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IN THE PHILOSOPHY OF THE SCIENCES AND THE HUMANITIES

29

# POSSIBLE ONTOLOGIES

Zdzisław Augustynek
and
Jacek Juliusz Jadacki

Rodopi

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## POSSIBLE ONTOLOGIES



## DISCUSSIONS

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**Jacek Juliusz Jadacki**

# PREFACE

## 1.

*Possible Ontologies*, the volume submitted hereafter to the judgement of the Philosophical Reader, consists of two books. Book I, *Point Eventism*, is written by Zdzisław Augustynek, Book II, *Ontological Minimum*, by me, *scil.* Jacek Jadacki.

It is not an accident that a single volume under this very title embraces two works of two authors. The reason consists in the fact that the authors are closely related both by their research programmes and by the means they select to complete them.

It seems that the source of the similarities is a common ground of Lvov-Warsaw School of Analytic Philosophy. Philosophically, we are both "great-grandsons" of Kazimierz Twardowski, the founder of the School. Zdzisław Augustynek is related through Henryk Mehlberg and Kazimierz Ajdukiewicz, while I trace my heredity through Jerzy Pelc and Tadeusz Kotarbiński. Moreover, the structure of reality is certainly such that those in philosophy who rely on the methods of inquiry we prefer cannot avoid reaching similar results.

## 2.

The scientific ideal of Twardowski was defined by three postulates: concern with clarity and precision in language, care for the merit and formal value of argumentation, and strive for a consequent elimination of pseudoproblems (cf. Jadacki 1987, p. 292).

If only the conviction that philosophy is, or at least can be, a science defines scientism, the members of the Lvov-Warsaw School are certainly adherents of scientism. Contrasting view on philosophy takes Her for an outlook (*Weltanschauung*), i.e. a set of non-scientific opinions concerning the sense of life and the sense of existence. As Jan Łukasiewicz put it:

> Scientific Philosophy must start Her construction from the foundations. This means that it must begin with the survey of philosophical problems and select those which admit intelligible formulation while rejecting all others ... Then we should try to solve those problems which admit intelligible formulation (Łukasiewicz 1936, p. 203).

Not surprisingly a systematic reconstruction of all possible ontologies is the most important part of our plan. Thus the title of the item is *Possible Ontologies*.

Like Łukasiewicz we do not reject metaphysics, we do not condemn philosophy, we are not prejudiced against any kind of philosophy and the only thing we reject is "bad think-work" (Łukasiewicz 1937, p. 214). Indeed, what we are mostly concerned with is to formulate in a comprehensive way those major problems which must be solved within the framework of every acceptable ontological system. Admittedly, Zdzisław Augustynek restricts his interests to ontological theories presupposing set-theoretical superstructure thus revealing his theoretical affiliation more openly than I do. The title of the Book I leaves no doubts that his approval goes to point eventism. Still, the Book I discusses not only the point eventism but the competing theories too (i.e. non-point eventism as well as radical, and liberal reism). Moreover, the point eventism itself is by no means a species of traditional philosophical reductionism. Although Zdzisław Augustynek assumes a single primitive ontological category he admits many derivative categories: things, processes, cross-sections, coincidences which all have equal ontological status.

We believe that the class of rational ontological problems cannot be extracted before they are precisely differentiated from epistemic problems. To this effect the conceptual apparatus must be purified from both non-logical and non-ontological terms. Although we both try to obey this restriction Zdzisław Augustynek makes use of e.g. the term "empirical object" which reveals epistemic provenance. Eventually it turns out that the term is equivalent to the ontological term "real object". I mention the epistemically described quasi-objects, so-called previdism etc. but I am not discussing them. Thus the epistemic contamination of *Possible Ontologies* is not essential.

### 3.

The scientic ideal of philosophy within the Lvov-Warsaw School is supplemented by anti-irrationalism and anti-maximalism. Anti-irrationalism rejects all free speculation and presupposition of afore-stipulated metaphysical theses. Philosophy, like the entire scientific knowledge, shall admit only the statements which are justified within the framework of the specified methodological rules. Anti-maximalism of the Lvov-Warsaw School differs from the ordinary minimalism; it confines to a simple advise against recklessness in inquiry. Each assertion of a philosophical statement should be preceded by the detailed consideration of its entire possible justification. No one should be surprised that many conclusions are still left suspended after completion of the consideration process. As Łukasiewicz put it: "it is wrong ... when there are statements above reproach in philosophy but it is worse when there are statements unjustified" (Łukasiewicz 1910, p. 5).



We share the opinion that rational ontology focuses on real world. In particular we stay as far as possible from instrumentalism. At this point Zdzisław Augustynek is even more radical. His "global realism which admits existence of concretes ... and abstracts founded in the concretes ... rejects both instrumentalism and nominalism" (Augustynek 1990, p. 64). NB. global realism does not contradict materialism when it is identified with the view that only material (i.e. interacting) concretes exist, or that all concretes are material (*ibidem*, p. 53). According to Zdzisław Augustynek only the global realism neither deprives the mathematics of the very domain of investigation (while nominalism does) nor does it with respect to physics (while instrumentalism does) (*ibidem*, p. 64).

### 4.

We share the opinion that the responsible choice of the ontological theory must be preceded with logical reinterpretation of the competing systems.

Two operations which at least in part can be performed parallelly compose such an reinterpretation.

The first one consists in filling the three kinds of related logical gaps: the gaps in the used conceptual apparatus, the gaps in system of definitions, and the gaps in the system of accepted statements. The terminological gaps are filled with the chains missing in the sequence of concepts. This is done when the limiting "minimal" or "maximal" concepts are constructed. The analytical gaps are filled with the specified atomic concepts, those which can "originate" the procedure of definig of molecular terms. The structural gaps are filled with the explicitly indicated logical relations between the statements of the interpreted system.

The second reinterpreting operation consists in translation of the competing systems already supplemented in the described way into a single, appropriately rich and precise language. We share the view that the development of the sufficiently rich language is both possible and necessary if only the ontology derives not from the random selection but from the rational one. Only when the competing systems are formulated in the same language they can be effectively compared.

We both exploit the conceptual apparatus of logic. Zdzisław Augustynek prefers the language of set theory while I am more akin to the language of predicate logic.

## 5.

We attach great expectations to the application of logical methods in philosophy, particularly in ontology.

Like all representatives of the Lvov-Warsaw School we attach special significance to the method of analytic description. We think like Tadeusz Czeżowski, that

> in the philosophical investigation ... the method of analytic description is the most secure if not the only method giving hopes for achievement of objective results of prolonged value ... The analytic description originates in the described object, depicts it as a representant of a specified kind and leads to statements of apodictic certainty .... The act of generalization present in the analytic description constitutes the specific cognitive act based in the analysis of the qualities of the described object. ... When we determine the class or type qualities of the described object ... we perform this act of generalization selecting only some of the qualities which can be distinguished and omitting the others ... Apodictic force of the analytic description originates elsewhere. The description provides with the analytic definition of the described object ... thus analyzing the meaning of the name of the object as well (Czeżowski 1953, pp. 200, 207).

This explains the presence of analytic factor in our metaphysical views. We differ only in the perception of the limits of the analytic domain in ontology. Zdzisław Augustynek would like to minimize this domain. That is why he adopts the directive to make the definitions as narrow in content as possible thus restricting analytical consequences. I am more liberal in this respect. The only claim I reject is that ontology is simply exhausted by analytic statements.

It is a separate problem that analycity of our assumptions derives from meaning intuitions. We do not appraise speculation; our definitions intend to be regulative. By the way, we accept a multitude of structural forms of definitions including definitions through abstraction.



## 6.

Being regulative all our definitions in some extent pretend to be adequate with respect to two languages: the natural language and the language of physics (the relativistic physics including). In this extent they reconstruct this part of analytic domain which is related to the natural and physical representation of the world. In case these two representations contradict each other we tend to give precedence to the latter even if we are forced to pay with the consequences which are non-intuitive or indeed "shocking" from the point of view of the common sense. (Let us take as an example Zdzisław Augustynek's construction of the "thing" as a distributive set.) We believe that physics provides for the more certain, intersubjectively verified and constantly growing knowledge about the world. Although the scientific knowledge had certainly developed from the common knowledge, the former remains at present only an imperfect reflection of the latter. As much as the analysis of the natural language is by no means infertile in philosophy we shall not limit ourselves to this method. We shall always keep in mind the warning expressed by Ajdukiewicz that the natural name is unstable.

In their efforts to make the language more accurate philosophers take one of the many tracks left open by the natural language. Aiming at greater accuracy of language results in "selection of only one of the *many possible conceptual apparatuses* hidden potentially in the system of *admissible* expressions of natural language" [my italics, J.J.J.] (Ajdukiewicz 1934, p. 206). Confronted with such a choice we do not hesitate to refer to the criterion of certainty being obviously aware that it does not satisfy the condition of intersubjectivity. Sometimes we (especially Zdzisław Augustynek) present a negative critique of the competing theory or the critique of the opponents of our conception. We are certainly conscious of the fact that the gaps in argumentation of our opponents do not provide satisfactory justification of our claims.

Like Czeżowski we think that "the analytic description ... is related to the empirical reality which it attempts to map and that it contains the existential thesis that the objects under description exist" (Czeżowski 1953, p. 201). Thus we try to remain in agreement with the contemporary physical theories in the synthetic domain of our consideration as well.

We attach varying degree of belief to our ontological statements. Zdzisław Augustynek seems to be more determined and makes decisive choices at points where I confine to listing of possible (coherent) standpoints. For example Augustynek decisively opts for the temporal and causal discontinuity of the world. Still, we admit lack of knowledge with respect to many questions. We share the conviction that reality is cognitively open. We do not conceive that for us some problems, ontological problems in particular, are open. (For instance Zdzisław Augustynek believes that admissibility of a temporal definition of time and theoretical status of material points are open questions.)

7.

We both acknowledge the need to distinct the basic ontic category and both claim that the objects belonging to this category are not "loose". Zdzisław Augustynek believes that point-events make this basic category while I am in doubt about how the point-events should be distinguished from, say, point-things if in this case the approximation is supposed to be a short-life elementary particle. That is why I would rather talk about point-objects. Even Zdzisław Augustynek himself calls his point-events "the logical atoms of reality".

We both characterize individuals in terms of opposition. Zdzisław Augustynek identifies them with non-sets while I identify them (more precisely: reserving different meaning for the term "individual" I identify things) with non-qualities. With some reservations from my side we both accept the principle of extensionality. We do not conceal that our long distance goal is not sheer recording of the major ontological problems but reaching the uniform depiction of reality. I am less optimistic than Zdzisław Augustynek about how close we are to this goal. He believes that point-eventism gives a close approximation of such an ideal depiction.

8.

We both identify existence with being real. Zdzisław Augustynek takes "existence" for a primitive term which is not defined and he strongly opposes all conceptions which admit various modes of existence. This view in its degenerated form claims – according to Zdzisław Augustynek – that virtually everything exists, only various types of objects exist each in its specific way.

A detailed analysis reveals that different meanings of the term "existence" are involved here. Since they have shockingly little or nothing in common it remains a mystery why the same term "existence" is being used to name all of them. It can be demonstrated that

the error originates ... in confusion of the concept of existence with either (1) the different qualities of different types of objects ... or (2) different criteria of existence or, (3) different methods of cognition of these types. An adherent of the discussed view asked about how the existence of concretes differs from the existence of abstracts ... cannot give 'the *differentiae specificae* for existence of concretes different from *differentiae specificae* for existence of abstracts. ... That is why I reject the view. I believe that the concept of "existence" ... has only one meaning, namely the one embeded in the natural language ... I have not invented this reconstruction of the meaning of the term. In this case I am following Ajdukiewicz... This natural concept satisfies two essential postulates concerning the definition of the term of "existence". First, it does not imply that everything exists ... Second, it does not seem to imply that abstracts do not exist (Augustynek 1990, pp. 51-52).



