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LOGIC AND THE DIFFERENT FORMS OF THINKING

We shall consider the formal systems when we use the expression 'logic as a science'. Logic as a formal system means a certain form of thought. Obviously, logic as a formal system must have a connection with other forms of thought as well. Our purpose is to lay down the foundations of the connection between logic and various forms of thinking. Let us first briefly reflect on what 'logical thinking' is.

A formal system consists of a symbolic language and rules indicating how these symbols should be used, i.e. an axiomatical system. Thus logic as a formal system is a type of thinking which is characterized as being both axiomatic and symblic. Keeping in mind the fact that logic also supplies the operation rules of thought and knowledge, one has to admit that the formal system displays this operation as a symbolic-axiomatic structure.

But one has to consider at this very step that there are indeed various systems of logic. That is to say, n-valued logic, modal logic, temporal logic and others are all symbolic systems. In fact the property common to all of them is that of being axiomatical. So even if it is asserted that different symbolic systems represent different forms of thinking, what is common to all of them is their being axiomatic. And at this point we find ourselves back in the beginning. That is to say, logic as a formal-axiomatic system emerges as a sui generis form of thinking.

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The relation between different formal systems; the foundations of logic as a formal system; its relation with language and physical objects; its degree of independene from these and whether it is the product of mind are all subject matters of the Philosophy of Logic. Such problems will be neglected in this text.

Now what remains finaly is the problem of the relationship between logic and other forms of thinking. This problem may be considered with regard to various perspectives. Our purpose is not the description of these perspectives either. Our purpose it to look for a common property concerning different forms of thinking thereby establishing a theoretical explanation concerning their relation to logic. That is to say, our purpose is to determine the manner wherein different forms of thinking with respect to a formal-exiomatic perspective, i.e logically examined.

We shall consider scientific, practical, utilitarian, intuitive, creative, deductive, inductive, dialectical, and literary thinking, etc. within the confines of the expression different forms of thinking !

Even if characterized by means of different concepts, there appears a common connection whatsoever among various forms of thinking. Indeed, creative thought, intuitive thought, and practical thought may coexist in scientific thought. Obviously, this coexistence does not imply that a particular form of thought is in relation with other forms of thought. Over and above this, the relation between literary thought and inductive thought may be wholly different than that between scientific thought and inductive thought. Thus one can point to the difficulty of finding a common property between logic and various forms of thinking. Besides, it is clear that even a certain form of thinking may require a multi-directional inspection. For instance, creative thought is in relation with neurology, genetics (heredity), psychology, sociology, etc. Thus, examining different forms of thinking from the standpoint of logic implies a rather limited look at this problem.

After these eplanations, our problem may be determined as follows : Is it at all possible to examine various forms of thinking from a logical point of view? If possible, how can it be realized ?

It is possible to agree on one of the properties of various types of knowledge which are products of thought (revelation, inspiration are excluded). The property is the *progress* and the *learneability* of knowledge. The progress of

knowledge means the establishment of new knowledge. The learnability of knowledge on the other hand, means the apprehending conceiving, and transfering of existing knowledge. Various forms of thinking are used in both cases. For example, during the course of learning a mathematical theorem or of proving a new one, scientific thinking, induction, deduction and other forms of thought besides intution are necessary. Thus we are always faced with various forms of thinking when maintaining the progress and the learnability, that is, the continuity of knowledge.

The relation of various forms of thinking to the continuity of knowledge may be considered within the confines of "*dialectics*" (Ural 1992). For the concept "dialectics' may appear within every domain in which the continuity of knowldege is mentioned. That is to say, one can place "dialectical thought" at the focal point of various forms of thinking, thereby establishing a relation between dialectical thought and other forms of thought. The construction of such a relation does not mean a reduction of various forms of thinking to dialectical thought. Still it is possible, to describe by means of the concept "dialectics", the process of producing new knowledge and that of learning, with the participation of different forms of thinking.

