Some Remarks on the Value of Information from the Viewpoint of Aristotelian Semantic Triangle

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Received January 12, 2007; final version accepted July 31, 2008

The purpose of this paper is to make a conceptual analysis on the value of information from a philosophical point of view. In the paper, confining myself to a short philosophical comment, I take the following steps. (1) By referring to the Shannon’s classical paper on communication theory, I reconfirm one of the philosophically basic problems about the value of information, namely, the twisted relation between the elimination of meaning and our common-sense understanding of the value. (2) To elucidate the relation from a philosophical point of view, I take advantage of the Aristotle’s schematic overview called "semantic triangle." The schema shows itself to have a systematic and wide-ranging conception. (3) Through analyzing the Aristotelian semantic triangle, I revaluate his philosophical insight that, in order to have a penetrating view of the value of information, we need more light on the value system from the viewpoint of human time, which is contrasted with physical or engineering time. What essentially matters is the relation between human time and Aristotelian common sense. (4) In temporary conclusion, I propose that to focus attention on human time lead us to an adequate assessment on the crucial divide between quality and quantity in the value of information.

KEYWORDS: value of information, semantic triangle, common sense, human time

1. Introduction

The theme given to the present author by the special issue editor is to make a philosophical analysis on the value of information. However, each one of the main concepts relevant to the theme, namely, value, information, and philosophy, seems to be ambiguous and multilateral. Therefore, it is at first necessary to prescribe the method and plan of the paper. In order to reconfirm what the fundamental problem of the value of information is from a philosophical viewpoint, I would like to choose, as a starting point, C. E. Shannon’s paper, "A Mathematical Theory of Communication" [15]. The reason is that this is without any doubt one of the classical and epoch-making papers in communication or information theory and that it suggests a significant clue for reconsidering the concept of value from the viewpoint of philosophy. I quote, though very well known, some paragraphs from Introduction of the paper, the body being pace Shannon irrelevant to my purpose for the present.

The fundamental problem of communication is that of reproducing at one point either exactly or approximately a message selected at another point. Frequently the messages have meaning; that is they refer to or are correlated according to some system with certain physical or conceptual entities. These semantic aspects of communication are irrelevant to the engineering problem. The significant aspect is that the actual message is one selected from a set of possible messages. The system must be designed to operate for each possible selection, not just the one which will actually be chosen since this is unknown at the time of design (italics in the original text).

Shannon definitely pronounces his strategy of excluding meanings or semantic aspects of communication. In the Preface to Shannon’s Collected Papers (Part A) [17], the editor also affirms that the meaning of information plays no role in the theory(1). However, the elimination of meaning here does not mean the complete exclusion of value. Shannon continues in his paper’s Introduction as below.

The logarithmic measure is more convenient for various reasons;

1. It is practically more useful. Parameters of engineering importance such as time, bandwidth, number of relays etc., tend to vary linearly with the logarithm of the number of possibilities. (……)
2. It is nearer to our intuitive feeling as to the proper measures. This is closely related to (1) since we intuitively measure entities by linear comparison with common standards. (……)
3. It is mathematically more suitable. Many of the limiting operations are simple in terms of the logarithm but would require clumsy restatement in terms of the number of possibilities.

The reasons picked out here by Shannon are almost all from a mathematical point of view and there is no problem in them. What I want to pay attention to is what Shannon calls ‘more convenient’ in a casual or candid way, that is,
practically more useful’ (or practical usefulness), ‘nearer to our intuitive feeling’ (or conformity to our intuitive feeling), and ‘mathematically more suitable’ (or mathematical suitability). These phrases, which certainly have directivity to value or valuation, arouse philosophical notice.

As shown below, the strategy in my paper consists in reconsidering the value of information from an Aristotelian semantic triangle, and the conclusion is, to put it briefly, in that, in order to have a penetrating view of the value of information, it is indispensable to keep a sharp eye on the foundation of our value system from the viewpoint of human time. In the following sections, I will explain both how the Aristotelian semantic triangle can play a role as compass needle for the present task and how the aspect of human time will turn out to be decisively relevant to the value of information.

2. Information Theory and Value

I will show in a little more detail which aspects in the Shannon’s paper I pay close attention to.

Shannon starts from the assumption that the actual message is one selected from a set of possible messages (italics in the original text above). This strategy enables him to do the following: (1) to preclude a crucial problem about actual selections unknown at the time of design, (2) to apply the convenience of mathematical procedures to the theoretical analysis of communication, and (3) to expand the value of convenience and efficiency into the communication theory itself. In considering the value of information, we should notice the distinction between (2) and (3) from the viewpoint of practical usefulness or conformity to our intuitive feeling. The former (2) is expressed clearly in the Shannon’s paper, but the latter (3), which is relevant to the fundamental problem of communication as Shannon’s Introduction says, is rather implicit in the practice of communication (or information) theory. But, needless to say, the information theory is supposed to be one of the engineering sciences or technologies the main aim of which is to improve more efficient and more accurate communication systems for human beings and society. Therefore, we face the two levels of value concept in the information theory. The objective in my paper is to make an analysis of the conceptual relation between (2) and (3) from a philosophical point of view.