Unlike Zdzisław Augustynek I try to define "existence" and although I do not introduce the "mode of existence" I discuss the "mode of being" taking existence as one of the modes of being.

9.

Everything we share in our research goals and methods gives more than enough reasons for publishing *Point Eventism* and *Ontological Minimum* in a single volume. Still we do not want to create impression that there are no important problems where our views differ. Here are the examples.

Among the qualities of individuals Zdzisław Augustynek includes such qualities which force to non-being i.a. empty and infinite individuals. I can not see the reason to introduce such a restriction though I admit I would be in trouble when asked to indicate e.g. the difference between such limiting objects like an empty thing and empty (*simpliciter*) object (*scil.* the one with no quality).

We both attach such a meaning to the term "time" according to which time is a distributive set. However, while Zdzisław Augustynek maintains that incoherence with relativistic physics makes the belief that time is a mereologic set inadmissible I would prefer to withhold such a definite negative solution.

We both define "the casual relation" referring *expressis verbis* to the relation of interaction. Still we differ slightly in our understanding of the interaction. Zdzisław Augustynek differentiates two subclasses among interactions: external and internal interactions. I see difficulties in introducing this classification and maintaining the coherence with the belief that interacting is an essential factor in the criterion of classification to things. The difference in understanding of interaction is related to the difference in understanding of causality as well as in our views about the domain of causal relation. According to Zdzisław Augustynek the adopted definition of "causal relation" overcomes

Humean difficulties. I am not certain if this is not the case that for each pair of events we can find the thing on which the events take place thus making the pair genidentical with the thing. Zdzisław Augustynek maintains that i.e. point events and temporal moments are subject to causal relation. I support the solution that the domain of interactive relation (and primarily the domain of causal relation) are things. At least I do not believe that the events which are point-like with respect of either time or space can interact. Therefore, unlike Zdzisław Augustynek I am not certain that there are no material (i.e. interacting) sets of non-material elements.

We both accept the postulate of causality. Zdzisław Augustynek maintains though that questions about the cause of a given object are meaningful only when there exist objects earlier than the one under consideration while I would rather say that non-existence of such objects proves non-existence of the causal relation but does not make the question senseless.

Warsaw, October 15, 1991.

## REFERENCES

Ajdukiewicz, K. (1934). W sprawie uniwersaliów (On the problem of universals). In: Ajdukiewicz (1960). *Język i poznanie* (Language and knowledge). Vol. I, pp. 196-210. Warszawa: PWN.

Augustynek, Z. (1990). Trzy realizmy (Three versions of realism). *Studia Epistemologiczne*, pp. 43-65.

Czeżowski, T. (1953). O metodzie opisu analitycznego (On the method of analytical description). In: Czeżowski [1958]. *Odczyty filozoficzne* (Philosophical lectures), pp. 197-207. Toruń: PWN.

Jadacki, J.J. (1987). Panorama Szkoły Lwowsko-Warszawskiej (Panorama of Lvov-Warsaw School), *Edukacja Filozoficzna* 2, 291-307.

Łukasiewicz, J. (1910). *O zasadzie sprzeczności u Arystotelesa* (On the principle of contradiction in Aristotle). Kraków: AU.

Łukasiewicz, J. (1936). Logika a filozofia (Logic and philosophy). In: Łukasiewicz (1961). *Z zagadnień logiki i filozofii* (Some problems of logic and philosophy), pp. 195-209. Warszawa: PWN.

Łukasiewicz, J. (1937). W obronie logistyki (In defence of logistics). In: Łukasiewicz (1961), pp. 210-219.

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# ONTOLOGICAL MINIMUM

## Acknowledgements

This work arises from the grand analytical tradition of the Lvov-Warsaw School, which I am proud to call my own. However, the direct impulse for writing it was provided by intellectual contact with, first, the works of professor Zdzisław Augustynek, and then with the author himself. Those familiar with the writings of professor Augustynek will realize what I owe to the former contact. As for inspirations I owe to the professor personally, the matter is less straightforward. I take responsibility for all I state in the following pages, but after several years of heated discussions at a joint seminar at Warsaw University, I am no longer able to distinguish precisely between my own ideas, and the ideas of — or reactions to criticisms by — professor Augustynek or other participants of the seminar, notably Witold Strawiński, Ph.D., and Tomasz Bigaj, M.A.

## *1. Preliminaries*

A language doing justice to the classical problems of ontology must feature the following predicates:

(i) object,
(ii) identity (of objects),
(iii) residing (of *properties* in an object),
(iv) belonging (of a *part* to an object),
(v) persistence (of an object over a *period* of time),
(vi) anteriority (of a period relative to a period),
(vii) locality (of an object in an *area*),

and also

(viii) equality (of periods or areas).

It turns out that certain problems from the borderline between ontology and epistemology require additional predicates, namely:

(ix) person,

(x) thinking (as when a person thinks about an object or that a property resides in an object),

(xi) knowing (as when a person knows about an object or that a property resides in an object),

(xii) perceptibility (as when a person perceives an object or that a property resides in an object),

and finally

(xiii) decision (by a person to have a property reside in an object).

Aside from these predicates, the ontological definitions and theses reconstructed here contain only terms peculiar to functional calculus and calculus of classes.

*2. Residing*

*2.1.*

The residing relation is irreflexive, asymmetric and intransitive. Its domain is formed by PROPERTIES and its counterdomain — by OBJECTS. We thus have for objects:

$\bigwedge x[\bigvee y(y$ resides in $x) \rightarrow x$ is an *object*]

and for properties:

$\bigwedge x[\bigvee y(x$ resides in $y) \rightarrow x$ is a *property*].

We have for things:

$\bigwedge x(x$ is a *thing* $\equiv \sim x$ is a property).

We also have:

$\bigwedge x(x$ is a property $\rightarrow x$ is an object).

As we can see, the set of objects does not coincide with the counterdomain of the residing relation. The latter is included in the former, since everything is an object and not just that in which something resides. The word "object" is said to be a transcendental term, i.e. one at once uninfinitizable and undeterminable, which may be expressed as follows:

$\bigwedge x[x$ is an object $\equiv x$ is identical with $x]$

or briefly as:

$\bigwedge x(x$ is an object).

(Conditions of identicity are given below.)



Let us assume that the variables $x, y, z$ run over the set of all objects, and the variables $P, Q, R$ over the set of objects which are properties. We shall interpret the expression $Px$ as: Property $P$ resides in object $x$, or: Object $x$ has property $P$.

Similarly, we shall read the expression: $Q(P)$ as: Property $Q$ resides in property $P$, or: Property $P$ has property $Q$.

Assume further that:

$\bigwedge x[x$ is a *superdefinite* object $\equiv \bigwedge P(Px)]$,

$\bigwedge x[x$ is a *definite* object $\equiv \bigvee P(Px)]$,

$\bigwedge x \bigwedge P(x$ is an object definite with regard to property $P \equiv Px)$,

$\bigwedge P[P$ is a *universal* property $\equiv \bigwedge x(Px)]$

and:

$\bigwedge P[P$ is an *inherent* property $\equiv \bigvee x(Px)]$.

Let us add to this:

$\bigwedge x(x$ is an *ad-definite* object $\equiv \{\hat{P}\}Px = \infty)$.

The largest ad-definite object, being one with an infinite number of properties, would be indistinguishable from a superdefinite object if the number of properties were infinite.

Let us call an indefinite object an "empty object", and a noninherent property — an "empty property". We thus have:

$\bigwedge x[x$ is an empty object $\equiv \sim\bigvee P(Px)]$

and:

$\bigwedge$P[P is an empty property $\equiv \sim\bigvee x(Px)]$.

According to the above definition of "empty object", the so-called qualityless substratum (or carrier) of properties, i.e. that which would remain of a definite object if this object were stripped of all its properties, would be precisely that empty object.

A peculiar kind of objects, by which we also mean properties, are mental or *quasi*-objects such that:

$\bigwedge x[x$ is a *mental* object $\rightarrow \bigvee y(y$ thinks about $x)]$.

Their peculiarity lies in the fact that no residing relation occurs between any *quasi*-properties and *quasi*-objects. What does occur in this case is a relation of *quasi*-residing with:

$\bigwedge x \bigwedge P[P$ quasi-resides in x $\rightarrow \bigvee y(y$ thinks that $Px)]$.

Mental objects (and properties) are thus in fact empty objects (properties).

In our further considerations we shall not be dealing with empty objects (or *quasi*-objects). Accordingly, we shall be using the words "object" and "property" to denote objects *sensu stricto* (i.e. definite ones) and properties *sensu stricto* (i.e. inherent ones). In what follows the variables: $x, y, z$ will in fact run over the set of objects *sensu stricto*, while variables: $P$, $Q$, $R$ run over the set of properties sensu *stricto*.

Let us now consider the following theorems:

(a) $\bigwedge x \bigwedge P(Px)$,

All objects are superdefinite

All properties are universal

(b) $\bigvee P \bigwedge x(Px)$

Some properties are universal

(c) $\bigvee x \bigwedge P(Px)$

Some objects are superdefinite

(d) $\bigwedge x \bigvee P(Px)$

All objects are definite

(e) $\bigwedge P \bigvee x(Px)$

All properties are inherent

(f) $\bigvee x \bigvee P(Px)$

Some objects are definite

Some properties are inherent

Of these theorems (a) is no doubt unacceptable, and (f) is certainly unrejectable. If we accept that certain objects (*sensu largo*) are empty objects, and that certain properties (*sensu largo*) are empty properties, we must reject theorems (d) and (e) respectively. Theorem (b) cannot be accepted since the relation of residing is irreflexive: there is no property that would be resident in itself.

The theorem:

$$\bigvee P \bigwedge x(x \text{ is a thing} \rightarrow Px),$$

being a weaker form of (b), is disputable. This theorem is particularly important if interpreted in agreement with the previously accepted convention:

$$\bigvee P \bigwedge x[(P \text{ is an inherent property} \wedge x \text{ is a definite thing}) \rightarrow Px].$$

It is sometimes believed that the search for such (nonempty) universal properties residing in (nonempty) things is among the principal tasks of ontology.



Yet another questionable theorem is (c), even if limited to things. Perhaps it is generally true that:

$$\bigwedge x(x \text{ is an object} \equiv x \text{ is non-superdefinite})$$

or, putting it more conveniently:

$$\bigwedge x(x \text{ is non-superdefinite}).$$

This, of course, also applies to empty objects which lack properties and are therefore non-superdefinite (not completely definite).

Let us add that if we accept that:

Universe = set of all (nonempty) things,

then the indication of exactly one property that would be universal (for things) would entitle us to assert the weakest *unity* of the universe.

