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INTRODUCTORY NOTE

This series of collected articles is published by the Institute of Philosophy of the Hungarian Academy of Sciences. First of all, it is meant to be a forum where documents of work done by the members of this Institute will become accessible with the shortest possible delay but, naturally, products from other cooperating philosophical institutions are also welcome.

The four nouns listed on the cover of each number indicate our main research profiles. Much of what we write is on social philosophy, the philosophy of mind, the philosophy and history of science, and the history and theory of religion. We hope to serve both a Hungarian and an international public, therefore the languages of the articles will vary from number to number, as best suited to their respective themes. Translations of the contents of back issues will be regularly found on the last page. If readers show interest in one or another title which has appeared, say, in Hungarian, we shall be pleased to reprint the text in the language required.

This is just one sign of our intention to enter into close contacts and collaboration with those who take interest in DOXA. We are also awaiting any response, suggestion or contribution which may arrive from scholars the world over, this country included. Our work would be greatly facilitated and, indeed, rewarded by such initiative.

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For the same reason, future contributors are requested to supply information on themselves (address, title, post held, etc.).

The first number of DOXA was published in Hungarian. The second number, which is here being introduced, is our first venture in English. Its publication coincides with the 5th Joint International Conference on History and Philosophy of Science (IUHPS) held at the Hungarian town of Veszprém, 14th to 20th August, 1984. This has been a unique opportunity to select our material from the latest products of those philosophers, logicians and historians of science who are somehow associated with this Institute. Our selection is, of course, far from being representative of all the important work done in Hungary on the themes mentioned, even though we have tried to extend our capacity and have devoted DOXA 3 to the same cause, which appears simultaneously. In our efforts, we were greatly helped by the Postgraduate Training and Information Centre of Loránd Eötvös University, Budapest, particularly from its Committee for the History, Logic and Philosophy of Science.

Many thanks are due to all those who have generously contributed their articles and have helped us in every way to compile this two-volume survey, however fragmentary, of Hungarian philosophy of science. Thanks to them, we are now able to greet the readers of our first two numbers in English, among them especially the IUHPS Conference participants, who will be the first to take DOXA 2 and 3 in their hands.

LÁSZLÓ HÁRSING

OUTLINE OF A LOGIC OF RELATIVE TRUTH

1. *Relative Truth as the Generalization of the Classical Truth Concept*

Scientific research is justly considered to be the most reliable cognitive method, for it is the best way of enriching human knowledge with new and true knowledge. Truth is the central value category of science. However, the concept of truth can only serve its axiological purpose in science if it also accounts for the truth status of hypotheses which are decisively important from the point of view of the progress of cognition.

If truth is interpreted in the classical sense as the congruence of thought and reality, then truth value can only be attributed to hypotheses in a definitional sense, at best, and, in most cases, not in a criterial sense, since comparison with reality cannot always be made. We could say that hypotheses have no truth value at all, as they are partly propositions referring to non-existent (past or future) phenomena. However, this regressive solution must be rejected unless we wish to challenge the validity of the truth multiplying function of science. We will therefore assume that the deterministic relationship of the present with the past and the future provides a sufficient basis for interpreting the concept of congruence.

Another suggested solution to the problem acknowledges that hypotheses have truth value in a classical sense but, without an adequate operative method, this cannot be defined. Instead, the introduction of the concept of *logical probabil-*

ity is suggested, which measures the degree of grounding the hypotheses have. This proposition has a positive element, in that hypotheses, from the point of view of their cognitive status, can only be evaluated through comparison with other statements. If a hypothesis shows agreement with a background of knowledge which has already been accepted, then it is attributed a probability factor above minimum; if, on the other hand, it lacks agreement, a probability factor under minimum is attributed to it. Given the knowledge of logical probabilities, hypotheses can be compared, and, in addition, measure functions assuring quantification can also be defined. However, from an epistemological point of view, this solution is not satisfactory, either. Its primary inadequacy is that it considers truth to be an epistemological noumenon (thing in itself), the existence of which we presume, while denying its cognizability.

A possible egression can be found in the proposition which interprets logical probability as the probability of the truth of the hypotheses, i.e. it takes it as the degree to which the truth of the given hypothesis is grounded. We can argue as follows: let us suppose that previous knowledge has a relevant part which is true in the classical sense. This knowledge is generally acquired as an intellectual inheritance from former generations. The hypothesis set up as possible new knowledge must be compatible with this relevant part. This compatibility assures indirect correspondance between the hypothesis and the facts of reality, the degree of compatibility being denoted by logical probability. This epistemological form of indirection is of such great importance from the point of view of gathering knowledge that no truth concept of any philosophical significance can disregard it.

For all that, our suggestion here is to accept *relative truth* as the measure of value of the hypotheses, instead of logical probability. To support our proposition, we put forward the following arguments:

a/ The concept of relative truth not only emphasizes the indirectness of the truth of hypotheses, but the historical character of this indirectness as well. It takes into account the fact that cognitive processes comprise a succession of situations and, in any of these situations, the relative truth value may alter.

b/ Over and above the historical indirectness of that correspondence, the concept of relative truth also underlines the momentum of self-reflection. When we talk about the relative truth value of a certain statement, we are not thinking of some independently existing epistemological indirectness but, rather, we are stressing its coming to be known by some cognitive subject. This cognitive subject is considered to be an ideal individual who is in possession of all historically possible relevant knowledge and performs his cognitive activities as a representative of the human race.

c/ Nevertheless, his relative truth value judgement may be false, because it is also possible that the hypotheses is false in the classical sense. This can occur in spite of the fact that it has been in agreement with relevant human knowledge so far, and it is attributed a high relative truth value.

d/ Relative truth value, as indirect and historical knowledge composed of the classical truth value, does not supersede the concept of the classical truth value, but serves as a cognitive index for the latter.

e/ When we determine the long-term goal of scientific research in the acquisition of new and true knowledge, we must necessarily think of relative truth values, since knowledge can be considered as new truth only in a historical sense.

f/ Using the relative truth concept as a basis, it is possible to elaborate a logical system which will, in turn, enable us to develop a theory of reasoning far more differentiated than classical logic. Thus, it seems justified to regard relative truth as a generalization of the classical truth concept.

2. *Structure of the Logic of Relative Truth (VL)*

The well-formed formulas of *VL* are the following:

(i) *An atomic V-formula* is every formula of classical propositional logic (CL) which is preceded by one and only one of the letters V, V_1, V_2, ... (simple *V*-expression) and is followed by one of the signs =,<,>, or by an intelligible combination of them, the latter being followed by a rational number belonging to interval (0,1), or by a simple *V*-expression.

(ii) *A molecular V-formula* is obtained if the simple *V*-expression of any atomic *V*-formula is substituted by at least two simple *V*-expressions combined with the arithmetic symbols +,-, and /.

(iii) A well-formed *V*-formula is *synchronic* if the letter *V* in it appears without an index. *A diachronic V*-formula is obtained when the indexes of the letters *V* are identical or consecutive natural numbers. Each well-formed *V*-formula is either a synchronic or diachronic formula.

Synchronic axioms:

A1. $0 \leq V(p) \leq 1$

A2. $V(\sim p) = 1 - V(p)$

A3. $V(p \,\&\, q) = V(p)V(q)$

A4. $V(p) = V(p \,\&\, q) + V(p \,\&\, \sim q)$

Diachronic axioms:

A5. $V_1(p \,\&\, q) < V_1(p)\, V_2(q)$, if $1 > V_2(p) > V_1(p)$

A6. $V_1(p \,\&\, q) = V_1(p)\, V_2(q)$, if $V_2(p) = 1$.

Synchronic axioms specify one single cognitive situation, and, accordingly, truth values occurring in these are constant. On the other hand, diachronic axioms reckon with the fact that truth values in a new, cognitive situation are different (due to the extension of the background of knowledge), and they thus indicate the relationship between two consecutive, cognitive situations. As we shall see, in most cases, the verification or refutation of the hypotheses is based on diachronic argumentation.

Here are some synchronic theorems which are either direct consequences of the axioms, or can be easily accepted on the grounds of the previous theorems.

T1. $V(p \,\&\, \sim p) = V(p) - V(p)^2$

Self-constradiction in *VL* is not false in all cases (that is to say, it is not identically false), since in the case of $0 < V(p) < 1$, $V(p \,\&\, \sim p) > 0$. Yet, in those cases where $V(p) = 1$ or $V(p) = 0$, we come to the analogue of *CL*, namely to $V(p \,\&\, \sim p) = 0$.

T2. $V(p \vee q) = V(p) + V(\sim p \,\&\, q)$

T3. $V(p \vee \sim p) = V(\sim p) + V(p)^2$

In *VL* the theorem known as the "excluded middle" is always a true formula (it is not identically true), since, in the case of $0 < V(p) < 1$, $V(p \,\&\, \sim p) < 1$, but in the cases of 1 and 0 we come to the analogue of *PL*.

T4. $V(p \,\&\, p) = V(p)^2$

T5. $V(p \,\&\, p) = 2V(p) - V(p)^2$

T6. $V(p \supset q) = V(\sim p) + V(p \,\&\, q)$

T7. If $V(p \supset q) = 1$, then $V(p) \leq V(q)$

T8. If $V(p \supset q) = 1$, then $V(p) = V(p \,\&\, q)$.

The majority of diachronic theorems can also be easily acknowledged.

T9. $V_1(p \,\&\, \sim p) = V_1(p) = V_1(p)V_2(p)$, if $1 \geq V_2(p)V_1(p)$

The value of $V_1(p \,\&\, \sim p)$ is 0 only in the case of $V_1(p) = 0$, or when $V_2(p) = 1$.

T10. $V_1(p \,\&\, p) = V_1(p)V_2(p)$, if $1 \geq V_2(p) > V_1(p)$

T11. $V_1(p \vee q) = V_1(p) + V_1(\sim p \,\&\, q)$

T12. $V_1(p \vee \sim p) \geq V_1(\sim p) + V_1(p)V_2(p)$, if $1 \geq V_2(p) > V_1(p)$

T13. $V_1(p \vee p) \geq V_1(p) + V_1(\sim p)V_2(p)$, if $1 \geq V_2(p) > V_1(p)$

T14. $V_1(p \supset p) = V_1(\sim p) + V_1(p \,\&\, q)$.

In fact, the diachronic character becomes especially prominent when $V_1(p \,\&\, q)$, $V_1(\sim p \,\&\, q)$ and *V*-expressions similar to these occurring in the *V*-formulas are developed according to A5 or A6. If none of the mentioned *V*-formulas appears in a synchronic *V*-formula, or if one occurs but is not developed according to A5 or A6, then it can be easily transcribed into a diachronic form so that each *V* is provided with an identical index.

T15. If a/ $V_1(p \supset q) = 1$ and b/ $V_2(q) = 1$, then $V_2(p) = V_1(p) / V_1(q)$

The thesis can be proved as follows:
from T8 and a/ consequently $V_1(p) = V_1(p \,\&\, q)$.
b/ enables us to apply A6: $V_2(p) = V_1(q)V_2(p)$
Thus, the thesis can be derived directly.

T16. If a/ $V_1(p \supset q) = 1$, b/ $V_1(p) > V_1(q)V_1(r)$ and c/ $V_2(r) = 1$, then $V_2(p) > V_1(q)$.

Proof:
it follows from premise b/ that (1) $V_1(p)/V_1(r) > V_1(q)$
According to a/ and c/, T15 is (2) $V_2(p) = V_1(p)/V_1(r)$.
From (1) and (2), $V_2(p) > V_1(q)$.

3. *Examples of Synchronic and Diachronic Reasoning*

The analogue of every single inferential procedure dealt with in *CL* can be constituted in *VL*. From these, let us consider a variant of the so-called *destructive dilemma:*

$$\text{S1.}\quad \begin{array}{ll} a/ & V(p \supset q) = 1 \\ b/ & V(p \supset r) = 1 \\ c/ & V(q \,\&\, r) = 0 \\ \hline & V(p) = 0 \end{array}$$

Proof: on the basis of a/ and b/ and T7, $V(p) \leq V(q)$ and $V(p) \leq V(r)$. According to c/ and A3, from $V(q)$ and $V(r)$ at least one equals 0. Hence $V(p) = 0$.

However, it is possible to justify a good number of reasoning procedures, the analogues of which cannot be formulated in *CL*. Let us mention a weak version of modus ponens:

$$\text{S2.}\quad \begin{array}{ll} a/ & V(p \supset q) > 0 \\ b/ & V(p) = 1 \\ \hline & V(q) > 0 \quad . \end{array}$$

Proof: from a/ and T6, $V(\sim p) + V(p \,\&\, q) > 0$. Since following from b/, $V(\sim p) = 0$ and $V(p \,\&\, q) = V(p)V(q)$, thus $V(q) > 0$.

Yet, from the point of view of those sciences where empirical information is also used as premise, and the verification and refutation of hypotheses is considered to be their primary task, it is diachronic reasoning which is really important. Below, we will deal with the so-called *inverse modus ponens* or confirmative reasoning and with analogical argumentation. These methods of reasoning are emphatically important in the field of factual sciences, and we advance the opinion that the only logic which will play a part in the methodology of these sciences is the one which can account for these methods.

$$\text{D1.}\quad \begin{array}{ll} a/ & V_1(p \supset q) = 1 \\ b/ & V_1(p) > 0 \\ c/ & V_1(q) < 1 \\ d/ & V_2(q) = 1 \\ \hline & V_2(p) > V_1(p) \end{array}$$

Proof: by virtue of a/ and T8, $V_1(p) = V_1(p \& q)$. According to b/, d/ and A6, $0 < V_1(p) = V_1(q)V_2(p)$. Since in compliance with b/ and c/, $0 < V_1(q) < 1$, thus $V_2(p) > V_1(p)$.

D2. a/ $V_1(p \supset q) = 1$

b/ $V_2(p \supset q) = 1$

c/ $V_1(p \supset r) = 1$

d/ $V_1(p) > V_1(q)V_1(r) > 0$

e/ $V_1(r) < 1$

f/ $V_2(r) = 1$

$$\frac{}{V_2(q) > V_1(q)}$$

Proof: according to a/, d/ and f/ T14. is $V_2(p) = V_1(p)$ $V_1(r) > V_1(q)$.

By virtue of b/ and T7., $V_2(p) \leq V_2(q)$. Hence $V_2(q) > V_1(q)$.

4. *Epistemic Utility of the Hypotheses*

When accepting or rejecting a hypothesis, we must consider its relative truth value and the *cognitive situation* in which our epistemic decision has been made. To begin with, let us consider the concept of cognitive situation.

We can distinguish two types of cognitive boundary situation: namely, the *revolutionary situation* which renews the given field of cognition, and the *process which only adds* to the given scope of experience. A certain boldness in the formation of hypotheses is characteristic of the former, while moderate advancement characterises the latter. Between these two extreme situations, all the other "mixed research situations" occupy an intermediate position.

Let λ signify the *factor qualifying the nature of the cognitive situation*. Let us postulate that regarding it, $0 \leq \lambda \leq 1$ is fulfilled, where $\lambda = 0$ denotes the moderate, and $\lambda = 1$

the bold, cognitive situation. For lack of a better method, the value of λ must be determined using estimation.

As already stated, the relative truth value (*V* truth value) constitutes an indirect type of correspondence between the thought content of a statement and reality. It may happen, then, that a certain *V* truth value is attributed to a hypothesis in a given cognitive situation, although it does not correspond to reality; that is to say, it is false in the classical sense. (*C*-false) It is feasible that we may be entirely right in our reasoning and cognition still suffers a loss, if we wrongly accept a hypothesis with a *V* truth value higher than the minimum, but *C*-false. Naturally enough, we also cause a loss if we reject a *C*-true hypothesis on the basis of a given *V* truth value. Nevertheless, it is evident that epistemic utility can only be expected if we accept *C*-true hypotheses or reject *C*-false hypotheses in the function of the cognitive situation.

Let us introduce the following notations to measure *epistemic utility*:

$U^+(p^+)$ = the epistemic utility resulting from the acceptance of the *C*-true hypothesis p;

$U^+(p^-)$ = the epistemic utility resulting from the acceptance of the *C*-false hypothesis;

$U^-(p^+)$ = the epistemic utility resulting from the rejection of the *C*-true hypothesis;

$U^-(p^-)$ = the epistemic utility resulting from the rejection of the *C*-false hypothesis.

Let us start from the following intuitive considerations:

(1) The bolder the cognitive situation, and/or the higher the *V* truth value of the hypothesis is, the less advantageous its acceptance, and vice-versa, presuming that the hypothesis is *C*-true.

(2) The bolder the cognitive situation, and/or the higher the

V truth value of the hypothesis is, the more destructive its acceptance, and vice-versa, presuming that the hypothesis is C-false.

(3) The bolder the cognitive situation, and/or the less the V truth value of the hypothesis is, the more destructive its rejection, and vice-versa, presuming that the hypothesis is C-true.

(4) The bolder the cognitive situation, and/or the higher the V truth value of the hypothesis is, the more advantageous its rejection, and vice-versa, presuming that the hypothesis is C-false.

The following equations fulfil conditions (1)-(4):

(i) $U^+(p^+) = 1 - \lambda V(p)$

(ii) $U^+(p^-) = -\lambda V(p)$

(iii) $U^-(p^+) = -\lambda V(\sim p)$

(iv) $U^-(p^-) = 1 - \lambda V(\sim p)$

Let us assume that $\lambda=1$ and $V(p) = 1$, i.e. we have a V-true statement of a maximum degree in a bold research situation. In this case, the following epistemic gains are possible:

$$U^+(p^+) = 0;\quad U^+(p^-) = -1;\quad U^-(p^+) = 0;\quad U^-(p^-) = 1$$

We believe that the obtained values correspond to our intuitive expectations.

Let us assume that $\lambda=0$ and $V(p) = 0$, i.e. we have a statement of minimum V truth value in a precautious research situation. The following epistemic gains proceed:

$$U^+(p^+) = 1;\quad U^+(p^-) = 0;\quad U^-(p^+) = 0;\quad U^-(p^-) = 1 .$$

These values call for some explanation. It may be surprising, but is still conceivable, that the acceptance of a V-false but classically true statement in a cognitive situation demanding precaution is maximally advantageous. Just as advantageous is to reject a V-false and a C-false statement. It does not directly follow from (1)-(4), but is required by equalities (ii) and (iii), that the hypotheses of the value of $V(p) = 0$, if they are *C*-false, and their rejection if they are *C*-true, should be epistemologically indifferent, Every formalization has less obvious consequences.

Due to lack of space, we will not analyse the other two pairs of possibilities.

5. *Epistemic Utility of Synchronic and Diachronic Reasoning*

Epistemic utility can not only be attached to the acceptance or rejection of certain statements, but to *inferences* as well. Here, however, we must introduce the concept of *expected epistemic utility*.

We start from the principle that an argumentation in a given cognitive stiuation is prospectively the more advantageous, the higher the *V* truth value of its conclusion, and the greater the epistemic utility of the conclusion when it is *C*-true and accepted; and also, the least its destructivity if it is *C*-false and yet accepted. This intuitive requirement is satisfied by the following formula:

(i) $E_s(p) = V(p)U^+(p^+) + V(\sim p)U^+(p^-)$

The appropriate substitutions and calculations give:

(ii) $E_s(p) = V(p)(1 - \lambda)$

(Index *s* indicates that $E_s(p)$ measures the expected epistemic utility of the synchronic inferences.)

To be able to apply formula (ii), however, we must determine the minimum value of the expected epistemic utility which still enables us to speak of a plausible acceptance. This is called the *norm of acceptance*. E_s must be at least as large as $1-\lambda$, which can be interpreted as the degree of reliability or cautiousness, namely:

(iii) $E_s(p) = 1 - \lambda$

Nevertheless, it can be seen from a comparison of (ii) and (iii) that $E_s(p)$ can only be, at the very best, equivalent to $1-\lambda$, that is, when $\lambda=1$ or if $V(p) = 1$ and $\lambda<1$. In every other case, the expected epistemic utility falls short of the norm of epistemic utility, i.e. types of reasoning like S2. do not provide acceptable epistemic utility.