Having set up the objective, I will next set a methodological direction as to a philosophical point of view. The Shannon’s Introduction again provides a clue to that. It is meaning that Shannon ignores in his paper. At the cost of meaning, he obtains the value of convenience by means of mathematical procedures including logarithmic measure. However, a communication without meaning would be meaningless without exception for ordinary senders and receivers of messages. Shannon himself says in fact that frequently the messages have meaning. Nevertheless, as said above, a communication theory without meaning is thought to produce the theoretical and practical value of convenience and efficiency for communication engineers and eventually for public users of communication tools. Here we encounter one of the simple and deep-rooted problems. We would intuitively feel an inscrutable or uncomfortable gap between the elimination of meaning and the acquisition of value. The gap, even if intuitively grasped, still remains nebulous and ambiguous. It is not easy to specify the reason why the gap happens and seems for us to be inscrutable. In this sense, this gap may be less nearer to our intuitive feeling than the logarithmic measure to Shannon’s (or a mathematician’s) feeling. The problematic situation caused by Shannon’s strategy seems to be similar to such an embarrassing feeling that we are apt to have when we see before our eyes an overwhelming success by the reductionism in modern sciences and technologies.

Anyway, it is requisite for us to make clear a mechanism or something by means of which the gap appears to our intuition to be inescapable. In order to carry out this task, we should for the time being go back to the stage before the elimination of meaning by Shannon. This being so, we need to take into consideration a schema called Semantic Triangle (henceforth ST). For ST is composed of the three entities that Shannon refers to in his paper, namely, linguistic, conceptual, and physical entities. ST is in a more concise way called name-concept-thing triangle or language-mind-world triangle, which can be illustrated with Fig. 1-1. (I add Fig. 1-2, which is one of classical schemata of ST by Ogden and Richards [12].)
In the end of this section, I would like to make a brief comment on what is relevant to (1) mentioned above. From a common-sense point of view, information is from \textit{world to mind} in ST, or an entity from the outer world. By excluding \textit{meaning} (conceptual/physical entities), Shannon concentrates on linguistic entities (messages/symbols). To exclude one thing means to select something else. This is a methodological selection in the Shannon’s paper. To borrow his words (see the citation in the Introduction above), it is an \textit{actual} selection \textit{unknown at the time of design}, that is to say, one selected from a set of possible \textit{methods}. A set of possible methods concerning ST can be obtained from possible combinations of all the apexes of ST. What is important is to examine what results from Shannon’s \textit{actual} selection, in other words, to diagnosis the side effects produced by the elimination of \textit{meaning}. Therefore, to make a philosophical analysis of the value of information by restoring \textit{meaning}, we should reconsider ST as a whole, which makes us understand a set of possible \textit{methods}. This is, in a sense, to search the \textit{lost meaning} from a common-sense point of view.

3. Aristotle’s Semantic Triangle

The semantic triangle (ST) has been long discussed and researched in philosophy as well as in linguistics and in semiotics. So it is furthermore necessary to determine how we should approach to ST itself. In this paper, I choose Aristotle’s ST as a guideline. The reason is simply that Aristotle is supposed to be a historical inventor of ST and that we need a philosophical viewpoint from which we can rethink about the value of information. In addition, as shown later, Aristotle’s ST has a methodologically unique program, which is different from some standard understandings of ST, e.g. [2, 5, 11]. (In other words, I do not aim to investigate \textit{semiotic} problems in this paper. This may be an \textit{actual} selection of mine.)

3.1 Basic Schema of Semantic Triangle in \textit{De Interpretatione}

Aristotle introduces ST in his treatise \textit{De Interpretatione} as follows [1(43)]\textsuperscript{2}.

Now spoken sounds are symbols [\textit{sumbola}] of affections [\textit{pathemata}] in the soul, and written marks symbols of spoken sounds. And just as written marks are not the same for all men, neither are spoken sounds. But what these are in the first place sings of — affections of the soul — are the same for all; and what these affections are likenesses of — actual things [\textit{pragmata}] — are also the same. These matters have been discussed in the work on the soul and do not belong to the present subject.

Just as some thoughts in the soul are neither true nor false while some are necessarily one or the other, so also with spoken sounds. For falsity and truth have to do with combination and separation. Thus name and verbs by themselves — for instance ‘man’ or ‘white’ when nothing further is added — are like the thoughts that are without combination and separation; so far they are neither true nor false.