*2.2.*

Assume now that:

$$\bigwedge x[x \text{ is a } \textit{supercontradictory} \text{ object} \equiv \bigwedge P(Px \wedge {\sim}Px)],$$

$$\bigwedge x[x \text{ is a } \textit{contradictory} \text{ object} \equiv \bigvee P(Px \wedge {\sim}Px)],$$

$$\bigwedge P[P \text{ is a } \textit{supercontradictorygenic} \text{ property} \equiv \bigwedge x(Px \wedge {\sim}Px)]$$

$$\bigwedge P[P \text{ is a } \textit{contradictorygenic} \text{ property} \equiv \bigvee x(Px \wedge {\sim}Px)].$$

Since:

$$\bigwedge x[\bigwedge P(Px \wedge {\sim}Px) \rightarrow \bigwedge P(Px)]$$

and:

$$\bigwedge x[\bigwedge P(Px \wedge {\sim}Px) \rightarrow \bigwedge P{\sim}(Px)]$$

supercontradictory objects are to be found exclusively among superdefinite or indefinite objects. Similarly, in view of:

$$\bigwedge P[\bigwedge x(Px \wedge {\sim}Px) \rightarrow \bigwedge x(Px)]$$

and:

$$\bigwedge P[\bigwedge x(Px \wedge {\sim}Px) \rightarrow \bigwedge x{\sim}(Px)]$$

supercontradictorygenic properties are only among universal or non-inherent properties.

We shall use: * as an abbreviation of the expression: $Px \wedge {\sim}Px$.

The following theorems about supercontradictory and contradictory objects, and supercontradictorygenic and contradictorygenic properties may be considered:

(a) $\bigwedge x \bigwedge P^*$
All objects are supercontradictory
All properties are supercontradictorygenic

(b) $\bigvee P \bigwedge x^*$
Some properties are supercontradictorygenic

(c) $\bigvee x \bigwedge P^*$
Some objects are supercontradictory

(d) $\bigwedge x \bigvee P^*$
All objects are contradictory

(e) $\bigwedge P \bigvee x^*$
All properties are contradictorygenic

(f) $\bigvee x \bigvee P^*$
Some objects are contradictory
Some properties are contradictorygenic

None of these theorems will survive criticism, despite many attempts to defend them. We should thus accept their negations, especially the strongest one of them all – the negation of (f) saying that no object (*sensu stricto*) is contradictory, and no property (*sensu stricto*) is contradictorygenic.

Let us call theorem:

$\bigwedge x \bigwedge P(Px \rightarrow Px)$

the "identicity principle", and theorem:

$\sim\bigvee x \bigvee P(Px \wedge \sim Px)$

the "noncontradiction principle", and theorem:

$\bigwedge x \bigwedge P(Px \vee \sim Px)$

the "excluded middle principle". If we accept that all three of these principles are equivalent (and bear in mind that not everyone would agree this is so), then the distinction between supercontradictory and non-supercontradictory as well as contradictory and non-contradictory objects on the one hand, and supercontradictorygenic and non-supercontradictorygenic as well as contradictorygenic and non-contradictorygenic properties on the other exhausts the possibilities of classifying objects with regard to whether a given property is or is not



resident ("$Px \rightarrow Px$", "$Px \wedge \sim Px$", "$Px \vee \sim Px$", where the first and third formula is equivalent to the negation of the second). As far as this goes, the sequence of theorems (together with negations thereof) reviewed above is exhaustive.

An open question, however, is whether:

$\bigwedge x \bigwedge P(\sim Px \equiv \text{non-}Px)$

and, in general, whether it is admissible to speak of negative properties and their residing in something.

Besides, it is not entirely clear how one should go about describing such properties. If one were to assume that:

$\bigwedge P[P \text{ is a } \textit{negative} \text{ property} \equiv \bigvee Q \bigwedge x(Px \rightarrow \sim Qx)]$

then every property would be negative.

## *2.3.*

Proceeding analogously as in the case of supercontradictory and contradictory objects, we will limit our considerations to the following relations between objects with regard to whether a given property does or does not reside in them:

$\bigwedge x \bigwedge y[x \text{ is } \textit{alike} \text{ to } y \equiv \bigwedge P(Px \rightarrow Py)]$,

$\bigwedge x \bigwedge y[x \text{ is } \textit{subalike} \text{ to } y \equiv \bigvee P(Px \rightarrow Py)]$

$\bigwedge x \bigwedge y[x \text{ is } \textit{supersimilar} \text{ to } y \equiv \bigwedge P(Px \wedge Py)]$

$\bigwedge x \bigwedge y[x \text{ is } \textit{similar} \text{ to } y \equiv \bigvee P(Px \wedge Py)]$.

We will also say that two objects are different when they are not alike, taking care not to confuse alikeness with the relation of IDENTITY. We thus have:

$\bigwedge x \bigwedge y[x \text{ is } \textit{different} \text{ than } y \equiv \bigvee P(Px \wedge \sim Py)]$.

Assume at least for nonsuperdefinite and nongeneral objects (see below) that:

$\bigwedge x \bigwedge y[\bigwedge P(Px \rightarrow Py) \rightarrow \bigwedge P(Py \rightarrow Px)]$

meaning that if all properties residing in some object also reside in some other object that is not alike to it, then this other objects has no properties besides these. If this is in fact so, we would have:

$\bigwedge x \bigwedge y[x \text{ is alike } \textit{sensu stricto} \text{ to } y \equiv \bigwedge P(Px \equiv Py)]$.

Alikeness (*sensu stricto*) would thus be a reflexive relation, and moreover every object would be alike (*sensu stricto*) to itself alone. It is useful to introduce the concept of "alikeness *sensu largo*" to denote objects that are not alike in respect to certain selected (and few) properties, such as for example those related to time and space (see below).

Since we have:

$\bigwedge x \bigwedge y[\bigwedge P(Px \wedge \sim Px) \rightarrow \bigwedge P(Px)]$,

and:

$\bigwedge x \bigwedge y[\bigwedge P(Px \wedge \sim Py) \rightarrow \bigwedge P\sim(Py)]$,

the only nonsubalike objects are objects superdefinite with respect to empty ones.

In turn, because:

$\bigwedge x \bigwedge y[\bigwedge P(Px \wedge Py) \rightarrow \bigwedge P(Px)]$

and:

$\bigwedge x \bigwedge y[\bigwedge P(Px \wedge Py) \rightarrow \bigwedge P(Py)]$,

the only supersimilar objects would again be the superdefinite ones.

We also have, *inter alia*:

$\bigwedge x \bigwedge y(x$ is alike to $y \rightarrow x$ is similar to $y)$.

Assume therefore that:

$\bigwedge x \bigwedge y[x$ is similar *sensu stricto* to $y \equiv (x$ is nonalike to $y \wedge x$ is similar to $y)]$.

Let us now collect the theorems about alikeness (*sensu stricto*).

(a) $\bigwedge x \bigwedge y(x$ is alike to $y)$
Everything is alike to everything
(*vs.*: Something is not alike to something)

(b) $\bigvee x \bigwedge y(x$ is alike to $y)$
Something is alike to everything
(*vs.*: Everything is nonalike to something)

$\equiv$

(c) $\bigvee y \bigwedge x(x$ is alike to $y)$
To something everything is alike
(*vs.*: To everything something is nonalike)

(d) $\bigwedge y \bigvee x(x$ is alike to $y)$
To everything something is nonalike
(*vs.*: To something nothing is alike

$\equiv$

(e) $\bigwedge x \bigvee y(x$ is alike to $y)$
Everything is alike to something
(*vs.*: Something is not alike to anything)

(f) $\bigvee x \bigvee y(x$ is alike to $y)$
Something is alike to something
(*vs.*: Nothing is alike to anything)

Of these theorems, (a) together with (b) and (c) equivalent to it are untenable. Theorems (d) and (e), which are also equivalent, should be accepted on the grounds that every object is alike to itself.



For similarity we have:

(a) $\bigwedge x \bigwedge y(x$ is similar to $y)$
Everything is similar to everything
(*vs.*: Something is dissimilar to something)

(b) $\bigvee x \bigwedge y(x$ is similar to $y)$
Something is similar to everything
(*vs.*: Everything is dissimilar to something)

$\equiv$

(c) $\bigvee y \bigwedge x(x$ is similar to $y)$
To something everything is similar
(*vs.*: To everything something is dissimilar)

(d) $\bigwedge y \bigvee x(x$ is similar to $y)$
To everything something is similar
(*vs.*: To something nothing is similar

$\equiv$

(e) $\bigwedge x \bigvee y(x$ is similar to $y)$
Everything is similar to something
(*vs.*: Something is not similar to anything)

(f) $\bigvee x \bigvee y(x$ is similar to $y)$
Something is similar to something
(*vs.*: Nothing is similar to anything)

Here neither (b) or (c) imply theorem (a) since in the former two cases similarity may be in respect to different properties (the similarity relation is intransitive). If some property were universal, then of course the strongest theorem (a) would have to be accepted. If one were to consider only similarity *sensu stricto*, then only the weakest theorem (f) might perhaps be acceptable. Theorems (d) and (e) would be satisfied without this limitation since it would be permissible to recognize every object as similar to itself.

The rejection of all the theorems (a)-(f), and hence the acceptance of the negation of (f), would be a consequence of the view that each object is exceptional and each property singular (see below).

## 2.4.

Let us introduce the following definitions:

$\bigwedge x\{x$ is an *exceptional* object $\equiv \bigwedge P \bigwedge y[(x$ is unidentical with $y \wedge Px) \rightarrow \sim Py]\}$,

$\bigwedge x\{x$ is a *subexceptional* object $\equiv \bigwedge P \bigvee y[(x$ is unidentical with $y \wedge Px) \rightarrow \sim Py]\}$,

$\bigwedge x\{x$ is an *individual* object $\equiv \bigvee P \bigwedge y[(x$ is unidentical with $y \wedge Px) \to {\sim}Py]\}$,

$\bigwedge x\{x$ is a *subindividual* object $\equiv \bigvee P \bigvee y[(x$ is unidentical with $y \wedge Px) \to {\sim}Py]\}$,

$\bigwedge P\{P$ is a *singular* property $\equiv \bigwedge x \bigwedge y[(x$ is unidentical with $y \wedge Px) \to {\sim}Py]\}$,

$\bigwedge P\{P$ is a *subsingular* property $\equiv \bigvee x \bigwedge y[(x$ is unidentical with $y \wedge Px) \to {\sim}Py]\}$,

$\bigwedge P\{P$ is a *limited* property $\equiv \bigwedge x \bigvee y[(x$ is unidentical with $y \wedge Px) \to {\sim}Py]\}$,

