LOGIC AND ONTOLOGY

L. APOSTEL

Dedicated to Professor Feys

SUMMARY

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Introduction:

As is shown by the exhaustive bibliography of his writings, published in the Journal *Synthese* (Vol. VII, n° 6-A, p. 448-452), Professor Feys has been studying both logical and metaphysical problems. His lectures on *Elements of Metaphysics* indicate that one of the leading formal logicians can simultaneously remain, in the traditional sense of the word, a philosopher. It thus seems to be a fitting tribute to this specific combination of interests, to ask ourselves here once more, how the collaboration of logic and philosophy can be organized, in the study of this most important and most fundamental philosophical problem, that is ontology.

1. *Ontology*

The content of ontology is well known.

What is there in the universe ? Are events, states, things, developments, persons, qualities, relations all existent or must we apply this term only to certain types of entities in this list ?

Concretely: what is the form and degree of reality of galaxies, atoms, groups, fictional characters, triangles and how can it be established ?

And what does the ascription of reality to an entity really mean ? When stating '*a* is real', are we asserting that *a* is an element of a class, or that *a* has certain relations, or that something occurs to *a*, or that *a* is some part of a singular whole, or that *a* characterizes as a quality some such singular whole, or that *a* 's properties have themselves certain properties ?

Briefly: to what logical type does 'existence' belong, what kind of entities can be characterized as such and what specific instances of these types possess this characteristic ?

2. *Logic as a standard in ontology*

A. *Ontology and the existential quantifier*

The ontological problem has attracted the attention of many logicians. At first, the result of their reflections has been best summarized by the following sentence, written by G. E. Moore, repeated on various occasions by Bertrand Russell: «what 'lions are real' means, is that some particular property... being a lion... does in fact belong to 'something'» (G. E. Moore, *Philosophical Studies, The concept of reality*, p. 187-219, Kegan Paul, reprint 1948).

If L is predicate, meaning «being a lion» then the existential sentence «lions exist» (considered here to be equivalent to: «lions are real») ,is translated formally as follows $(Ex)(Lx)$, where Ex is the well known existential quantifier.

In papers like Bela Juhos' *Anwendung der Logistischen Analyse auf Philosophische Probleme* (*Methodos*, v. 3, n. 10, p. 81-100) and in books like Hans Reichenbach's *Elements of Symbolic Logic* (Mac Millan 1948), this analysis is used as a paradigm settling and eliminating traditional disputes: «With the expression of existence by means of an operator and a bound variable, symbolic logic settles the historical controversy about existence in a way that definitively excludes misuses and pseudo-demonstrations manipulating the term» (p. 89, *op.cit.*).

The claim is thus the following one:

1. In lower functional logic occurs a term: the existential quantifier, that is, for a sufficient sense of the word «translation», an adequate translation of one or all of the meanings of the concept «existence» and 2. Thus the study of the properties of this quantifier allows us to answer traditional questions about existence exhaustively and definitively.

We do not think this claim to be acceptable.

It should be stressed that the claim is very astonishing. There are as many different quantifiers as there are different types of variables, and a variable is given by the domain that constitutes its range. Its seems clear that if this is true, traditional disputes will occurr again, with reference to the selection of variables and ranges.

But many signs seem to indicate that, even when this semantical aspect is neglected, the existential quantifier is not an appropriate translation (Hugo Bergmann in his *Probleme des Existenz begriffes*

(*Theoria,* 1950, p. 21-35) and later Albert Menne in *Logik und Existenz* have pointed out some of the following facts:

a) The sentence 'John exists' asserting an individual to be real, cannot be well formed according to the proposed translation, if existence should always indicate the non-emptiness of a predicate (no predicate being present in this sentence). This implies that the type of entities most consistently considered to exist by ontologists of the past cannot even be said to exist or not exist in the present translation.

b) H. S. Leonard (in *The Logic of Existence, Philosophical Studies,* June 1956) reminds us of the fact that all systems of functional calculus contain the rule «*fa* implies (E*x*)(*fx*)». This gives in a particular case «Don Quichotte loves Dulcinea» implies «There exists somebody who loves Dulcinea». If now the existential quantifier is an adequate translation of existence, then fictional characters, inasfar as they have properties, exist.

c) It is also true that (*x*) (*fx*) implies (E*x*) (*fx*). In a particular case, this becomes «all unicorns have horns» implies «there exist some unicorns having horns». Again, if the existential quantifier has any relation with existence, the possibility to make general statements about a concept, would already imply its existence.

d) Finally, in higher functional logic, the sentence «something exists» becomes analytical if our translation is accepted. Indeed, «something exists» must mean that there is at least some predicate characterising some subject. Formally we write this as follows:

(E*x*) (E*f*) (*fx*). This is easily shown to be analytic and necessary (in an empty universe, we still have the empty class that has indeed the property of having no members).

The four facts that we described convinced most logicians in the last ten years, that the existential quantifier is not an adequate translation of existence. In fact, their rejection of the hypothesis on this basis did lead to some generally accepted criteria of adequacy for any acceptable definition of existence.

C1. It should be possible for individuals to exist (we are not going so far as to say that some individual necessarily exists, but this much should be at least granted).

C2. Truth and reality should be distinct: '*p* is true' should not presuppose anything about the existence of the denotata of the terms occurring in *p* (It is against this criterion that in fact (b) and (c) sin; (b) and (c) taken together mean that if we can assert true particular or general sentences about an entity we must hold it to exist).

C3. Fitting relations should exist between existence and the mo-

dalities: a) it should not be true that everything exists with necessity; b) it should not be true, on the basis of the definition of existence alone, that it is necessary that something exists; c) it should not be true that it is impossible, by the definition of existence itself, for something to exist with necessity. These criteria are certainly very much in doubt (for instance, on the basis of the rejection of the ontological argument, many writers like Hume and Kant have demanded that one of the criteria of adequacy should be that all existence is synthetic; thus asking much more than (a), (b) and (c).)