This is probably due to the fact that we live in an environment consisting of quite different objects, physical or mental. The process of producing knowledge, i.e *conceptualization* or judging is the very same thing as expressing the common properties of different objects. Now, the process of conceptualization and judging in any context whatsoeer, pass through different stages like thesis, anti-thesis and synthesis, as will be tried to be snown in the proceeding paragraphs. Within this process, as will yet be shown below, there exist diferent forms of thinking. Therefore one can assert that dialectical thought while being in a certain relation to various forms of thinking, can also describe the continuity of knowledge.

The concept "dialectics", have throughout history been defined in various ways, being tried to be explained by means of different ontological and epistemological views. One property of this concept which remained without appeal to change is its three stage structure which consists of thesis, anti-thesis and synthesis. This stage can be observed at every instance of establishing a new concept or judgement. For it is possible to characterize every new concept or judgement, as a synthesis. That is to say, the thesis-anti thesis stage is a matter of course prior to every new concept and judgement.

One of the fundamental properties of every concept or judgement is that of referring to different objects having common properties. For example, the concept "pencil" in the statement 'This pencil is green', is the expression of objects having the property of writing in common, but which differ in size, colour, structure, weight, length etc.The very same situation holds, for example, for the concept "green". For this concept articulates the difference in tone of colour, objects coloured with these various tones, and at he same time the property of being different from other colours. It is an obvious fact that not only concepts but judgements as well, articulate a common property which separates an object from various other objects. Now these properties when judging or conceptualizing, implies basically the existence of thesis and anti-thesis stages. The existence of thesis and anti-thesis stages enable us to construe both concepts and judgements as a synthesis which states the common properties of elements with contrasting properties.

Another consideration which states that concepts and judgements having synthesis as a basic property, express not only the common but the contrasting properties of the objects that they refer to. For in order to make a judgement, be it universal (All... s, are ...) or particular (Some ... s, are ...) ; that is, in order to attribute a property to an object, not only objects that a specific property is attributed but various other objects as well are taken into account. For instance, not merely the thorny ones of a particular kind of plant, but those which look like roses and whether or not the very roses are thorny must be investigated in order to judge that 'all roses are thorny". That is to say, various judgements that are the anti-theses of the judgement which is being tried to be accomplished, must be taken into account.

A similar situation holds for the process of conceptualization. For a concept articulates both a similarity and a dissimilarity between objects of a certain kind. Thus various kinds of objects which are used for writing is apprehended when the word "pencil" is uttered. This property distinguishes it from other objects as well. For not every object, for exampel a type writer, which is used for writing, is a pencil. Thus a concept while being used to establish the common propreties of different objects, states also the difference between objects which, due to some of their properties, look similar. In just the same way, a glass expresses the common properties of various objects which are used for drinking. But not every object which is used for drinking is a glass. Every triangle is a geometrical figure ; but not every geometrical figure is a triangle. Hence the appearing of different objects within the confines of a concept due to their common properties implies not just an agreement but also a

disagreement between these objects and various other concepts. For an object is both a pencil and a piece of wood at the same time ; a glass may at the same time appear within the confines of the concept "material" ; the concept "triangle" while articulating certain geometrical figures other than rectangle, appear nevertheless within the confines of the concept "side" or "line". In that case, not only the similarities but also the dissimilarities, that is theses and anti-theses must be considered during the process of conceptualization or judgement. In just the same way, the theses and anti-theses which determine the meaning, for example of the concept "pencil" are statements like 'some pieces of wood are not pencils" and 'some pieces of wood are pencils' ; 'some objects which are used for writing are pencils' and 'some objects which are used for writing are not pencils'; 'some objects which are made of metal are pencils' and 'some objects which are made of metal are not pencils' etc.

Consequently, the process of putting forward a new concept includes the stages of thesis and anti-thesis. For within this process not only different objects (for example various pencils) but properties which distinguish these different objects from the others as well (for example, a pencil from a piece of wood or a typerwriter) are considered.