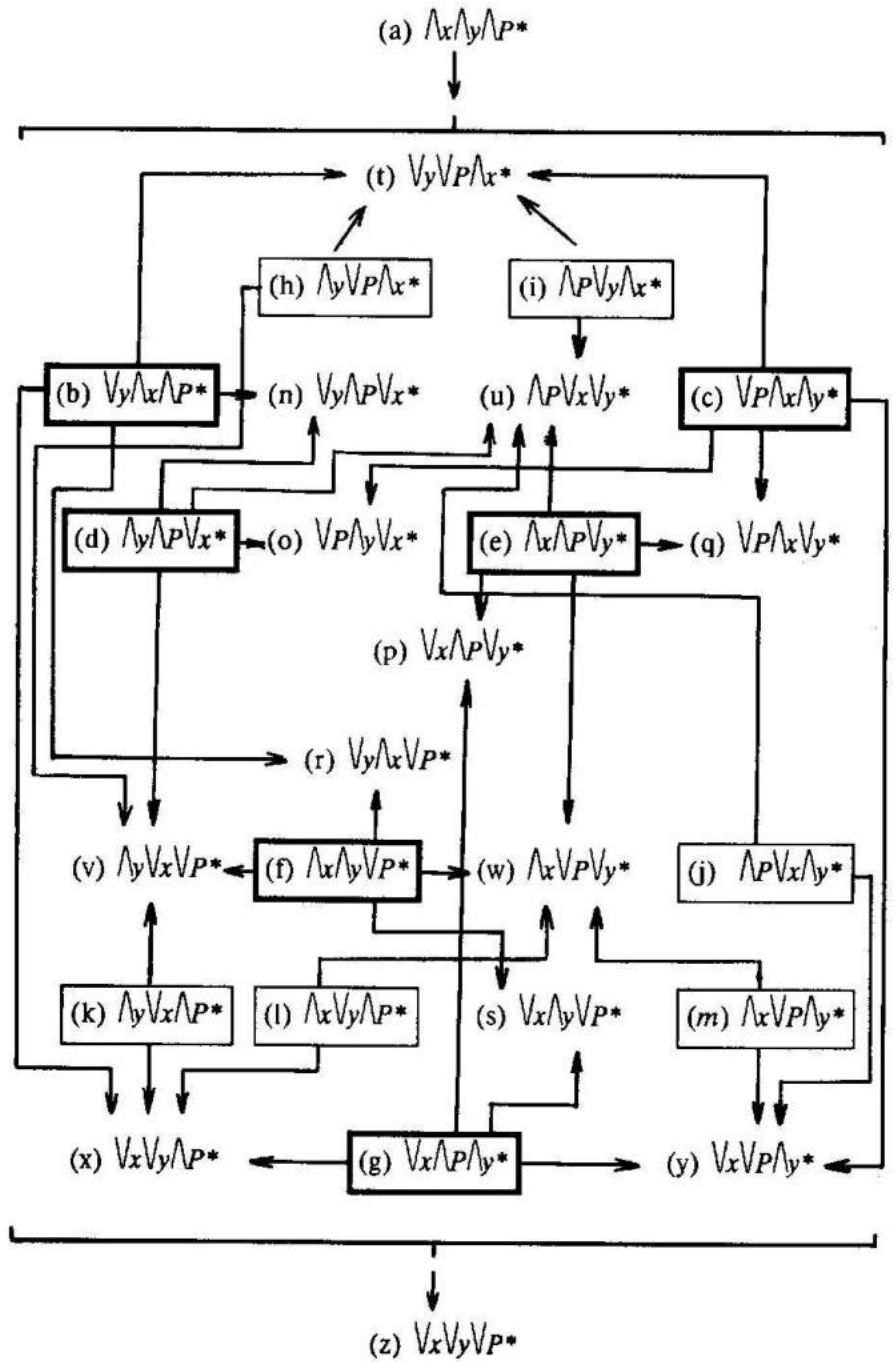
$\bigwedge P\{P$ is a *sublimited* property $\equiv \bigvee x \bigvee y[(x$ is unidentical with $y \wedge Px) \to {\sim}Py]\}$.

As we can see, an exceptional object is such that none of its properties resides in any other object, meaning that each of its properties is singular. On the other hand, a subexceptional object is such that each of its properties does not reside in a certain other object, being a limited property. An object is individual when it has some property that does not reside in any other object, that is when it has a singular property. A subindividual object is distinguished by some (limited) property that does not reside in a certain other object. A singular property is one which resides in one object at most (it resides exclusively in the object which has it). A limited property is such that does not reside in at least one object, which makes this property nonuniversal.

Singular and subsingular properties are indistinguishable, as are limited and sublimited ones. There can be no more than one object having a certain property exclusively. Similarly, a property of an object is limited when it remains as it is no matter which object it resides in (as long as this property is nonuniversal).

Let * stand for: ($x$ is unidentical with $y \wedge Px) \to Py$. We have the following theorems (see next page). These theorems refer to issues which continue to be objects of controversy. The principal positions in this controversy are, on the one hand, acceptance of theorem (a), and, on the other, rejection of theorems (c) (Some properties are singular), (g) (Some objects are exceptional), (q) (Some properties are limited), and (z) and hence also (a). The controversy is part of one form of the controversy about universals concerning the question of what corresponds to predicables in sentences like "This here object is red": the redness-of-this-here-object, i.e. a certain singular property, or redness-in-general, i.e. a general (common) property? In the former case, residing would consist in a kind of coalescence of the entirety of the





given property with the other properties residing in this same object. In the latter case, according to one approach, redness would be resident in a given object if a *part* of this redness were fused with relevant parts of the remaining properties residing in this object. According to another view, the question of properties and general objects in general would have this form:

$\bigwedge x \bigwedge y \bigwedge z\ \langle x$ is a generalization of $y$ and $z \equiv \{(x$ is unidentical with $y \wedge x$ is unidentical with $z \wedge y$ is unidentical with $z) \wedge \bigwedge P[(Py \wedge Pz) \equiv Px]\}\rangle$.

Analogously:

$\bigwedge x[x$ is a *general* object $\equiv \bigvee y \bigvee z(x$ is a generalization of $y$ and $z)]$.

**Note**: General objects may be generalizations of more than two objects falling under them.

Such a treatment of general objects is open to various criticisms.

Firstly, objects falling under every general object would be general *ex definitione*. Secondly, if any one of them had, for example, some singular property, then, *ex definitione*, it would also have a corresponding negated property since the general object would have it. If:

$\ldots \bigwedge P[(Py \wedge Pz) \rightarrow Px]$

were assumed to rule out these consequences, then a generalization of two arbitrary objects similar in some respect would be every object similar to them in this particular respect. If we put:

$\ldots \bigwedge P\{Px \equiv [(Py \wedge Pz) \vee \bigwedge x'(x'$ is a general object $\equiv Px')]\}$,

then we would have an (indirect) vicious circle.

It would thus seem that general objects are at most *quasi*-objects.

### 3. *Persistence*

#### *3.1.*

The persistence relation is irreflexive and asymmetric. Its domain is formed by objects, and its counterdomain by PERIODS. For the latter we have:

$\bigwedge x[\bigvee y(y$ persists over $x) \rightarrow x$ is a *period*$]$.

Let the variables $T$, $U$, $V$ run over the set of all periods. The expression: $x$ is at $T$, shall stand for: Object $x$ persists over the period $T$. For $x$ the range of variability here is the set of all objects. In particular assume that:

$\bigwedge x \bigwedge T($that $Px$ persists over period $T \equiv Px$ at $T)$.



Assume that:

$\bigwedge x[x$ is an *everlasting* object $\equiv \bigwedge T(x$ is at $T)]$,

$\bigwedge x[x$ is a *temporal* object $\equiv \bigvee T(x$ is at $T)]$,

$\bigwedge x[x$ is a *fragile* object $\equiv (x$ is a temporal object $\wedge \sim x$ is an everlasting object$)]$,

$\bigwedge T[T$ is a *complete* period $\equiv \bigwedge x(x$ is at $T)]$,

$\bigwedge T[T$ is a *full* period $\equiv \bigvee x(x$ is at $T)]$.

When speaking of existential necessity and possibility, one has in mind everlasting and fragile objects respectively; we thus have:

$\bigwedge x(x$ is an *existentially necessary* object $\equiv x$ is an everlasting object$)$

and

$\bigwedge x(x$ is an *existentially possible* object $\equiv x$ is a fragile object$)$.

Let us note straight away that an everlasting object may not be infinitely lasting (see below), and this when the longest period is not infinitely long.

We now have the following theorems:

(a) $\bigwedge x \bigwedge T(x$ is at $T)$
Every object is everlasting
Every period is complete
Everything is always
(*vs.*: Something is not there at some time)

(b) $\bigvee x \bigwedge T(x$ is at $T)$
Some objects are everlasting
Something is always
(*vs.*: Everything is not there at some time)

(c) $\bigvee T \bigwedge x(x$ is at $T)$
Some periods are complete
Sometimes there is everything
(*vs.*: At all times something is not there)

(d) $\bigwedge T \bigvee x(x$ is at $T)$
Every period is full
At all times there is something
(*vs.*: At some time there is nothing)

(e) $\bigwedge x \bigvee T(x$ is at $T)$
Every object is temporal
Everything is at some time
(*vs.*: Something is never there)

(f) $\bigvee x \bigvee T(x$ is at $T)$
Some objects are temporal
Some periods are complete
Something is at some time
(*vs.*: Nothing is at any time)

Theorems (a) and (c) must, it seems, be rejected. The object satisfying theorem (b) would be the universe (or indestructible components thereof) provided that theorem (d) would be true at the same time. This last theorem may be viewed as an explication of the temporal *attributivism* (antisubstantialism) thesis, whose negation is the temporal *substantialism* thesis which states, putting it trivially, that time is apart from the universe (it is there even if nothing lasts through it).

Theorem (d) must not of course be confused with this one:

$\bigwedge T \bigvee x[x$ is at $T \wedge \bigwedge y(y$ is at $T \rightarrow x$ is identical with $y)]$

saying that exactly one object persists over each period. Similarly, theorem (e) must be distinguished from:

$\bigwedge x \bigvee T[x$ is at $T \wedge \bigwedge U(x$ is at $U \rightarrow T$ is identical with $U)]$

saying that each object persists over exactly one period.

The negation of theorem (e) could be accepted if advocates of the historical version of idealism according to which extratemporal objects are ideas, among other things, were proved to be right.

*3.2.*

The set of periods is partly ordered by the irreflexive, asymmetric and transitive SHORTERNESS relation. We have:

$\bigwedge T \bigwedge U(T$ is longer than $U \equiv U$ is shorter than $T)$

and:

$\bigwedge T \bigwedge U[T$ is equal to $U \equiv (\sim T$ is shorter than $U \wedge \sim T$ is longer than $U)]$.

Shorterness and longerness may be more or less specified. We then have a triadic relation: period $T$ is shorter or longer than period $U$ by period $V$.

The usually proposed yardsticks of shorterness (e.g. the signal-kinetic or organic criteria) unfortunately refer to highly debatable strong assumptions.

Let us assume that:

$\bigwedge T[T$ is the *shortest* period $\equiv \bigwedge U(T$ is unidentical with $U \rightarrow T$ is shorter than $U)]$,

$\bigwedge T[T$ is an *extremely long* period $\equiv \bigwedge U(T$ is unidentical with $U \rightarrow \sim T$ is shorter than $U)]$,

$\bigwedge T[T$ is the *longest* period $\equiv \bigwedge U(T$ is unidentical with $U \rightarrow T$ is longer than $U)]$,

$\bigwedge T[T$ is an *extremely short* period $\equiv \bigwedge U(T$ is unidentical with $U \rightarrow \sim T$ is longer than $U)]$.



Let * stand for the expression: T is unidentical with $U \rightarrow T$ is shorter than $U$.

We will refer to an extremely short period as "moment"; thus we have:

$\bigwedge T(T$ is a *moment* $\equiv T$ is extremely short$)$.

Also, we will call an extremely long period "time", so that:

$\bigwedge T(T$ is *time* $\equiv T$ is extremely long$)$;

for the time being we leave aside the question whether time is also the longest period. We have the following theorems:

(a) $\bigwedge T \bigwedge U*$
Every period is shorter than other periods
Every period is longer than other periods

(b) $\bigvee T \bigwedge U*$
Some period is shortest

(c) $\bigvee U \bigwedge T*$
Some period is longest

(d) $\bigvee U \bigwedge T \sim *$
Some periods are extremely short

(e) $\bigvee T \bigwedge U \sim *$
Some periods are extremely long

(f) $\bigvee T \bigvee U*$
Some period is shorter than others
Some period is longer than others

Theorem (a) is of course unacceptable. Theorem (b) is not identical with the opinion that time is *discreet* (i.e. there are no infinitely short periods). Likewise, theorem (c) is not to be confused with the view that time is *unlimited* (that is to say infinitely long). Theorem (c) would differ from theorem (e) if time were not *exceptional*, i.e. if there were, say, two times, running in parallel or separated by some empty intertime).

*3.3.*

The set of moments is completely ordered by the irreflexive, asymmetric, transitive and connected ANTERIORITY relation.