Aristotelian ST — \textit{sumbola/pathemata/pragmata} triangle (Fig. 2) [21] — seems to be in principle almost the same as the foregoing ones. What is important, however, is that Aristotle is supposed to present ST here as a schematic design of his wide-ranging research program of \textit{Corpus Aristotelicum}. Aristotelian ST indicates two fundamental perspectives, one of which is about how to chart the positions of particular sciences, the other of which is as to how to consider the relation one science has to each other. The former helps us to determine which subject to concentrate on, ignoring the others. Aristotle says in the citation above that the problem of the affections of soul, situated in one of apexes of ST, belongs to other treatise, namely, psychology (the work on the soul). The latter perspective shows us both a line of demarcation between particular sciences and a limit of value each particular science has in itself.

![Semantic Triangle by Aristotle](image)

However that may be, following Aristotle who assigns psychology to the affections of soul, we can tentatively allocate logic to language, and physic to actual things, with the proviso that each modern title (logic/psychology/
physical (physics) may be different from what Aristotle has in mind. In addition, the allocation of physics to actual things is not definite at this stage. But Shannon will agree with this assignment, since he refers to physical entities in his paper. The problem about such an allocation will be solved as our discussion proceeds. To make the allocation clear is an Aristotle’s latent purpose in De Interpretatione. For, according to Aristotle’s program, ST is intended to represent a systematic schema of sciences from a methodological point of view. This is a starting point in this paper.

The next step in this paper is to get some basic concepts by which we can draw the schema of ST in further detail, so that we can transfer from one apex to others in ST. Since each apex seems to be qualitatively different from every other, we cannot grasp the internal relation between these apexes without such concepts. In the citation above, Aristotle refers only to the symbolic relation and the likeness relation. It is expected that Aristotle will give us some clues in the body of De Interpretatione. The topics relevant to the understanding of ST in De Interpretatione are as follows.

1. Logical structure of sentence and its elements, i.e. subject (onoma) and predicate (rhema)
2. Problem of negative facts and truth-values
3. Syntax of tensed sentences (past/present/future)
4. Syntax of modal sentences (necessary/contingent/possible)

3.2 Logical Structure of Sentence and Truth-Value

In Aristotle’s logic as well as in a modern standard logic, each ordinary declarative sentence (or proposition) has a truth-value, either truth or falsity. Which truth-value a sentence has depends on the correspondence between sentence (logos) and world (pragmata). But we cannot decide this semantic correspondence simply by making a comparison between sentence ‘p’ and fact p. The reason is as follows. In two-valued logic, if ‘p’ is true, then ‘¬p’ is false, and if ‘¬p’ is true, then ‘p’ is false. So, if ‘¬p’ is true, the fact corresponding to that is ¬p. Here we face with a philosophical difficulty of explaining what the fact corresponding to a sentence with negation sign ‘¬’ is. This is a philosophical problem concerning negative facts.

Aristotle’s principal method of solving this problem is to divide a sentence into subject-predicate on the one hand and a fact into substance-property on the other [10(72-3)]. The correspondence is determined by the structural accordance between subject-predicate structure and substance-property structure, which is called combination or separation by Aristotle. By adopting this criterion, we will not be perplexed anymore with negative facts. For we can exclude negative facts from the world of ST. For example, “Socrates does not walk” means, if true, that the substance (Socrates) is separated from the property (to walk) and, implicitly, connected with other property (e.g. to run), so that Aristotle can leave negative facts out of consideration. The elimination of negative facts from world does not mean the uselessness of a negation sign in language. Aristotle’s aim in virtue of ST is to supply a syntactical analysis of sentence that can confirm the correspondence between language and world(13).

3.3 Syntax of Future Tensed Sentence

Aristotle has overcome the problem of how a true negative sentence corresponds to a fact (not a negative fact) by virtue of the logical structure of a sentence. But another problem attacks him uninterruptedly. A sentence has a tense, i.e. past/present/future. The function of tenses here is not genuinely grammatical but rather philosophical. The reason is that a question about the tense happens as follows. If it is admitted that a past event does not exist anymore and a future event does not yet, there can be no correspondence between a tensed sentence and a fact except the present. Then, how can the truth-value of a tensed sentence be determined by the correspondence? Given the Aristotelian realism concerning the past, we can put aside a past sentence for now. We can admit that, once an event happened, the truth-value of a sentence about it will never change. Therefore, the truth-value of a past sentence can be fixed. However, the case of the future is different, since the future is supposed to remain undermined or unfixed. How do we then set out the truth-value of a future sentence?

A simple way of dissolving this problem is just to admit that a future sentence has no truth-value insofar as it does not correspond to any fact or any event. This is handy and reasonable in a sense. The truth-value of a future sentence cannot be determined anyway before the event described by the sentence actually happens. However, even if so, this remedy devalues the syntax of tense. The tense system as a whole will be then semantically incomplete or incoherent, regardless of our intuitive feeling that the truth-value depends on the correspondence between a sentence and a fact and that the tense system is fundamental and indispensable in our everyday language.