If the reader is not in complete agreement with this list of criteria, this is not important. Let it only be clear that even the revolt against incorrect translation of existence in logic, has been able to give new precision, in logical terms, to the concept of existence.

B. *The ontological commitments of formal Systems*

After the earlier analysis of existence by the existential quantifier had been more or less completely and consciously discarded, another attempt was made to use logic as a standard in ontology.

A specific translation of the term «existence» in a formalised axiomatic system was no longer given, but it was asserted that certain features of formal axiomatic systems imply certain ontological commitments. If a language *F* has property *P*, then, for this language *F*, a certain type of entity exists. If this is true for certain *P*, it is very important. The question then is: «What properties of a language imply what kind of ontological commitments ?».

At least two, very different answers have been given to this question. W. V. Quine, who originated this method states in his influential paper *On what there is* (reprinted in *Form a Logical Point of View*), that «to be, is to be the value of a variable» (when quantification, either universal or existential over this variable, is allowed). Gustav Bergman, however, in his book *Meaning and Existence* (where he summarizes his earlier interpretation) states, on p. 92, «What there is or exists, in the sense in which ontology speaks of existence, is shown by the undefined descriptive constants of the ideal language». These two conceptions of the ontological commitments of a language will, this is obvious, lead to very different results. How then are they defended by their proponents ? W. V. Quine in *Designation and Existence* (reprinted in *Readings in Philosophical Analysis*, edited by Feigl and Sellars, p. 44-51) leaves no doubts as to the foundation of his belief: «to say that there is such a thing as appendicitis, or that 'appendicitis' designates something, is to say that the operation of existentially generalizing with respect to appendicitis is valid;

id est; that it leads from truths only to truths» (48, *op.ci.*). This is sufficient to show that all arguments that have earlier been introduced against the existential relevance of existential quantifiers, are equally relevant against Quine's position. Everything depends here upon the semantical interpretation given to the formal system to which the quantifiers belong, and only if this interpretation is of a certain type, could we hold that a language behaves towards objects as existent if it admits quantification over variables having these objects in their range. In general: quantifiers are only certain algebraic operators (of cylindrical algebra to speak with Tarski, or of polyadic algebra to speak with Halmos) much related to equivalence operators.

Quine's definition of ontological commitment is thus untenable. Is Bergman's definition more acceptable ? It is rather clear that he claims the irreducible synthetic components of his language (names or predicates) to exist. For him irreducibility means reality.

We have however some doubts:

a) Quine himself (in *Ideology and Ontology*) has mentioned the fact that we hold many more individuals (things and qualities) to exist than those we can explicitly name; if Bergman's criterium is thus sufficient, it is not necessary.

b) Can the concept of «ideal language» be made sufficiently explicit without already presupposing the meaning of existence or reality ?

c) Can the term «descriptive» be sufficiently completely defined without already presupposing the term «reality» ?

d) Is there a unique «ideal language» ?

e) Is it not true that what we call «existent» should not be dependent upon syntactical contigencies, while it is a question of choice what we shall consider as defined or undefined in a given language ?

The question «what are the ontological commitments of a language ?» can also be asked for non formal or non-axiomatic languages, and will be presumably fruitfull there. However the use of formal logic for philosophy proves its necessity once more when we look at the superior precision with which the ontological commitments of formal languages can be defined.

Quine's and Bergman's proposals, as is shown by a recent symposium in the *Journal of Philosophy* (vol 55, 1958) on ontological commitment, are not able to convince fully because of the simple fact that it is not possible to know what a language implies about existence without having a theory of existence.

The moment such a theory would be introduced however, research on ontological commitments of various formal and non

formal systems would be one of the most fruitfull tools ontology could use.

It becomes then possible to make a positive study of what there is, by examining the features of adequate languages.

Untill then however, the concept itself of ontological commitment hides all the complexity of traditional ontology. One should perhaps interpret the study that follows as an attempt to give a more systematic foundation to the idea of ontological commitment.

3. *The logical method in philosophy*

It thus becomes clear that we cannot hope to draw immediately from the data given by logic and axiomatics a ready made ontology. Logic as a standard cannot be used, because different aims have been in the past pursued by the two disciplines. In what capacity can we then use logic in ontology ? Here we must introduce some methodological remarks; one of the main weaknesses of logical research in ontology is an insufficient awareness of the large number of possible strategies that can be used.

Nicholas Rescher describes in his *Discourse on Method* (*Methodos* 1959) a sequence of steps that are executed by those philosophers that want to use the logical method.

1. Some criteria of adequacy summarize our a priori convictions about the term to be studied.
2. Guided by these criteria, a tentative formalization is given.
3. It is proved that the formalization satisfies the criteria of adequacy (and if possible, that all systems satisfying the criteria are either identical with the one given or have important features in common).
4. The formal system is then developped and some major theorems are proved.
5. The historically known puzzles about the concept are, as far as possible, solved by means of the formalization.

Rescher very aptly stresses how the cooperation of deduction and induction holds this method close to the general scientific method. Ontology should develop in this way (and neither the ontology of the existential quantifier nor the ontology of the commitment theory have had sufficiently this character). We want however to stress the large number of possibilities present in each step.

A. General remark

We might consider the term studied to have different meanings (in function of difficulties encountered to match one analysis to all requirements). We could then give various sets of requirements of adequacy, having some more general structure in common. Once the multiplicity and the common structure were fixed, we could study the structure of the variations on the common structure imposed by the multiplicity of meanings, and thus enhance, if we can find some regularity in the variations, the internal cohesion of the concept, after having admitted its multiplicity. This splitting and reunifying has not often enough been exemplified by logical research in philosophy, leaving the acknowledgement of ambiguity to those analytical philosophers that reject the symbolic method.