The situation is entirely different in the case of diachronic argumentations. Here we must take the following premise as our starting point: the higher the V truth value of an argumentation measured in a later cognitive situation, and the more the epistemic utility gained by its acceptance, if it is C-true (and the less the loss resulting from its acceptance if it is C-false) then the higher its expected epistemic utility will be. This requirement is fulfilled by the following formula:

$$E_d(p) = V_2(p)U^+(p^+) + V_2(\sim p)U^+(p^-)$$

Substitutions and calculations lead to

(iv) $E_d(p) = V_2(p) - \lambda V_1(p)$.

Let the norm of the expected epistemic utility also be $1-\lambda$ in the case of diachronical inferences, and let it be required that

(v) $E_d(p) \geq 1 - \lambda$.

Let us consider reasoning D1. from the point of view of requirement (v):

Suppose that $\lambda = 1$. Then

$$E_d(p) = V_2(p) - \lambda V_1(p) > 0 \text{ and}$$

$$1 - \lambda = 0 .$$

Consequently $E_d(p) > 0$.

Let $\lambda = 0$. In this case

$$E_d(p) = V_2(p) > 0 \quad \text{and}$$

$$1 - \lambda = 1 \ .$$

Therefore, only the equality

$$E_d(p) = 1$$

may subsist, and only when $V_2(p) = 1$.

In other words, in a precautious cognitive situation, the only acceptable diachronic reasoning is that which offers a maximally *V*-true conclusion. This result does not contradict our intuitive expectations.

It is hoped that we have succeeded in demonstrating that *VL*, even in this roughly outlined form, can be a useful device in the philosophy of science. It is suitable in elucidating many problems which are beyond the reach of the majority of logical systems. It is a significant merit of *VL* that it clarifies the relationship between the relative and the classical truth concept and in many respects generalizes probabilistic logic.

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KATALIN G. HAVAS

IMPLICATIONS OF AN ONTOLOGICAL POINT OF VIEW

(*A Critique of M. Bunge's Critical Examination of Dialectics*)

A good old maxim advises us to take heed to every criticism even if it only contains five per cent of the truth. The trouble is that in most cases truth and falsehood are not conveyed by separate propositions in the criticisms and therefore it is often impossible to select five, ten, twenty or even more per cent of the critical statements which are true and justified as opposed to the rest which are false. Criticism must therefore be considered in its entirety, within its systemic context. Moreover, sometimes unjustified critical statements may be the consequences of some deficiency in the theses criticised and are thus useful and instructive. That is why one must clarify the presuppositions that underlie one's system in order to make sure if the critic's presuppositions basically coincide with them or not. Otherwise the arguments and counterarguments do not refer to the same theses, which constitutes the logical fallacy of *ignoratio elenchi*.

Applying these methodological principles to "A Critical Examination of Dialectics" by Mario Bunge,[1] the first question to arise is as follows:

Does M. Bunge really criticise *the* theory of dialectics?

However, in the given case, even putting the question poses some problems. It implies admitting the existence of *the* scientific theory of dialectics, of which some philosophers - such as M. Bunge - may have a clear conception, or they may have a faulty conception if they do not know it properly.

M. Bunge's point of departure is that *the* theses of dialectics are not formulated with sufficient precision to contemporary scientific standards. They are ambiguous and are surrounded by a mystical fog. I agree with this and, for the same reason, I propose that M. Bunge's picture of dialectics (and the presuppositions underlying it) cannot be contrasted with "the real", "the actual" theory of dialectics, only with *some* conception or interpretation of it.

To be sure, one cannot say that M. Bunge attacks a nonexistent theory which he only contrives for the purpose of shadow fighting. Even though his reformulation of dialectical theses exaggerates some allegedly Marxist views, most of his conclusions are supported by evidence we find in some studies in dialectics. This does not only hold true of simplistic textbooks or of seemingly original works which lack scientific rigour. What is here concerned is the essential core of a real and effective theory, an ontological approach to dialectics. I am going to examine some features of M. Bunge's critique of dialectics which follow from this (I believe fallatious) ontological point of view.

1. The Principles of Dialectical Ontology

1.1 On the theory of reflection

As is well known, Hegel wanted to base his explanation of the laws of being on the laws of thinking. He saw the "idea", the "concept" as existing forever independently of the human brain and as manifesting itself in nature as well as becoming itself in human thinking. Therefore, by exploring the idea or the form it has found in human thought we also get the structure of reality. Hegel believed he could construe the world on the basis of the analysis of the movement of thought. Marx remarked of Hegel that "With him, it [dialectic] is standing on its head. It must be turned right side up again, if you would discover the rational kernel within the mystical shell."[2] Some philosophers interpreted Marx's instruction like this: Hegel's point of departure is thought, for him it is the movement of thought which is objectified in nature. Turning dialectic right side up again means that now nature should be the point of departure and every product of thinking is to be considered as a reflected image of nature. While for Hegel the laws are primarily mental and exist in nature as manifestations of the spirit, once the relationship is reversed we suppose that laws exist in nature independently of thinking and that their copies in the mind are the laws of thinking. Objective dialectics is the dialectics of real things. The laws of dialectical logic - so they say - are the photographic images of that objective dialectics.

The implications of this version of the theory, for example, for the approach to contradictions can be summarized briefly and approximately like this: In reality there are contradictions, therefore those logical contradictions are necessary which express real contradictions. Hence a pair of contradictory propositions are both true if they express some contradiction of reality.

One has indeed no other choice than question the validity of either dialectics or formal logic unless one recognizes the active, creative character of reflection. M. Bunge criticises dialectics on the same grounds: "Indeed, if every statement reflects something real, then every contradictory statement must reflect some ontic contradiction, which is in turn the source of some change. But since a contradiction is false, it cannot reflect anything real. Hence either there is no change or the reflection theory of knowledge must part company with dialectics."[3] All that would be so if the reflection theory of knowledge indeed claimed that in the case of every true statement there is something in reality of which the given statement is a copy. It would be so if that theory ignored the fact that man's reflection of nature is no simple, direct, total reflection, or to quote Lenin, that "... in human concepts nature is reflected *in a distinctive way* (this NB: in a *distinctive* and d i a l e c t i c a l way!!)"[4]

1.2 The activity of consciousness as an ontic factor

M. Bunge's criticism of dialectics rests on the assumption that dialectical ontology deals with concrete objects. Thus his criticism is only relevant for such theories of dialectics as maintain that ontology describes things as existing independently of man and his practical activity. Such theories ignore the fact that *every* ontology (i.e. every system aiming to describe the world's general characteristics) necessarily reproduces the objective transposed into concepts and propositions. This mental transposition implies that *ontology is inextricably bound up with the characteristics of mental reconstruction*. This makes ontology no less representative of objective reality than are physics, chemistry, etc, for the latter are not indirectly based on the things in themselves either (in most cases) but on things as conceived by consciousness (and embedded in a language).

It is essential for every materialist to recognize the external world as existing independently of consciousness and as being primary over consciousness. However, it is not at all essential for materialism to regard the reflection of reality in consciousness as free from the specific consequences of mental transposition. Moreover, a materialist need not believe in the direct derivability of every product of consciousness from reality which is not qualified as the product of false consciousness. On the contrary: the ignorance of the active, creative nature of the reflection by consciousness and the ontology resulting from that ignorance generates the above mentioned "mystical fog" surrounding the laws of dialectics.

2. The thesis that for every thing there is an antithing

M. Bunge formulates one of the theses of the dialectical ontology he criticises as follows:

"Dla For every thing (concrete object) there is an antithing"[5]

First of all it must be clarified what the "thing" subjected to ontological investigation is.

2.1 The "thing" as the starting point of ontological investigations is not the thing in itself but its mental representation already transposed into concepts

A "thing" is a "plant", an "electron" or a "product" etc. But if I say "thing", "plant", "electron", "product", etc., I already speak of something in the form of a concept. It has already been isolated from whatever else I do not consider as that thing, that plant, that electron etc. What is more, I am now thinking of the particular thing as belonging to some system (as a living organism, a microphysical object, a social phenomenon etc.) and thus I am abstracting from its characteristics which are not related to its belonging to that system. Without isolation, we cannot speak about it even though we known that nothing isolated exists in nature which would only be a "living organism", an "electron" (only a thing individuated by the group of properties "A") and nothing else. The isolation and delineation of something from the rest of nature is an act of man. No individuation or separation (which results in the isolation of "A" from "non A") can take place without thinking, i.e. some activity of mind. Now, is this order imposed upon nature by us? No, or at least not arbitrarily. Abstraction is based on objective grounds. Let us take, for example, a concrete thing which behaves as a commodity when brought to the market while in other areas it appears as an article of consumption. That is why we can say: it is a "thing with exchange-value" or a "thing with use-value". In fact it is both at the same time and also many other "things": a blue thing, a warm thing, somebody's favourite piece of clothing, an antiquity etc.

Generally speaking, if a concrete thing is conceived of in the form of a concept resulting from the selection of group A of its properties, it will always be true that as long as it preserves group A of its properties it is identical with itself as a thing possessing properties A and is different from all those not having properties A. Taken in this sense, the self-identity of things is a general law of reality valid for all real things. This self-identity of things is a precondition to the existence of scientific laws. When we think of some concrete thing as A, we have in this way raised the particular to the level of the general. For this very reason, whatever we know of a thing with property A conceived as A will always and everywhere be true of any other thing with property A also conceived as A.

2.2 Is M. Bunge right to suppose that, according to Marxist dialectical ontology, every "thing" exists separately in the world and there exists one and only one "antithing" isolated from it?

Marx sets out to examine the categories of political economy by explaining that "production" is a result of abstraction: "*Production in general* is an abstraction, but a rational abstraction in so far as it really brings out and fixes the common element..."[6] "There are characteristics which all stages of production have in common, and which are established as general ones by the *mind*..."[7] (italics mine, K.G.H.) Having stated that "production" is the result of the mind's act of generalization and abstraction Marx adds that every category established through abstraction also implies the separation of the abstract moments. He refers to Spinoza's thesis: "determinatio est negatio".

Through creating the concept of "production" we have separated this process from consumption, distribution, or exchange. However, as Marx says, thinking must not be reproached with that. The separation is a consequence of "the grasping of real relations", even though it is a mistake to think that, for example, the spheres of distribution and of production are independent, autonomous neighbours.

"Production, then, is also immediately consumption, consumption is also immediately production", Marx says and he goes on: "Thereupon, nothing simpler for a Hegelian than to posit production and consumption as identical".[8]

Later he summarizes his own position like this: "The conclusion we reach is not that production, distribution, exchange and consumption are identical, but that they all form the members of a totality, distinctions within a unity."[9] According to Marx, the contradiction between production and consumption is a real contradiction, as far as it is a reflection of a relation of reality. But what has previously been said about "production" clearly indicates that the contradiction here formulated is influenced by the fact that "production" relations as well as "consumption" relations are already defined and therefore distinguished from every other relation.

Engels writes: "The recognition that these antagonisms and distinctions, though to be found in nature, are only of relative validity, and that on the other hand their imagined rigidity and absolute validity have been introduced into nature only by our reflective minds - this recognition is the kernel of the dialectical conception of nature."[10] It would be false to conclude from Engels's idea that it is a *mistake* in our thinking to make what exists in reality rigid and distinct. On the contrary, this is a necessary characteristic of the thinking activity. The mistake is not to recognize this as a necessary characteristic of *thinking*. The dialectical approach requires us to take this fact into account and to accept the conclusions that follow from it.

In this respect, I attach great importance to one of Hegel's remarks and Lenin's comments on it. "What makes the difficulty is always thought alone, since it keeps apart the moments of an object which in their separation are really united." Lenin thought Hegel's idea was right and commented: "We cannot imagine, express, measure, depict movement, without interrupting continuity, without simplifying, coarsening, dismembering, strangling that which is living. The representation of movement by means of thought always makes coarse, kills, - and not only by means of thought, but also by sense-perception, and not only of movement, but *every* concept."[11]

2.3 The concrete thing in its totality

The following is a quite frequent - and, in my judgement, fallacious - argumentation:

If something has contradictory properties in different respects (i.e. in one respect it is A while in another it is not-A) then the concrete thing viewed as a *whole* can be said as such to be both A and not-A. Hence if a concrete thing is *conceived in its totality,* then contradictory statements can be truly asserted of it.

The fault with this argument lies in the vagueness of "the thing conceived in its totality." Another question is whether it is possible to judge the thing as a whole in one statement, i.e. whether "the thing in its totality" can be the subject in a statement.

To answer these questions, we must first of all distinguish between the concrete *in reality* and the concrete *in the mind.* Thinking proceeds through the particular propositions, i.e. from the knowledge of some aspect of the concrete in reality (the really concrete) towards the production of the concrete in the mind (the mentally concrete).

At the beginning of the cognitive process we only have abstract concepts of the object. Such concepts arise as the results of previous processes of observation or thinking. Abstract concepts give us the possibility to understand different aspects of the really concrete. When in the process of our cognizance of a concrete thing we formulate our knowledge in statements we never use one statement to say something about the real concrete *whole*, only about some aspect of the concrete whole. The mentally concrete is a system of knowledge, i.e., on a given level of knowledge, it is the synthetization of particular propositions about the different respects of the really concrete.

Certain investigations seem to show that contradictory propositions follow from the system of knowledge reproducing a concrete thing. This type of logical contradiction has a positive role in cognition. It may arise from the fact that different sides, or aspects, of the concrete thing have not been sufficiently isolated from each other. If the contradiction stems from this circumstance (of course it may also be due to some other, logical fault), then the consideration that property A belongs to the concrete thing under a different aspect than property non-A will raise the mentally concrete image of the thing to a new level, where the former logical contradiction is resolved. As is well known, Aristotle saw no logical contradiction between statements which attribute contradictory properties to one and the same substance under different aspects.

3. *Dialectical negation*

I agree with M. Bunge's claim that the concept of negation needs to be clarified if we are to get rid of the mistifying fog surrounding dialectics. The concept of negation is indeed ambiguous. Recent logical investigations have shown that outside the framework of classical, two-valued logic quite a wide range of negations can be distinguished. Moreover, even within classical two-valued logic, the concept of negation is subject to various philosophical interpretations. But let us mind our business: it is no excuse for the vagueness of the concept of "dialectical negation" that the concept of "formal logical negation" is not clear, either.

The concept of dialectical negation is sometimes used in the ontological and sometimes in the logical sense.

3.1 Ontological dialectical "negation"

An example of ontological dialectical "negation" is where Engels considers the barley plant as the dialectical negation of the grain from which it has arisen. Another example is private landed property which he says to be the dialectical negation of the common ownership of land found at an earlier stage of the development of civilised peoples.

It is one of the most essential characteristics of "negation" so interpreted that it corresponds to a stage of development, which opens up the possibility of further development, that is, the negation of negation through further negation.

To return to Engels's examples, the fully developed barley plant once more produces grains of barley, and as soon as they have ripened the stalk dies; private landed property becomes a fetter on production, so its negation becomes necessary in its turn, that is, the transformation of land into common property. After several other examples, Engels points out that each of these processes is specific and basically different from the rest. "When I say that all these processes are a negation of the negation, I bring them all together under this one law of motion, and for this very reason I leave out of account the specific pecularities of each individual process."[12]

Unfortunately, Engels did not specify what characteristics these processes had in common owing to which, despite all their differences, they would be taken to be the manifestations of one and the same law of motion, the law of the negation of negation. It is nevertheless sure that the meaning of the word "negation" in this case significantly differs from that associated with logical operations. (This is why I put it in quotes above where I used it to mean the ontological dialectical negation). It is questionable whether the word negation should have been borrowed from Hegel at all to signify the Hegelian idea "turned right side up again". However, what is important is not the words but the clarity of their conceptual contents. The characteristics of ontological dialectical "negation" and the "negation of negation" can be described as follows. Such "negation" is the result of the transition from being so to being otherwise where "becoming otherwise" means the emergence of something ontologically new, which amounts to development. In the new thing emerging from negation, there is the possibility of another negation (the transition from being so to being otherwise), that is to say, the possibility of the negation of negation. The new thing coming about as a result of the negation of negation does not merely correspond to the restoration of the original condition, it rather constitutes a higher stage of its development. The new thing which has come about in this way can be said to have an inherent, "innate" dialectical contradiction. Here again, similarly to "ontological dialectical negation", the term "contradiction" is used in a special sense which does not correspond to what the term "logical contradiction" designates. To be contradictory means, in this special sense, to possess characteristics of both the old thing and its ontological dialectical negate.

It must also be noted that ontological "negation" is a feature of the process of transition. Obviously, in Engels's example, the grain does not exist simultaneously with the plant which has arisen from it as its negate. The new grain (--x) does not come about through the union of the old grain (x) and the plant (-x). To suppose this would be an absurdity.

Consequently M. Bunge, in objecting to the Marxist interpretation of ontological dialectical negation that "... one thing x and its dialectical negate -x cannot continue to form a third object..."[13], commits the logical mistake of substituting another thesis for the one he seeks to refute.

3.2 Dialectical negations in the development of knowledge

The results of a cognitive process are formulated in propositions or, rather, in systems of propositions. Propositions on a certain level of knowledge can only provide a relatively faithful representation of what is in reality. The progress of knowledge leads to the formulation of new propositions which ensure a deeper understanding of reality. According to the theory of dialectics, the progress of knowledge in this way constitutes an infinite process of man's attaining more and more profound knowledge of things, phenomena or processes, a constant progress from the phenomena to the essence, and from superficial to intrinsic essence. Throughout this process new knowledge, even though it is different from the old one and transcends it, in most cases does not exclude the old body of knowledge as unacceptable in every respect. Such a relationship between old and new knowledge is called the relation of dialectical negation, Lenin so characterizes this form of negation: "Not empty negation, not futile negation, *not sceptical* negation, vacillation and doubt is characteristic and essential in dialectics, - which undoubtedly contains the element of negation and indeed as its most important element - no, but negation as a moment of connection, as a moment of development, retaining the positive, i.e., without any vacillations, without any eclecticism".[14]

"Empty" negation turns a true proposition into a non-true one, and vice versa. In such a case, assertion and negation are incompatible. By contrast, in the acts of dialectical negation performed by cognitive thought, "in relation to the... negative proposition, the »dialectical moment« demands the demonstration of »u n i t y«, i.e., of the connection of negative and positive, the presence of this positive in the negative. From assertion to negation - from negation to »unity« with the asserted - without this dialectics becomes empty negation, a game, or scepsis."[15]

Dialectical negation is not a logical operation performed upon an elementary proposition. Let A be an elementary (unanalyzed) proposition (which, within the frame of two-valued logic, can take one and only one of the values true or false.) Then the dialectical negation of A is only possible through analyzing A into its components and thus transforming it into a compound proposition. If A was previously considered true, then, after the transformation, only one of its parts or aspects is regarded as true, while another part, which is no longer considered true, is replaced by contents different from the earlier ones. Furthermore, throughout the development of knowledge, dialectical negations are not only connected to changes in the components of compund *propositions*, but to the development of the *concepts* used in the propositions.

To take an example, let the proposition A be an assertion of the initial practical application of penicillin:

> Antibiotics are effective against diseases caused by microorganisms.

Contrary to this assertion, it later turned out that penicillin (the only antibiotic known at the time) destroys only certain strains of microorganisms, while other germs remain (or become) resistant to it. Researchers tried to surmount this difficulty by producing more and more kinds of antibiotics different from penicillin in some respects. Thus the concept of "antibiotics" has undergone development and generalization, covering several new species concepts. Consequently, the proposition A containing the concept of antibiotics has also changed.

However, even other antibiotics discovered subsequently proved to have only short-lived success. Soon new types of microorganisms appeared which could resist them. Moreover, it was found that the increasing number of resistant microorganisms changed the symptoms of some diseases, thus rendering diagnosis more difficult and aggravating the patients' condition. These facts seemed to question the truth of both the original proposition A and its improved versions. But in the course of the development of science, it was not enough to resort to an "empty" negation of proposition A, like:

> It is not true that antibiotics are effective against diseases caused by microorganisms.