On the other hand, the idea of a tensed sentence encounters a more radical problem, that is to say, it is, from the start, illogical to define the truth-value of a tensed sentence by means of the correspondence between a tensed sentence and a tenseless fact [20]. For the tense system is a contrivance by language-users (human beings) and the world (facts or events) itself should be thought to be tenseless. The world knows no borders of the tense. This reminds us that one of the most important points of ST is to point out such an indirectness between language and world, which is indicated by dotted lines in the figures of ST.

How can these problems be overcome? Aristotle responds to this problem with a philosophical analysis of the tense in the following way. On the one hand, as to the past and the present, he determines the truth-value in the ordinary way described above, on the other hand, in the case of the future, being indeterminable beforehand, he proposes to coordinate the correspondence by means of a syntactical modification of a tensed sentence. What enables him to do
such a modification is the concept of modality (necessary/contingent/possibility). His strategy is to transform a future sentence into a modal sentence, in other words, he exchanges the tense system for the modal one.

### 3.4 Syntax of Modal Sentence

Aristotle’s strategy seems to be a mere stopgap. However, his philosophical insight shows itself behind such a syntactical modification. The modality introduced here leads to a pair of the fundamental concepts of his metaphysics, that is, actuality (energeia/entelecheia) and possibility (dynamis). An attempt to elucidate his metaphysical development in detail should be another long story. In this paper, I confine myself to making a sketchy outline of it.

What Aristotle has in mind as a basic structure of (tenseless) world is motion (or change). The main aim of physics in an Aristotelian sense is to explore the nature of physical motion and its necessary conditions. The principal structure of motion is, according to him, described as “from something to something,” for example, from the situation that $m$ is $G$ ($\sim F$) at $t_1$ to the situation that $m$ is $F$ at $t_2$ ($t_1$ is earlier than $t_2$), in other words, as to the truth-value of the sentence that $m$ is $G$ ($\sim F$), from true to false. By connecting this descriptive formula with Aristotle’s famous and knotty definition of motion, the actuality-qua-potentially-being of that which potentially is [9(58)], we acquire a modal description of tenseless world in the following way. A future tensed sentence, for example, “$m$ is now $G$ ($\sim F$), but $m$ will be $F$,” can be modified to a modal sentence: a thing $m$, which was $G$ ($\sim F$), but has a possibility to be $F$, is now in the process of the actuality of the possibility. The modal sentence does not have future tense anymore, though it has past or present tense.

Consequently, a future sentence can have a truth-value as long as it is transformed into a modal sentence describing a motion. Aristotle’s strategy is to transform a future sentence to a modal sentence concerning a physical motion: $m$ changes from $G$ ($\sim F$) to $F$. While this strategy may be convenient for inquiries into physical world, it seems to us to be an over-simplification of a future sentence used in everyday language. For there is no legitimate reason why we are obliged to use a future sentence only for a description (or a prediction) of physical world.

However, what we should not overlook here is the following crucial point. The principal program in De Interpretatione has two phases, one of which is that Aristotle presents the future as undetermined or unfixt and, therefore, needs to set up the criterion of truth-value of a future sentence, the other of which is that he interprets a modal sentence as appropriate for description of a physical motion. There is a gap between these two phases. The former is mainly introduced by the common-sense or intuitive idea that our action in the future, which is one of physical facts too, is supposed to be undetermined and, if determined beforehand, we would lose the role of deliberation or free will. On the other hand, the latter is supported by the physicalism that physical world can be explained or described by means of causal laws. We can contrast the two phases by saying that, in principle, the world of the former is practically contingent and that of the latter is physically necessary.

Regardless of this gap, Aristotle here seems to give priority to the latter without explanation, in other words, to eliminate the phase of the former. The existence of the gap and the elimination of the one side are essentially similar to Shannon’s strategy. The explication of the internal relation between language and world only by physicalism is a methodological selection by Aristotle. We will follow his program of ST for the present, keeping in mind that we are still on the way. I should here write one point in addition. It is certainly possible that physical world itself is contingent or indeterminate. But, as seen later in Section 5, according to Aristotle, the contrast between necessity and contingency is ontologically rooted to that between physical (or natural) world and practical world.