B. Second remark

The criteria of adequacy can be given extensionally or intensionally. They are given extensionally when a set of objects is given, that are to be called existent, and (or) another set of objects, to be called non existent. They are given intensionally when a series of properties are given that existent beings ought to have.

They can be given partly extensionally, partly intensionally. They can be given completely (sufficient to solve the problem: complete extension or intension) or incompletely. If given intensionally they can be given on object language level, or on metalinguistic level (as properties of any existing object, or as properties of any term adequately representing existence, properties considered in the syntactical, semantical or pragmatical domain).

Functional criteria, for instance, are important members of the last subclass: I can state the function the term to be defined has in the methodology of the languages in which it occurs and I can state the function my search for the meaning of this term has in the methodology of the inquiry in which I am engaged.

C. Third remark

The formalisation of the term examined can take the form of an isolated system, in which this term is defined by the axioms about it, or in which it occurs as a defined object. The formalisation, by definition or axiomatization can however also occur as an addition to an existing axiom system. If there is a definition given all sorts of definition can be used (recursive, conditional a.s.f.). If there is an axiomatization given, all sorts of axiom building are efficient (in particular: syntactic or semantic).

D. Fourth remark

When developing the formalization proposed as a solution and when solving puzzles, a natural classification should be provided giving the reasons of the choice of the puzzles and theorems in question, reasons drawn from the nature of the problem itself. As long as this does not occur, the success achieved in deduction and solution remains contingent and its importance cannot be assessed.

We wished to stress the great plasticity of the axiomatic method in philosophy to prevent misunderstanding leading to discouragement. It will be clear, as the result of the following analysis, that most of the attempts made in ontology used Rescher's simple methodology and did not, or very rarely use the more complex one that is equally compatible with the use of the logical method in philosophy.

Our conclusion will show in what sense the present problem situation makes diversification of attack necessary.

4. *Logic as a tool in the study of specific ontological difficulties*

We shall now meet attempts to master the difficulties of the concept of existence directly, by giving definitions or axioms for it. These axioms and definitions will however not be inspired by any desire to avoid very specific puzzles.

In the analysis that follows, and in order to continue our study of the methods of collaboration of logic and ontology, we want to do three things:

a) we want to apply some supplementary tests of adequacy,

b) we want to stress the relationship between these solutions and certain traditional problems,

c) we want to see some systematic relationships between the different solutions proposed.

A. G. Nakhnikian and W. C. Salmon, in their paper *Exists as a predicate* (*Philosophical Review,* 1957, 535-542), have as their professed aim the study of an argument against the hypothesis that existence would be a predicate, argument used by Brown, Ayer and Wisdom. These writers claim that if existence were a predicate, all statements asserting existence would be analytic, and all statements denying existence would be contradictory. They come to this conclusion because the use of singular or general terms,

in their complete intension (including the predicate of existence among other qualities making up this intension), makes the assertion of existence redundant, and its denial contradictory.

Nakhnikian and Salmon are not distressed by this situation and give an analysis of existence that explains it. For them exerything exists $(x)(E!x)$ (where E! will denote the predicate of existence). As, in a calculus using material implication and without modalities, all universal predicates are equivalent, they claim they could define existence by means of any universal predicate. The one they select is: $(x)(E!x \equiv (x=x))$.

In terms of this definition of existence (a) There is a necessary being (the ontological argument is valid), and even: all existents exist necessarily because existence is an analytic characteristic of every concept (it being equivalent to self identity); (b) The «cogito ergo sum» is also valid (but without any significance as it cannot distinguish pure fiction from reality); (c) There are no degrees or modes of being and (d) If an object a exists, any part of it or any predicate and relation of it are equally existent, if identity between such entities is defined.

The affinity between this attitude and certain traditional positions, is clear: the possibility of ontology is denied if it is denied that there exists a characteristic having content and shared by all beings. This can be expressed by the assertion that only analytical predicates are capable of defining being.

This analysis is however quite certainly false.

a) From the fact that there is an object, Napoleon for instance, that has existed but that does not exist. I must infer that there is an object that does not exist (my language has names that do not denote).

b) From the fact that there are no tigers in Ghent, I should infer that Ghentian tigers are non existent, and from this that there are non existent objects.

c) Finally I should like to be able to introduce modalities and to say «Not everything that is possible, is real». As it prevents me from doing any of these things that I am compelled to do in any language that represents my usage in an at all adequate fashion, the analysis we have been quoting is certainly false. But it is not insignificant; it expresses the difficulty to be general enough and yet not too general in our definitions.

The problem, if we consider existence to be a predicate, how not to have all existential statements as analytic or contradictory, remains open, if we are not able to accept the writers conclusion, nor the conclusion Broad and others adhere to.

B. In his paper *The Logic of Existence* (Philosophical Studies, June 1956, p. 49-64) H. S. Leonard wants to avoid the difficulty quoted under a, p. 27. The difficulty was, that from fa, $(Ex)(fx)$ follows. Leonard wishing to avoid such a conclusion with existential import, states the following definition for existence: an object exists, if and only if, it has a property that it also could not have (so possibility, or better: contingency, defines existence). If we only think about this puzzle, the opposite solution might have done as well: it is also true that from fa does not follow that there is a property that a necessarily has. But the reason why Leonard introduces contingency in the definition of existence, is an analysis of the cogito (occurring on p. 57 of his paper). He stresses that from «I think or I do not think», my existence does not follow while obviously from 'I think' this existence does follow. This makes him decide to identify existence with the possesion of contingent properties.

Let us analyse some consequences of this position:

(a) The ontological argument is clearly false (there cannot exist any being all of whose properties are necessary ones, if existence is contingency); the existence of a God is impossible.

(b) Strangely enough, the cogito that was the basis of Leonard's definition becomes false too (a strong argumentum ad hominem): if thinking is not a contingent but a necessary property of the ego and if no property can with certainty be attributed to it that would not be derivable from this first one, the ego does not satisfy definition.