Let the variables $t$, $u$, $v$ run over the set of all moments.

Assume that:

$\bigwedge t \bigwedge u$($u$ is posterior to $t \equiv t$ is anterior to $u$),

$\bigwedge t \bigwedge u$[$u$ is simultaneous with $t \equiv$ ($\sim t$ is anterior to $u \wedge \sim t$ is posterior to $u$)].

We also have:

$\bigwedge t \bigwedge u$($t$ is simultaneous with $u \equiv t$ is identical with $u$).

Furthermore:

$\bigwedge t$[$t$ is the *earliest* moment $\equiv \bigwedge u$($t$ is unidentical with $u \rightarrow t$ is anterior to $u$)],

$\bigwedge t$[$t$ is the *terminal* moment $\equiv \bigwedge u$($t$ is unidentical with $u \rightarrow \sim t$ is anterior to $u$)],

$\bigwedge t$[$t$ is the *latest* moment $\equiv \bigwedge u$($t$ is unidentical with $u \rightarrow u$ is anterior to $t$)],

$\bigwedge t$[$t$ is the *initial* moment $\equiv \bigwedge u$($t$ is unidentical with $u \rightarrow \sim u$ is anterior to $t$)].

Let us add that the earliest moment is identical with the initial one, and the latest with the terminal. Anteriority and posteriority may be precisely defined in terms of intervals, and in such a case we have to do with a triadic relation: $t$ is anterior or posterior to $u$ by period $V$.

The equivalents of these distinctions concerning periods are as follows (see below for discussion of belonging):

$\bigwedge t \bigwedge T$⟨$t$ is *earliest* in $T \equiv$ {$t$ belongs to $T \wedge \bigwedge u$[($t$ is unidentical with $u \wedge u$ belongs to $T$) $\rightarrow t$ is anterior to $u$]}⟩,

$\bigwedge t \bigwedge T$⟨$t$ is *terminal* in $T \equiv$ {$t$ belongs to $T \wedge \bigwedge u$[($t$ is unidentical with $u \wedge u$ belongs to $T$) $\rightarrow \sim t$ is anterior to $u$]}⟩,

$\bigwedge t \bigwedge T$⟨$t$ is *latest* in $T \equiv$ {$t$ belongs to $T \wedge \bigwedge u$[$t$ is inidentical with $u \wedge u$ belongs to $T$) $\rightarrow u$ is anterior to $t$]}⟩,

$\bigwedge t \bigwedge T$⟨$t$ is *initial* in $T \equiv$ {$t$ belongs to $T \wedge \bigwedge u$[($t$ is unidentical with $u \wedge u$ belongs to $T$) $\rightarrow \sim u$ is anterior to $t$]}⟩.

The anteriority relation — and its derivatives — may also be defined in a set of periods longer than the moment (i.e. periods whose parts are moments) or of temporal objects.

Two solutions are possible in the set of nonmomentary periods:

$\bigwedge T \bigwedge U${$T$ is anterior *sensu stricto* to $U \equiv \bigwedge t \bigwedge u$[($t$ belongs to $T \wedge u$ belongs to $U$) $\rightarrow t$ is anterior to $u$]}

or — provided the concept of "belonging" is used (see below):



$\bigwedge T \bigwedge U$[$T$ is anterior *sensu largo* to $U \equiv \bigwedge t \bigwedge u$[⟨{$t$ belongs to $T \wedge \bigwedge v$ [($v$ belongs to $T \wedge u$ is unidentical with $v$) $\rightarrow t$ is anterior to $v$]} $\wedge$ {$u$ belongs to $U \wedge \bigwedge v$[($v$ belongs to $U \wedge u$ is unidentical with $v$) $\rightarrow$ $u$ is anterior to $v$]}⟩ $\rightarrow t$ is anterior to $u$]],

or, more simply:

$\bigwedge T \bigwedge U${$T$ is earlier *sensu largo* than $U \equiv \bigwedge t \bigwedge u$[($t$ is earliest in $T \wedge u$ is earliest in $U$) $\rightarrow t$ is earlier than $u$]}.

Analogously:

$\bigwedge T \bigwedge U$($T$ is posterior *sensu stricto* to $U \equiv U$ is anterior *sensu stricto* to $T$),

but:

$\bigwedge T \bigwedge U$[$T$ is anterior *sensu largo* to $U \equiv \bigwedge t \bigwedge u$[⟨{$t$ belongs to $T \wedge \bigwedge v$[($v$ belongs to $T \wedge u$ is unidentical with $v$) $\rightarrow t$ is posterior to $v$]} $\wedge$ {$u$ belongs to $U \wedge \bigwedge v$[($v$ belongs to $U \vee u$ is unidentical with $v$) $\rightarrow u$ is posterior to $v$]}⟩ $\rightarrow t$ is posterior to $u$]].

On the other hand:

$\bigwedge T \bigwedge U${$T$ is simultaneous (*sensu stricto*) with $U \equiv$ [$\bigvee v$($v$ is earliest in $T \wedge v$ is earliest in $U$) $\wedge \bigvee v$($v$ is latest in $T \wedge v$ is *l*atest in $U$)]}.

Here too:

$\bigwedge T \bigwedge U$[$T$ is simultaneous (*sensu stricto*) with $U \equiv T$ is identical with $U$].

Finally:

$\bigwedge T$[$T$ is earliest $\equiv \bigwedge U$($T$ is unidentical with $U \rightarrow T$ is anterior to $U$)],

$\bigwedge T$[$T$ is terminal $\equiv \bigwedge U$($T$ is unidentical with $U \rightarrow \sim T$ is anterior to $U$)],

$\bigwedge T$[$T$ is latest $\equiv \bigwedge U$($T$ is unidentical with $U \rightarrow U$ is anterior to $T$],

$\bigwedge T$[$T$ is initial $\equiv \bigwedge U$($T$ is unidentical with $U \rightarrow \sim U$ is anterior to $T$)].

Also here the earliest (*sensu stricto*) period is identical with the initial (*sensu stricto*) one, and the latest — with the terminal one.

Among temporal (temporally extensive) objects we will distinguish momentary objects so that:

$\bigwedge x$[$x$ is a momentary object $\equiv \bigvee t$($x$ is at $t$)

or, more clearly:

$\bigwedge x${$x$ is a momentary object $\equiv \bigvee t$[($x$ is at $t$) $\wedge \bigwedge u$($t$ is unidentical with $u \rightarrow x$ is at $u$)]}.

Let us stress in this context that persistence over a certain period must not be confused with occupying that period. For persistence we have:

$\bigwedge x \bigwedge T \bigwedge U$[($x$ is at $T \wedge U$ belongs to $T$) $\rightarrow x$ is at $U$],

and, as we see, one has to employ here the concept of "belonging" (see below). Let us agree that by: $x$ is within $T$, we mean: Object $x$ occupies period $T$.

For *occupying* we now have:

$\bigwedge x \bigwedge T$($x$ is within $T \equiv$ {$x$ is at $T \wedge \bigwedge U$[($T$ is unidentical with $U \wedge T$ belongs to $U$) $\rightarrow \sim x$ is at $U$]}).

For temporal nonmomentary objects we have respectively:

$\bigwedge x \bigwedge y${$x$ is anterior to $y \equiv \bigvee T \bigvee U$[($x$ is within $T \wedge y$ is within $U$) $\wedge\ T$ is anterior to $U$]},

$\bigwedge x \bigwedge y$($x$ is posterior to $y \equiv$ $y$ is anterior to $x$)

and:

$\bigwedge x \bigwedge y${$x$ is simultaneous with $y \equiv$ [($x$ is temporal $\wedge$ $y$ is temporal) $\wedge$ ($\sim x$ is anterior to $y \wedge \sim x$ is anterior to $y$)]}.

Here we cannot put:

$\bigwedge x \bigwedge y$($x$ is simultaneous with $y \equiv x$ is identical with $y$)

unless we reject the view that more than one object may persist over a given period. Thus the anteriority relation, being unconnected, does not order the set of objects.

Remaining in the set of nonmomentary objects, we further have:

$\bigwedge x$[$x$ is the earliest object $\equiv \bigvee T$($x$ is within $T \wedge T$ is earliest)],

$\bigwedge x$[$x$ is a terminal object $\equiv \bigvee T$($x$ is within $T \wedge T$ is terminal)],

$\bigwedge x$[$x$ is the latest object $\equiv \bigvee T$($x$ is within $T \wedge T$ is latest)],

$\bigwedge x$[$x$ is an initial object $\equiv \bigvee T$($x$ is within $T \wedge T$ is initial)].

Initial objects (of which there may be several) may differ from the earliest object (which may only be one); similarly, terminal objects may differ from the latest one.

Theorems concerning the anteriority relation may be variously interpreted depending on whether the set is that of objects (momentary or nonmomentary), moments or periods. It is characteristic that if any criteria of anteriority are at all given (e.g. the intuitive, signal, causal, thermodynamical, electrodynamical or organic) – and when the very possibility of providing such criteria is put in doubt – the theorems in any case refer to anteriority defined in the set of objects (and in particular of events).



Let * be the abbreviation of the expression: $x$ is unidentical with $z \rightarrow x$ is anterior to $y$. We thus have:

(a) $\bigvee x \bigwedge y$ *
Everything is anterior to everything
Each moment is anterior to every other moment
Each period is anterior to every other period

(b) $\bigvee x \bigwedge y$ *
There is the earliest object
There is the earliest moment

(c) $\bigvee y \bigwedge x$ *
There is the latest object
There is the latest moment

(d) $\bigvee y \bigwedge x$ ~*
There is an initial object
There is an initial moment

(e) $\bigvee x \bigwedge y$ ~*
There is a terminal object
There is a terminal moment

(f) $\bigvee x \bigvee y$ *
Something is anterior to something
There is a moment anterior to some other moment

Theorem (a) cannot be left unrejected or (f) unaccepted. The negation of (b) or (d) is sometimes in the form of the opinion that time (or the universe) is *eternal*. The view that time (or the universe) is *perpetual* corresponds to the negation of (c) or (e). Both these negations combined form the opinion that time (or the universe) is unlimited. In the set of moments (and periods) theorem (b) is identical with (d), while (c) is identical with (e).

Let us look now at theorems concerning the relation of simultaneity which in the set of objects is identical with the coexistence relation.

(a) $\bigwedge x \bigwedge y$($x$ is simultaneous with $y$)
Everything is simultaneous with everything
Every moment is simultaneous with every moment

(b) $\bigvee x \bigwedge y$($x$ is simultaneous with $y$)
Something is simultaneous with everything
Some moments are simultaneous with all momenth

≡

(c) $\bigvee y \bigwedge x$($x$ is simultaneous with $y$)
With something everything is simultaneos
With some moments all moments are simultaneous

(d) $\bigwedge y \bigvee x$($x$ is simultaneous with $y$)
With everything there is something simultaneous
With every moment there is some simultaneous moment

≡

(e) $\bigwedge x \bigvee y$($x$ is simultaneous with $y$)
Everything is simultaneous with something
Every moment is simultaneous with some moment

(f) $\bigvee x \bigvee y$($x$ is simultaneous with $y$)
Something is simultaneous with something
Some moments are simultaneous with some moments

The strongest acceptable theorem here is (d) and also its equivalent theorem (e). It is satisfied because every object is simultaneous with itself, as is every moment (and period). If we impose on these theorems an additional condition of nonidenticalness of the considered objects, (d) and (e) are true for objects which are not moments if at least two objects persist over every full moment (or, more generally, period). If this condition were to remain in force in the set of moments, then even theorem (f) would have to be rejected. Reminiscent of the negation of (f) — for objects and not moments — are some claims meant to express temporal *relativism* according to which there is, for example, no absolute simultaneity, i.e. simultaneity in every reference system. Let us cautiously say that relativism implies the negation of (f).