### 3.5 Syntax of Reasoning

If we attempt to make clear the relation between language and (physical) world in further detail, we shall proceed to the descriptive level of physical laws. The elucidation of physical world is, in a sense, equivalent with the discovery of physical laws. This means that we are going to move from an analysis of a tensed sentence to that of a causal sentence. According to Aristotle, a causal sentence, for example, “$F$ is $H$ because of $G$,” is analyzed by a form of reasoning, that is, a combination of sentences, which is called syllogism or demonstration.

| major premise | All $G$ are $H$ ($H$ is predicated of all $G$) |
| minor premise | All $F$ are $G$ ($G$ is predicated of all $F$) |
| conclusion | All $F$ are $H$ ($F$ is predicated of all $H$) |

An analysis of a causal sentence by Aristotle indicates that a scientific inquiry into a physical cause is to find out a middle term $G$ in the syllogism above, by means of which why $F$ is $H$ can be explained. The structure or syntax of a causal sentence is reflected in the structure of syllogism or demonstration. However, as said before, since physical facts are tenseless and are transformed by the concept of modality, the logical structure of causal demonstration should be too described by a modal syllogism, for example, as below. “$\Box$” here stands for a modal operator of ‘necessarily.’ (The form of syllogism in the left type is called de dicto interpretation, and that in the right type de re interpretation. Unfortunately, neither of the interpretations can explain the whole system of Aristotelian modal logic consistently [13, 14]. This defect is, however, irrelevant to the purpose of this paper.)
Consequently, the schema of ST will be as below (Fig. 3). This strategic arrangement by Aristotle can be called modal logical suitability, compared with mathematical suitability in the Shannon’s paper.

4. Semantic Triangle and Mind

4.1 Tense and Mind

In the above sections, we have estimated the relation between language and world to be that between modal syllogism and causal reality. However, we have been putting aside one apex of ST, namely, mind (affections in the soul). This is not an appropriate approach in terms of Aristotle’s ST. For, since the relation between language and world is supposed to be essentially indirect or non-causal, we need a bridge through which we can move from language to world and vice versa. The apex of mind is in a sense a relay station for the transference. In other words, using a traditional title of an Aristotle’s treatise (De Interpretatione), it can be called an interpreter. Now let us take a direction toward the mind. Aristotle’s research program in Corpus Aristotelicum proceeds from physics to psychology. What we should hold forth to the mind is the tense system in the apex of language. As the arguments above show, according to Aristotle, mind has the function of understanding tensed/modal sentence and reasoning. The question will then be: Which functions in the mind correspond to the tense/modal system in the language? Aristotle’s answer to that is again not out of the common at all. His basic idea is in that the cognitive functions of mind (memory/sensation/prediction[or expectation]) correspond to the phases of tense system (past/present/future), namely, memory to the past, sensation to the present, and prediction to the future [18(47)]. Needless to say, it is not an easy task to investigate how to confirm the correspondence experimentally or other. Following Aristotle, however, once the past and the future can be set up in the same way as the present, we can apply the criterion of truth-value, namely, combination and separation, to the past and the future. Aristotle says in a concise manner as follows (De Anima III-6, 430a).

Where there is both falsity and truth, there is already a combination of thoughts as forming a unity. (.....) and if the thinking is concerned with things that have been or will be, then time is thought of in addition and combined in the thought. For falsity always depends upon a combination. (.....) But at any rate, it is not only that Cleon [a person’s name] is white that is false or true but also that he was or will be. And that which produces a unity is in each case the intellect [7(60-1)].

It is necessary for us to trace the route via which Aristotle is going to arrive at the concept of tense or time. To do that, we should turn to the most fundamental checkpoint, that is, his theory of sensation and common sense.

4.2 Sensation and Common Sense

According to Aristotle, each of five senses has a sensible object proper to itself (Table 1). For instance, color is a sensible object proper to sight, and its sense organ is an eye. Sense organs except eyes cannot perceive a color (I use here sensation and perception interchangeably). What Aristotle proposes is, in a sense, that, as a maxim goes, there is a big difference between hearing and actually seeing. Concerning a sensible object proper to each of five senses, it is impossible for a sense organ to go beyond its commission and to have an interconnection to each other. On the other hand, for example, motion is a sensible object to all the five senses. Such sensations the objects of which are motion, magnitude, shape, and so on, are called common sense (koine aisthesis, sensus communis). Aristotle’s common sense should be distinguished from synesthesia in modern psychology, though not irrelevant. (Note that Table 1 is not definite but provisional. We make only a brief and tentative analysis of it.)
In addition, Aristotle offers the following principal idea: the five senses can be divided into two types, one of which is touch-type, the other non-touch-type. While the former are smell, taste, and touch, and their basic function is for the sake of existence (survival), the latter are sight and hearing, and for the sake of well-being (living well). Regardless of these distinctions, Aristotle presents a reductionist idea that the touch among the five senses functions as basic. He says that it is not possible for any other sense to exist without touch (De Anima III-12). Furthermore, Aristotle proposes, as to the common senses too, a kind of reductionism in the following way (ibid. III-1, 425a).