(c) No mathematical entity can exist, because mathematical entities have all their properties as necessary properties.

(d) It is not true that if a whole exists, necessarily all of its parts equally exist: indeed it is not true that all properties of the whole characterize also the parts, and if the contigent property that allows us to declare the whole existent, is such a non-dissective one (to use Goodman's terminology), the paradoxical consequence follows. If the terms of a relation exist, the relation itself does not necessarily exist either; and if it were true that all relations are internal ones, necessitated by the nature of their terms, no relation ever could exist.

(e) We can define degrees of existence (the number of contingent properties could order them) and modes of existence (the type of contingent properties could distinguish them). It is doubtful however if this order and kind would be natural.

The relationship with traditional ontological positions is very clear: existence is here the higher order predicate of having a con-

tingent predicate (it is thus only a quality in as far as higher order qualities are admitted). Hume asked exactly this in his analysis of existence (*Dialogues concerning Natural Religion,* p.t. IX).

This theory is also very close to existentialism. Existentialism can be defined as the theory asserting that all existence is contingent, and that its existence *is* its contingency.

This extreme assertion follows from Leonard's definition if the higher order property of having a contingent property, is itself contingent. It is not clear if this is the case or is not the case, but if this is true, then the existentialist thesis follows from Leonard's definition.

It seems again very clear to us that this definition cannot satisfy. It does not solve the problem it was intended to solve: fictional creatures might have contingent properties and yet not be existent. Bluebeard should have a beard but is not necessarily wearing red trousers.

It is anyway clear that the initial puzzle can be avoided at much smaller cost, by the demand that before we allow from fa, the conclusion E ! a, the f must be of a certain form.

C. Nicolas Rescher, in his paper *On the Logic of Existence and Denotation* (*The Philosophical Review,* n° 2, April 1959, p. 157-180) would like simultaneously to deny that everything exists (and thus avoid the purely analytical character of existential statements) and that mathematical entities necessarily do not exist (and thus admit the sometimes analytical character of existential statements). For Rescher, an object is called existent if it has at least one property, of a qualitative nature, such that there is another individual that does not have this property. A property will be of a qualitative nature if it is either a primitive property in the language or definable by using conjunction and alternation only (not negation) from primitive properties. This last provision has to be made to avoid again that everything exists: any individual has a property that it does not share with any other individual, namely the property of being identical to its specific self. But this property Rescher hopes is not qualitative.

We have several objections against this proposal.

(a) It is very much ad hoc, and uniquely inspired by the fact that in an extensional language, all empty classes coincide. P. 165, the reasoning that finally leads to the definition quoted starts from the thesis that, if a thing does not exist, its only qualitative properties are those which qualify all objects. We claim this feature to be contrary to common usage. (Snow White and the bad Queen certainly are not sharing all qualitative properties with each other), and not present in a language that uses intensional relationships. Any

satisfactory definition of existence should not be as deeply dependent upon contingent features of language systems.

This objection, decisive to our mind, does not claim to deny that Rescher is tending towards a valuable insight: he is certainly seeing that the real is individualised, and his definition is an attempt to express this, but only an attempt.

Moreover we still have another powerful objection: the distinction between qualitative property and non qualitative property is not strictly feasible. For two reasons: (a) if we have quantification over propositions, we can use the Tarski device to define negation and (b) if we have the principle of identity of indiscernibles, any individual can be exhaustively characterised by a qualitative description, so that the incriminated property can be reconstructed.

Let us now consider as is our custom, a few consequences of our last definition:

(a) The ontological argument is true (a God defined by simple superlative attributes has certainly one attribute not shared by some other object). Rescher himself at the end of his paper comes close to admitting this, but has scruples before the fact that he did not decide by his definition if yes or no, existence was a predicate. Indeed writing it syntactically as a predicate does not say a thing about its content. But in all significant respects, Rescher behaves towards existence as towards a predicate.

(b) The cogito also seems to be true, if we are allowed to consider «to think» as a qualitative property (indeed, in the universal potential nothingness, the ego has certainly a property at least one other object does not have).

(c) Degrees of existence can be defined by the number of properties a certain number of other objects do not have and modes of being by the kind of properties in question. The same remark as in the case of definition B has to be made however.

(d) If the individualising property of a is not a dissective property, it is not certain that if a exists, all parts of a equally exist.

4. Let us finally examine the fact that for certain logicians, *logic was ontology*. This was the case for Lesniewski and for Heinrich Scholz (deeply influenced by Lesniewski in this respect). Here the science of logic has quite explicitly as its object the study of certain very general laws of being. In the not well known work of Heinrich Scholz *Die Metaphysik als Strenge Wissenschaft* and in a famous paper by Lesniewski *Über die Grundlagen der Ontologie* (*Comptes rendus des Séances de la Société des Sciences et des Lettres de Varsovie,* classe III, 1930), these opinions have been expres-

sed. Recently they have been clearly explained and analysed by Czeslaw Lejewski in *Logic and Existence* (*British Journal for the Philosophy of Science*, 1954-1955, p. 104-119) and in *On Lesniewski's ontology* (December 1958, Ratio).

It will perhaps astonish the reader that we examine such a very divergent view in this context. The reason however is that the definition of existence we meet in Lesniewski's ontology (we regret not to have been able to consult Prof. Scholz'book) is extremely close to the definitions we have been studying.

In Lejewski's analysis:

$$(x)(\mathrm{E}!x=(\mathrm{E}y)(\mathrm{N}[(y=x)0(x \text{ in } y)]))$$

This definition states in set theoretical language exactly the same fact as Rescher's definition in predicate language. The techniques for building up sets will provide for the limitations that the term 'qualitative' wanted to provide.