If such a negation was ever made, it was just the starting point on the way to understanding the causes. Then it was necessary to subdivide the contents of statement A into several statements, and to separate the portion of its contents which was true from that which was not true.

Since further research showed that the propagation of resistant microorganisms was, to a lesser extent, due to the antibiotics themselves and, to a greater extent, to their misapplication, a new suggestion could be put forward:

> Antibiotics can only be used with great care and caution, in the appropriate quantity. So used, antibiotics are very efficient against certain kinds of disease.

In this phrasing, in some sense, we have some back to proposition A, which, however, has retained some elements of its negate.

The dialectical negation of negation in thought is, in general, the law of development of systems of propositions, i.e. theories.

The development of a theory may occur merely through the development of knowledge or through the extension of the theory over new areas. But it may also occur in relation to changes or development in reality. As the above example shows, knowledge (here the discovery of penicillin) can have an effect on reality where it may induce changes (the appearance of new microorganisms), and these changes may in turn urge the further development of theory. This is another reason why it is important to stress that the dialectical negation of negation is but an *apparent* recurrence to the original point.

Does the truth of the original proposition A follow from the truth of the system of propositions (theory) resulting from the dialectical negation of the negation of A?

In the sense "true" is understood in two-valued logic, I do not think so. We may say that the original statement A involved the kernel of the truth, but it is by no means on the same level of truth than the result of the negation of negation. Now we come to understand that the truth concept used for dialectical negation in cognitive thought is different from the concept of "truth" used in classical two-valued logic. It is not only dialectical negation which must be interpreted as a moment of development, but truth must also be seen as developing, according to the dialectical view.

4. The relation of dialectic to formal logic

In Bunge's view, logical theory describes the behaviour of concepts and propositions, while the laws of dialectics are ontological hypotheses. Therefore, logical objects and dialectical objects are incomparable.

It has been mentioned that the interpretation of the objects of dialectics which M. Bunge presupposes is not the only one possible. Perhaps the most crucial issue in the prolonged controversy over the relationship between dialectics and formal logic is the general disagreement as to the nature of their objects.

In what follows, I will try to show that the incomparability of logics and dialectics is a claim which presupposes the ontological view here criticised. I will also try to show that there are several conceptions of the nature of the objects of these two disciplines which may serve as bases for the comparability and compatibility of dialectics and logics.

4.1 Logic as ontology

The ontological conception of logic was already associated with traditional formal logic, and it also characterized

Hegel's dialectical logic. Ever since its origin, mathematical logic has also been accompanied by the philosophical consideration that the aim of logic is to build ontological structures. This view was given a degree of rationality by the fact that the construction of syntactical calculuses in mathematical logic indeed caused changes in the subject matter of logic. Namely, the syntactic systems themselves are no longer about the laws and specificity of reasoning. The theses they contain usually have various possible interpretations each. Among others, in many cases, it is possible to give them an ontological interpretation.

In ontologically interpreted logical systems (OILS's), a tautology is a statement referring to all individuals. For example, the ontological interpretation of the proposition $\forall x(Fx \lor \sim Fx)$ in classical two-valued first-order predicate logic (PL) is that any individual x either has property F or has not property F. Thus the ontologically interpreted tautologies or laws in PL only differ in their degree of generality from the laws of such sciences as chemistry, physics, biology etc. They differ from them in the fact that, while the latter delineate a set of existents and only make statements about them, the laws of PL are general assertions, about *every* existent, and not only about actual existents, but also possible ones.

An OILS is an ontology of actual and possible worlds. In classical mathematical logical systems, the logical structures of the real world (the world of actual existents) and possible worlds have the same principles. In these systems - in accordance with the Leibnizian principle -, what is necessarily true in a given world w_o is true in every possible world. By now, following the development of semantics of modal logics, this principle has taken a modified form: the idea of all possible worlds has been replaced by the set of worlds which are the alternatives of world w_o, i.e. which bear a certain "alternativeness relation" or "accessibility relation" to w_o. Thus, within certain non-classical logical systems, there are possible worlds permitted whose laws are not alternative to the laws of the worlds in classical logic. Owing to this, the following questions justly arise:

Is the real world indeed the way it is described by the laws of classical logic? Are really all the worlds which are described as "deviating from the normal" (i.e. deviating from the world described by classical logic) such as do not correspond to the structure of the real world? If they are so, can they be considered as worlds at all? Can the structure of an "impossible possible world" be called an ontological structure?

In order to find proper answers to these questions it is necessary to take account of the fact that no ontology, hence no OILS, corresponds to the structure of the existing world *in itself*. Every OILS bears certain specific traces of mental reconstruction. One such specific feature is that these systems inevitably rest on certain abstractions and presuppositions about the world. (PL, for example, presupposes that the things of the world have sharply distinguishable properties etc.) Every OILS draws a picture of the world according to the abstractions and presuppositions which were accepted, consciously or unconsciously, during the construction of the system. If the presuppositions and/or the abstractions about the world are changed (like, for instance, the specificity of the alternative relation), then the class of worlds gets a different structure. In this way, according to the different structures, we obtain different "actual worlds", each of which can be regarded at a certain level of abstraction as giving a picture of the world with certain presuppositions, but none can be regarded as free from presuppositions.

In his day, Hegel may have aspired to construct a system in which the deduction of one concept from another would yield the structure of *the* World, but by now we know that this is impossible. In the differently construed logical systems, if they are ontologically interpretable at all, nothing more is possible than the mental representation of certain sides, or features, of reality, at a certain level of abstraction, and with certain presuppositions about the structure of the class of worlds and hence of the real world. The "different actual worlds" construed in different OILS's together form the mentally concrete picture of *the* World.

4.2 The relationship of OILS's with dialectics as an ontology

If it is supposed that both the ontologically interpreted classical formal logical system (OICLS) and dialectics attempt to give the ontology of the world *in itself*, then one of them must be rejected because it cannot fulfil its task. But if we regard the OICLS as being about the structure of the world pictured according to certain abstractions and presuppositions serving cognitive goals, then this alone is enough to find it compatible with dialectics, even the ontological conception of dialectics which Bunge presupposes.

If we extend our interest beyond classical formal logical systems (and nowadays it seems clear that formal logic covers much broader areas), then it will become even more obvious that OILS's are not contradictory to dialectics. (For example, it is possible for certain paraconsistent logical systems to receive even the kind of ontological interpretation which corresponds to the view of dialectics Bunge criticises.)[16] If dialectical ontology is regarded as having presuppositions different from those of the OICLS, then, outside classical formal logic, it is possible to contruct OILS's which correspond to certain presuppositions of dialectical ontology. However, to use a term borrowed from modal semantics, such a system constitutes the image of a world which is *inaccessible* to the world of classical logic.

4.3 Logic as a theory of cognition

Personally, I agree with M. Bunge's opinion that logic deals with concepts and propositions, but I do not find it precise enough to say, as he does, that logic *describes* their *behaviour*. Namely, such a statement does not exclude a fallacious, psychologistic conception of logic. Logic in fact does not *describe* thinking, as geometry (or, to be more precise, any of the various systems of geometry) does not give descriptions of parallel objects (like, for example, railway tracks). What geometry deals with: parallel lines, circles, points without extension, one-dimensional lines etc. are abstractions, but, as such, they are suitable for grasping certain characteristics of objects. In a similar way, various logical systems, and hence logic as a whole, are suitable means of revealing certain characteristics of concepts and statements used in thinking. A particular logical system constitutes only one approach to concepts and statements having concrete contents in thinking; it only reconstructs certain formal characteristics of thoughts. No chapter of logic covers "*the* concept" or "*the* statement" in their entirety, as they exist in human thinking. Logic, on the other hand, extrapolates. It deals with the forms of *possible* operations which can be used to attain knowledge.

My view of logical objects is also different from M. Bunge's in maintaining, contrary to him, that the nature of logical objects is not independent from the nature of real entities and certain linguistic phenomena. Logic must, therefore, indirectly deal with objects belonging to these areas as well. Based on presuppositions about certain general features of reality, logic investigates the possible forms, and the laws of the forms, of reasoning appearing in lingustic form and making knowledge of reality possible.

There is a view which, instead of construing dialectics as an ontology, holds it to be the theory of cognition. One version of this approach considers dialectical logic as a part of dialectics, the part which deals with the process of the development of knowledge in thinking, that is, with the characteristics of the development of concepts, propositions and their systems. It analyses, for example, problems like the ones mentioned above: the negation of negation in the cognitive process, or the path leading from abstract concepts to construing the mentally concrete.

Interpreted in such a way, dialectical logic is not a rival theory to classical formal logical systems, but another part, in its own right, within the whole of logic. There are logicians who find it possible to construct calculuses based on the study of certain characteristics belonging to this part of logic.

Within the variety of positions regarding dialectics as a theory of cognition, there is an approach to dialectical logic as the philosophy of logic. According to this view, dialectical logic is about the set of all logical theories. It is based on the general principle that any theory in the set of logical theories, or any logical system, only constitues a partial approach to logical objects. There is no absolute logical system with true laws independently of any abstraction whatever. Based on this principle, this approach deals with the philosophical comparison of different logical systems. In this sense, the task of dialectical logic is what Hegel said to be the most important task of reason; to show the infinite in the finite, to point out that what is disintegrated, isolated, abstracted in the different systems is in fact connected and can thus be brought into unity.

I fully agree with M. Bunge on the point that formal logic *cannot be replaced by* dialectics. But it is again his fault that he pretends as if the opposite conviction were an organic part of *the* theory of dialectics. In fact such a view is an implication of a rash identification of the laws of being and of consciousness, and I have tried to show that this fallacy need not characterize a Marxist, materialistic approach to dialectics.

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LANGUAGE, ACTION AND SOCIETY

1. It is hard to imagine a more exemplary common place than the statement that language is a social institution. However, the discussion about the social nature of language has not lost its attraction. Among the causes of the current importance of this discussion we may note the following:

a/ It is always sensible to ask the question whether language should not rather be considered as a biological or individual-psychological fact.

b/ The arguments in favour of the possibility of a private language have not been out-dated even after Wittgenstein.

c/ It is by no means simple to expound what is meant by saying that language is a social phenomenon.

In this paper I should like to deal with the notion of the social character of language. Let me observe by way of introduction that by accepting the statement about the social nature of language to be true one is committed to reject the possibility of a private language and the strong versions of innatism. This is of course not an empirical thesis; so I could have expressed this point perhaps by saying that I am using the notion of the social character of language in a sense which excludes the possibility of a private language and innatism (at least its strong versions).

This interpretation of the social character of language follows a great tradition the investigation of which might reveal unexpected connections. I have in mind the tradition in the framework of which Herder, Hegel, Humboldt, Marx or Wittgenstein, in view of certain basic problems, can be regarded as representatives of very similar ideas. This tradition has evolved through breaking with classical rationalism and empiricism and rests on the supposition, formulated in different ways, that the concepts capturing oollective phenomena are primary in relation to the concepts expressing individual ones. Such collective concepts are the concept of Spirit (Geist), of popular Spirit or Spirit of Nation (Volksgeist), of life (das Leben), of social consciousness (Gesellschaftsbewusstsein), of forms of life (Lebensformen), and so on. It is part of this supposition that the isolated individual (such as the animated statue of Condillac or Diderot) is unthinkable not only on a factual but a conceptual level too. Human consciousness and awareness cannot have emerged on the basis of the sensuous experiences belonging merely to an individual biography. The individual person can become what he is only by appropriating the conditions of his community and by participating in the different forms of the common Spirit. Therefore, language cannot be a device of connecting subsequently the separate individuals or of expressing and communicating ulteriorly the thoughts which were born in the private and independent sphere of the mind. Language is a social phenomenon essentially and not only with respect to the contingent circumstances of its functioning.

In this tradition the philosophy of language obtains great importance. The essentially social character of language becomes the main reason for taking every kind of individuality to be of a social disposition and for taking the very individual mind to be a social entity. It is worth while comparing a few characteristic quotations. F. v. Schlegel says that "even when we are alone, or we believe us to be alone, in our thinking we have to be, actually, in two and our most intimate and deepest being has to be recognized as essentially dramatic." ("...daß wir selbst dann, wenn wir allein sind, oder allein zu seyn galuben, immer eigentlich [noch] zu Zweyen [denken und dieß auch so] in unserem Denken finden, und unser innerstes tiefstes Seyn als ein wesentliches drammatische anerkennen müssen.")[1] W. v. Humboldt expounds this idea in a similar way: "Without taking into consideration the communication among men language is a necessary condition of the thinking of an individual in closed isolation." ("Ohne daher irgend auf die Mittheilung zwischen Menschen und Menschen zu sehn, ist das Sprechen eine nothwendige Bedingung des Denkens des Einzelnen in abgeschlossener Einsamkeit."[2]) And I believe the similarity of Marx's formulation is quite striking: "Even if I pursue a scientific activity, an activity I seldom pursue jointly with others, I am acting in a social way because I am acting as a human being. Not only the medium of my activity - such as language itself in which the thinker works - is given me as a social product, my own existence is a social activity...". ("Allein auch wenn ich wissenschaftlich etc. tätig bin, eine Tätigkeit, die ich selten in unmittelbarer Gemeinschaft mit andern ausführen kann, so bin ich gesellschaftlich, weil als Mensch tätig. Nichtnur das Material meiner Tätigkeit ist mir - wie selbst die Sprache, in der der Denker tätig ist - als gesellschaftliches Produkt gegeben, mein eignes Dasein ist gesellschaftliche Tätigkeit..."[3]) Another characteristic statement by Humboldt is that "in man language is essentially related to social being". ("Im Menschen aber ist das Denken wesentlich an gesellschaftliches Dasein gebunden."[4]) Note, by the way, that Humboldt already used the category of "gesellschaftliches Sein".

2. Even if it may seem to be astonishing I think it is true that analytical philosophy has repeated the development which led from classical empiricism through Kant to Hegel and the romantic movement. In a fairly interesting book Richard J. Bernstein has the following to say: "The stages in contemporary epistemological investigations which have moved from phenomenalism with its foundation in sense data to the emphasis on a ,thing language' as an epistemological foundation, to the realization of the importance of 'theoretical constructs' and finally the 'new' concern with total 'conceptual frame-

works' or 'language games' closely parallels the development that Hegel sketches for us in the opening sections of the *Phenomenology*."[5] Bernstein's statement can be supported by the fact that, in opposition to the early stage of analytical philosophy, in the last two decades the problem of action has risen into prominence. The concept of action has come to play an important part for analytical philosophers just as the concept of praxis has come to be one of the basic notions for Marxist thinkers. I am not proposing to deal with this striking parallel or its possible consequences, I am going to touch upon its linguistic aspects.

It is evident that there is an intimate connection between the popularity of speech act theory and the general interest in the problem of action. Austin accomplished a real revolution, as he could subsume language under a new category, the category of action, the introduction of which into linguistic investigations seemed to have no precedent and was contrary to the usual way of accounting for language in terms of sign systems. This revolution, however, amounts to restore (willy-nilly) the tradition I characterized with the names of Herder, Schlegel, Humboldt or Marx. The foundation of Humboldt's philosophy of language is to be found in the idea that language is primarily action and it is only its secondary feature that it can be taken for a system of signs, a structure, a means of expression, and so on. It is indeed conspicuous that the notions in terms of which Humboldt characterizes language as a phenomenon of social life are activity (Handlung) and labour (Arbeit). He says, e.g.: "Language is no work (Ergon), but an activity [...]. It is a for ever recurring labour of the Spirit (Energeia)." ("Sie selbst ist kein Werk (Ergon), sondern eine Thätigkeit (Energeia) [...]. Sie ist nemlich die sich ewig widerholende Arbeit des Geistes."[6]

It is small wonder that the appreciation of language as an essentially social phenomenon and its consideration as a form of activity were so intimately interwoven in the tradition discussed above. I believe this contingent historical fact throws light upon a conceptual connection too. *It is a part of the thesis of the social character of language that language is a form of activity* and its all other functions, including the descriptive one, are submitted to this feature. This conceptual connection is described in Marxism in the form of reducing language to labour. As is well known, the explanation of language in terms of labour is, according to Engels, the only correct account.[7] Engels's relevant statements seem to refer only to a genetic tie between language and labour but it is fully intelligible to suppose that labour has a prominent role not only in the genesis of language but also in framing its immanent structure. So far, Marxism has not taken much advantage of its theoretical possibilities in this field but what is to be regarded as a starting-point for a Marxist theory in examining the nature of language was explicity formulated by G. Lukács: "in the dynamic structure of ordinary language the most general features of human praxis are expressed." ("In dieser dynamischen Struktur der Sprache des Alltags drückt sich die allgemeine Wesensart [...] der menschlichen Praxis aus [...]".[8])

3. The most dangerous rival conception to explaining language in terms of praxis, to subsuming it under the category of action and, in general, to the idea of the social determination of language is to be found in the theory in which the linguistic power of man is accounted for in biological terms. If the view of holding language to be part of the inherited biological programme is accepted then the reflections related to labour and to the forms of social actions will become irrelevant.

It is well-known that Chomsky worked out his innatism in controversy with the behaviourist conceptions (which are a matter of secondary importance for our discussion here). Moreover, the arguments in favour of his own conception owe their strength to having been born in this context.

Let us recall that the argument which has been considered the most powerful rests upon the assumption that in the process of language learning the child is confronted with a finite number of data from adult language. On the basis of a finite number of data he succeeds, however, in constructing a grammar which enables him to generate an infinite number of sentences. This fact counts as evidence both for the creativity and the innateness of the human language faculty. It is worth noting that this argument seems to be strong also because the scientific paradigm prevailing in the given situation, the behaviourist learning theory, was not able to account for the relation between the available data and the grammar possessed by the child.

Is this argument as strong as it appears to be? In the first place, its premise is false. It is not the case that the child is confronted with data from adult language. We get a better picture if we take into consideration that, while talking to children, adults are using a reduced language adapted to the level of the children. In other words, the conversation of adults between them can be truly described in accordance with the picture given by Chomsky, but in the light of a common experience and of current research we have to suppose the existence of a particular strategy applied by adults in the verbal interaction with children. This strategy rests upon a principle of gradual growth. It is only to a small degree that in its formal and semantic aspects the speech of adults can be more complicated than the actual language of children is. In the verbal interaction with adults the child is not "exposed" to a chaotic conglomerate of data.

How is it possible to overlook such a simple fact? The answer, in my opinion, is to be found in Chomsky's philosophy of science, namely, in the way in which he extends the explanatory models of physics to linguistics. Conforming to Chomsky's picture the child is (subconsciously) a little scientist. He observes the speech of adults as the scientist observes the behaviour of physical bodies, and on the basis of the available data he constructs and controls hypotheses as the scientist does in the light of his own data. (Needless to say: the child performs these acts of scientific observation without being aware of what he is doing.) According to this picture the child has the role of an observer. Contrary to this, during the period of language learning the child does not *observe* anything. He communicates and takes part in interactions.

At this stage Chomsky could work out a defence in the following way. It makes no difference what kind of language is used by the adults. What counts alone is the fact that the child constructs a grammar relying upon a finite number of observational data. Quite apart from the nature of the data, he is gaining experience and his experience is sufficient for actualizing the underlying innate principles. This, in essence, amounts to a Kantian solution in itself and though, in general, it is not to be rejected it does not work here. The counter-argument is still founded upon the assumption that the child does observe the linguistic facts of his environment. However, observing the linguistic facts and taking part in communicative interactions are two fully different things. We have to make a sharp conceptual distinction between them. There is evidence that the child who is exposed to a number of linguistic stimuli but lacks the possibility of taking part in mutual communication does not learn to speak in a normal way.[9] (Such a situation arises in the case of a child who may watch the television but is not talked to.) Relying on these findings there is much to be said for the thesis according to which language learning does not follow the pattern underlying learning strategies in the field of other kinds of knowledge. Language learning cannot be described in terms of theoretical generalizations on the basis of observational data; it is to be described in terms of interaction and controlled communication. Communication is action and, as has been pointed out by Habermas[10] as well, it is not experience.