Nor, again, can there be any special sense-organ for the common sensibles, which we perceive incidentally by every sense; for example, motion, rest, figure [shape], magnitude, number, unity. For all of these we perceive by motion. Thus it is by motion that we perceive magnitude, and consequently figure, figure being one variety of magnitude; while that which is at rest we perceive by the fact that it is not moved. Number we perceive by the negation of continuity and by the special sense-organs also; for each sensation has a single object [8(111)].

What Aristotle argues is that all the objects of common senses can be reduced to the sense of motion. Let us take the sense of shape as an example. In touching a thing, we cannot perceive its shape without perceiving the magnitude at the same time, and the sense of magnitude is produced by the sense of motion, e.g. motion of fingers or hands. In the same way, though the interpretation here is tentative, the number (e.g. how many triangles are there?) is perceived by means of the negation of the unity, which indicates here a certain size of continuum (e.g. a triangle) and is reduced to the shape. Therefore, at least, the objects of common sense picked up here by Aristotle are all reduced to the perception of motion. Furthermore, Aristotle makes a supplementary explanation of why we have several senses from the viewpoint of common sense (ibid. III-1, 425b).

But, it might be asked, why have we several senses [for the common sensibles], instead of only one? I answer, it is in order that we may not be so likely to overlook the common attributes, such as motion, magnitude, number, which accompany the special sensibles. For, if sight had been our only sense and whiteness its object, we should have been more apt to overlook the common sensibles and to confuse all sensibles, because colour and magnitude, for instance, must always go together [8(113)].

### 4.3 Tense Cognition as Human Function

Touch is a basic or primitive sensation for sense organs and motion is for common senses. The reason why Aristotle focuses attention to these two sensations can be explained by his hierarchical insight on the natural beings that have life (psyche called by Aristotle). The hierarchy has, though simple and biased, the following three stages, plants/animals/human beings. According to Aristotle, the primitive function of the first psyche is the capacity of nutrition (including motions caused by nutrition, i.e. growth and decay), and the second psyche has, in addition to nutrition, the capacity both of motion (locomotion in place) and of sensation (ibid. II-2). The next question will then be: What is the primitive function of the third psyche by virtue of which human beings can be distinguished from plants and animals? The answer to the question is action, which is caused by desire with thinking and reasoning and is described on the basis of the perspective of tense or time. See the following paragraphs in which Aristotle connects action with time, especially future.

In the soul, the things determining action and truth are three: perception, intelligence, and desire. But of these, perception is not an originator of any sort of action; this is clear from the fact that brute animals have perception but do not share in action. What affirmation and denial are in case of thought, pursuit and avoidance are with desire; so that, since excellence of character is a disposition issuing in decision, and decision is a desire informed by deliberation, in consequence both what issues from reason must be true and the desire must be correct for the decision to be a good one, and reason must assert and desire pursue the same things (Nicomachean Ethics VI-2, 1139a) [3(177)].

Now desires arise which are contrary to one another, and this occurs whenever reason and the appetites are opposed, that is, in those animals which have a perception of time. For intelligence bids us resist because of the future, while appetite has regard only to the immediate present; for the pleasure of the moment appears absolutely pleasurable and absolutely good because we do not see the future (De Anima III-10, 433b) [8(153)].

But at other times under the influence of the images or thoughts in the soul [mind] you calculate as though you had the objects before your eyes and deliberate about the future in the light of the present. And when you
pronounce, just as there in sensation you affirm the pleasant or the painful, here in thought you pursue or avoid: and so in action generally (ibid, III-10, 431b) [8(143)].

The capacity of time cognition or that of understanding the tense system mentioned here indicates that time and tense in the case of human beings should have not only the present and the past but also the future. Without the cognitive function as to the future tense, we cannot draw a strict distinction between human beings and other animals, since some of animals also have memory, therefore, a sense of the past. We have arrived at the point where the problem transferred from the apex of language leads to the fundamental theme in mind. The language of ST actually refers to human language. The humanity in this case is most appropriately reflected in the cognitive functions of tense system. Consequently, according to Aristotle, the core of the human language is nothing but the tense system including the future. Thus, we can find out the route from (human) language and (human) mind. What remains is to settle the route from mind to world.

Before moving to the next step, it is useful to reconfirm an important point as to the transference between the apexes in ST. In the case of transference from language to world, as shown above, it is realized by the modification of a tensed sentence to a modal one. The world in that case is a physical world and the fundamental characteristics of physical entities is to have a capacity or power of motion. In the same way, in the case of transference from language to mind, the basic function of mind is to have a capacity or power of memory/perception/prediction. Summing up, in each case of the transference, Aristotle turns his attention to the concept of capacity (or power).

At the same time, we should not pass over the following definite difference. We can rephrase the relation between language and mind into that between human language and human mind on the basis of past/present/future. But the relation between language and world has been constructed as that between human language and physical motion. Therefore, in throwing light on the relation between (human) mind and (physical) world, in other words, between psychology and physics, we should take this difference or gap into consideration. Where should we go in Corpus Aristotelicum in order to find a lead for it? It is in the theory of time in physics that Aristotle provides us a crucial clue to this problem.