No doubt, a dialectical process cannot be mentioned when using a familiar concept or when making a judgement for the sake of mere information. For the investigation or even the consideration of theses and anti-theses in such a process is not a matter of course.

The result as reached above does not intend to consider the whole process only as a dialectical operation. Thus the transition from a concept or a judgement, i.e a thesis, to an anti-thesis or even the establishing of a synthesis, requires for example, intuitive thinking, experiences, analogies, beliefs concerning nature, and our practical needs. In fact, the investigation of the truth of a judgement is firstly a matter of experiment and observation. For the verification of, for example, the proposition 'some pencils are made of wood' is possible by observing a few wooden pencils. But before the accomplishment of such a judgement (or a concept) ; the conditions of validity and the limits of the judgement (or the concept) ; their confinements; and various alternatives must be investigated. It is precisely at this point that *the validity of the initial thesis* depends on the determination of its anti-theses and the investigation of their truth. That is to say, this process is completely dialectical in nature. In such a process, one can also emphasize the role of analogy as well. Because when looking for new examples for judgements in the form of theses and anti theses,

various resemblances (i.e, analogies) may have a heuristic importance. Obviously, our practical knowledge, and sometimes aesthetical values can also take part in the aforementioned process.

Just as we have to consider other forms of thinking when talking about dialectical thought, dialectical thought must be taken into account whereupon talking about, say, induction.Thus in reaching, by means of particular tokens to a generalization, i.e induction, not merely certain objects, but tokens of a type exhibit different properties, alternative situations, shortly anti-theses of the theses, are obviously investigated. Hence dialectical thought together with induction emerges.

The explanations given above render possible an interpretation of every new concept and judgement as a synthesis. For it is by means of considering various alternatives, contrary, or contradictory properties, i.e. investigating the theses and anti-theses, that every new concept or judgement is reached. The dialectical process which is at work here does obviously not explain the whole operation of conceptualizing and judging. For in this process, other forms of thought must also be mentioned. But what is important here is that, dialectical process, as has been emphasized before does by no means prevent the participation of different forms of thought. That is to say, it is possible to consider, within the concept of "dialectical thought", other forms of thought as well.

Conceiving dialectical thought together with other forms of thinking shows also that the operation of reaching a synthesis is not realized mechanically. For synthesis is in the form of a method which is used together with our intuitions or habits or abstraction or yet other factors and which leads the way to a new classification, a new theory, an assumption or any generalization. Therefore dialectical thought can be characterized at the same time as a heuristic method.

Conceiving dialectical thought as a heuristic method alludes at the same time to its referring to a process. For dialectics, also represents the continuous changing of our knowledge. This process consists of a pre-established synthesis acting now as a thesis in order to establish a different synthesis with the aid of an anti-thesis.

The above mentioned process, that is to say, looking for the anti-thesis of a synthesis later conceived of as a thesis in order to establish a new synthesis

(shortly, D_1) can be distinguished from another proess (D2) which may be considered as the investigation of a synthesis obtained from the existing thesis and antithesis, hence rendering possible two different approaches to dialectics.The theis and anti-thesis in the latter case are pre-established and so a reconciliation of the two and the search for a synthesis by means of various factors is a matter of course. For example, the dual character of light appearing both as a particle and a wave, arises as thesis and anti-thesis and this fact leads us to look for a synthesis, that is to say a reconciliation of them. The emergence of an event or an object which may be considered as an anti-thesis takes place sometimes by chance, sometimes by attracting the attention of someone for the first time, spontaneuously or in any other manner. In such circumstances we are faced with two judgements already existing and which may be construed as the thesis and the anti-thesis of each other and which must be reconciled as a synthesis. The process (D2) here must be considered apart from the other. For D1 consists of logically or rather deductively establishing a thesis from a synthesis and the search for its anti-thesis. Although determining a precise border between D1 and D2 thereby, considering the one independently of the other may not always be possible, dialectical thought shall inevitably be examined within two different processes in order to exhibit the above mentioned properties and those which will be reconsidered again below.