4. If language capacity is innate then, evidently, what is to be taken into consideration in explaining its nature is

only its structure. There cannot be any essential connection between its structure and its use. So there cannot be any interesting connection between structure and speech acts, between structure and communication. Chomsky himself emphasizes that "language is essentially a system for expression of thoughts",[11] and, therefore, language cannot be accounted for in terms of communication. "Communication is only one function of language, and by no means an essential one."[12] (The quotations are taken from Chomsky's book of 1975 but, as far as I can see, his standpoint, in this respect, has not changed substantially[13]. As a matter of fact, it is the standpoint which is compatible with innatism.)

Searle, on the other hand, has convincing arguments for assuming that meaning and speech acts, linguistic structure and communication are interdependent.[14] The debate of Chomsky and Searle is going on in terms of structure and function, but it is only one form, the modern form, of the debate on the more general question whether language is essentially or only contingently a social phenomenon.

The notion of action refers to the specific human behaviour all forms of which presuppose an explicit or implicit social context. It is, by the way, one of the main reasons for the descriptions of action to be dualistic, and that is why it is impossible to eliminate from them the intentional terms which cannot be translated into physical ones. What has been said holds true of linguistic actions too. If we take into consideration these characteristics of the notion of action the following conclusion is to be drawn from the assumed innateness of linguistic structures: The structure, already given on the biological level, anticipates those contingent social contexts in which our actions are performed and are to be taken for actions at all. Since every kind of social contexts emerged through history, such a conclusion, in my opinion, is both unacceptable and senseless.

The danger of having to draw such a conclusion is evoked in Katz's proposal to combine spech act theory with generative grammar.[15] Katz's endeavour leads to a grammatical monism which makes all linguistic facts appear as a grammatical fact. This can be seen from the thesis that all information about the illocutionary force of a sentence is incorporated in the grammatical structure of that sentence. The thesis is ambiguous. On the one hand, it would follow that language has a social nature also in the sense that all information about the essential types of social situations and actions are somehow coded in its historically developed structure. On the other hand, the above mentioned unacceptable conclusion can follow from it as well. According to this, provided the linguistic structure is inherited, language anticipates the historical types of social situations and actions. If one succeeded, as in my opinion Katz did not, in constructing a theory in the framework of which the speech acts and the illocutionary meanings can be completely represented on a grammatical level I would commit myself to the former conclusion.

5. Finally, I would like to touch upon one more question in connection with the social character of language. Some time ago Marxists were discussing whether language belonged to the basis or the superstructure of the society. As is known, since the memorable debate Marxists have accepted the view that language belongs to neither. In the light of this it seems to be striking that in an important place of The German Ideology Marx speaks about a "bourgeois language". With respect to certain words ("propriété", "Eigentum" and "Eigenschaft"; "Property", "Eigentum" and Eigentümlichkeit" and so on) Marx analyzes the interesting semantic feature of their being used both in a mercantile and an individual-psychological sense.[16] He noticed that the language governed by such semantic rules is a product of bourgeoisie. According to Lukács's interpretation this remark refers to the effects of reification upon language. The structures of reification penetrate into the linguistic structure as such. Lukács added: "A philological study from the standpoint of historical materialism could profitably begin here".[17] I believe, following

the remarks quoted, it could be systematically demonstrated that the concrete social structures and ideologies also have an effect upon the formal structure of language. The writers[18] who suppose there being such a phenomenon as linguistic alienation may be right. Such phenomena call attention to a new dimension of the social character of language.

Those, however, who limit the social character of language to this dimension or are trying to build upon it a global linguistic theory, relevant from the point of view of social theory too, are on the wrong tack. One has to make a careful distinction between what is to be taken for universal categories of a general social and linguistic theory and in what terms the connections of historically given social and linguistic structures are to be described. In a given state of language these two kinds of determinations are interwoven, they form the different strata of a unique code. A linguistic theory which aims at elucidating the social nature of language has to establish a connection between the fundamental strata of the code and the basic structures of social life as such. It will afterwards be possible to show the way in which the social-historically more specific strata or subcodes are related to this basis and in which they are organized into a functional whole in a given state of language. Although in the functioning of language these different factors cannot be separated and the consciousness of a given speaker is determined by the network of specific subcodes, language presupposes nothing else but the social as such. That could be put in this way too: The real language games are related to this or that form of life, but there is a transcendental language game which is the expression of the social as such.

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NOTES

1. Friedrich v. SCHLEGEL, *Philosophische Vorlesungen insbesondere über Philosophie der Sprache und des Wortes (1830)*. F.v..SCHLEGEL, *Philosophie des Lebens, Philosophie der Sprache und des Wortes*, Kritische Friedrich-Schlegel-Ausgabe, Herausgegeben von E. Behler, München-Padeborn-Wien: Verl. F. Schöningh, Thomas-Verl., 1969, p. 352.

2. Wilhelm v. HUMBOLDT, *Über die Verschiedenheiten des menschlichen Sprachbaues*. W. v. HUMBOLDT, *Schriften zur Sprachphilosophie*, Werke III, Stuttgart: Cotta, 1969, p. 196.

3. MARX, *Ökonomische-philosophische Manuskripte (1844)*. Karl Marx/Friedrich Engels, Werke, Berlin: Dietz Verlag, 1956-1968, Ergänzungsband I., p. 538.

4. W. v. HUMBOLDT, *Über die Verschiedenheiten des menschlichen Sprachbaues*, p. 201.

5. Richard J. BERNSTEIN, *Praxis and Action*, Philadelphia: University of Pennsylvania Press, 1971, p. 24.

6. W. v. HUMBOLDT, *Über die Verschiedenheiten des menschlichen Sprachbaues*, p. 418.

7. "Daß diese Erklärung der Entstehung der Sprache aus und mit der Arbeit die einzig richtige ist, beweist der Vergleich mit den Tieren." Engels, *Dialektik der Natur*. Cf. Marx/Engels, *Über Sprache, Stil und Übersetzung*, Berlin: Dietz Verlag, 1974, p. 49.

8. Georg LUKÁCS, *Die Eigenart des Ästhetischen*, Georg Lukács Werke, Neuwied am Rhein, Berlin Spandau: Luchterhand, 1963, Bank 11, p. 61.

9. Jean Berko GLEASON'S conference in Budapest, April 1981, Verbal communication.

10. Jürgen HABERMAS, *Was heißt Universalpragmatik?* K-O. APEL /Ed./, *Sprachpragmatik und Philosophie*, Frankfurt am Main:

Suhrkamp, 1976, p. 203.

11. Noam CHOMSKY, *Reflections on language*, New York: Pantheon Books, 1975, p. 57.

12. Ibidem, p. 69.

13. In *Rules and Representations* (New York: Columbia University Press, 1980) Chomsky holds the somewhat different view that language has no basic function. I do not think it should be taken, in the relevant respect, for an essential revision of his views about language.

14. John SEARLE, "Chomsky's Revolution in Linguistics". Gilbert Harman /Ed./, *On Noam Chomsky*, New York: Anchor Books, 1974, pp. 2-34. Cf. SEARLE, *Expression and Meaning. Studies in the theory of speech acts*, Cambridge University Press, 1979.

15. Jerrold J. KATZ, *Propositional structure and illocutionary force. A study of the contribution of sentence meaning to speech acts*, New York: Thomas Y. Crowell, 1977.

16. MARX/ENGELS, *Über Sprache, Stil und Übersetzung*, p. 123.

17. Georg LUKÁCS, *History and Class Consciousness*, Cambridge Massachusetts: The MIT Press, 1971, p. 209.

18. E.g. ROSSI-LANDI. Cf. Ferruccio ROSSI-LANDI, *Linguistics and Economics*, The Hague-Paris: Mouton, 1975.

LÁSZLÓ PÓLOS

IS FREGEAN TRADITION DEAD?

(*Or does it contain a viable alternative to Situation Semantics?*)

Barwise and Perry introduced a new semantic theory in 1981,[1] attacking the semantic tradition initiated in Gottlob Frege's work. Frege's main claim is that the distinction between two kinds of semantic values for linguistic expressions is indispensable for the resolution of semantic problems. In his original terminology, these two values are 'Sinn' and 'Bedeutung', and he distinguishes between the customary and the indirect uses of expressions:

> If words are used in the ordinary way, what one intends to speak of is their reference [Bedeutung] ... In reported speech, words are used *indirectly* or have their *indirect* reference ... The indirect reference of a word is accordingly its customary sense [Sinn] [2]

Frege extends the use of the Sinn - Bedeutung distinction from words to sentences as well. When a sentence is used embedded - e.g. in the case of attitude reports - it refers, not to its Bedeutung but to its Sinn. This is only half of the story, however; one must also specify what Sinn and Bedeutung are. Frege's main objective is to model Bedeutung. Let the Bedeutung of individual terms be the object the term refers to. (This is the only point where the use of 'refers to' is *not* misleading.) The Bedeutung of predicates can be straightforwardly defined in terms of their extension. (This is already more problematic.) Finally, Frege defines the Bedeutung of a sentence as a truthvalue. (This is the strangest choice. It appears a sentence may have a truthvalue; however a sentence *does not refer* to its truthvalue.) Problems, if there are any, are of a terminological nature. To avoid misunderstanding, the following modification seems expedient: 'Bedeutung', which is a natural expression only in connection with individual terms, will be uniformly replaced by *'factual value'*.

Barwise and Perry essentially retain the Fregean idea that sentences or words have two semantic values (although they hardly use the term 'semantic value'). They call the semantic value corresponding to Frege's Bedeutung 'interpretation', and the one corresponding to Sinn 'meaning'. The point they attack concerns the definition of interpretation. They argue that the Fregean treatment of truthvalues as interpretations/factual values of sentences is fundamentally wrong. Their argument can be summarized as follows. Frege's notion of Sinn is not a technically well established notion. Those logical-semantic theories (e.g., possible worlds semantics in general and Montague's intensional logic in particular), which attempt to explicate this notion in model theoretic terms, are faced with serious problems. These problems essentially stem from the fact that meaning (i.e. intension) is modelled as a function that assigns a factual value to expressions in every world and at every time point. Given that the factual value of a sentence is either TRUE or FALSE, such a theory is incapable of distinguishing between the meanings of logically equivalent expressions, and must therefore declare logically equivalent expressions to be freely interchangeable. On the basis of this, it does not take a great effort to generate an infinite number of semantic paradoxes.

The question posed in the title of this paper can now be articulated more clearly: Is it possible to have a logical semantic theory that is compatible with Frege's choice as to the factual value of sentences but, at the same time, is capable of distinguishing between the intensions of logically equivalent expressions? Accepting the metaphysical premise according to which whatever is, is possible, the answer must be yes. Imre Ruzsa's intensional logic is such a theory.[3]

Frege's own work cited above already contains the idea which, developed into an explicit theory, may offer a possibility to distinguish between the meanings of logically equivalent expressions:

> At any rate, one might expect that such sentences occur, just as there are parts of sentences having sense but not reference. And sentences which contain proper names without reference will be of this kind.[4]

Ruzsa's theory constitutes a consistent realization of this Fregean idea within the framework of intensional logic. The kernel of Frege's idea is retained: every linguistic expression has two semantic values, a factual value and an intension. Linguistic expressions are classified into types, with the types of individual names and declarative sentences as primitives. All other expressions belong to some extensional, or intensional, functor type. Every type has its domain, and the factual values of expressions belonging to a given type are taken from the domain of that type. The lack of a Bedeutung is represented in the theory in the following way: the domain of every extensional type contains a *null-entity*. The property of having the null-entity (of the appropriate type) as a factual value - i.e. the value-gap - is inherited in extensional contexts, from subexpressions to containing expressions.

Bearing in mind that every type has a null-entity in its domain, the definitions of 'intension' and 'intensional context' are retained (with the difference that Ruzsa does not allow the iteration of intensions, but this is not pertinent to the present discussion).

The introduction of null-entities enables one to distinguish between the intensions of logically equivalent expressions. This is rather straightforward in cases when two such expressions are built up from different non-logical constants, given that for some interpretation of the non-logical constants, one sentence will have the null-entity as its factual value in some world and at some time point, whereas the other sentence will not. In some cases, logically equivalent sentences can be distinguished even if they are built up from identical non-logical constants. (E.g. *Peter loves Mary or Peter does not love Mary*, versus *Mary loves Peter or Mary does not love Peter*.)

The criterion of the free interchangeability of two expressions is not logical equivalence but identity of intensions. It is also possible to define a strong - intensional - notion of consequence: A closed expression φ has φ' as its intensional consequence iff every interpretation of φ is the interpretation of φ' as well and every interpretation that assigns the value 1 to φ also assigns the value 1 to φ'.

Let us now turn to the other aspect of the question posed in the title. We have seen that value-gap semantics does not suffer from the shortcomings Barwise and Perry criticize Fregean theories of semantics for. What is this theory capable of, however, beyond the above distinction between intensions? Is it capable of everything that Situation Semantics has been devised to account for? Naturally, this question could only be satisfactorily answered if the range of problems to be dealt with in Situation Semantics were well-delimited. This not being the case, even the investigation of problems analyzed so far would be extremely space-consuming, and therefore I will concentrate on two problems in comparing the power of the two theories. It is hoped that this comparison will have a more general moral.

In his paper published in The Journal of Philosophy, Jon Barwise suggests that the analysis of naked infinitive perception reports is crucial, and given that his handouts for the 1983 Salzburg Congress support this view, I will restrict my attention to this problem.[5] Let us accept seeing as a paradigmatic case of perception.

Barwise proposes to interpret a NI perception statement "*a* sees φ" as asserting that *a* sees a scene *s* that supports the truth of φ.[6]

In the formal treatment, "*a* sees" turns out to be a sentential operator that cannot be iterated. A model for the extension of classical first order logic that only contains this new symbol is obtained by adding, to a model M of first order logic, a set of ordered n+2-tuples $\langle P^n, a_1, \ldots, a_n, t\rangle$ for every n. The union of these is called S. P^n is an n-ary predicate, $a_1, \ldots, a_n$ are elements of the domain of quantification of M, and $t \in \{0, 1\}$. The model of the extended language is the ordered pair $\langle M, S\rangle$

$S_a\varphi$ is true in $\langle M, S\rangle$ iff φ is true in S. This latter notion is recursively definable.[7] The use of S serves to ensure that φ need not be either true or false in the model but may also be neither true nor false. Note that this possibility is part and parcel to the value-gap conception. The points where treatment within Situation Semantics differs from treatment within Ruzsa's theory are as follows:

(i) For Barwise, it is a necessary and sufficient condition for the truth of the alternation $\varphi \vee \varphi'$ in S that one of its members be true in S. That is, an alternation can be "seen" even if one of its members cannot be "seen", i.e. is invisible. One of his axioms is as follows:

$$S_a(\varphi \vee \varphi') \leftrightarrow S_a\varphi \vee S_a\varphi'$$

This solution introduces the possibility for adding irrelevant members to the alternation. In Ruzsa's theory the value-gap is inherited in extensional contexts, wherefore if, say, φ has the null-entity as its factual value in some world, then $(\varphi \vee \varphi')$ must also have the null-entity as its factual value in that world. Thus the addition of irrelevant members is excluded.

(ii) Another crucial difference concerns the treatment of quantification. For Barwise, the domain of quantification is the domain of quantification of first order models, as can be seen below:

$$S \underset{f}{\overset{M}{\models}} \exists x\, \varphi \quad \text{iff} \quad S \underset{f(b:x)}{\overset{M}{\models}} \varphi \quad \text{for all } b \in U_M$$

Ruzsa's value-gap semantics allows one to define a weaker notion of quantification domain as well. Let S_a be an intensional functor that forms sentences from sentences. S_a not being a logical constant, it will have its own interpretation. In order to account for what Barwise calls the logic of non-logical expressions, semantic postulates are required. Such postulates may be like Barwise's principles, e.g.: If $S_a\varphi$ is true in some world at some time point in an interpretation, then φ is true in the same world at the same time point in that interpretation.

The universal quantification may be handled as follows:

(i) Let the domain of quantification be the same for every world.

(ii) Let the universal quantifier be defined by the following equation:

$$\forall x.\varphi(x) =_{df} \varphi = (\lambda x((\lambda p.p) = (\lambda p.p)))$$

Thus we get Barwise's quantification rule. The crucial difference lies in the fact that this latter rule can be weakened. This will be significant whenever we wish to quantify over the objects in an actual scene and not over the whole model.

Value-gap semantics thus appears to be a framework for the description of natural language that is capable of *handling* the same problems as Situation Semantics and which is also set-theoretically well-founded. Situation Semantics, however, may serve as a better heuristic tool in *discovering* what we really want to handle.

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NOTES

1. BARWISE, J. (1981), Scenes and other situations. *Journal of Philosophy* 78, pp. 369-397
   BARWISE, J.-PERRY, J. (1981), Situations and Attitudes. *Journal of Philosophy* 78, pp. 668-691
   BARWISE, J.-PERRY, J. (1983), *Situations and Attitudes*. MIT Press, Cambridge
2. FREGE, G.: Über Sinn und Bedeutung in: Translations from the Philosophical Writings of Gottlob Frege (GEACH, P. and BLACK, M.) Basil Blackwell, Oxford, 1960, p. 58-59
3. RUZSA, I. (1981), An approach to intensional logic. *Studia Logica* 40, pp. 269-287
4. FREGE *op.cit.*, p. 62
5. The discussion in BARWISE and PERRY (1983) does not seem to deviate from these in any relevant respects.
6. BARWISE *op.cit.*, p. 391
7. BARWISE, J. (1983), A few results about scene semantics. Handout for the 7th International Congress of Logic, Methodology, and the Philosophy of Science, Salzburg

IMRE RUZSA

SEMANTIC VALUE GAPS

0. *Preliminaries*

According to Frege and Carnap, a well-formed expression of a language may have two semantic values called *Sinn* und *Bedeutung* by Frege [1] and mentioned as *intension* and *extension* by Carnap [2]. In our days, Carnap's terminology is widely accepted (however, in some writings mostly written in English, one finds 'reference' instead of 'extension'). In most cases, 'meaning' and 'intension' are used synonymously, although in some writings the term 'intension' refers only to the set-theoretic representation of meaning (a function from possible worlds into a set of extensions). I shall use the term 'factual value' instead of 'extension' (since it seems to me somewhat perverse to speak of *the extension* of a sentence or an individual name). Of course, by the *factual value* of an individual term I mean the object (if any) denoted by the term and by the factual value of a (declarative) sentence I mean its truth value (if it has one). The factual value of any extensional functor (including predicates) is assumed to be a function (in the set-theoretical sense) which may be called its *extension*.

It may happen that a well-formed (meaningful) expression of a language has no factual value. I shall use the term 'semantic value gap' to refer to this phenomenon. The simplest case of a semantic value gap is perhaps a definite description without an actual denotation. If such a term occurs in a sentence in a *de re* position - as in the traditional example 'The present king of France is bald' -, then the sentence has no truth value (at least, it is claimed to be so by Frege [1]). This is an example of the *truth value gap* (the latter term is not unknown in the literature of logic).

However, semantic value gaps are not restricted to names and sentences. Some philosophers and some linguists argue that there are predicates which are *undefined* for some objects. For example, colour predicates are undefined for numbers, the predicate 'ruminant' is inapplicable to inanimate physical objects, and mathematical predicates (such as 'has a quadratic divisor') are undefined for physical objects. Even in the language of a science, some predicates and operations are partial ones: Think of division in arithmetic, square root operation in the field of real numbers, limit operations, differentiation and integration of functions in analysis. Accepting this view, we have new sources of semantic value gaps. Moreover, we can distinguish *the emptiness of the extension* and *the lack of the extension* of a monadic predicate. For example, if our domain of individuals is the set of natural numbers, then the extension of the predicate 'even prime number greater than two' is empty, whereas the predicate 'green' - being totally undefined for numbers - has no extension at all. Similarly, the predicate 'child of Chronos' has no extension in worlds other than that of Greek mythology.