We see that in this more ambitious attempt, where the predicate E ! is taken as basic for the whole system of logic, the same weaknesses necessarily shall appear that vitiated Rescher's proposals.

Both Lesniewski and Rescher define existence to exclude the null class. As the null class is however here a very disputable concept, this methodology is, to say the least, doubtful. It is certainly true that there is strict duality between the definition of existence and nothingness; but nothingness defined as the set of all null sets, or as the common property of all empty properties, cannot simply be identified, for all metaphysical languages, as identical with any empty property or with any null set. This being the case, we do not make progress, by the exclusive pursuit of the definition of existence trough exclusion of the null class (a problem as big as the one we started with).

We have thus criticised the main attempts made in recent litterature to define, with the tools of logic, and inspired by the aim to solve logical difficulties, the concept of existence.

We can now bring together various definitions and compare their contents.

1. $(x)(\mathrm{E}!x \equiv [(\mathrm{E}y)(y=x)])$
2. $(x)(\mathrm{E}!x \equiv (x=x))$
3. $(x)(\mathrm{E}!x \equiv [(\mathrm{E}P)(\mathrm{N}Px)])$
4. $(x)(\mathrm{E}!x \equiv [\mathrm{P}(x) \,.\, (\mathrm{E}y)(\mathrm{N}Py)])$
5. $(x)(\mathrm{E}!x \equiv [\mathrm{P}(x) \,.\, \Diamond(NPx)])$
6. $(x)(\mathrm{E}!x \equiv [\mathrm{N}P(x) \,.\, \Diamond(Px)])$.

Some of these definitions are variants of those we have discussed. We can at least state the following facts: (where we express by

the sentence «Definition A implies definition B», the fact that if an object is existent according to A, it necessarily also exists according to B):

1. Definition 5 is equivalent to definition 6, by substituting N*P* for *P* in 5, in any non intuitionistic normal calculus.

Definition 6 implies definition 3.

Definition 2 implies definition 1 (through existential quantifier introduction).

For certain definitions of possibility (a predicate is possible for an individual if another individual posesses the predicate), 4 implies 5.

Three important trends we thus have been able to discover in the sequence of these attempts, that turn out to have so much in common: (a) the desire to reach maximal generality (1 and 2); (b) the desire to reach individualisation (3 and 4) and (c) the desire to reach contingency (5 and 6). These themes, needed to avoid certain logical impossibilities, are traditional themes of the ontological litterature. We have not found a possibility to combine all our desirable features in one definition, even though as the definitions stand all of them are throughout compatible (and even though the structure as it stands before our eyes calls for completion by means of various other modalities).

It being the case however that we rejoin, by very devious ways, classical ontology and it being also the case that classical ontology is not motivated by the desire to avoid specific traps but rather by the need to give an analysis of existence as a whole, we shall now briefly point out the use of formal logic in the analysis of traditional ontology.

5. *Logic as an instrument of clarification in traditional ontology*

Traditional Ontology may be said to have its origin in Plato's *Parmenides*. The main problem of the Parmenides is the problem of the one and the many (if the one exists, must we not say that it is not the one, because it has composition: its unicity and its existence ?). In order to avoid this puzzle (that is the classical puzzle of ontology) subsequent writers, and among them Aristotle, Plotinos, Duns Scotus, Aquinas, Suarez, Caietanus, Ockham, Hegel and so many others, are compelled either to assimilate very strongly existence to what is, making it lose itself in this multiplicity, or to separate very strongly existence from what is, reducing it to empty unity and making the relationship between existence and what is, ununderstandable.

Professor Feys, in his mimeographed lectures on Metaphysics summarizes briefly and clearly the Aristotelian tradition, one of the many attempts to solve Plato's problem. We shall concentrate on showing that this tradition needs clarification, by logical means, of its main assertions, and that it can obtain this through modern logic.

In order to know what assertions in Prof. Feys' lectures we should choose to characterize the central features of the tradition, we are now stating the minimal features that any satisfactory definition of existence should exhibit.

1. We should state what types of relationship between beings their common existence necessarily produces, and this should be done positively and also negatively: relationships present and absent.
2. We should state how existence modifies and is modified by that which exists.
3. How existence is reducible or not to some other entity in the universe ?
4. What is the relationship between existence and our knowledge of it ?

These are the questions we shall have to answer in any systematic ontology. These are the questions the tradition asks; these are the questions that Prof. Feys answers in his mimeographed *Elements of Metaphysics* (from which we quote the edition 1958-1959).

1. In the sentence «this exists», «exists» is used as undefinable and irreductible (M 36).
2. The sentence «this exists» is never synonymous to a sentence of the form «For a subject S, this exists» or «In a language L, 'This exists' is true» (M 37).
3. a. It is true for ever that now and here «this exists» (M 36).
   b. The sentence «This exists» is categorical, non hypothetical (M 36).
4. «This exists» is only true, if «this» is not *only* a part of some other existent (M 38).
5. Anything that exists has other qualities that give it a specific content, also called «perfection» (M 40).
6. Anything that exists
   a. is an organized whole,
   b. has unique properties.
   Thus: anything that exists is an individualized entity (M 40).
7. Existence is simultaneously that which is most individual to the existent being, and that which is most widely predicated. From this double characteristic follows that existence is an analogical term (M 41 and 42).
8. Anything that exists «has a reason to exist» (M 52).

In the section that follows, the only aim we pursue is to show how formal logic can and should be used in the analysis of these assertions. That they should be analyzed is certain, as we cannot claim to see clearly either the independence of some or all of these assertions, or their mutual dependence (Is 3b compatible with 8 ?). Could we select 1 and have the other properties ? Deny 8 and have 6 ? Deny 7 and have 6 ? Is 4 compatible with 6 ? Could we deny 2 and keep the other features ? If these assertions are independent, a large number of possible ontologies ly before us, to be investigated. But we have to ascertain first the relations between the theses by logical means.