K. R. Popper, holds the view that the solution of scientific problems are attainable through a method of trial-error wherefore the process expressed by the trilogy synthesis-thesis-antithesis is a means for the solution of the aforementioned problems (Popper 1974, s. 105). Scientific activity, according to Popper begins with a problem (P1). A tentative theory (TT) is then proposed for the solution of this problem which is in the form of a synthesis. At a later stage, a new anti-thesis which has been criticized is looked for, for the elimination of the errors (EE). A new synthesis, that is to say, a new problem (P2) arises consequently, as has been seen during the dialectical process. Popper had formulated this process schematically as follows.

$$P1 \rightarrow TT \rightarrow EE \rightarrow P2$$

In view of Popper's conception of dialectics, anti-thesis means the refutation or negation of thesis. For thesis is the testing of a theory, a problem i.e, synthesis ; whereas anti-thesis is the operation of establishing for the same synthesis the invalid, incomplete conditions.This operation, from Popper's point of view is at the same time a criterion for science (Ural 1981, pp. 77 ; Ural 1985, foreword). This means that if synthesis is in the form of a scientific

theory, it must also bring with it the property of being proved false. Thus the judgements which have been envisaged by the theory and which verify the theory may be conceived as theses; the judgements which have been envisaged by the theory and which probably falsify the theory are anti-theses. That is to say, Popper construes scientific development as a dialectical process. It is possible to construe the relationship between a scientific theory (synthesis) and the event (thesis) it envisages as the transition from a universal to a particular proposition, as a deductive inference. Therefore, as has been mentioned in the beginning, a certain relation can be instituted between dialectical and logical thinking. And the anti-thesis will be in the form of judgements which are the negation of the thesis and which are also envisaged by the very same theory. The general relativity for instance, envisages that the speed of light cannot be exceeded. Asserting whereon such a generalization that no matter how much energy is given, the pencil in my hand cannot exceed the speed of light is the same thing as an thesis accomplished by means of a synthesis in a deductive, that is to say a logical pattern. The exceeding of the speed of light by any object whatsoever, happens to be a result in the form of an anti-thesis that refutes the theory. These relationships can symbolically be formulated as follows: If T is a theory, the judgements a1, a2, ..., an which have been obtained by means of logical thinking from the theory are characterized as theses. The relation between them can be shown as

$$a1, a2, \ldots, an \notin T$$

The anti-theses, on the other hand, are considered as judgements which are in opposition or in contradiction to the theses and which may be symbolized as $\bar{a}1$, $\bar{a}2, \ldots, \bar{a}n$. That is to say, these judgements are not the elements of the first theory. Thus

$$\bar{a}1, \bar{a}2, \ldots, \bar{a}n \in T$$

will hold anti-theses, in case they are verified, will either broaden or narrow the theory by means of modification or will help reach a new theory, hence being placed in company with new elements, in, for example, a theory K. The emergence of theory K may be possible in certain circumstances by means of $\bar{a}$'s negating a. But in certain other circumstances both a and $\bar{a}$ may appear in the same theory. This situation, may at first sight seem to be surprising. Though it is possible to consider for example "bulu colours" and "non blue colours" within the confines of the concept "colour". Thus some concepts or judgements, even if logically in opposition or in contradiction to each other, may be thought of as thesis and anti-thesis within a generalization, i.e, synthesis.

However, the above mentioned opinions of Popper (on the transition from synthesis to thesis and anti-thesis as the negation of thesis) is insufficient for the explanation of the operation of the dialectical process (D1). For the anti-thesis may not always arise as the negation of the thesis, but may rather emerge independently. In that case, anti-thesis, not being in the form of a result that has been reached by means of a1, a2,..., an, may rather be conceived of as b1, b2,..., bn. Indeed, it is not a consequence of Newton's theory that an electron's movement in its orbit is not in accordance with the Newtonian laws. This result brings with it a new conception (hence a new synthesis as wel) on Newton's theory, (i.e, as the synthesis).

