 & 0 & L & 0 \\ B_{m1} & B_{m2} & L & B_{mn} & 0 & 0 & L & 0 & 0 & 0 & L & 0 \\ L & L & L & L & L & L & L & L & L & L & L & L \\ 0 & 0 & L & 0 & 0 & 0 & L & 0 & 0 & 0 & L & 0 \end{pmatrix}$$

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