1) We shall first begin with the key term of the Aristotelian tradition, and ask ourselves if a logical analysis of «analogy» can be given and if it can be applied to the «analogous» character of existence. I. Bochenski has shown that it is possible to give such an analysis (*Gedanken zur Mathematisch-Logischen Analyse der Analogie,* in *Studium Generale,* 1956, pp. 121-125), but did not apply it to the concept of existence. Let us take his definition, and examine what would be the effect of such an application.

A term T is analogous whenever, applied to two different objects D and E, the term T designates property P in D and property Q in D, where both these properties are different, but where either there is some relation between $P(D)$ and $Q(E)$ of a real nature (like being cause of) or of a formal nature (like $R(PD)$ being isomophic to $S(QE)$). If this is the meaning of the word «analogous» applied to existence, then we must say that «existence» designates properties that are different in different things (existence is a predicate, even if it is a rather complex one), and that stand in causal relations to each other (attributional analogy) or rather that have their relationship to their supports isomorfic (proportional analogy).

The fruitfulness of this logical analysis of existence could only be fully clear if we could ask about the existence of parts, relations wholes, given the existence of other entities. But even at first sight, our problem situation is clarified by this analysis: if it is the attributional analogy (causal relation) that is meant, then assertion 7 implies assertion 8; if it is the proportionality analogy that is meant, then assertion 7 implies 5 and part of 6.

But moreover in the most plausible case, when we take some specific examples like the existence of a thing and the existence of a quality, then in order to assert them both as existent we must find for the thing and for the quality two properties, the relations of which to their subjects would be isomorphic (id est: would have all structural properties in common). This allows us to attack the usual

analysis that sees the existence of the thing in some form of independence and the existence of the quality in some form of inherence. Indeed can it be shown that *R* (thing, invariance) is isomorphical to *S* (quality, inherence) ? Not to our mind. So we have to state — either that qualities do not exist — or that the analysis of the existence of things and of qualities was not correct — or finally that weaker criteria of analogy have to be found than strict isomorphism.

We think that Bochenski's important initiative, when applied to traditional ontology should have a most creative effect, and we hope to have made this probable.

Two other consequences become clear: one as to the relationship between analogy and definability, and another as to the relationship between the analogy concept and the problem of unity and plurality.

If we define existence through an analogy of proportionality we can define existence as the property that stands in the relation *S* (isomorphical relations can be grouped) to either *D* or *E* or etc.

Thus, the demand that existence should be an undefinable would be in contradiction with the demand that existence should be defined by analogy of proportionality.

We claim then that the puzzle has not been solved by the analogy concept;. either it is to weak (attributive analogy) or too strong (proportionality). It seems that we should look for partial isomorphism to use this concept in the analysis of existence. Formal logic will again be of much assistance, but the formidable problem of unity and plurality of existence remains unsolved and should be acknowledged as such.

2) Kasimir Ajdukiewicz, in a most valuable paper (*Studia Philosophica,* vol. 4, pp. 7-22) has used the resources of modern logic to study the reasons for the demand 2. Let us use with him the familiar distinction between a language and a metalanguage speaking about the first (either syntactically or semantically). If the independence of existence is not asserted, then I must in my object language define my object language predicates, by means of meta-linguistic ones (because the fact that the world will be relative to someone's thinking about it, will have exactly this linguistic counterpart). While Ajdukiewicz does not assert that this situation is in all circumstances impossible, it is clear that, to avoid a vicious circle, any analysis of «*x* exists» by means of «*y* thinks that *x* exists» must introduce two radically different meanings of «exist», or else accept an infinite regress.

We might perhaps add here some remarks of a more general nature. «*x* exists» means most naturally «*x* is independent from anybody's knowing *x*», and this independence of *x* from the class of

knowers, is verified by stating that x remains invariant under all types of modifications of these knowers, or that there is an invariance in the picture of x formed by these various knowing subjects. The real is thus the invariant. It is a pity that this clear characteristic cannot be used in the definition of «existence», but we must understand that defining something as being independent from something else, is still defining it in dependence from that something else ? Moreover, let us add that, if the knower is not real, defining the real through its independence from the knowing subject is of no use, so we should at least define as existent (a) the knowing subjects (plural) and (b) that which is independent from them. If this is done however, our definition of existence is lost, because we have to find that which the knowing subjects and that what is independent from them, have in common, to catch te meaning of existence. Finally, we still do not have given a clear meaning for the concept of independence. Something that I have made and that I can destroy depends upon me and yet, it exists; it exists because I cannot destroy it by pure act of will. But how can I distinguish my internal from my external actions ?(the concept of existence, as something independent from any awareness of it, is now function of this distinction).

We must conclude that indeed existence implies independence from consciousness, but that this characteristic is neither a clear nor a sufficient characteristic for existence. Much could be done here by studying (a) types of independence and (b) types of invariance.

Again, to make demand 2 precise, we need formal logic.

We think that here we can grasp the root of such a radical ontological thesis as Professor Kotarbinski's pansomatism. A body is an object that has (a) continuity, (b) shape, (c) place, (d) parts, (e) regular dependence on the external world and (f) impenetrability. All these characteristics can be structurally defined in an arbitrary space. A body is a closed subset of a space, invariant under all coordinate transformations of it. As the concept of space is simply the concept of an independently and multiply ordered manifold, the assertion that anything that is real must be a body (a lump in such a manifold having definite and relatively invariant characteristics), follows immediately from the premise that the real is the invariant. But as a purely structural definition of body can be given, this pansomatism (as Brentano clearly saw) does not imply any materialism.