However, since Frege, there has been a constant effort to drive out semantic value gaps from the realm of logic. In my view, this is the wrong policy. Firstly, it seems that the appearance of semantic value gaps is a real phenomenon. Secondly - and this is the most important argument - a logical system permitting semantic value gaps provides a natural means for a fine differentiation of meanings. To begin with simple examples, we all have learned that pairs of tautologies such as "$A \supset A$" and "$B \supset B$" are not distinguishable in logic, both being true in all logically possible worlds (and at all moments of time), and hence, their intensions must coincide. Similarly, sentences of the form A and "$A \,\&\, (B \vee \sim B)$" are logically synonymous: their truth values coincide in all logically possible worlds. Most linguists are not content with these results of logic. They argue that there *is* a significant difference between the meanings of these sentences. Now assume that there is a logically possible world w in which sentence A has a truth value but B has none. Then - assuming that the truth value gap is hereditary via truth functions - "$B \supset B$" and "$A \& (B \vee \sim B)$" have no truth value in w, but A is true or false and "$A \supset A$" is true in w. By this, our linguists are satisfied: it is possible that "$A \supset A$" is, but "$B \supset B$" is not, true in a world w, and hence, they are not synonymous. Similarly for the pair A and "$A \& (B \vee \sim B)$". [Of course, the case that "$B \supset B$" is false, or that A is true and "$A \& (B \vee \sim B)$" is false remains impossible.] As a consequence, it is not automatically guaranteed that A and "$A \& (B \vee \sim B)$" are interchangeable *salva veritate* in all contexts. (They are surely not so as arguments of intensional functors such as 'thinks that', 'sees' etc.)

A more striking example: Are the following tautological sentences synonymous?

Bill likes or does not like steak.
Steak likes or does not like Bill.

In general: are sentences of the form

"$Fab \vee \sim Fab$" and "$Fba \vee \sim Fba$

synonymous? If we admit the possibility that the two-place predicate F is defined (true or false) for the couple $\langle a,b \rangle$ but is undefined for $\langle b,a \rangle$, our answer is NO. Here lies the advantage of permitting partial functions as factual values (extensions) of predicates.

As an objection against accepting partially defined predicates, one might say that it is highly uncertain to limit the domain in which a predicate is defined (is true or false). Most people perhaps agree that 'ruminant' is not defined for inert objects, but even these might be confused in answering the question whether this predicate is applicable to amoebas or protozoa. It seems to be a metaphysical dogma that every predicate P has its own 'applicability domain', a domain of objects such that P is true or false of them. Is this a stronger dogma than the assumption that every predicate has a clear-cut truth domain? If you think that the latter is not a metaphysical dogma, but an unavoidable idealization for practising logic, then anyone who (like myself) wishes to maintain the use of partially defined predicates will answer that this is another (hardly avoidable, but at any rate, useful) idealization for the purpose of *better* practising logic. Moreover, we can assume that in our actual world, every predicate is totally defined (applicable to all assumed existing objects). To enjoy the benefits of a logic with semantic value gaps it is sufficient to assume that there are possible worlds in which the factual values of some functors are partial functions. That is, you are requested to accept only *the possibility* of partial functions, leaving open the problem of the actual existence of such functions. However, I should like to stress that the notion of partially defined predicates originates from a linguistic intuition, and hence, it does not lack a real, empirical base.

As far as I know, the first formal system permitting truth value gaps is A. N. Prior's modal propositional logic *Q* (see [3], Chapter V, and [4], pp.157-159). Since 1970, I have made efforts to extend Prior's pioneering approach to systems of quantified modal logic [5] and to the theory of descriptions in modal contexts [6]. In the last six or seven years, I set out to develop a general theory of semantic value gaps in the frame of a type-theoretical tensed intensional logic. My first report on this subject was a lecture given at a workshop 1979 (this was published only in Hungarian; a Russian version is in press). A somewhat modified version in English [7] appeared in Studia Logica 1981.

On these pages, I shall outline a semantic system of tensed intensional logic with factual value gaps. Here the basic ideas are the same as in my first approach 1979, but the details are refined and simplified in several respects. Before the systematic exposition, it may be appropriate to make a few informal, preliminary remarks.

Concerning type theory, my point of departure is the usual system of extensional types. Thus, o and ι are extensional types - the types of sentences and individual terms, respectively - and if α and β are extensional types, so is $(\alpha\beta)$. However, I will not introduce a new symbol '*s*' for senses - as R. Montague did in [8] - for creating new types of *names of intensions*. Instead, I will distinguish extensional and intensional functor types (the latter will be called *operator types*). The latter are defined as follows: if $\alpha, \beta_1, \ldots, \beta_k$ are extensional types ($k \geq 1$), then $(\alpha; \beta_1; \ldots; \beta_k)$ is an operator type. In this way, I shall avoid the unlimited iteration of intensions which endows Montague's system with a highly platonic character. The intuitive difference between a functor belonging to type $(\alpha\beta)$ and an operator belonging to type $(\alpha;\beta)$ is, as one might guess, that the first one operates on the *factual value*, and the second one on the *intension*, of its argument.

As primitive logical symbols, I shall use (besides parentheses) the lambda operator (λ), the identity sign ($=$), the descriptor (I) for forming names from monadic predicates, the intensor ($\hat{}$) for forming names of propositions from sentences, and two temporal operators '*since*' and '*till*'. Other connectives ($-$, $\&$, $\supset$, $\vee$,) quantifiers, modal operators, and the usual past and future tense operators (P, F) can be introduced by definitions.

An intensional language may contain *nonlogical constants* in all extensional and operator types. On the other hand, *variables* will be permitted only in the extensional types. But I shall use two sorts of variables in all extensional types called *extensional* and *intensional* variables, respectively. In the metalanguage, I shall refer with Roman letters to the extensional variables, and with Greek letters to the intensional ones. The main difference of the two sorts of variables is as follows: an expression of form "$(\lambda x\ A)$" is an extensional functor, whereas "$(\lambda \xi\ A)$" is an operator (an intensional functor). Thus, if A belongs to type α, and x and ξ belong to type β, "$(\lambda x\ A)$" belongs to type $(\alpha\beta)$, whereas "$(\lambda \xi\ A)$" belongs to the operator type $(\alpha;\beta)$.

An identity "$(A = B)$" will be accepted as well-formed only if the expressions A and B belong to the same *extensional* type. Quantification will be defined by means of λ-abstraction and identity. As a consequence, *only extensional variables* (of the extensional types) *are quantifiable*. Intensional variables will be proved to be eliminable from closed terms and formulas. This means that intensional variables are only auxiliary tools which are useful, for instance, for expressing incomplete natural language expressions, but they disappear as soon as the full sentence is built up.

The basic syntactic operations will be as follows: functional application (forming "C(B)" if C belongs to type $(\alpha\beta)$ or $(\alpha;\beta)$ and B belongs to type β), λ-abstraction, and identification (mentioned above).

The semantics begins in the usual way. We shall provide for all extensional types α a domain $D(\alpha)$ of factual values and a domain $Int(\alpha) = {}^{I}D(\alpha)$ of intensions where I is an index set of form WXT, W is the set of worlds, and T is the set of time moments. (I use '${}^{B}A$' to denote the set of functions from B into A.) As regards operator types, if α,β are extensional types, the domain of $(\alpha;\beta)$ will be defined as ${}^{Int(\beta)}Int(\alpha)$, and so on. Furthermore, a function d defined on W will provide the set of actual individuals for all worlds $w \in W$ (with the proviso $d(w) \subseteq D(\iota)$. Quantification in type ι will be restricted to d(w) at index $i = \langle w,t \rangle$ (a remarkable difference from Montague's intensional logic).

The factual value of an extensional functor of type $(\alpha\beta)$ will be a partial function from $D(\beta)$ to $D(\alpha)$. I assume that the factual value gap is *hereditary* in extensional contexts; i.e., if A and B are well-formed extensional terms, some occurrence of B in A does not lie in the scope of an intensional operator in A, and B is without factual value at an index i, then so is A. The semantic rules are in accord with this assumption. Of course, the value gap need not be hereditary via intensional operators: the sentence

John thinks that the wife of the present
Prime Minister of the U.K. is a nice lady

may have a truth value.

In the formal semantics, all value gaps will be filled in by distinguished elements called *zero entities*. For each extensional type α, its domain $D(\alpha)$ will contain a zero entity denoted by θ_α.

If A is a sentence, "$^\wedge A$" is a term denoting its intension and belonging to type ι. In accordance with this syntactic rule, the domain $D(\iota)$ will include sentence intensions as well. The set of actual individuals of the world w - denoted by d(w) - always includes all sentence intensions, but it is possible that it contains no other (real) objects.

In the last section of this paper, I shall mention an extension of the system by accepting "(A = B)" as well-formed in the case when A and B belong to the same *operator* type. In this way, quantification of *intensional* variables is definable. Then, our ontological commitment will be somewhat higher than before, but it still remains far from that of Montague's system. Iteration of intensions remains impossible.

1. *Type theory*

1.1 Type symbols

I will use 'o' (omicron) and 'ι' (iota) for denoting the logical type (or category) of the (declarative) *sentences* (formulas) and (individual) *names* (terms), respectively. If α and β are type symbols, I shall use "$(\alpha\beta)$" for denoting the type of *extensional* functors which, combined with an argument of type β, yield an expression of type α. Finally, "$(\alpha;\beta)$" will denote the type of *operators* (intensional functors) which might be combined with arguments of type β to yield an expression of type α. More formally and exactly:

The set EXTY is the smallest set of symbols such that:

(i) $o, \iota \in$ EXTY and

(ii) $\alpha,\beta \in$ EXTY $\Rightarrow$ "$(\alpha\beta)$" $\in$ EXTY .

And the set OPTY (of operator types) is the smallest set of symbols such that

(iii) $\alpha,\beta \in$ EXTY $\Rightarrow$ "$(\alpha;\beta)$" $\in$ OPTY and

(iv) ($\tau \in$ OPTY and $\beta \in$ EXTY) $\Rightarrow$ "$(\tau;\beta)$" $\in$ OPTY .

Finally, the set TYPE of all type symbols is to be

$$\text{TYPE} =_{df} \text{EXTY} \cup \text{OPTY} .$$

Omitting parentheses. I shall write

"$(\alpha\beta\gamma)$" instead of "$((\alpha\beta)\gamma)$" , and

"$(\alpha;\beta;\gamma)$" instead of "$((\alpha;\beta)\gamma)$" .

Furthermore, I shall omit the outermost parentheses surrounding type symbols. For example, I shall write

'$o\iota\iota$' instead of '$((o\iota)\iota)$', and

'$o\iota;o(o\iota)$' instead of '$((o\iota);(o(o\iota)))$' .

1.2 By a *type-theoretical structure* let us mean a sixtuple

$$S = \langle U, W, T, <, D, d\rangle$$

where U, W, T are nonempty sets, < is an ordering on T, D is a function with domain TYPE, d is a function from W, and the conditions (i) to (vii) below are fulfilled.

[Intuitively: U is a set of individuals, W is a set of (labels of) possible worlds, T is a set of time moments, $<$ is the relation *earlier than* (between time moments), the function D provides a domain of objects for all extensional and operator types, and the function d provides a domain of individuals for each world $w \in W$.]

(i) T is an infinite set linearly ordered by $<$ without first and last members. (One can assume that T is either the set of integers, or the set of the rational or the real numbers, and $<$ is the usual 'less than' relation between numbers.)

(ii) If $\alpha \in$ EXTY, then $D(\alpha)$ is a set containing a distinguished element θ_α called the *zero entity* of type α. By the domain of *intensions* of type α let us mean the set

$$Int(\alpha) =_{df} {}^{I}D(\alpha) \quad \text{where} \quad I = W\times T .$$

(iii) $D(o) = \{0,1,2\} = 3$, and $\theta_o = 2$. (Here '0' and '1' represent the truth values falsity and truth, respectively, and '2' represents the truth value gap.)

(iv) $D(\iota) = U \cup {}^{I}3 \cup \{U\}$, and $\theta_\iota = U$. (I hope $U \notin U$.) (The members of U may be regarded as primitive physical individuals, and the members of ${}^{I}3$ may be called sentence intensions. In fact, $Int(o) = {}^{I}3$.)

(v) If $\alpha,\beta \in$ EXTY,

$$D(\alpha\beta) =_{df} \{\varphi \in {}^{D(\beta)}D(\alpha): \varphi(\theta_\beta) = \theta_\alpha\} ,$$

and let $\theta_{\alpha\beta}$ be the function such that

$$b \in D(\beta) \rightarrow \theta_{\alpha\beta}(b) = \theta_\alpha .$$

(vi) If $\alpha,\beta \in$ EXTY,

$$D(\alpha;\beta) = {}^{Int(\beta)}Int(\alpha) ,$$

and if $\tau \in$ OPTY and $\beta \in$ EXTY, then

$$D(\tau,\beta) = {}^{Int(\beta)}D(\tau) .$$

(vii) For all $w \in W$, ${}^{I}3 \subseteq d(w) \subseteq U \cup {}^{I}3$.

2. *Grammar*

By an *intensional language* let us mean a quintuple

$$L^{int} = \langle LC, Var, Con, Op, Cat \rangle$$

satisfying the following conditions (G1) to (G5):

(G1) LC is the set of the *logical constants* of L^{int}:

$$LC = \{(,\ ),\ \lambda,\ =,\ I,\ \hat{},\ since,\ till\}.$$

(G2) Var is the set of *variables* of L^{int}:

$$Var = \bigcup_{\alpha \in EXTY} (Var^{ext}(\alpha) \cup Var^{int}(\alpha))$$

where $Var^{ext}(\alpha) = \langle x_{\alpha n} \rangle_{n \in \omega}$ and $Var^{int}(\alpha) = \langle \xi_{\alpha n} \rangle_{n \in \omega}$

(G3) Con is the set of (nonlogical) *extensional constants* of L^{int}:

$$Con = \bigcup_{\alpha \in EXTY} Con(\alpha)$$

where $Con(\alpha)$ is a (possibly empty) denumerable set of symbols called *constants* of type α.

(G4) Op is the set of (nonlogical) operators (intensional constants) of L^{int}:

$$Op = \bigcup_{\tau \in OPTY} Op(\tau)$$

where $Op(\tau)$ is a (possibly empty) denumerable set of symbols called *operators* of type α.

(G5) Cat is the set of the well-formed expressions of L^{int}:

$$Cat = Cat.ext \cup Cat.int,$$

$$Cat.ext = \bigcup_{\alpha \in EXTY} Cat(\alpha), \quad Cat.int = \bigcup_{\tau \in OPTY} Cat(\tau),$$

where the sets $Cat(\alpha)$ and $Cat(\tau)$ are inductively defined by the items (S1) to (S7) below. For the sake of brevity, the category of an expression A will be indicated by writing "A_α" E.g., in (S2) below, »"$C_{\alpha\beta}(B_\beta)$" $\in$ Cat(α)« abbreviates the following text: »If C $\in$ Cat($\alpha\beta$) and B $\in$ Cat(β), then "C(B)" $\in$ Cat(α).« .

(S1) $\alpha \in$ EXTY $\Rightarrow$ $Var^{ext}(\alpha) \cup Var^{int}(\alpha) \cup Con(\alpha) \subseteq Cat(\alpha)$;

and $\tau \in$ OPTY $\Rightarrow$ Op(τ) $\subseteq$ Cat(τ).

(S2) $\alpha,\beta \in$ EXTY $\Rightarrow$ "$C_{\alpha\beta}(B_\beta)$" $\in$ Cat(α); and

($\tau \in$ TYPE, $\beta \in$ EXTY) $\Rightarrow$ "$C_{\tau;\beta}(B_\beta)$" $\in$ Cat(τ) .

(S3) $\alpha,\beta \in$ EXTY $\Rightarrow$ ($\lambda x_\beta A_\alpha$)" $\in$ Cat($\alpha\beta$); and

($\tau \in$ TYPE, $\beta \in$ EXTY) $\Rightarrow$ "($\lambda\xi_\beta A_\alpha$)" $\in$ Cat($\alpha;\beta$).

[Here x $\in$ $Var^{ext}(\beta)$, and $\xi \in Var^{int}(\beta)$.]

(S4) $\alpha \in$ EXTY $\Rightarrow$ "($A_\alpha = B_\alpha$)" $\in$ Cat(o) .

(S5) "$IA_{o\iota}$" $\in$ Cat(ι).

(S6) "$^\wedge A_o$" $\in$ Cat(ι).

(S7) "(A_o *since* B_o)" $\in$ Cat(o); "(A_o *till* B_o)" $\in$ Cat(o).

Free and *bound* occurrences of a variable in a term are distinguished as usual. Also, *open* and *closed* terms are defined in the canonical way.

3. *Semantics*

3.1 Projections

By a *projection* (or *interpreting function*) of L^{int} into a type-theoretical structure S let us mean a function σ on Con $\cup$ Op such that:

(i) if C $\in$ Con(ι), σ(C) $\in$ U $\subseteq$ D(ι),

(ii) if C $\in$ Con(α), $\alpha \neq \iota$, then σ(C) $\in$ Int(α), and

(iii) if C $\in$ Op(τ), σ(C) $\in$ D(τ).

Remark. The constants of type ι are to be considered as rigid terms (like proper names); this is the reason of the difference between clauses (i) and (ii). Non-rigid individual terms may be expressed as descriptions, see later on.

3.2 Assignments

By an *assignment* (or *valuation*) of (the variables of) L^{int} in the structure S let us mean a function v on Var such that for all $\alpha \in$ EXTY, if $x \in Var^{ext}(\alpha)$, then $v(x) \in D(\alpha)$, and if $\xi \in Var^{int}(\alpha)$, then $v(\xi) \in Int(\alpha)$. Given L^{int} and S, let us denote by S(V) the set of all assignments of Var in S. - If $x \in Var^{ext}(\alpha)$, $a \in D(\alpha)$, $\xi \in Var^{int}(\beta)$, $\phi \in Int(\beta)$, v, v_1, $v_2 \in S(V)$, and for $z \in Var$,

$$v_1(z) = \begin{cases} a, \text{ if } z = x, \\ v(z) \text{ otherwise}; \end{cases} \qquad v_2(z) = \begin{cases} \phi, \text{ if } z = \xi, \\ v(z) \text{ otherwise}; \end{cases}$$

then we write "$v[x:a]$" for v_1, and "$v[\xi:\phi]$" for v_2.

Remark. As one sees, the possible values of a variable x_α are factual values of type α, whereas those of ξ_α are intensions of type α. This shows the *semantic* difference between the two sorts of variables.

3.3 Intensions

Let σ and v be a projection and an assignment of L^{int} into S, respectively. For all $A \in$ Cat, we define the *intension* of A in S, according to σ and v, denoted by "$int^S_{\sigma,v}(A)$", by the recursive clauses (I1) to (I7) below. I shall write "$int_v(A)$" instead of "$int^S_{\sigma,v}(A)$" assuming S and σ to be fixed. - If $A \in$ Cat.ext, then $int_v(A)$ is a function defined on $I = W \times T$; hence, it can be defined by determining $int_v(A)(i)$ for all $i \in I$. I shall use this possibility in some clauses below.

[The category of a metavariable will be indicated by a type symbol superscript - as introduced in Sect.2, (G5) - at its first occurrence in a rule.]

(I1.1) If $x \in Var^{ext}(\alpha)$, then

$$int_v(x)(i) = \begin{cases} \theta_\iota & \text{if } v(x) \in D(\iota) - d(i_1), \\ v(x) & \text{otherwise} \end{cases}$$

where i_1 is the first term of the couple $i \in I$. [Of course, the case $int_v(x)(i) = \theta_\iota$ may occur only if $x \in Var^{ext}(\iota)$.

(I1.2) If $\xi \in Var^{int}(\alpha)$, then

$$int_v(\xi)(i) = \begin{cases} \theta_\iota & \text{if } v(\xi)(i) \in D(\iota) - d(i_1), \\ v(\xi)(i) & \text{otherwise.} \end{cases}$$

(I1.3) If $C \in Con(\iota)$, then

$$int_v(C)(i) = \begin{cases} \theta_\iota & \text{if } \sigma(C) \notin d(i_1), \\ \sigma(C) & \text{otherwise.} \end{cases}$$

(I1.4) If $C \in Con(\alpha)$, and $\alpha \neq \iota$, then $int_v(C) = \sigma(C)$.