### 4.4 Physical Time and Mind

Aristotle’s definition of time (Physics IV-10, 219b) is: a number of motion in respect of the before and after. I have to put aside the problem of interpretations on how Aristotle deduces this definition. I will concentrate on the following two questions in brief. First (1), what is the central point of this definition? Secondly (2), how is the relation between time and mind?

1. The answer to the first question is simply that time is defined as a measure of quantity of motion. What Aristotle points to is a time measured by a stopwatch, a clock, etc., for example, when asked, how many hours have you been working in the office today? What matters is that the definition of time in Aristotle’s physics seems to ignore or eliminate the tense system (past/present/future). By borrowing familiar terms in the philosophy of time, this point can be more emphasized in the following way: the time in physics is B-series (before/after) and the time in psychology is A-series (past/present/future).

2. The second question is triggered by the definition of time. From the definition one can argue that, if time is a number, time cannot exist without mind (intellect) having a capacity to count. Aristotle says as follows.

   One might find it a difficult question, whether if there were no soul there would be time or not. For if it is impossible that there should be something to do the counting, it is also impossible that anything should be countable, so that it is clear that there would be no number either, for number is either that which has been counted or that which can be. But if there is nothing that has it in its nature to count except soul, and of soul [the part which is] intellect, then it is impossible that there should be time if there is no soul, except that there could be that X which time is, whatever X makes it what it is; as for example if it is possible for there to be change without soul. The before and after are in change, ant time is these qua countable (ibid. IV-13, 223a) [9(52)].

   The answer by Aristotle seems to be as simple as the first: even if the mind does not exist, the substratum of time, i.e. motion, can exist actually or objectively. For time as a number of motion is ontologically only an aspect or a property of motion. What Aristotle means here is that, even if the mind does not exist, the substratum of time exists (from the viewpoint of physical realism) and, therefore, it is possible that time exists as a countable (not actually counted) number of motion. (Note that, as seen below, the understanding of time here still remains within the physical level and do not aim only at indicating that time is mind-dependent or subjective. cf. [6(159-60)]).

   In summary, by the first answer, Aristotle excludes time as past/present/future from the field of physics and, by the second, he argues that it is sufficient for physicists to set up time as a countable number of motion, which assures that time as before/after has a possibility of existence without human mind. What Aristotle provides as a theory of time in physics is consistent with the fundamental program of ST. For physical world is supposed to be tenseless in principle. In addition, Aristotle’s psychology also supports this program, though partially. For, since time is defined as a number of motion and, as shown before, both motion and number belong to common sense, time can be counted as common sense on the one hand and can be reduced to motion in the same way like other common senses on the other hand. Thus, the concept of time as a number of motion seems to be consistent with the psychological theory of common sense.
Nevertheless, the more consistent the relation between mind and world becomes in this respect, the more crucial the elimination of time as past/present/future seems to be for the Aristotelian hierarchy above. For it was exactly the human time, i.e. the time as past/present/future that adequately reflects the tense system of human language, and the human time is the criterion by means of which Aristotle distinguishes human beings from other animals. In brief, human mind is *tensed mind* and animal mind is *tenseless mind* in the sense that animals do not have the future. If so, we cannot transfer directly from mind (psychology) to world (physics), in spite of the fact that Aristotle in *De Interpretatione* pronounces that there exists a kind of *likeness* between mind and world. We should dissolve this discrepancy.

5. Human Time and Human Action

As said before, the gap between a tensed sentence and a tenseless motion in physical world has been filled by the concept of *modality*. How about the gap between mind and world? We need to build a bridge across this gap, in other words, we need to find out in the apex of world an entity to which the human time properly (or by nature) corresponds. What is the entity? From the foregoing arguments over the Aristotelian program of ST, we can conjecture that it is *action*. Aristotle has hitherto put it aside by design in order to give priority to physical motions, regardless of the fact that the concept of action plays an important role in introducing the concept of modality (see Section 3.4). But, as suggested in Section 4.3, the cognitive function of human time is in principle for human action as far as the Aristotelian hierarchy is concerned. Without the intellectual capacity (deliberation, decision, etc.) on the basis of human time, we could not control and understand our action effectively and the meaning of action would disappear. Aristotle says in the ethical treatise (*Nicomachean Ethics* III-2, 1111b) as follows.

Decision, then, is clearly something voluntary, but is not the same thing as the voluntary, for the voluntary is a wider type: the voluntary is shared in by children and the other animals, whereas decision is not, and things done on the spur of the moment we say are voluntary, but not done from decision [3(126)].