3) Let us now come to the concept of individuality. Here we have to define what it means to be a whole, and what it means to be unique. An object is unique if it has a property that nothing else has; it is again unique if it has a property that nothing else can

have. The meaning of Professor Feys is certainly the second one (because it is not sufficient surely to say that if something exists, is has accidentally as a unique property that any other thing could have). This means that existence (as has been indicated by Leonard in recent controversy), even though it is different from necessity or from contingency, is a modal concept (having the property of having necessarily some property that nobody else can have is not having necessarily that property).

But it is not sufficient to define individuality, we must define wholeness. Here we can for the moment take over Goodman's assertion (*The Structure of Appearance,* p. 44): one thing is part of another if and only if whatever overlaps the former, also overlaps the latter. This is a very weak definition of being a part of (it is much more plausible to say that whenever the part-whole relation is realised, this double overlapping occurs, than to claim that whenever this double overlapping occurs, the part-whole relation is realized, — but we must rest satisfied with this attempt, that is essentially the only one we have). It is now claimed by Professor Feys that any existent object should be a whole. We should again not define a whole simply as any object having parts. We should presumably mean by whole any object having parts in such a way that the relations among these parts determine the properties of the parts in such a way that no part would have the same properties completely if these relations were partially or completely severed.

If this is the case, it certainly is to be excluded, in Professor Feys opinion, that the necessary uniqueness of any existent object is without relation to the wholeness of each existent object. Then if these two are related, the wholeness of each existent object should be the foundation of its uniqueness and, as this uniqueness is a necessary one, it should also be true that the relations among the parts have their transforming effects with necessity.

But then (a) the qualities are so transformed by their common inherence in an existent object that it cannot be true that coming into existence is not a qualitative change (then there cannot be a concept of a possible individual radically identical to the concept of this individual realised) and (b) the qualities as they exist in the whole cannot exist in such a fashion except in this whole and thus exist only as parts and thus cannot be admitted to existence according to Professor Feys' criterion. This is again a very old problem: the necessary composition of the individual but also the necessity to keep the individual an irreducible existent. Formal logic gives us here new hope because it allows us to see the extreme complication of the concepts used. (a) We have to have a calculus of modalities,

(b) combined with a calculus of relations and properties, (c) combined with a calculus of wholes or parts (we have many different partial versions of these three things without having any of them uniquely defined and without having them in combination).

4) Everything that exists has a reason to exist. This concept of reason» is again one of the most difficult ones one could use. We know a few very simple axioms for causation (Good, Rescher, Burks), but causation is here always a relation between one event and another, one quality and another. If the phrase 'reason of existence' is used and if the existence of an object is an objective characteristic of this object, the problem arises if we have not only to give an explanation for the qualities of it but also an explanation for its existence; this is obviously not the case, but the many explanations for various qualities are presumably approximations toward an explanation of the totality of these qualities referred to each other in a unique organization called existence.

The way in which the total explanation will behave has however to depend upon the definition of partial explanation. This partial explanation must be some approximation to 'reason of being' (raison d'être). We should thus use a relation between an *e* that can be any existent object (it depends thus on the ontology accepted what *e* should be) and the existence of an *f* (of same description). The reason of *f*'s existence must be *e*. Let us define some properties for this relationship. (a) If $R(e,E!f)$, then if *e,f* (not inversely); (b) If *f* is necessary given *e*, then *f* is contingent, and *e* also, $R(e,E!f)$ (but not in general); (c) If *e* is the reason of *f*'s existence, then the absence of *e* cannot be also the reason for *f*'s existence (but many different *e*'s can be the reason for *f*'s existence). (d) This concept is not transitive, but if there is a necessity linking one consequence to another, then the first reason is also the reason of the last consequence.

Nicolas Rescher, in his axiomatization of «conditional realization», gives the closest approximation to the concept of «reason of existence», but we do not think the two concepts are to be identified. More research is needed.

This clarification being given, we can then try to define the total reason of existence for not only certain properties of an existent but for this existent itself.

If this axiomatic definition of «reason of existence» is given, the question arises: is it analytic that something that exists, has a reason for its existence ? (substituting for existence various definitions, using implication, conjunction, modalities). The truth or falsity of such a principle becomes a function of (a) the set of axioms

accepted for reason of existence and (b) the set of qualities implied by the notion of «existence».

In this final respect also, formal logic could help in clarifying the relationship between the various traditional assertions.

Such a clarification is here the more needed, when it is understood that the concept of foundation of being is in some sense the dialectical opposite of the concept of independence. Plato defines being univocally as force, as that what is capable of being a reason of being, and Aristotle defines being analogously as substance, as that what is self sufficient. The traditional ontology tries to give a synthesis for these two points of view. Such a synthesis is entirely dependent upon the concept of foundation or reason of being, concept that we begin only now to analyse in its complexity, thanks to attempts like Burks causal modalities or Rescher's conditional realisation, that served as prototypes for our partial axiom system.

We think that we have now made a survey of most of the key concepts in the principles of Prof. Feys, key concepts the study of which has already begun in recent analytical work.

Before finishing however this section of our paper, we want to show that the secular problem of degrees and modes of existence can equally not hope to be solved without the aid of logical analysis.

If we want to speak about the degree of existence of a given entity, we have to define an order, a transitive, antisymmetrical and antireflexive relation on the field of all existents. Very often the assertion has been made in traditional ontology that there are degrees of being (this was easy if, out to the multiplicity of criteria of existence, only one criterion was preserved: Plotinos' unity for instance), but never to my knowledge has it been shown that indeed such an order can (or cannot) be defined. If we examine the various dimensions mentioned here: degree of foundation, degree of independence, degree of unicity, degree of wholeness, it is by no means evident that they constitute orders. Most probably they constitute quasi-orders. The problem to define a degree of existence reduces now to the much clearer problem to construct out of these heterogeneous quasi-orders (by techniques presumably taken from scaling theory) one complete order.