(I1.5) If $C \in Op$, then $int_v(C) = \sigma(C)$.

(I2.1) If $\phi(i) = int_v(C_{\alpha\beta})(i)(int_v(B_\beta)(i)$, then

$$int_v(\text{"}C(B)\text{"})(i) = \begin{cases} \theta_\iota & \text{if } \phi(i) \in D(\iota) - d(i_1), \\ \phi(i) & \text{otherwise.} \end{cases}$$

(I2.2) If $\phi = int_v(C_{\alpha;\beta})(int_v(B_\beta)$, then

$$int_v(\text{"}C(B)\text{"})(i) = \begin{cases} \theta_\iota & \text{if } \phi(i) \notin d(i_1), \\ \phi(i) & \text{otherwise.} \end{cases}$$

(I2.3) If $\tau \neq \iota$, $int_v(\text{"}C_{\tau;\beta}(B_\beta)\text{"}) = int_v(C)(int_v(B))$.

(I3.1) For all $b \in D(\beta) - \{\theta_\beta\}$

$$int_v(\text{"}(\lambda x_\beta A_\alpha)\text{"})(i)(b) = int_{v[x:b]}(A)(i),$$

and
$$int_v(\text{"}(\lambda xA)\text{"}(i)(\theta_\beta) = \theta_\alpha .$$

(I3.2) For all $\phi \in Int(\beta)$,

$$int_v(\text{"}(\lambda \xi_\beta A_\alpha)\text{"})(\phi) = int_{v[\xi:\phi]}(A) .$$

(I4)
$$int_v(\text{"}(A_\alpha = B)\text{"})(i) = \begin{cases} 2 & \text{if } int_v(A)(i) = \theta_\alpha \text{ or } int_v(B)(i) = \theta_\alpha, \\ 1 & \text{if } int_v(A)(i) = int_v(B)(i) \neq \theta_\alpha, \\ 0 & \text{otherwise.} \end{cases}$$

(I5) $int_v("IA_{o\iota}")(i) = u_o$ provided

$\{u \in d(i_1): int_v(A)(i)(u) = 1\} = \{u_o\}$;

in other cases $int_v("IA")(i) = \theta_\iota$.

(I6) $int_v("\hat{}A_o")(i) = int_v(A)$.

(I7) $int_v("A_o$ *since* $B_o)") = \phi$, $int_v("(A_o$ *till* $B_o)")=\psi$,

where ϕ and ψ are functions on I defined as follows:

$$\phi(i) = \begin{cases} 2 \text{ if for all } t<i_2,\ int_v("(A = B)")\langle i_1,t\rangle = 2\ , \\ 1 \text{ if for some } t<i_2,\ int_v(B)\langle i_1,t\rangle = 1 \text{ and for all } t', \\ \qquad t<t'<i_2 \Rightarrow int_v(A)\langle i_1,t'\rangle = 1, \\ 0 \text{ otherwise} \end{cases}$$

[here i_1 and i_2 are the first and the second terms of i, respectively];

$$\psi(i) = \begin{cases} 2 \text{ if for all } t,\ i_2<t \Rightarrow int_v("(A=B)")\langle i_1,t\rangle = 2, \\ 1 \text{ if for some } t,\ i_2<t,\ int_v(B)\langle i_1,t\rangle = 1 \text{ and for} \\ \qquad \text{all } t',\ i_2<t'<t \Rightarrow int_v(A)\langle i_1,t'\rangle = 1, \\ 0 \text{ otherwise.} \end{cases}$$

Remarks. (i) It is easy to show that if $A \in Cat(\alpha)$, then $int_v(A) \in Int(\alpha)$ provided $\alpha \in EXTY$, and if $A \in Cat(\tau) \subseteq Cat.int$, then $int_v(A) \in D(\tau)$. - (ii) Similarly, if $A \in Cat(\iota)$, then for all $i \in I$, $int_v(A)(i) \in d(i_1)$ where i_1 is the first term of the couple i. The (somewhat complicated) formulation of the group of semantic rules (I1) and (I2) will serve to guarantee this. - (iii) Extensional variables and individual constants as well as names of sentence intensions of form "$\hat{}A_o$" are rigid terms; cf. (I1.1), (I1.2), (I1.3) and (I6).

3.4 Factual values

If $A \in \text{Cat.ext}$, then

$$|A|_{vi} =_{df} \text{int}_v(A)(i)$$

will be called the *factual value* of A *at i* ($i \in I$), according to S, σ, and v. If $A \in \text{Cat}(\alpha) \subseteq \text{Cat.ext}$, then $|A|_{vi} \in D(\alpha)$. [Remember that the current term for 'factual value' is 'extension'.]

Using the notation just introduced, some of our semantic rules is expressible more shortly. E.g.,

$$\text{(I2.1)} \quad |C_{\alpha\beta}(B_\beta)|_{vi} = \begin{cases} \theta_\iota \text{ if } |C|_{vi}(|B|_{vi}) \in D(\iota) - d(i_1), \\ |C|_{vi}(|B|_{vi}) \text{ otherwise.} \end{cases}$$

(I3.1) $|(\lambda x_\beta A_\alpha)|_{vi}(b) = |A|_{v[x:b],i}$ provided $b \neq \theta_\beta$, and

$|(\lambda x A)|_{vi}(\theta_\beta) = \theta_\alpha$.

(I6) $|{}^\wedge A_o|_{vi} = \text{int}_v(A)$.

3.5 Absolute intensions

For $A \in \text{Cat}$, $\text{int}_v(A)$ may be regarded as the *contextual intension* of A according to S, σ and "the context" v. Of course, if A is *closed*, $\text{int}_v(A)$ does not depend on v. The absolute intension of A (according to S and σ) might be defined as a function $\|A\|$ from S(V) by

$$v \in S(V) \rightarrow \|A\|(v) = \text{int}_v(A) .$$

[Contextual and absolute intension is called by Montague 'sense' and 'meaning', respectively; cf. [8].]

3.6 The central notions of semantics

The couple $\langle S,\sigma \rangle$ is said to be an *interpretation* of the language L^{int} iff S is a type-theoretical structure and σ is a projection (an interpreting function) of L^{int} into S.

The quadruple $\langle S, \sigma, v, i\rangle$ is said to be a *representation* of the set $\Gamma \subseteq$ Cat.ext (of L^{int}) iff $\langle S,\sigma\rangle$ is an interpretation of L^{int}, $v \in S(V)$, $i \in I = W\times T$, and for all $\alpha \in$ EXTY,

$$A \in \Gamma \cap Cat(\alpha) \rightarrow |A|^{S}_{\sigma vi} \neq \theta_{\alpha} .$$

If, in addition,

$$A \in \Gamma \cap Cat(o) \Rightarrow |A|^{S}_{\sigma vi} = 1$$

holds, then we say that $\langle S, \sigma, v, i\rangle$ is a *model* of Γ.

Let K be a class of interpretations of L^{int}, and $\Gamma \subseteq Cat(o)$. Then Γ is said to be *K-satisfiable* iff Γ has a K-model $\langle S, \sigma, v, i\rangle$ where $\langle S,\sigma\rangle \in K$. A sentence $A \in Cat(o)$ is said to be a *strong K-consequence* of Γ iff every K-representation of Γ is a representation of $\{A\}$ and every K-model of Γ is a model of $\{A\}$; in symbols:

(1) $$\Gamma \Vdash_K A.$$

The sentence A is said to be *K-irrefutable* iff for all $\langle S,\sigma\rangle \in K$

$$(v \in S(V) \text{ and } i \in I) \rightarrow |A|^{S}_{\sigma vi} \neq 0$$

holds. Further, A is said to be *K-valid* iff A is a strong K-consequence of the empty class of sentences; in symbols:

(2) $$\Vdash_K A.$$

Terms B and C are said to be *K-synonymous* iff they belong to the same (extensional or intensional) category, and for all $\langle S,\sigma\rangle \in K$, $\|B\|^{S}_{\sigma} = \|C\|^{S}_{\sigma}$ (i.e., iff their absolute intensions coincide in all K-interpretations). We denote this relation by

(3) $$A \underset{K}{=} B .$$

If K is the class of all interpretations of L^{int}, we omit the subscript 'K' in the notations (1), (2), and (3).

A weak consequence relation will be introduced later on.

Remark. If $A \in$ Cat.ext, then "(A=A)" is K-irrefutable (for every class K of interpretations), but it need not be K-valid (for $|(A=A)|^{S}_{\sigma vi} = 2$ might be possible). However, "$((\lambda x\ x) = (\lambda x\ x))$" *is* valid (i.e., K-valid for all class K).

4. Some semantical metatheorems

[Proofs will be omitted throughout.]

4.1 The law of replacement

Assume that A, B belong to the same category, A is a part of $C \in Cat$, and denote "C[B//A]" the term obtained from C by replacing an occurrence of A not preceded immediately by 'λ' by B. Then:

$$(A \underset{K}{=} B) \Rightarrow (C \underset{K}{=} C[B//A])$$

for all class K of interpretations of L^{int}.

Let us say that *B is substitutable for the (extensional or intensional) variable* η *in A* iff η and B belong to the same (extensional) type, $A \in Cat$, and whenever ζ is a variable occurring free in B, and "(λζC)" is a part of A, then no free occurrence of η in A stands in "(λζC)". Let us denote by "A[B/η]" the term obtained from A by substituting B for all free occurrences of η.

4.2 The law of intensional lambda-conversion

If B is substitutable for the *intensional* variable ξ in A, then

$$(\lambda\xi A)(B) = A[B/\xi] .$$

Corollary: The eliminability of intensional variables. If $A \in Cat.ext$ is a *closed* term, then there is a term A' containing no intensional variables such that

$$A = A' .$$

A term $B \in Cat.ext$ is said to be a *rigid* one iff $int_v(B)$ is always a constant partial function on I. Rigid terms are the extensional variables, the constants of type ι, the sentence-intension names of form "$\hat{}A_0$", and all extensional terms involving only bound variables and logical constants (e.g., "$((\lambda x\ x) = (\lambda x\ x))$".

By an *intensional operator* let us mean any term of Cat.int as well as any of the logical constants *since*, *till*, and the intensor '^'.

4.3 The law of extensional lambda-conversion

Assume that the *extensional* variable x has some free occurrence in A ∈ Cat.ext, B is substitutable for x in A, and one of the following two conditions if fulfilled:

(i) No free occurrence of x in A is a part of an argument of an intensional operator.

(ii) B is a rigid term.

Then

$$(\lambda x\ A)(B) \equiv A[B/x] .$$

Remark. If x does not occur free in A, then

(4) $$|(\lambda x\ A)(B)_{vi} = |A|_{vi}$$

except when $|B|_{vi} = \theta_\beta$ in which case the left side of (4) is θ_α (provided A ∈ Cat(α), B ∈ Cat(β)). This the reason of the stipulation that x must have some free occurrence in A.

The term A ∈ Cat.ext is said to be *pure extensional* if it involves no intensional operators and no intensional variables.

4.4 The hereditaryness of factual value gaps in extensional contexts

Assume that A ∈ Cat(α) ⊆ Cat.ext, A is pure extensional, B ∈ Cat(β), B is a part of A, and no free variable of B is bound in A. Then:

$$|B|^S_{\sigma vi} = \theta_\beta \rightarrow |A|^S_{\sigma vi} = \theta_\alpha ,$$

for all interpretations ⟨S,σ⟩, for all v ∈ S(V), and for all i ∈ I.

5. *Definition of classical connectives and operators*

[In the following definitions, the category of a metavariable will be indicated by a type symbol subscript at its first occurrence. Some parentheses will be omitted if no misunderstanding arises by their omission.]

5.1 The symbols '$\uparrow$', '$\downarrow$', and '$\sim$' (Verum, Falsum, and Negation, respectively) are to be introduced as follows:

$$\uparrow =_{df} \text{"}(\lambda p_o p) = (\lambda p.p)\text{"}; \quad \downarrow =_{df} \text{"}(\lambda p_o p) = (\lambda p.\uparrow)\text{"};$$

$$\sim =_{df} \text{"}\lambda p_o(p{=}\downarrow)\text{"};$$

where p is the first member of $Var^{ext}(o)$.

We write

"A $\neq$ B" for "$\sim$(A = B)" .

5.2 '*P*' and '*F*' (past and future tense-operators) are defined as follows:

$$P =_{df} \text{"}\lambda \pi_o(\uparrow \textit{ since } \pi)\text{"}; \quad F =_{df} \text{"}\lambda \pi_o(\uparrow \textit{ till } \pi)\text{"};$$

where π is the first member of $Var^{int}(o)$.

5.3 The modal operators '$\Box$' and '$\Diamond$' (necessity, possibility) are defined by:

$$\Box =_{df} \text{"}\lambda \pi_o(\hat{}\pi = \hat{}\uparrow)\text{"}, \quad \Diamond =_{df} \text{"}\lambda \pi_o(\hat{}\pi \neq \hat{}(\pi{\neq}\pi))\text{"},$$

where π is as above. Note that "$\sim\Diamond(\sim$A)" and "$\Box$(A)" are not synonymous, and that "$\Box$(A)" and "$\Diamond$(A)" never take 2 as their factual value.

5.4 Quantifiers. If C $\in$ Cat($o\alpha$), the formula

$$(C = \lambda x_\alpha \uparrow)$$

expresses that the (perhaps higher-order) predicate C holds *true for all* members of D(α), whereas

$$(C = \lambda x_\alpha(Cx = Cx))$$

expresses that C is *false for no* members of D(α). [In a semantic without value-gaps, the two formulas are synonymous.] It is the latter which we shall call the universal quantification of C. However, in the case $\alpha=\iota$ we want to restrict quantification to $d(i_1)$ instead of $D(\iota)$. By this, the general definition of the quantifier $\forall_\alpha$ (of type α) is as follows:

$$\forall_\alpha =_{df} \text{"}\lambda P_{o\alpha}[\lambda x_\alpha((x=x) = Px) = \lambda x((x=x) = (Px = Px))]\text{"}.$$

If $\alpha\neq\iota$, this is synonymous with the shorter one:

$$\forall_\alpha =_{df} \text{"}\lambda P_{o\alpha}[P = \lambda x_\alpha(Px = Px)]\text{"}.$$

Here P is the first member of $Var^{ext}(o\alpha)$.

Now we can introduce the following abbreviations:

"$\forall x_\alpha . A_o$" for "$\forall_\alpha(\lambda x_\alpha . A_o)$",

"$\exists x_\alpha . A_o$" for "$\sim\forall x_\alpha . \sim A_o$",

"$Ix_\iota . A_o$" for "$I(\lambda x_\iota . A_o)$" .

We then have the following valuation rule:

$$|\forall_\alpha . A_o|_{vi} = \begin{cases} 2 \text{ if for all } a \in D(\alpha),\ |A|_{v[x:a],i} = 2\ , \\ 0 \text{ if for some } a \in D(\alpha),\ |A|_{v[x:a],i} = 0, \\ 1 \text{ otherwise.} \end{cases}$$

In the case $\alpha=\iota$, "$a \in D(\alpha)$" is to be replaced here by "$a \in d(i_1)$".

Now we can introduce '&' (conjunction) as Montague did in [8]:

$$\& =_{df} \text{"}\lambda p_o . \lambda q_o . \forall h_{oo}[p = (hp = hq)]\text{"}$$

where h is the first member of $Var^{ext}(oo)$, and p, q are the first two members of $Var^{ext}(o)$. Of course, we write "$A_o \& B_o$" instead of "$\&(A_o)(B_o)$". If one of A, B takes the factual value 2, then so does "A & B".

The functors 'v' and '$\supset$' can be introduced by using '~' and '&' as usual. We do not need the biconditional, since "$(A_o = B_o)$" does the same job.

5.5 Subordination. Let us note that if B, C $\in$ Cat($o\alpha$), then

$$\forall x_\alpha(Bx \supset Cx)$$

does not mean that all B's are C's. [It only means that no B's belong to the falsity-domain of C; i.e., it is not excluded that C is undefined for some B's.] To express the latter, we will introduce the functors 'sub_α'.

Assume $P \in Var^{ext}(o\alpha)$ and $x \in Var^{ext}(\alpha)$. Noting that both are rigid terms, we have that for all assignments v, if for some $j \in I$, $|Px|_{vj} = 1$, then for all $i \in I$,

$$|Px|_{vi} = 1$$

with the proviso that in the case $\alpha = \iota$, $v(x) \in d(i_1)$. Hence:

$$|\Diamond(Px)|_{vi} = \begin{cases} 1 & \text{if } |Px|_{vi} = 1, \\ 0 & \text{otherwise} \end{cases}$$

(with the same proviso as above). We then define:

$$sub_\alpha =_{df} \text{"}\lambda P_{o\alpha}\lambda Q_{o\alpha}\forall R_{o\alpha}[(R = Q) \supset \forall x_\alpha(Px \supset \Diamond(Rx))]$$

where P, Q, R are the first three members of $Var^{ext}(o\alpha)$.

We write "$B_{o\alpha} sub\ C_{o\alpha}$" instead of "$sub_\alpha(B_{o\alpha})(C_{o\alpha})$. Then "B *sub* C" abbreviates the formula

$$\forall R_{o\alpha}[(R = C) \supset \forall x_\alpha(Bx \supset \Diamond(Rx))]$$

which takes the value

2, if the factual value of B or of C is $\theta_{o\alpha}$,

1, if all B's are C's, and

0 in the remaining cases.

Note that

"B *sub* C" and "(λx.~Cx) *sub* (λx.~Bx)"

are not synonymous. The same holds for

"B sub λx(Cx v ~Cx)" and "C *sub* λx(Bx v ~Bx)" .

Thus, if we translate a sentence of the form "Every B is a C" as "B *sub* C", we get that the following tautological sentences are not synonymous:

Every boy is or is not a pupil.

Every pupil is or is not a boy.

Again, this is a remarkable result of value-gap semantics.

A final abbreviation:

"$B_{o\alpha}$ *equ* $C_{o\alpha}$" stands for "($B_{o\alpha}$ *sub* $C_{o\alpha}$) & (C *sub* B)".

5.6 Weak consequence. Let K be a class of interpretations of L^{int}, $\Gamma \subseteq Cat(o)$, and $A \in Cat(o)$. We say that A is a *weak K-consequence* of Γ (denoted by "$\Gamma \models_K A$") iff the set $\Gamma \cup \{\sim A\}$ has no K-models. - Note that the weak K-consequences of the empty set are just the K-irrefutable formulas; thus, the K-irrefutability of A can be denoted by "$\models_K A$".

5.7 A new law of extensional lambda. Assume $A \in Cat(o)$, $x \in Var^{ext}(\beta)$, $B \in Cat(\beta)$, and x does not occur free in B. Then:

$$\models (\lambda x.A)(B) = \exists x(x = B. \& A)$$

6. *Extended intensionality*

The semantics explained on the previous pages makes our ontological commitment to admit intensional objects as moderate as it is possible at all. A shortcoming of the system: the metalanguage statement "$int_v(A) = int_v(B)$" is not expressible in the object language if A, B ∈ Cat.int. (If A,B ∈ Cat.ext, then

$$\hat{}(A = A) = \hat{}(B = B) \;\&\; \hat{}(A = B) = \hat{}(A = A)$$

is suitable for expressing their synonymity.) The way of the correction is obvious: let us extend the syntactic rule (S4) - the use of identity symbol - for intensional terms:

($S4^i$) If $A,B \in Cat(\tau) \subseteq Cat.int$, then "$(A = B)$" $\in Cat(o)$.