Obviously,the manifestation of anti-thesis in the form of b1, b2,..., bn, independently from thesis and whereupon a synthesis, cannot be described as being a dialectical process. Still, at the next step we are faced with the properties of dialectical thought (D2). Because according to a theory T, there happens to be two judgements which are incompatible and which are in the relation of being thesis and anti-thesis of each other. As a matter of course, the existing theory (i.e, synthesis) will be subject to a closer scrutinization or a new theory (i.e, a synthesis) will be constructed. That is, the wish for the achievement of a synthesis by means of an existing opposition or a contradiction are the steps envisaged by dialectical thought.

If we take a glance at the logical structure of dialectical thought in the light of the above given explanation, the interpretation of D1 as being a deductive inference seems to be possible. For the thesis is in the form of consequences which are directly related to the synthesis and which can be obtained deductively, whereas the anti-thesis, being its negation, can be obtained from the synthesis, though indirectly.

But the deduction in D2 operates almost in a reverse manner. It is true that synthesis, as has been pointed out above is characterized as a creative operation in which several factors play a role. But still, when the synthesis has once been reached, the thesis and the anti-thesis will deductively be obtainable from the synthesis. In such a case, that is, when a new synthesis is accomplished, the anti-thesis may be conceived of as being a thesis. Using the above notation, a new theory M once asserted for

$$a1, a2, \ldots, an \in T$$

and for

$$b1,b2,\ldots, bn \notin T$$

includes the thesis and the anti-thesis as its elements. Thus, it will be the case that

$$a1,b1,a2,b2,\ldots, an,bn \in M$$

Naturally, it will be possible to obtain from this new theory, deductively, the anti-thesis (for example, $\bar{a}1$, $\bar{b}1$, $\bar{a}2$, $\bar{b}2$,..., $\bar{a}n$, $\bar{b}n$] which can falsify it.

From all that has so far been laid down, the following consequences follow. That is to say, the knowledge-producing operation may be characterized as a dialectical procedure. The concept "dialectics" as has been used above, is by no means subject to a philosophical interpretation, but is rather the mere description of a process. The reason for characterizing this process, i.e, the process of producing knowledge, as being dialectical in nature, is due to the existence of various possibilities and alternatives. Because a new process of knowledge and learning arises as a result of the investigation of different possibilities and objects, i.e, different alternatives. During the investigation of various alternatives intuition, experience, creativity, ethical or easthetical factiors, and even chance can play a role. At the next step, during the achievement of a concept or a judgement, i.e, establishing a synthesis, forms of thinking which are radically different will apear. Now, this process can be described by the aid of the concept "dialectics".

This dialectical process, on the other hand, can be described from the standpoint of logic, i.e, in a formal-axiomatic manner. Indeed, we may probably never lay down all the factors which play a role in the determination of anti-thesis and synthesis. But the factors which play a role in the achievement of an anti-thesis and synthesis must be distinguished from the very process itself. For the dialectical process, means the investigation of new knowledge (anti-thesis) which is the alternative of existing knowledge (thesis) and consequently the accomplishment of synthesis. Now, this process can be described from the view point of logic: There happens to be a relation of inference between thesis and anti-thesis, since, the former is a possible consequence of the latter. And the anti-thesis, must be, logically opposing or contradicting the possible consequences (theses) which may be obtained from the *synthesis*. The synthesis which will finally be accomplished, ought to reconcile the thesis and the anti-thesis; that is, it must be derivable from this new synthesis. Thus, the logical relations in the course of the development of knowledge, can theoretically be explained by means of a formal-axiomatic system.

This consequence means an even wider domain for the application of logic. With another saying, not merely the axiomatical structure but the process of development as well, of a system of knowledge can be described by means of a formal system. The explanations given above render such a description possible.

Translated by Cemil Güzey

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