*3.4.*

It is accepted that *time* is a set of all moments, completely ordered by the anteriority relation. We may thus say that time is identical with the longest period. We deny here that there be more times separated by



some immobile intertime. Only in such a case we could have, say, two extremely long periods.

We have already explained the way one is to understand properties of time such as exceptionality (when there are no two unidentical periods that would be simultaneous), discreetness (when there are no infinitely short periods) and unlimitedness, that is to say at once eternality and perpetuality (when there is no earliest and latest moment). Let us now add to these properties nonconsistency and directness. Time is *nonconsistent* when there are two unidentical moments between which there is no third, unidentical with them. The *directness* of time is a property whereby of any two unidentical moments one is anterior to the other (the relation of anteriority is connected). Note that the theorem about the directness of time — the irreversibility of its course — is sometimes erroneously identified with the theorem about the irreversibility of physical processes.

A notable controversy is about the *instantaneity* of the universe, that is to say about whether there is a certain distinct period that is the *present*, a period such that all the periods anterior to it are the *past*, and all the posterior ones — the *future*.

The present is distinguished with respect to a certain temporal object. If this object were object $a$ we would have:

$\bigwedge T$($T$ is the present [of $a$] $\equiv a$ is at $T$)

or, putting it more precisely:

$\bigwedge x$($x$ is in the present [relative to $a$] $\equiv x$ is simultaneous with $a$).

Analogously:

$\bigwedge x$($x$ is in the past [relative to $a$] $\equiv x$ is anterior to $a$)

and:

$\bigwedge x$($x$ is in the past [relative to $a$] $\equiv x$ is posterior to $a$).

An open issue, of course, is what exactly acts as this distinctive object $a$. Usually this is some concrete person, or ourself or even a certain phase of ourself. It is obvious that there are as many ourselves as there are people, and accordingly there are just as many presents and corresponding pasts and futures.

Note that an additional condition is sometimes imposed on this eternality and perpetuality, saying that:

$\bigwedge x$($x$ is eternal $\rightarrow x$ persists over the present)

and also that:

$\bigwedge x$($x$ is perpetual $\rightarrow x$ persists over the present).

Likewise, existential possibility is defined so that:

$\bigwedge x\{x$ is existentially possible $\equiv [(\sim x$ persists over the past $\wedge \sim x$ persists over the present$) \wedge \bigvee T(T$ belongs to the future $\wedge\ x$ is within $T)]\}$.

Existential possibility thus treated is sometimes being distinguished from reality on the basis that:

$\bigwedge x(x$ is real $\equiv \{\bigvee T[(T$ belongs to the future $\vee\ T$ belongs to the present$) \wedge x$ is within $T] \wedge \bigvee T[(T$ belongs to the past $\vee\ T$ belongs to the future$) \wedge \sim x$ is within $T]\})$.

It is obvious that if this condition is accepted, eternality and perpetuality, as well as possibility and reality would change with the change of the reference assumed for the present.

## 4. *Locality*

### *4.1.*

The relation of locality is irreflexive and asymmetric. Its domain is formed by objects, and its counterdomain by a set of three-dimensional parts of space which we shall call AREAS.

We thus have:

$\bigwedge x[\bigvee y(y$ lies on $x) \rightarrow x$ is an *area*$]$.

Assume that the variables: $L$, $M$, $N$ run over the set of all areas. The expression: $x$ is on $L$, is to be interpreted as: Object $x$ lies on area $L$. Let us accept the following definitions:

$\bigwedge x[x$ is an *omnioccurrent* object $\equiv \bigwedge L(x$ is on $L)]$,

$\bigwedge x[x$ is a *spatial* object $\equiv \bigvee L(x$ is on $L)]$,

$\bigwedge L[L$ is a *complete* area $\equiv \bigwedge x(x$ is on $L)]$,

$\bigwedge L[L$ is a *full* area $\equiv \bigvee x(x$ is on $L)]$.

Of course, if it were to turn out that the greatest area is not infinitely large, the omnioccurrent object would be finitely extensive.

The following theorems involving the introduced concepts may be put forward:



(a) $\bigwedge x \bigwedge L(x$ is on $L)$
Everything is everywhere
(*vs.*: Something is not present somewhere)

(b) $\bigvee x \bigwedge L(x$ is on $L)$
Something is everywhere
(*vs.*: Everything is not present somewhere)

(c) $\bigvee L \bigwedge x(x$ is on $L)$
Somewhere there is everything
(*vs.*: Everywhere something is not present)

(d) $\bigwedge L \bigvee x(x$ is on $L)$
Everywhere there is something
(*vs.*: Somewhere there is nothing)

(e) $\bigwedge x \bigvee L(x$ is on $L)$
Everything is somewhere
(*vs.*: Something is nowhere)

(f) $\bigvee x \bigvee L(x$ is on $L)$
Something is somewhere
(*vs.*: Nothing is anywhere)

The principal argument in this context is between proponents of theorem (d), i.e. of spatial *plenism* (antisubstantialism), and those of the negation of (d) — of spatial *absolutism* (substantialism). This latter position is generally expressed as the view that space is a *sui generis* reservoir which might be entirely or partly empty (unfilled with objects). It cannot be precluded, however, that the stronger theorems, (a) included, are true. Bear in mind that for (a) to be acceptable it is not necessary for everything to be everywhere *always*.

### *4.2.*

The set of areas is partly ordered by the irreflexive, asymmetric and transitive relation of NARROWNESS corresponding to the relation of shorterness in the set of (unidimensional) distances.

We have:

$\bigwedge L \bigwedge M(L$ is wider than $M \equiv M$ is narrower than $L)$

and:

$\bigwedge L \bigwedge M(L$ is equal to $M \equiv (\sim L$ is narrower than $M \wedge \sim L$ is wider than $M))$.

Assume that:

$\bigwedge L[L$ is the *narrowest* area $\equiv \bigwedge M(L$ is unidentical with $M \rightarrow L$ is narrower than $M)]$,

$\bigwedge L[L$ is an *extremely wide* area $\equiv \bigwedge M(L$ is unidentical with $M \rightarrow {\sim} L$ is narrower than $M)]$,

$\bigwedge L[L$ is the *widest* area $\equiv \bigwedge M(L$ is unidentical with $M \rightarrow L$ is wider than $M)]$,

$\bigwedge L[L$ is an *extremely narrow* area $\equiv \bigwedge M(L$ is unidentical with $M \rightarrow {\sim} L$ is wider than $M)]$.

Let * stand for the expression: $L$ is unidentical with $M \rightarrow L$ is narrower than $M$. The theorems pertaining to the narrowness relation are as follows:

$$
\begin{tikzcd}
& \begin{array}{c}\text{(a) } \bigwedge L \bigwedge M\, * \\ \text{Every area is narrower than every other area}\end{array} \arrow[dl] \arrow[dr] & \\
\begin{array}{c}\text{(b) } \bigvee L \bigwedge M\, * \\ \text{Some area is the narrowest}\end{array} \arrow[d] & & \begin{array}{c}\text{(c) } \bigvee M \bigwedge L\, * \\ \text{Some area is the widest}\end{array} \arrow[d] \\
\begin{array}{c}\text{(d) } \bigvee M \bigwedge L\, {\sim} * \\ \text{Some area is extremely narrow}\end{array} \arrow[dr] & & \begin{array}{c}\text{(e) } \bigvee L \bigwedge M\, {\sim} * \\ \text{Some area is extremely wide}\end{array} \arrow[dl] \\
& \begin{array}{c}\text{(f) } \bigvee L \bigvee M\, * \\ \text{Some area is narrower than some other area}\end{array} &
\end{tikzcd}
$$

An extremely narrow area is identified with a place:

$\bigwedge L(L$ is a *place* $\equiv L$ is extremely narrow$)$,

while an extremely wide area is identified with space, so that:

$\bigwedge L(L$ is *space* $\equiv L$ is extremely wide$)$.

If we were to deny that there are, say, two distinct (separated by a void) spaces, then in the above treatment space would be the widest area.

The acceptance of theorem (d) would not be, obviously, tantamount to recognizing that space is *discreet* or the acceptance of (e) — that space is *unlimited*.



*4.3.*

The set of places cannot be ordered with a relation similar to the anteriority relation ordering the set of moments. What is possible, though, is the introduction of an equilocation relation analogous to the simultaneity relation.

Let $l$, $m$, $n$ be variables running over the set of all places. We thus have:

$\bigwedge l \bigwedge m(l$ is equilocated with $m \equiv l$ is identical with $m)$

and similarly in the set of areas wider than places:

$\bigwedge L \bigwedge M(L$ is equilocated with $M \equiv L$ is identical with $M)$.

For spatial objects we have:

$\bigwedge x \bigwedge y[x$ is equilocated with $y \equiv \bigwedge L(x$ is on $L \equiv y$ is on $L)]$

Here we may put:

$\bigwedge x \bigwedge y(x$ is equilocated with $y \equiv x$ is identical with $y)$

if we have in mind equilocation in a given or every period and we rule out the possibility of any interpenetration of objects (see below).

Remember also to distinguish between lying on a certain area, or in particular on a place, satisfying the condition:

$\bigwedge x \bigwedge L \bigwedge M[(x$ is on $L \wedge M$ belongs to $L) \rightarrow x$ is on $M]$

(again with the assumption that this takes place in the same or every period) and the occupying of this area.

Let us agree that the expression: $x$ is within $L$, stands for: Object $x$ occupies area $L$. For occupying we have:

$\bigwedge x \bigwedge L\langle x$ is in $L \equiv \{x$ is on $L \wedge \bigwedge M[(L$ is unidentical with $M \wedge L$ belongs to $M) \rightarrow {\sim} x$ is on $M]\}\rangle$.

Let us stress once again that before a position is taken with regard to theorems about equilocation, one must first decide whether conditions imposed on equilocation (and nonequilocation) allow for two objects to be considered equilocated if they *simultaneously* lie on the same area (place), or whether it is enough for them to have been on the area (place) *at some time*.

We have the following theorems about equilocation to consider:

$$\begin{tikzcd}[column sep=small]
 & \begin{array}{c}\text{(a) } \bigwedge x \bigwedge y(x \text{ is equilocated with } y)\\ \text{Everything is equilocated with everything}\end{array} \arrow[dl] \arrow[dr] & \\
\begin{array}{c}\text{(b) } \bigvee x \bigwedge y(x \text{ is equilocated with } y)\\ \text{Something is equilocated with}\\ \text{everything}\end{array} \arrow[d] & \equiv & \begin{array}{c}\text{(c) } \bigvee y \bigwedge x(x \text{ is equilocated with } y)\\ \text{With something everything is}\\ \text{equilocated}\end{array} \arrow[d] \\
\begin{array}{c}\text{(d) } \bigwedge y \bigvee x(x \text{ is equilocated with } y)\\ \text{With everything something is}\\ \text{equilocated}\end{array} \arrow[dr] & \equiv & \begin{array}{c}\text{(e) } \bigwedge x \bigvee y(x \text{ is equilocated with } y)\\ \text{Everything is equilocated with}\\ \text{something}\end{array} \arrow[dl] \\
 & \begin{array}{c}\text{(f) } \bigvee x \bigvee y(x \text{ is eqilocated with } y)\\ \text{Something is equilocated with something}\end{array} &
\end{tikzcd}$$

*4.4.*

If we regard space – the set of all places – as the widest area (at the same time denying that there is more than one space), then in addition to discreetness and unlimitedness, discussed above, we may also talk of nondirectedness, multidimensionality, nonconsistency and instantaneity of space thus understood.