The corresponding semantic rule:

($I4^i$) If $\tau \in OPTY$, then

$$|(A_\tau = B_\tau)|_{vi} = \begin{cases} 1 & \text{if } int_v(A) = int_v(B)\ , \\ 0 & \text{otherwise.} \end{cases}$$

The increase in our ontological commitment is clearly indicated by the fact that our intensional variables became quantifiable: if $C \in Cat(o;\beta)$ and $\xi \in Var^{int}(\beta)$, then

$$(C = (\lambda\xi.\dagger))$$

expresses that C holds true for all $\phi \in Int(\beta)$. Thus, we can write

$$"\forall\xi_\beta.A_o" \quad \text{for} \quad "(\lambda\xi_\beta A_o) = (\lambda\xi\dagger) ."$$

Of course, the intensional variables are no longer eliminable

Another advantage of the extended use of identity is that one can quantify in type ι on $U \cap d(w)$ (remember that $D(\iota) = U \cup {}^I3 \cup \{U\})$. Let us call the members of $U \cap d(w)$ the *real objects* of the world $w \in W$. We define:

$$real =_{df} "(\lambda x_\iota \forall \pi_o \; (x \neq {}^\frown\pi))" ,$$

where π and x are the first members of $Var^{int}(o)$ and $Var^{ext}(\iota)$ respectively. Then

$$\forall x_\iota(real(x) \supset A_o)$$

or, in a stronger form,

$$real \; sub \; (\lambda x_\iota A_o)$$

expresses the universal quantification of A over the real objects of d(w). Let us note that if d(w) contains no real objects, i.e., $d(w) = {}^I3$, and $i = \langle w,t\rangle$, then

$$|\exists x_\iota(real(x))|_{vi} = 0.$$

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KORNÉL SOLT

ARGUMENTS AGAINST ATEMPORAL DEONTIC LOGICS

1. Introduction

1. Norms and codes of norms "exist" in time. They are valid over a period of time *t-t'* (*t<t'*), after which they become invalid. A particular norm (or code) is not valid before a certain *t* and after a certain *t'*. Acts regulated by norms are also performed in time. The addressee of a norm acts in accordance with it - or fails to do so - in the course of time. Therefore, I believe the only adequate way of representing norms logically is through temporal deontic logic. I agree with those who think it necessary to make a link between deontic logic and temporal logic. There are now more and more authors who share this view, for example, P.S. GREENSPAN [6], H-N. CASTAÑEDA [4], [5], J. LYONS [7], and R.H. THOMASON [18].

I intend to examine here the temporal relations between some components of norms, and the "position" of norm-regulated acts in time. Through this, I will be able to support my view that atemporal deontic logic cannot *in principle* provide adequate means to describe certain features of norms and of acts regulated by norms.

2. My point of departure is a conception of G.H. von WRIGHT to the effect that every norm can be related to a corresponding deontic statement, true or false, with which it is semantically equivalent: i.e. the prescriptive character of the norm is semantically preserved.[1] Accordingly, a universal legal norm like "Loans ought to be repaid" can be "translated" into the deontic statement "It is obligatory for the addressee to repay the loan." (For brevity's sake, in this essay, I will also call a deontic statement a norm.)

The operator "*O*" will here be used exclusively in the prescriptive sense.[2] Thus *O*(—) approximately means that "The addressee is obliged to act so that the statement in brackets be true." (In standard deontic logic: *Op*.)

Drawing on von WRIGHT's idea again, I distinguish between categorical norms and those which are conditional.[3] A categorical norm has no conditions or, to be more precise, it only has the pseudo-condition that it be performable. A conditional norm, on the other hand, also has some "real" conditions. (An example of a categorical norm: "A promise ought to be kept"; and a conditional norm: "If you cause damage, you ought to repair it.")

The present investigation is only concerned with concrete norms, i.e. norms deducible from universal norms with respect to a particular addressee. (The universal norms of codes are or are not fulfilled by the individuals' acts.)

Among deontic operators, only "*O*" is used here, so the use of the symbols *P* and *F* will not cause ambiguity. The latter are here not deontic but tense operators in the same sense as in the RESCHER-URQUHART system K_b. [11]

2. *The inherent present-tenseness of the operator "O"*

3. To my knowledge, Hector-Neri CASTAÑEDA was the first to point out the inherent presentness of "*O*". He formulated this as "the principle of the present-tenseness of ought", meaning that "... times and tenses change around 'ought'...", while "'ought' remains an unmovable bastion".[4] Indeed, norms are always uttered in the present tense. The prescriptive operator "*O*" has neither past nor future tense.

4. If we formulate the three tenses of *O*(—) we obtain:

(1) *PO*(—) "It was obligatory for the addressee to act in such a way"

(2) *O*(—) "It is now obligatory for the addressee to

act in such a way"

(3) *FO*(—) "It will be obligatory for the addressee to act in such a way."

Among the three statements (2) is the only one with a normative content, while (1) and (3) are merely descriptive. If (1) is true, then it is a statement about something which *was* a norm. If (3) is true, then it is a statement about something which *will be* a norm (e.g. a bill in Parliament). Applying the tense operators to the symbol *"Op"* in standard deontic logic, we get the non-standard symbols *POp*, *Op*, and *FOp*, of which only the second one is prescriptive, the other two being descriptive. No atemporal instrument of logic can distinguish between the three versions.

3. *Categorical norms and time*

5. A norm can only prescribe that a *future* act be performed by the addressee, after the moment of its uttering. Neither acts in the past, nor those already completed in the present, can be prescribed "now" by any norm. No norm can prescribe that the present be different from what it is. Consequently, it would be a mistake to symbolize a categorical norm by using *"Op"*. The prescriptive formula *O*(—) and its argument are never synchronical.[5] The performance (or violation) of a norm is always posterior to its utterance. Atemporal standard deontic logic contemplates norm-regulated "events" in their eternal synchronity, although these events are always diachronical and not synchronical. For this reason, I put forward the following formulation for a categorical norm instead of *"Op"*:

(4) *OFp*

Explication: "It is obligatory for the addressee to act so that *p* become true in the future."

The "norm" *Op* (*"O"* being interpreted prescriptively) obliges the addressee to accomplish something which is impossible to perform: "The addressee ought to render *p* true even when the truth-value of *p* has already been fixed as either true or false." Thus, in *"Op"*, the operator *"O"* can only have a descriptive meaning: *"Op"* furnishes factual information regarding *p's* present deontic status, it belonging to that set of things which are obligatory. It simply informs us that an act *p* performed by the addressee in the present is, according to the code, obligatory in a descriptive sense.

6. Deontic logic is an "offshoot" of alethic modal logic. There is definitely a great deal of similarity between deontic and modal operators, and the analogy proved very useful to deontic logic at its beginning. Nevertheless, there are also many differences between the two logics, and heavy emphasis on the analogies is bound to be detrimental to deontic logic.

The difference between deontic and modal logic is significant with regard to our problem as well, since it seems that a deontic statement cannot be completely expressed in atemporal terms, while a modal statement lends itself easily to the atemporal approach. For example,

(5) *Op & p*

seems to make no sense if *"O"* is taken normatively, because it prescribes the performance of an act which it simultaneously claims to have been performed already.

(6) *Np & p,*

however, makes sense, for there is no successive relation between *Np* and *p*.

4. The retroactive force

7. It happens (mainly in the field of legislation) that a code or a norm is introduced with a retroactive force (Cf.

e.g. V. PESCHKA [10]). That is to say, a code C becomes effective at t', but it prescribes that its norms be applied to acts performed at an earlier period $t-t'$.

Norms (or codes) cannot have any retroactive force in the prescriptive sense. When, for example, a code C_2 comes into force at t' with a retroactive effect covering the period $t-t'$, it would be absurd to assume that the code makes its addressees act in the past $t-t'$ in a way different from that in which they actually did. It rather means that the bodies entrusted with the application of C_2 (such as courts of justice) are obliged (note here the genuine prescription) to judge certain past acts, performed by the addressees between t and t', on the basis of the new code C_2, instead of on the *then* effective code C_1.

The retroactive force of C_2 is of a "descriptive character". This force changes *ex post facto* the deontic status of the acts performed earlier by the addressees, that is, between t and t'. If a prescription in C_2 is more rigid than the corresponding prescription in C_1, then an act which, according to C_1, was not obligatory during $t-t'$ is later considered as one "the addressee ought to have performed" (and the addressee may eventually be punished for failing to perform it.)[6]

The retroactive effect of a norm cannot, therefore, be described through atemporal logic.

5. Performance or non-performance of a categorical positive norm in the course of time

8. Among categorical concrete norms, I will deal exclusively with commands which are positive norms prescribing acts. I am not concerned here with prohibitions.

When a categorical positive norm OFp has been uttered, the addressee faces the alternative of either doing p or not doing p. He finds himself in a situation of choice. He must decide which path to follow: the one which leads to *p* or the one which leads to *-p*. Let us see these possibilities represented in a K_b time diagram:

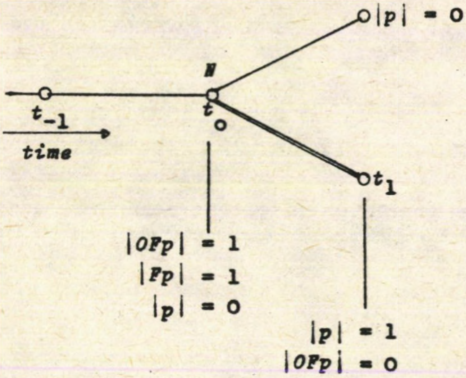

Fig. 1

In the diagram, t_0 signifies the actual present, i.e. "now" (=*N*), the moment when the norm *OFp* is uttered. Let us suppose that the norm ought to be performed at t_1. The figure demonstrates the two possible alternatives. If the addressee follows the lower course, he performs the norm, whereas if he follows the upper one, he fails to perform it (in other words, he violates it). The lower double line in the figure indicates the future, so the diagram shows the lower version to be a fact. In the two "critical points of time", the truth-values of some of the more important statements are given. Note that when *p* assumes the value true in t_1 (the addressee performs the norm), then, at the same time, *OFp* becomes false (the norm ceases to be valid). As a result of its performance, the concrete positive norm "disappears".[7] (This obviously does not hold for universal norms and concrete prohibitions.)

9. But how are we to show, at t_1, that the addressee has performed a valid positive categorical norm?

Like this:

(7) *POFp & p*

An exact formulation of this information is not possible by means of atemporal deontic logic. Expressed in the symbols of standard deontic logic,

(8) *Op & p*

does not mean the same as (7), for (8) states simultaneously that *p* ought to be true and that *p* is already true. Similarly, the realization that a valid categorical norm has been violated by the addressee is not expressed by the conjunction *Op & -p*, because of the simultaneity of its components.

6. *Future contingency*

10. While, in the rest of this article, I use the terms "necessary", "impossible", and "contingent" in the logical sense, in this and the next sections (7 and 8) I will refer to them in the *physical* sense.

A norm can only regulate *contingent* acts, which, thus, may or may not be performed.[8] No norm can prescribe something necessary (for that would be fulfilled in any case) or impossible (since that cannot be fulfilled).

Acts regulated by norms are situated, firstly, in the future[9] and, secondly, in contingency. Accordingly, the object regulated is always something in the "contingent future". But what is meant by this much disputed philosophical concept?

11. How is contingency situated in the future? How can the future be said to "branch off"? What is branching? Is it time itself - in the future? Or the events?[10] Or, rather, the possibilities?[11] I think it is the possibilities. Time does not branch off, even in the future, because both the past and the future are linear, unlike the system K_b. There are no alternatives on the real time line.

When we have progressed from "now" (*t*) to some *t'* and we "look back", we see the "line" of a single past left behind. There is one single future ("the" future) in the same way as there is one single present and one single past. (In real time, there are no ontic uncertainties.) This has been succintly stated by Bertrand RUSSELL: "We all regard the past as determined simply by the fact that it has happened; but for the accident that memory works backward and not forward, we should regard the future as equally determined by the fact that it will happen." ([12], p.146) - "If you already know what the past was, obviously it is useless to wish it different. But also you cannot make the future other than it will be;..." "...the future is determined by the mere fact that it will be what it will be..." ([12], p.147).

Indeed, the future can no more be changed into something else than the present or the past.

12. Does it then follow from this conception of "one single future" that the future is pre-determined? Certainly not. (If it did, then norms would make no sense.)

There are events which must necessarily occur in the future and there are other "events" whose occurrence in the future is impossible. (These are the two areas in which norms are ineffective.) But there are also events whose occurrence in the future is neither necessary nor possible (i.e. they are contingent). That the future "will be what it will be" may well be true, but it is never pre-determined (within the boundaries of the necessary and the impossible) *what it is that will be.*[12]

This is the area which, as seen from the present, is open to alternatives. Among the events or acts that are "waiting" in the future, it is the active subject who chooses the ones he performs at a given "now". This is the sphere where norms are meaningful and significant, the sphere of responsibility. Where we are free, we are responsible. It is precisely the function of norms to motivate the addressees into "choosing" and performing the contingent future acts which are ordered by the code.

Here, I have tried to point out that the conception of a "single linear future" is not necessarily connected with the idea of a "pre-determined future". However, I see this as only a preliminary approach to the concept of the "contingent future", as I believe it still requires further analysis.

7. The vagueness of future contingency

13. Necessary future events are *ab ovo* on the line of the future (that is, we are unable to prevent them from occurring). On the other hand, events of the "contingent future" are not on the line of the future: they are either brought onto the line by us or they are not. In the latter case, they are not in the future in any real sense of time, as such events are only situated on the line of an imaginary future.

Temporal logic often mentions "factual future" as opposed to that future which is not factual, i.e. never realized (e.g. McARTHUR [8]). Such phrases are misleading because the future is always "factual", or else it is no future at all. The future which is not "factual" is no future in any real sense of the word.

14. Let us suppose that at t ("now"), I am dropping a metal ball from Elizabeth Bridge into the Danube. The event we can call "the metal ball hits the surface of the Danube" will happen at time t', but, already at t, it is *ontologically certain* that the above event will happen at t'. The case is different with a contingent event which has not yet taken place. Such an event may be, for example, that John Smith repays a loan to Peter Brown at t'. It is *ontologically uncertain* at t that the event will take place at t'. It remains uncertain until t'. At t, John Smith faces an open alterna-

tive which is only closed at t'. (We ourselves close our open alternatives with our decisions and acts, rightly or wrongly.)

The truth-conditions of the following two statements are analogous:

(9) "The metal ball will hit the surface of the Danube", and

(10) "John Smith will repay the loan to Peter Brown".

But there is a fundamental difference between them: (9), unlike (10), already has a definite truth-value for t at t. The truth-value of (10) for t will only be determined at t' (*post festa*), with a retroactive effect on t. During the interval t-t', the truth-value of (10) for t has not yet been ontologically determined. As Richmond H. THOMASON writes: "Future contingencies are neither true nor false." ([19], p. 192). This assertion is basically true, if one adds the restriction that a statement in the "contingent future" has no truth-value during period t-t'. This is precisely where the *openness* of the contingent future manifests.

In fact, the phrase "open alternative" is a pleonasm, since there is no alternative which is not open. What is "closed" cannot be an alternative. It is a necessary precondition to the existence of an alternative that the future have at least two possible "scenarios", each of which should have the chance of being realized.

15. Throughout the history of mankind, the realm of physical contingency has expanded as man has extended his control over nature, society and himself. This is illustrated in Figure 2, where "necessary", "impossible" and "contingent" are used in the physical sense:

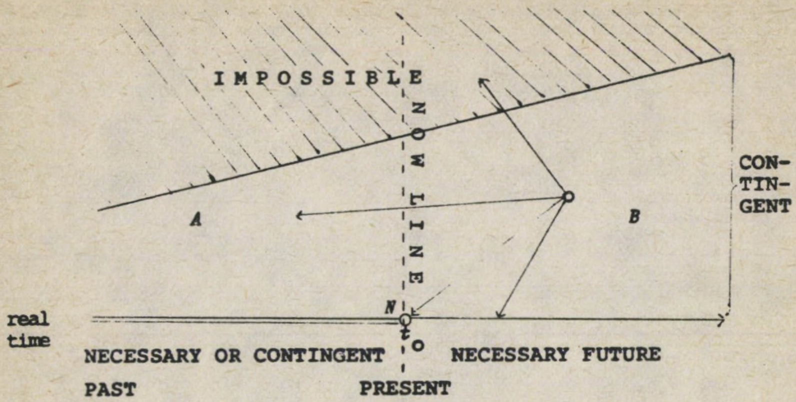

Fig. 2

In Fig. 2, at t_o there are both events which were necessary and others which were contingent before their occurrence. To the left of t_o on the real time line are found the past events which occurred necessarily and others which were realized (performed) out of contingency. To the right of t_o only necessary events are on the line of real time. These qualify as future events "in advance". Beside the line of real time, we find imaginary time. To the right of the vertical broken line of "now", in the space between impossible events and the line of the real future (sector B), the so-called "contingent future events" are "waiting for their turn". They tend to move towards the "now line". (1) Some of them become necessary in a nearer future. (2) Others become actual in a real "now" and will "eventually" have a place on the real time line, becoming real past events. For the rest of them, there is no "now" in which they become actual. (3) Some events become impossible already in the future. (4) Others, after having crossed the "now" line, fall into the blank area to the left, between impossible events and the line of the real past (sector A). They are "events" which could have occurred, but did not, at an earlier point of time. (The four kinds of possible "courses" of events emerging from "future contingency" are illustrated in Fig. 2. by the four arrows.)

16. It seems that the term "contingent future" is also misleading, for it expresses a self-contradictory concept: namely, if an imaginary event is already a future event at *t*, then it is not contingent, and, conversely, if it is contingent, then it is not yet a future event at *t*. A "future contingency" in the process of occurring is no longer future, it only used to be so. On the other hand, a "future contingency" that fails to occur is not future and never has been, as it is no "future" in any sense of the real future. These are, I believe, the characteristic features of "future contingency" which can be, and are meant to be, influenced by norms.

8. Conditional concrete norms and time

17. A conditional norm prescribes some sort of acts when a certain condition obtains. There are several types of conditional norms. I only intend to examine here the type whose condition is a deontically indifferent contingent event which has not yet occurred.

It is an ever-disputed question in deontic logic as to how the structure of a conditional norm can be precisely formulated using symbolic notation. The problem does not lie with the symbols, but with our insufficient knowledge of the facts. Among the attempts to solve this problem, I accept those which employ a quasi-alethic modal operator to express a conditional norm.[13] The "main operator" in a conditional norm cannot be deontic in the usual sense: it is a special alethic modal operator. A conditional norm does not prescribe any action until its condition arises. It can be neither performed nor violated as long as its condition does not obtain. Therefore, a formula representing a conditional norm cannot begin with the normative operator "*O*".

18. I think that a conditional norm makes a special statement about the categorical norm it contains.[14] It "merely" conveys the information that "*within the spatial, temporal and personal range of the given code C, it must be considered necessarily true that,* if a certain condition obtains, then a certain categorical norm will become valid." By symbolizing the phrase in italics (the special alethic operator) with "L_c" (briefly meaning "necessary with respect to the code *C*"), a conditional concrete norm can be expressed as

(11) $L_c(Fq \supset FOFp)$

The operator "L_c" establishes the special alethic modal status of the sentence in brackets and prescribes that the addressees of the code should consider the phrase in brackets true. Consequently, if the contingent condition obtains, the categorical norm *OFp* necessarily comes into effect. *OFp* in (11) only becomes valid if its condition arises.[15]

19. In the case of conditional norms, too, the "events" are seen in strict *sequence*, and not synchronity. The condition either becomes actual or not at a time after the uttering of the conditional norm. Until it becomes actual, no obligation follows from the conditional norm. If it comes to obtain, the addressee will, at a later point of time, either perform the norm (which has now become actual) or not. Such aspects of sequence cannot be formulated in atemporal deontic logic.

Take, for example, the following sequence of events: 1. the conditional norm becomes effective; 2. the condition becomes actual; 3. the addressee performs the now actual categorical norm. This sequence of events is not expressed properly by the formula

(12) $((q \supset Op)\ \&\ q)\ \&\ p$

because this conjunction, formulated in standard deontic logic, asserts the simultaneous truth of its components whereas events 1., 2. and 3. are not simultaneous.[16] But if, for example, we state the following at t_o (that is, the time of uttering (11)):

$$(13)\quad (L_c(Fq \supset FOFp) \& Fq) \& FFp ,$$

then we have a formula which seems to be an exact prognostic statement about the above sequence of events.