In addition, we should notice that Aristotle explains the distinction between *physical* and *human* by means of the concept of modality. He insists that the distinction between *theoretical* and *practical* is equivalent with that between *necessary* and *contingent* (ibid. VI-1, 1139a).

Previously we said that there were two parts of the soul, the one that possesses reason [*logos*], and the other non-rational; now with the part that possesses reason we must in the same way make a division. Let us assume the parts possessing reason to be two, one by virtue of which we reflect upon the sorts of things whose principles cannot be otherwise, one by virtue of which we reflect upon things that can be otherwise; for with things that are generically distinct, the part of the soul that stands in a natural relationship to each genus will itself be generically distinct, given that they have cognition in accordance with a certain likeness and affinity to their objects [3(177)].

Things in the world can be generically divided into two types, one of which ‘cannot be otherwise,’ namely, *necessary*, the other of which ‘can be otherwise,’ namely, *contingent*. Consequently, the two-layer structure of the Aristotelian ontology can make the systematic program of ST fully consistent from the viewpoint of the modal concept. In order to understand the physical world systematically, Aristotle has introduced modal (theoretical) syllogism (Section 3.5). In the same way, he proposes practical syllogism (or practical reasoning) for the practical world. Following Aristotle (ibid. VII-3, 1147a), let us take a simple example as below.

| major premise (appetite/belief) | Every thing sweet should be tasted. |
| minor premise (particular situations) | This (some particular item) is sweet. |
| conclusion (action) | I taste this. |

When we act with deliberation in an Aristotelian sense, that is to say, when we perform practical syllogism for action, we cannot exclude particular situations which are given as a minor premise. This condition or characteristic in a practical syllogism makes human action an entity done only once in a particular situation at particular time and also, in this sense, gives it the modality of contingency in one’s historical lifetime. The particular situations are for us nothing but a bundle of information which comes from external world or environment in our doing action. If we ignored or eliminated the attribute essentially relevant to semantic aspect of human action, though Shannon did so, we would lose the meaning of human time at the same time. (Note, however, that we should not forget the indispensable role of major [universal] premise of practical syllogism, which is connected with our intellectual function on the other hand.)

In the end of this section, I would like to add one remark on what Aristotle consistently intends through the strategy of ST. As Fig. 4 below indicates, the crucial point in his ST consists in that the apexes of ST, i.e. language/mind/world, should not and could not be mutilated at the ontological level. The ontological level here means the mutual interaction between the route from world via mind to language and its converse in our action in a particular situation. The interaction should not be reduced to a simple mechanism of input/output. The schema indicated by Fig. 4 offers us a suggestive hint as to the philosophical problem of so-called mind-body dualism or Cartesian dualism (Aristotle refers to the body in action as ‘instrumental parts’ [arms, legs, etc.] *ibid.* III-1, 1110a16). What Aristotle suggests is that the
mind-body problem comes up when we focus attention only on the theoretical aspect in ST. If we are to make a precise analysis of how we exist in the world, that is to say, how we not only see the world but also act in the world — since we cannot in principle exist without doing an action in a way — the separation between mind and body will make us misunderstand the ontological status of our existence. In this sense, the mind-body problem is a pseudo-problem.

6. Temporary Conclusion

Human beings are called mortals by ancient Greek thinkers including Aristotle. Human time is a time of mortals. It has an irreversible direction toward death. This seems to be a severe and nature-bound limitation on human life. In spite of the human condition, however, mortals are fated to make an assessment of the value of information not only for the sake of their survival but also for the sake of their well-being. As shown in Section 4.2 above, Aristotle refers to the fundamental dimensions of the value of information in terms of the structural difference of perceptual functions (touch or non-touch type of sensation). This is, needless to say, what resonates with the Socratic way of life: the really most important thing is not to live but to live well.

The opportunity of reminding us of such a difference cannot be lost as long as we intuitively feel the gap indicated by Shannon’s strategy. In a supreme sense, the feeling is rooted exactly in the human nature that we could not and should not eliminate from ourselves. The intuitive feeling of the gap is nothing less than the evidence that we, as beings in the perspective of human time, are surely striving to live in search of the meaning of life that can be said to vertically transcend the horizontal or Shannonian perspective, the meaning and value of which is usually estimated and calculated only for the sake of survival or extravagance.

Notes

(1) On the elimination of meaning by Shannon, see also Weaver’s apology in [16(8–9)] and Capurro’s persuasive comments in [4(105–110)].

(2) The aim of this paper is not to attempt to expound Aristotle’s texts, but to pick up some useful suggestions from Aristotle so that we may reconsider the philosophical insights involved in his semantic triangle. Therefore, I use English translations by some scholars without any modification.

(3) It is useful to compare Aristotle’s idea with the insights of Wittgenstein’s Tractatus Logico-Philosophicus [22].

REFERENCES

Some Remarks on the Value of Information from the Viewpoint of Aristotelian Semantic Triangle