If we want to speak about modes of being, we must differentiate between the sharing of the same existence by qualitatively different essences and the being existent in various modes of various contents. How can this be done ? Only if the factor «existence» has a multiplicity of ingredients (as is here indeed the case) and if the way in which these ingredients are organized constitutes a structure that falls in natural classes. The possibility to apply the techniques

of natural classification to the multiplicity of relations beween foundation, unicity, independence and so forth, cannot be given if not through a formalization of these various constituents.

We hope that two conclusions are now evident.

A. Traditional ontology, in order to be refuted or in order to be proved needs logical analysis before anything else. It may perhaps be added that Nikolai Hartmans' work, the modern revival of traditional ontology, is ideally adapted to an attempt towards formalization.

B. The second conclusion is that we have now a wide field in which we can, with some arbitrariness for the while, look for a definition of the ontological commitment of a language. It is no longer possible after having understood the potential power of the concepts of our last section, to behave towards the concept of ontological commitment as if it could be solved on the simple basis of quantification theory.

6. *Logic, ontology and the philosophy of science*

When the heavy task of clarifying and modernizing the past will be completed ,we shall find ourselves however with a large number of possible and incompatible ontologies, inspired by many different and equally plausible requirements of adequacy.

How are we going to decide among them ?

It is easy to understand that we can only hope to decide by applying once more the techniques mentioned in our section 3, but this time to a domain that is more than others stable and clear.

We think that ontology will only be able to decide not only what exists (this was everywhere admitted), but even what it means «to exist» through application of the techniques mentioned to the positive sciences.

Some attempts have already been made, in the philosophy of science towards a scientific definition of reality. We however must regret that the great logical effort spent in ontology since Quine revived the subject, has not taken the slighest notice of these earlier attempts (and conversely).

To plead in favor of unification of this common effort, will be the last aim of this paper.

In his *Foundations of Science,* Norman Campbell has a very interesting part called *Science and Metaphysics* (p. 234-256).

Campbell uses the extensional method, and applies it, not to common language, but to science. He asks himself what is called «real» or «existent» in other sciences ? The first answer is: material objects

and substances. But while it is true that objects are claimed to be existent because of certain laws, not all concepts about which laws can be stated are said to exist (eg. pressure, force, volume, density). Then we find theoretical concepts analogues to things (molecules and atoms) and finally other persons. The problem of the definition of existence becomes then: what do these objects have in common ? Campbell cannot give a complete answer: he tries (p. 245) to state the beginning of an answer: (a) «all that appears certain is that our decision whether a concept is real is determined in some way by the form of the law which defines it» (245); (b) and things, thinglike concepts and persons are distinguished by the fact that the laws defining them are symmetrical ones, and are involved in the laws defining other types of concepts.

But Campbell himself recognises that these criteria are not sufficient. It should be stressed that once an intensional definition is reached on this extensional basis, we can ask what other element will fall in the extension of this new concepts; these elements can then be chosen outside of the scientific domain, and the consequence (elements to be selected or rejected) of our intensional definitions can then be studied and lead to their modification. The method is a continual exchange of empirical and deductive steps, but remains after all based on the arbitrary fiats of intuition.

This arbitrariness becomes even more obvious when we look at certain attempts by Bridgman (*The Logic of Modern Physics*) and Hans Reichenbach (*Experience and Prediction*) to define reality on the basis of data taken from the methodology of the sciences. For Bridgman essentially a concept is real if it is a theoretical construct defined operationally in multiple fashion. For Reichenbach (in his *Experience and Prediction,* and perhaps more clearly still, in the short summary of his views on reality published in his *Verifiability theory of Meaning, Proceedings of the American Academy of Arts and Sciences,* p. 55-80, vol. 80, n° 1, July 1951), for this author, who departs from the intuitive idea «the real world is the world as it is when nodoby looks at it», certain rules called «extension rules» describe the behavior of things when they can not in principle be observed. Many different sets of extension rules can be given. Rules of extension are called «normal» if they ascribe to the unobservables the same behavior as to the observables (it is obvious that only degrees of normalcy can be considered, because only a certain number of properties of the observables can be taken over in the unobservables). That there is a real world is attested by the fact that one and only one normal extension can be constructed, and the reals are those entities present in this normal extension.

How can we relate Bridgmans definition of reality by multiple definition, Reichenbach's by normal extension and Campbells by the symmetrical form of the laws and their explanatory character ?

Only functionally. The real world is the world science speaks about, the world it tells us something about, it gives us information on. The world, science speaks about, must appear in the history of science as something like an invariant of this history, an invariant becoming clearer and clearer in the course of this history. Defining reality as the intersection of the various stages of scientific development, or as the limit of scientific development, or as the part of science that has maximal chance of stability, or as a world on equal distance of all stages of science, all these attempt (each of them to be rejected) try to capture somewhat the functional significance of reality or existence, *as that what science is about.* Campbell's, Reichenbach's and Bridgman's attempts are going in the same direction. It is certain if we consider the observational language as representing an earlier stage of scientific development, that then a construct having multiple connections, or one following similar laws will have maximal stability, as equally a concept the defining laws of which are involved in the defining laws of others and the different elements out of which it is built having similar roles and equal importance.

If I ask «what is there ?», I try to transcend the limitations of what I know about what there is, of what I add, due to perspective and human nature, to what there is, in order to capture what there is, what was there before I began to think, what there will be after my thinking shall have finished and what constantly guides my thinking. But only in my thinking and through it, can I find the traces of this, and the common properties, one or multiple, it, the invariant, will have. Ontology is an empirical science, that has to compare all various stages of the sciences, in simplified formalized versions, in order to discover the common property of all irreducible elements in this approximate model of what science is about. This will be existence. The function of logic in ontology will be quite more complex than present day logic claims it to be; but it will be extremely important ([1]).

University of Ghent Leo Apostel

([1]) In a recent issue (1959) of *Philosophy of Science,* H. Putnam has tried to formalized «about». This tool have to be used.