20. Let us suppose that 1. the conditional norm (11) is uttered at t_o, and 2. its condition becomes actual at t_1, and 3. the addressee of the norm performs it at t_2. The sequence (course) of these events is illustrated in Fig. 3 in a K_b time diagram:

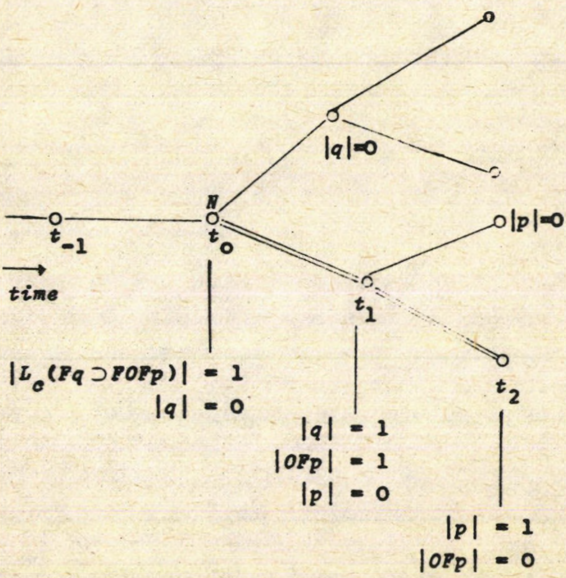

Fig. 3

In the diagram, the lower double line represents real time. In the three "critical points of time", the truth-values of some of the more important statements are given. (Note that the obtaining of the condition "actualizes" the categorical norm *OFp* at t_1.)

21. My endeavour was to investigate some aspects of the relation of norms and time (tenses). I have sought to clarify my view that no adequate logical description of norms can be given using "static", atemporal means.[17] Such a description would require dynamic tools stemming from a combination of deontic and temporal logics.

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NOTES

1. G.H. von WRIGHT [21] , pp. 93-106
2. On the two interpretations of the operator "*O*", see E. BULYGIN [3], p. 127. In E. STENIUS [17], we find two different symbols: "O_f" for the "factual "*O*" and "O_n" for the "normative".
3. G.H. von WRIGHT [21], p. 74
4. H-N. CASTAÑEDA [4], p. 783
5. J. LYONS thoroughly analyses the relations of precedence between utterance and performance of norms. However, I cannot agree with his view that the utterance of a norm can be simultaneous with its performance: "the world-state in which the obligation holds cannot precede, though it may be simultaneous with, the world state ... in which the obligation is imposed." [7], Vol.2, p. 824
6. It is no doubt morally objectionable if a norm, stricter than its predecessor, has a retroactive force.
7. This has been pointed out by P.S. GREENSPAN. Commenting on her idea, H-N. CASTAÑEDA remarks: "the ought disappears once the truth of its fulfilment, or non-fulfilment, is fixed." [4], p. 784. Let me point out that if the truth-

value gap is allowed, *OFp* does not become false, but meaningless at t'.

8. What the norms regulate are never possible but contingent events, since the former also include necessary events. (Note that Aristotle's distinction between δυνατὸν - possible - and ἐνδεχόμενον - contingent - only becomes clear-cut from Chapter 13, Book I of the First Analytic on. Cf. SZALAI, S. [1], p. 89)
9. J. LYONS emphasizes the close link between norms and the future: "...there is an intrinsic connection between deontic modality and futurity." [7], Vol.2, p.824
10. Cf. RESCHER, N.-URQUHART, A. [11]
11. On modalities and time, see McARTHUR, R.P. [8], and on modalized future, SMIRNOV, V.A. [16]
12. S. SZALAI writes: "...if a fact is only realized, through its contingency, in the future, then a statement in the future tense about a fact, uttered before it is realized, is not *ab ovo* and definitely true. Therefore it is not necessary at the moment of its utterance." [1], p.89, n7
13. E.g. RUZSA, I. [14], p.114
14. I disagree with von WRIGHT on whether "We could also say that a hypothetical norm does not contain a categorical norm as a part." [21], p.170
15. A norm which is "not actual" is, in fact, self-contradictory, for something which is not actual is not obligatory and, hence, not a norm. (On the actuality of norms, see RUZSA, I. [13], p.154)
16. Of course, (12) is also incorrect, because the material conditional cannot be employed to express the logical structure of a conditional norm. It is curious how even recently J. BERKEMANN for example, treated the problem of the negation of a conditional norm as if $q \supset Op$ expressed one. [2], p.191
17. J. TOMBERLIN has reviewed unsuccessful attempts at resolving the "contrary-to-duty imperative paradox". [19] All of

the attempts employed atemporal logic, in spite of the important role time plays in the four premises of the paradox and in their two contradictory conclusions. (An example of an atemporal approach is P. MOTT's article. [9]

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VILMOS SÓS

THE CERTAINTY OF KNOWLEDGE AND THE TRUTH

The exact meaning of the term "truth" greatly depends on what it is meant to be used for. The word truth might mean a number of things in the scientific and in the ordinary language as well.

As far as the philosophical term "truth" is concerned, I would like it to be applied to statements.

The word "true" is used more or less in the following way: "It is true that Peter is tall", "This statement is true", "The statement that Peter is tall is true".

Sometimes a sentence can also be regarded to be true, but in that case, it is always the statement incorporated in the sentence which is referred to. A sentence is made *in* words, a statement however, is just made *with* words. We can say of a sentence that it is not an English sentence or that it is not a correct English sentence, but in the case of a statement we cannot say the same, we can only say that it has not been told in English or it has not been told in correct English. A statement is told or expressed, while a sentence is used. I can say that "It is my statement", but I cannot say that "It is my sentence". The very same sentence can express a number of entirely different statements. A sentence like "This suitcase is mine" may be said by two different persons, but then these two sentences have obviously two different meanings. And likewise the other way round: we can express the very same statement by different sentences. For example, speaking of John you might say that "He is ill", or speaking to him I can say that "You are ill", or John can say to any of us that "I am ill". These are different sentences and, what is more, they have different meanings, still all the three assert the same, all the three state that "John is ill". It is exactly in this sense that it is only a statement that can be true or false.

Let us look at some other statements as well: "The cat is mangy", "The man whom she had supper with was a tall one with a good pronunciation" etc. When we use such sentences referring to a thing or a person, we state something with which we mean to characterize the thing or person in question. A statement has a descriptive and a referring part. The referring part indicates whom or what the statement refers to. The descriptive part characterises that which the statement refers to. The statement is not identical with the description or the reference either; it is a peculiar connection between the two. The reference can be right or wrong, the description can be adequate or indadequate, fitting or unfitting. The statement tells something about whom or what the referring part refers to, and the descriptive part does or does not fit.

What can this be? Is there something in the world that could make a statement true or false? It is certainly not a person or a thing or an event to which a statement is adequate. For instance, it is not a cat in the world that makes the statement "The cat is mangy" true, but the state of the cat expressed by the statement, i.e. the fact that the cat is mangy. A fact, however does not exclusively belong to the world, while an event, a thing or a person is a part of the world. But a fact is not merely a linguistic entity either. A fact is a common product of the world and the language, or to put it otherwise, a fact is reality fixed by descriptive statements. To illustrate this, take a recent theory that provides an explanation of a state of affairs that occurred some hundred years ago or even earlier. For example, a calculation is now made of the orbit of a planet as it was a hundred years ago, together with the changes this orbit has undergone since then. It is obvious that, in some way, this fact must have already existed a hundred years ago, although at that time the recent explanatory theory had not come into being yet. Therefore, more precisely, it was not the fact that existed then but a physical event belonging to the world, because this fact had not yet been separated from the natural process of events. The event only became a fact when it was put on a linguistic-logical record by the theoretical explanation.

A statement, on the one hand, states something about the things, events and persons belonging to the world, and, on the other, asserts facts. A fact belongs to a statement as to an undivided whole. That is to say, statements, if they are really true, assert facts, but they do not speak about facts. The events belonging to the world can be dated and localized, things and persons can also be at least localized. But the facts the statements - if they are true - assert can be neither dated nor localized. Which point of time or place would they belong to? Would they belong to the place and time of whom the statement was told by or to those of the event, thing or person referred to by it?

And what does a statement say according to which another statement is true? We have postulated that the term "true" refers to such statements that have both a descriptive and a referring part. The majority of statements is formulated in the object-language. In this sense, a statement about the truth of another statement does not satisfy the above mentioned requirements. It is an object-language requirement that a statement should contain a descriptive part, whereas a statement that states truth is a meta-language statement. Such a statement has a referring part, namely the statement which we declare to be true or false. But it has no descriptive part. It has an evaluating part instead, which declares that the original statement faithfully describes its reference, that is to say, the corresponding fact. In other words, it ascertains that, from a cognitive point of view, the original statement is informative and orientative.

It is at this point that the question of truth is connected with the certainty of knowledge. It is a truism in the sociology of knowledge that people have always preferred those statements that were said, regarded and believed to be true. They preferred them, i.e. they attached certain values to them because those statements usually played a positive and orientative role in their way of life. They have mostly evaluated the achievements of knowledge according to how reliable their informative and orientative functions were. The reliability of a piece of knowledge means that the intentional ends of human activity can be better achieved with their help than with less reliable ones. Is there any difference between the statements that are believed to be true and those that are really true? Let us make a simple experiment. Someone should be asked to write down on two different sheets of paper those statements that he regards to be true and those that he firmly believes in, so that the two groups mutually exclude each other. Such a classification is not contradictory in itself, still it cannot be reasonably carried out by the experimentee. For very probably there will be a number of true statements among those he does not believe in, and a number of false statements among those he firmly believes. He can only accidentally accomplish his task if those statements that he believes in are all false, whereas those in the other group are all true. If we asked someone to list true and false statements, and if he acted reasonably, he would presumably list statements he does or does not believe. The fact that such a task can only be accidentally carried out shows that, though the questions "to be true" and "to be regarded to be true" are logically independent of each other, the distinction practically has no significance, because there is no rational pattern according to which it could be carried out. From the point of view of the individual, the two questions cannot be separated, therefore, as far as the individual is concerned, the truth of a statement is reduced to belief in it.

A statement according to which another statement is true usually has to be grounded. The justification is usually done by one or more other statements. Is there among them a statement about which we cannot reasonably ask why it is true or reliable? Even if we came across statements that do not require any further proof - let us call them statements of ultimate evidence -, it would still be questionable whether they would make the whole of human knowledge more certain. My opinion is that knowledge would only be more certain if those evidence statements somehow served as a foundation of all further knowledge. If not, then it would merely cause psychological satisfaction to us that here or there we can obtain a piece of certain knowledge, and therefore this might be possible on other occasions as well. It can be logically proved that these verificatory statements cannot establish the whole of our knowledge. The foundation of knowledge should rather be sought for in the general and perhaps formal structure of that procedure of human activity which is aimed at obtaining knowledge.

As an example, we can mention the difference between the truth of the statements stated in the course of scientific research and that of our everyday life. The most important difference is that in our everyday life the correct use of language would usually suffice to consider a statement to be true. In science, however, the correct use of language in itself can hardly assure the truth of even the simplest statements.

In everyday life, we usually accept a statement to be true if in the very same situation and language the others declare the same. The explanation of this phenomenon is that people in general learn their mother tongue in a situation where, for the sake of orientation or communication, they make identical or greatly similar statements.

The structure and the language of scientific activity is not independent of those of everyday life: the former makes use of, relies upon and can hardly exist without the latter. In science, we cannot refer back to language as ultimate evidence since there is no universal scientific language or explanation. As long as there exist complementary and often rival theories, the language of scientific description has to be grounded as well. It is not evident either that the language of a certain scientific description is adequate to describe and explain the field of research. Therefore, in science, we cannot elude the question whether there is an essential difference between the *truth of* and the *belief in* a certain statement.

In ordinary language there can also be a difference between these two, namely in the following two cases:

1. When the statements of ordinary language state something about which scientific statements also exist. It is a well-known sociological phenomenon that widely circulated scientific statements often get deformed and cause misunderstanding in the course of everyday life. In everyday thinking, scientific statements are usually contrasted to two kinds of statements: one that relies on "common sense" and another based on earlier scientific achievements that have already filtered into everyday thinking. We can ask anybody to decide whether natural numbers or even numbers are more numerous. In most cases, the answer will be that there are more natural numbers because they include both even and odd numbers. Being aware of the scientific answer some people will give a different reply. And there will also be some others who, without knowing what science says in this question, will give an approximately correct answer, for example, that both groups are infinite in muber therefore neither of them can be enumerated. The scientific answer, however, is not that they cannot be enumerated, but that in the case of an infinite set another kind of calculation is needed than in the case of a finite set. To make this new kind of operation possible an infinite set is defined by science as that which contains a proper subset of the same cardinal number. Therefore, in the case of ordinary language, the discrepancy between the acceptance and the objective truth of a statement is the outcome of the difference in the competence, information and knowledge different

people have.

2. A characteristically everyday statement is, however, another case. For example, somebody claims that in the pub John slapped Peter in the face, someone else denies this claim, and possibly there will be some people who believe the latter. Suppose John has really slapped Peter in the face. Even if the above statements are made exactly where the event itself took place, the difference is still possible. In this case, however, if somebody knows the sentences of everyday language and can correctly use and understand them, a reference to the rules of language can sufficiently prove the statement. But if the two different statements are made somewhere else, then our belief in them does not concern the relationship between the questionable event and the statements relating it. It rather concerns *which* person we believe. And this will determine *what* we believe. So the truth of the statement and our belief in it are traced back to interpersonal relationships. As far as characteristically everyday statements are concerned, the discrepancy between the acceptance and the truth of a statement is not justified because in this field there is no difference between the competence of different people.

Here we cannot go into details concerning the relationship of truth and the belief in truth in the sphere of *scientific theories*. There is only one single point about scientific theories which I would like to make. To declare a scientific statement to be true there has to be an agreement based on certain principles. Scientists who accept a theory and keep the rules of the game which the very same theory requires believe the statements of the theoretical system to be true, and therefore there is no discrepancy between the truth of a statement and the belief in it. In Thomas Kuhn's analysis of scientific progress, the phase when an old theory is rejected or substituted by a new theory incompatible with the old one has been called scientific revolution or change of paradigm. Throughout the progress of science such moments occur very rarely because scientific work has got its so-called "normal" phases and the basic research is dominated by these. In the normal phase the current theory is usually not tested; it is accepted by the scientists as the rules of the game. During his research the scientist has to solve some puzzle or problem, and it is assured by the current theory that the problem can be solved. The difficulty of solving the problem is the difficulty of the scientist and not the theory. In empirical sciences tests are of course frequently made, but it is usually the scientist who is checked and not the current theory. To keep the rules of the game means that the statements of the theory are or are not regarded to be true according to the rules of the game which are valid within the frame of the theory. Therefore, the scientists who accept these rules cannot separate the truth of a certain statement from the question whether the other scientists in his group believe the same statement to be true. Since current theories always exist, if scientists agree on something within a theory, that is, believe it to be true, then usually it will really be true. This fact needs no explanation. Explanation would only be needed if it were not so. As far as science is concerned, interpersonal agreement is a necessary condition of the truth of a certain statement.

I do not want to say that everything the scientists agree upon at a certain point of time is true, for in every theory there are shortlived hypotheses which are born to be soon rejected by the majority of even those scientists who formerly agreed upon it. But we cannot use this fact to deny that true statements are usually believed to be true and are also agreed upon, because without such a coincidence no language of fact would be possible in science.

Let us now return to the problem of certainty. When the grounds of some branch of science are sought for, the question usually is whether this branch of science has got a background that could assure the certainty of that particular field of knowledge. From a philosophical point of view this background is epistemological, but in fact a number of scientists search for a solid basis within their own branch of science. In the western world mathematics has always been the basic example of reliable knowledge. The analysis of reliable knowledge has always rested on the supposition that there is at least one kind of reliable knowledge, mathematics. As far as certainty is concerned, all the other types of knowledge have been compared to mathematics as the ideal.

In my opinion, if there is anything that could make knowledge "certain", this cannot be a special kind of knowledge but a more general epistemological background. But then we have to point out at least some non-mathematical types of knowledge that can be accepted as reliable.

Learning always takes place against a special background. Let us call this background a world picture. I do not shape my picture of the world by assuring myself of its correctness, for this is a typical specimen of such a socially inherited background, in the light of which I distinguish between true and false.

To consider a statement verifiable means that it is considered to be deduced from another statement, which thus provides a ground of verification. But in principle this other statement, the ground of verification might also be considered as needing verification, and so forth. So if I do not want to fall into an infinite regress in the search for a foundation I must stop somewhere. But who will establish the criteria of accepting a statement as the final foundation? Within the realm of knowledge there is no such criterion. Therefore we have to say that this final foundation cannot be another statement. This foundation is an ungrounded way of action.

If a child is told that a good many years ago Mont Blanc was amassed by someone, the child will believe it. Later, of course, he will learn that there are reliable and unreliable informants, but he will only learn this much after he has already learned a number of facts told by different, more or less trustworthy informants. At the beginning, a child has no doubts. When I stand on my feet, why do I not check whether I have two feet at all? There is no why. I simply do not. This is how I act.

In certain situations one cannot make a mistake. In order to make a mistake, one must first make a judgement of something in conformity with mankind. When a child learns, he believes what the grown-ups say and his doubts come only after believing. Reasonable beings do not have certain kinds of doubts. We cannot doubt everything. That we do not doubt everything is simply the way we judge things and the way we usually act. This is because the fact that normally I have two hands is just as sure as anything else by which I could prove it. It is not only I who believes that I have two hands but any "reasonable" being acts on the supposition that normally every human being has two hands. A child learns with the same inexorability that "this is a hand" as that "twice two is four". All these are fundamental in our life and therefore we cannot change our opinion about them. Precisely that is why they are fundamental.

About the certainty of mathematical knowledge we can say the following: If I have learned how to multiply I can do the same multiplication twice, so that I should not make a mistake; but will the result be more reliable if I repeat the operation, say, twenty more times? Calculation is an important part of our activities, and in the course of our life we make use of it day by day. If we repeat a certain calculation, it is always a pattern of calculation that we accomplish and by way of repetition we can check only the calculation and not the pattern. We expect that a certain multiplication should have the same result in each case, but our expectation concerns the pattern of calculation and not the concrete operation. We expect the reliability of the *pattern* for sure. And *what* we expect for sure is essential from the point of view of our whole life.

My argumentation does not deny, and does not declare to be wrong, the experience which aims at giving a final foundation to scientific statements within the realm of science on the basis of another kind, and in some way deeper, knowledge. No contradiction or vicious circle can be attributed - though there are a number of technical difficulties -, say, to the reduction of arithmetic to set theory. We just cannot accept this as a foundation, simply because as far as the certainty of knowledge is concerned, it does not serve with any surplus. It number theory is questionable, then so is set theory. As far as the certainty of knowledge is concerned, number theory is no less fundamental than set theory.

Though we do not find the tracing back of knowledge and the statements which make up knowledge to a final foundation effective, it might seem that, since we have declared some statements to be unquestionable, we also seek for a foundation. We do not seek for a foundation in the sense as if certain types of knowledge could be traced back to such a foundation or in the sense as if the certainty of knowledge could be proved by knowledge itself either. On the other hand, we have indicated certain philosophical-epistemological considerations, which suggest that it is a basis and a part of human life and human activities that certain statements are believed to be solid. We regard these statements as solid, though from a scientific or a logical point of view they are not any more solid than the others. This means that even those statements which can be considered to be firm have a logical alternative, that is, they could be, or at least could be imagined to be otherwise. But to question these fundamental statements would be much more dangerous for our life - including scientific activities as well - than to regard them as firm, as indisputable.

Our final conclusion is quite trivial and perhaps not too significant. In case the truth of our statements needs to be grounded in the sense that the foundations are expected to make this truth certain, these foundations cannot be true or false any more, because then they would need to be grounded as well. If there are such foundations, or if they are needed at all, we can find them only outside the sphere of knowledge.

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