Space is *nondirected* since there is no relation that would order the set of all places combining to form it. It is multidimensional, in particular *three-dimensional*, because no area can be described using less than three quantities. It is also *nonconsistent*, meaning that there are no two unidentical places that would not always have a third place between them.

It is noteworthy that although we can talk of a certain area in terms of *here-ness* with respect to a certain object, e.g. $a$, which occupies this area:

$$\bigwedge L(L \text{ is the here-ness [of } a] \equiv a \text{ is within } L),$$

there is no talk in this context of *instantaneity* of space, probably because each area – also the here-area – may basically be returned to repeatedly.



## *5. Existence*

### *5.1.*

Theorems concerning spatial relations may be formulated with greater precision only after temporal relations are taken into account, and *vice versa*. Things are made simpler when we introduce the triadic relation of existence over a certain period on a certain area (*existence* in short) and the concept of space-time that goes with it.

Let the expression: $x$ is at $T$ on $L$, stand for: Object $x$ exists over period $T$ on area $L$. Let us make clear straight away that we are considering a relation satisfying this condition:

$$\bigwedge x \bigwedge T \bigwedge U \bigwedge L \bigwedge M\{[x \text{ is at } T \text{ on } L \wedge (U \text{ belongs to } T \wedge M \text{ belongs to } L)] \rightarrow x \text{ is at } U \text{ on } M\}.$$

Let the expression: $x$ is within $TL$, be interpreted as: Object $x$ within period $T$ occupies area $L$. For occupying thus defined we have:

$$\bigwedge x \bigwedge T \bigwedge L\,[x \text{ is within } TL \equiv \langle x \text{ is in } T \text{ on } L \wedge \bigwedge U \bigwedge M\{[(T \text{ is unidentical with } U \wedge T \text{ belongs to } U) \wedge (L \text{ is unidentical with } M \wedge L \text{ belongs to } M)] \rightarrow {\sim} x \text{ is at } U \text{ on } M\}\rangle].$$

The relation between existence and persistence in time and location in space is as follows:

$$\bigwedge x \bigwedge T \bigwedge L[x \text{ is at } T \text{ on } L \rightarrow (x \text{ is at } T \wedge x \text{ is on } L)].$$

We will also assume:

$$\bigwedge x \bigwedge T \bigwedge L[x \text{ is within } TL \equiv (x \text{ is in } T \wedge x \text{ is within } L)].$$

Moreover, it is possible that

$$\bigwedge x[\bigvee T(x \text{ is at } T) \equiv \bigvee L(x \text{ is on } L)]$$

and also:

$$\bigwedge x[\bigvee T(x \text{ is within } T) \equiv \bigvee L(x \text{ is within } L)].$$

If this were indeed so, we would have simply:

$$\bigwedge x(x \text{ exists} \equiv x \text{ persists} \equiv x \text{ lies}).$$

One encounters the view that:

$$\bigwedge x[x \text{ exists} \equiv \bigvee T(T \text{ is the present} \wedge x \text{ is at } T)].$$

As we recall, the present is always determined by the period over which a distinguished object persists. If this object were to be suitably selected — for example if we ourselves were this object — the concept of "existence" would become narrower. But we can approach the issue as follows:

$$\bigwedge x[x \text{ exists} \equiv \bigvee y(x \text{ is in the present of } y)]$$

and here the range of "existence" would be identical with the range determined above (everything is at least in *its own* present).

Assume that:

$$\bigwedge x[x \text{ is a } \textit{superreal} \text{ object} \equiv \bigwedge T \bigwedge L(x \text{ is at } T \text{ on } L)],$$
$$\bigwedge x[x \text{ is a } \textit{real} \text{ object} \equiv \bigvee T \bigvee L(x \text{ is at } T \text{ on } L)].$$

Given these assumptions, a *real universe* would be the set of all real objects. Since ideal objects are described as extratemporal and extraspatial, they are *nonreal* according to the definition given above, and as such they cannot be eternal, despite the frequently expressed views to the contrary.

The concepts of "completeness" and "fullness" have been introduced earlier without settling the question whether a condition for the completeness of period T is that:

$$\bigwedge x \bigvee L(x \text{ is at } T \text{ on } L)$$

or that:

$$\bigwedge x \bigwedge L(x \text{ is at } T \text{ on } L)$$

or whether its fullness requires that:

$$\bigvee x \bigvee L(x \text{ is at } T \text{ on } L)$$

or that:

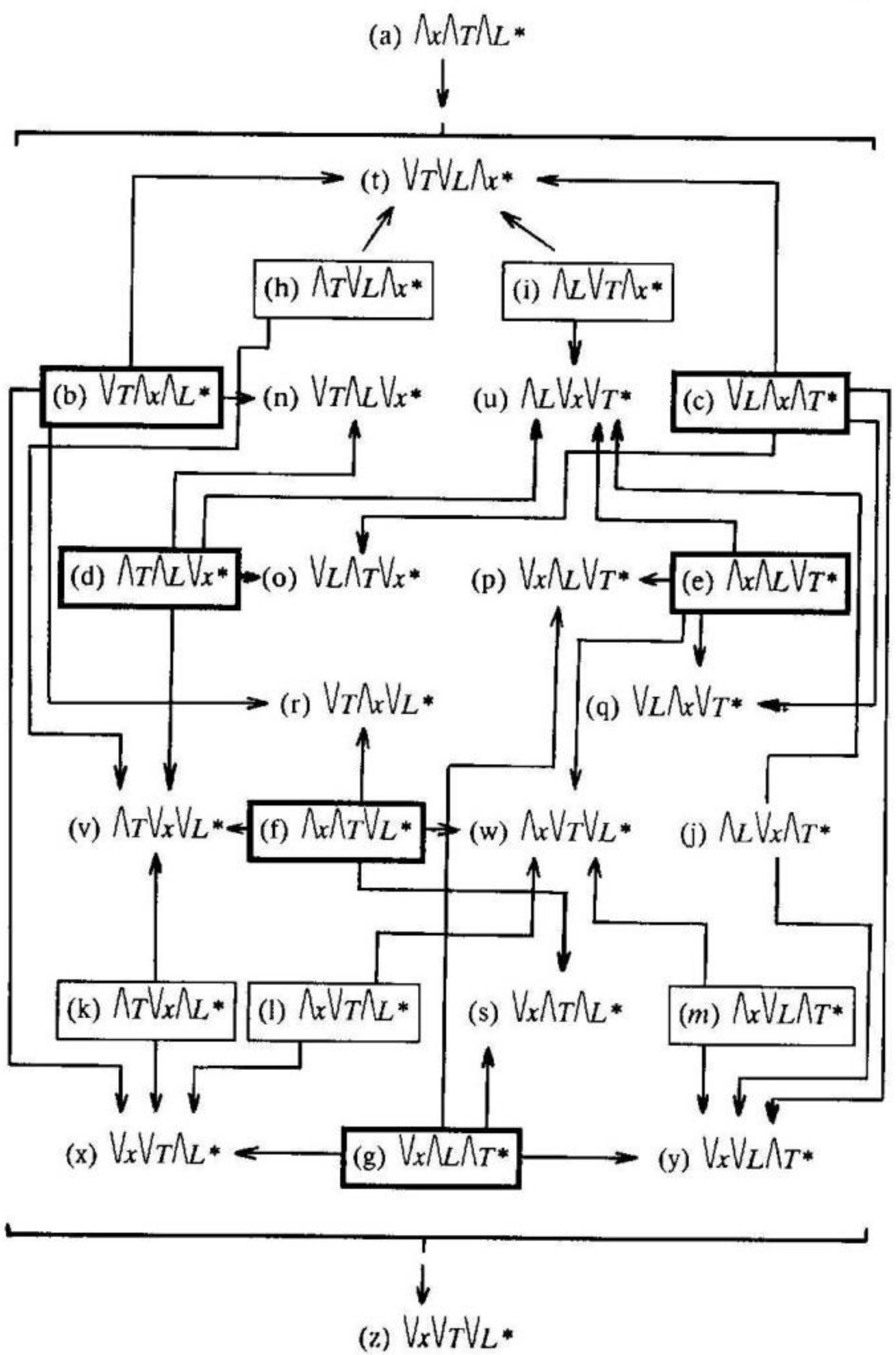
$$\bigvee x \bigwedge L(x \text{ is at } T \text{ on } L),$$

and likewise for areas. Let us now state clearly:

$$\bigwedge T[T \text{ is a complete period} \equiv \bigwedge x \bigvee L(x \text{ is at } T \text{ on } L)],$$
$$\bigwedge T[T \text{ is a full period} \equiv \bigvee x \bigvee L(x \text{ is at } T \text{ on } L)],$$
$$\bigwedge L[L \text{ is a complete area} \equiv \bigwedge x \bigvee T(x \text{ is at } T \text{ on } L)],$$
$$\bigwedge L[L \text{ is a full area} \equiv \bigvee x \bigvee T(x \text{ is at } T \text{ on } L)].$$

Let us consider the following theorems concerning this relation assuming: * as the abbreviation of the expression: $x$ is at $T$ on $L$.





The controversies here concentrate primarily around theorem (d) (Always something exists everywhere), i.e. around the question of the relation between space-time and the objects filling it. It is not being ruled out, among other things, that the latter are reducible to certain systems (curvatures) of space-time, which would mean that all properties are *de facto* reducible to (spatial-temporal) existence. In turn, if one accepts the theorem:

$\bigwedge x[\bigvee T(x \text{ is at } T) \equiv \bigvee L(x \text{ is on } L)]$,

then one cannot reject either theorem (e) (Everything exists everywhere at some time) since there is nothing that never exists everywhere, in every place, or theorem (f) (Everything always exists somewhere) since there is nothing that exists nowhere always, in every period.

Much debate is also focused around theorem (w) (Everything exists sometime somewhere) — the thesis of ontological *existentialism* formulated briefly as: Everything exists — and theorem (z) (Something exists sometime somewhere) — the thesis of ontological *objectivism* formulated briefly as: Something exists — as well as around the negations of these theorems, i.e. *fictionalism* and *subjectivism* respectively.

*5.2.*

Assume that:

$\bigwedge x\{x \text{ is a } \textit{tight} \text{ object} \equiv \bigwedge y \bigwedge T \bigwedge L[(x \text{ is within } TL \wedge y \text{ is within } TL) \rightarrow x \text{ is identical with } y]\}$.

In keeping with these assumptions, no unidentical tight and certain subtight objects can simultaneously hold the same area, meaning they cannot be simultaneously equilocated.

An open issue is which of the theorems about tightness and subtightness that can be considered are most justified:

$$\begin{array}{c}(a)\ \bigwedge x(x \text{ is a tight object})\\ \downarrow \\ (b)\ \bigvee x(x \text{ is a tight object})\end{array}$$

(Physical) *bodies* are often considered tight. The existence thereof lets us accept at least theorem (b). Nontight bodies are exemplified by certain



(physical) properties and *fields*, the existence of which would justify the rejection of theorem (a).

In the set of tight objects we have:

$\bigwedge x \bigwedge y\{(x \text{ is a tight object} \wedge y \text{ is a tight object}) \rightarrow [x \text{ is identical with } y \equiv \bigwedge T \bigwedge L(x \text{ is at } T \text{ on } L \equiv y \text{ is at } T \text{ on } L)]\}$.

Identity, being a similarity with respect to space-time properties, would *ex definitione* be a weaker relation than alikeness (similarity with respect to all properties).

For clarity's sake, the concept of "identity *sensu stricto*" defined above may be complemented with the concept of "alikeness *sensu largo*":

$\bigwedge x \bigwedge y \langle x \text{ is alike } \textit{sensu largo} \text{ with } y \equiv \{\sim x \text{ is identical with } y \wedge \bigwedge P[\sim P \text{ is identical with space-timeness} \rightarrow (Px \equiv Py)]\}\rangle$.

Thus, alikeness *sensu largo* would not be a reflexive relation.

## *6. Belonging*

### *6.1.*

The relation of belonging is nonreflexive, nonsymmetric and transitive. Its field is always homogeneous, and can be e.g. a set of periods or a set of areas.

Let us first consider the belonging relation confined to the set of periods. Note that this relation together with that of EQUALITY allows the concept of "shorterness" to be defined as follows:

$\bigwedge T \bigwedge U\{T \text{ is shorter than } U \equiv \bigvee V \bigvee W[(V \text{ belongs to } W \wedge \sim W \text{ belongs to } V) \wedge (V \text{ is equal to } T \wedge W \text{ is equal to } U)]\}$,

or, more simply:

$\bigwedge T \bigwedge U\{T \text{ is shorter than } u \equiv \bigvee V[(V \text{ belongs to } U \wedge \sim u \text{ belongs to } V) \equiv V \text{ is equal to } T]\}$.

Assume now that:

$\bigwedge T[T \text{ is an } \textit{all-containing} \text{ period} \equiv \bigwedge U(U \text{ belongs to } T)]$,

$\bigwedge T[T \text{ is a } \textit{divisible} \text{ period} \equiv \bigvee U(T \text{ is unidentical with } U \wedge U \text{ belongs to } T)]$,

$\bigwedge T$[$T$ is a *nodical* period $\equiv \bigwedge U$($T$ belongs to $U$)],

$\bigwedge T$[$T$ is a *constituent* period $\equiv \bigvee U$($T$ is unidentical with $U \wedge T$ belongs to $U$)].

Let * stand for the expression: $T$ is unidentical with $U \rightarrow T$ belongs to $U$. We now have the following theorems:

$$\begin{tikzcd}[column sep=small]
 & \begin{array}{c}\text{(a) } \bigwedge T \bigwedge U^{*} \\ \text{Every period is all-containing} \\ \text{Every period is nodical}\end{array} \arrow[dl] \arrow[dr] & \\
\begin{array}{c}\text{(b) } \bigvee U \bigwedge T^{*} \\ \text{Some period is all-containing}\end{array} \arrow[d] & & \begin{array}{c}\text{(c) } \bigvee T \bigwedge U^{*} \\ \text{Some period is nodical}\end{array} \arrow[d] \\
\begin{array}{c}\text{(d) } \bigwedge T \bigvee U^{*} \\ \text{Every period is constituent}\end{array} \arrow[dr] & & \begin{array}{c}\text{(e) } \bigwedge U \bigvee T^{*} \\ \text{Every period is divisible}\end{array} \arrow[dl] \\
 & \begin{array}{c}\text{(f) } \bigvee T \bigvee U^{*} \\ \text{Some period is divisible} \\ \text{Some period is constituent}\end{array} &
\end{tikzcd}$$

Observe that the theorem allowing the shortest periods is equivalent to the rejection of theorem (a). If we agree that time is exceptional, it would satisfy theorem (b), being the longest period.

The question of the belonging relation confined to the set of areas is similar. Here too this relation, together with that of equality, makes it possible to define the concept of "narrowerness":

$\bigwedge L \bigwedge M$\{$L$ is narrower than $M \equiv \bigvee N \bigvee O$[($N$ belongs to $O \wedge \sim O$ belongs to $N$) $\wedge$ ($N$ is equal to $L \wedge O$ is equal to $M$)]\}.

Assume again that:

$\bigwedge L$[$L$ is an all-containing area $\equiv \bigwedge M$($M$ belongs to $L$)],

$\bigwedge L$[$L$ is a divisible area $\equiv \bigvee M$($L$ is unidentical with $M \wedge M$ belongs to $L$)],

$\bigwedge L$[$L$ is a nodical area $\equiv \bigwedge M$($L$ belongs to $M$)],

$\bigwedge L$[$L$ is a constituent area $\equiv \bigvee M$($L$ is unidentical with $M \wedge L$ belongs to $M$)].



Now let * stand for: $L$ is unidentical with $M \rightarrow L$ belongs to $M$. We have:

$$\begin{tikzcd}[column sep=small]
 & \begin{array}{c}\text{(a) } \bigwedge L \bigwedge M^{*} \\ \text{Every area is all-containing} \\ \text{Every area is nodical}\end{array} \arrow[dl] \arrow[dr] & \\
\begin{array}{c}\text{(b) } \bigvee M \bigwedge L^{*} \\ \text{Some area is all-containing}\end{array} \arrow[d] & & \begin{array}{c}\text{(c) } \bigvee L \bigwedge M^{*} \\ \text{Some area is nodical}\end{array} \arrow[d] \\
\begin{array}{c}\text{(d) } \bigwedge L \bigvee M^{*} \\ \text{Every area is constituent}\end{array} \arrow[dr] & & \begin{array}{c}\text{(e) } \bigwedge M \bigvee L^{*} \\ \text{Every area is divisible}\end{array} \arrow[dl] \\
 & \begin{array}{c}\text{(f) } \bigvee L \bigvee M^{*} \\ \text{Some area is divisible} \\ \text{Some area is constituent}\end{array} &
\end{tikzcd}$$

### *6.2.*

We will now define in the set of real — and, for simplicity's sake, not undergoing displacement — objects three concepts of "PART", referring to the introduced belonging relation, namely "section" ("temporal part"), "fragment" ("spatial part") and "cutting" ("space-time part"):

$\bigwedge x \bigwedge y$\{$x$ is a section of $y \equiv \bigwedge T \bigwedge U \bigwedge L$[$x$ is within $TL \wedge y$ is within $UL$) $\rightarrow$ $T$ belongs to $U$]\},

$\bigwedge x \bigwedge y \bigwedge L$\{$x$ is on $L$ a section of $y \equiv \bigwedge T \bigwedge U$[($x$ is within $TL \wedge y$ is within $UL$) $\rightarrow$ $T$ belongs to $U$]\},

$\bigwedge x \bigwedge y$\{$x$ is a fragment of $y \equiv \bigwedge T \bigwedge L \bigwedge M$[($x$ is within $TL \wedge y$ is within $TM$) $\rightarrow$ $L$ belongs to $M$]\},

$\bigwedge x \bigwedge y \bigwedge T$\{$x$ is over $T$ a fragment of $y \equiv \bigwedge L \bigwedge M$[($x$ is within $TL \wedge y$ is within $TM$) $\rightarrow$ $L$ belongs to $M$]\},

$\bigwedge x \bigwedge y$\{$x$ is a cutting of $y \equiv \bigwedge T \bigwedge U \bigwedge L \bigwedge M$[($x$ is within $TL \wedge y$ is within $UM$) $\rightarrow$ ($T$ belongs to $U \wedge L$ belongs to $M$)]\}.

For parts of all kinds we may assume generally that:

$\bigwedge x$[$x$ is an all-containing object $\equiv \bigwedge y$($y$ is a part of $y$)],

$\bigwedge x$[$x$ is a divisible object $\equiv \bigvee y$($x$ is unidentical with $y \wedge y$ is a part of $x$)],

$\bigwedge x$[$x$ is a nodical object $\equiv \bigwedge y$($x$ is a part of $y$)],

$\bigwedge x$[$x$ is a constituent object $\equiv \bigvee y$($x$ is unidentical with $y \wedge x$ is a part of $y$)].

Let * be an abbreviation of the expression: $x$ is unidentical with $y \rightarrow x$ is a part of $y$. We now have the following theorems:

(a) $\bigwedge x \bigwedge y$ *
Every object is all-containing
Every object is nodical

(b) $\bigvee y \bigwedge x$ *
Something is an all-containing object

(c) $\bigvee x \bigwedge y$ *
Something is a nodical object

(d) $\bigwedge x \bigvee y$ *
Every object is constituent

(e) $\bigwedge y \bigvee x$ *
Every object is divisible

(f) $\bigvee x \bigvee y$ *
Something is a divisible object
Something is a constituent object

The principal controversy here is between the proponents and opponents of theorem (e). The latter allow the existence of objects that are indivisible temporally (i.e. ones lacking sections proper) or spatially (lacking fragments proper).

*6.3.*

Assume now that:

$\bigwedge x \bigwedge y${$x$ is *conjoint* with $y \equiv \bigvee z$[z is a (temporal or spatial) part of $x \wedge$ z is a (temporal and spatial) part of y]},

$\bigwedge x \bigwedge y$[x retains *temporal continuity* with $y \equiv \bigvee z$($z$ is a section of $x \wedge z$ is a section of $y$)],

$\bigwedge x \bigwedge y \bigwedge L$[$x$ retains temporal continuity with $y$ on $L \equiv \bigvee z$($z$ is a section of $x$ on $L \wedge z$ is a section of $y$ on $L$)],



$\bigwedge x \bigwedge y$[$x$ retains *spatial continuity* with $y \equiv \bigvee z$($z$ is a fragment of $x \wedge z$ is a fragment of $y$)],

$\bigwedge x \bigwedge y \bigwedge T$[$x$ retains spatial continuity with $y$ over $T \equiv \bigvee z$($z$ is a fragment of $x$ over $T \wedge z$ is a fragment of $y$ over $T$)],

$\bigwedge x \bigwedge y$[$x$ retains *space-time* continuity with $y \equiv \bigvee z$($z$ is a cutting of $x \wedge z$ is a cutting of $y$)],

$\bigwedge x \bigwedge y$($x$ is *separated* from $y \equiv \sim$ x is conjoint with y),

$\bigwedge$x{$x$ is *isolated* $\equiv \bigwedge y$[$x$ is unidentical with $y \wedge \sim y$ is a (temporal or spatial) part of $x$) $\rightarrow x$ is separated from $y$]},

$\bigwedge x$[$x$ is *subisolated* $\equiv \bigvee y$($x$ is separated from $y$)].

We have the following theorems:

(a) $\bigwedge x \bigwedge y$($x$ is conjoint with $y$)
Everything is conjoint with everything
(*vs.*: Something is separated from something)

(b) $\bigvee y \bigwedge x$($x$ is conjoint with $y$)
With something everything is conjoint
(*vs.*: Everything is separated from something)

(c) $\bigvee x \bigwedge y$($x$ is conjoint with $y$)
Something is conjoint with everything
(*vs.*: From everything something is separated)

(d) $\bigwedge x \bigvee y$($x$ is conjoint with $y$)
Everything is conjoint with something
(*vs.*: From something everything is separated)

(e) $\bigwedge y \bigvee x$($x$ is conjoint with $y$)
With everything something is conjoined
(*vs.*: Something is separated from everything)

(f) $\bigvee x \bigvee y$($x$ is conjoint with $y$)
Something is conjoint with something
(*vs.*: Everything is separated from everything)

Note that although:

$\bigwedge x \bigwedge y$($x$ is a part of $y$) $\to$ $x$ is conjoint with $y$)

we have at the same time:

$\bigvee x \bigvee y$($x$ is conjoint with $y \wedge \sim x$ is a part of $y$).

According to the traditional definition, an *individual* is to be *indivisum in se et divisum ab aliis*. In terms of the introduced concepts, we would say:

$\bigwedge x$[$x$ is an individual $\equiv$ $\langle \bigwedge y\{y$ is a part of $x \to \bigvee z$[($\sim z$ is a part of $y \wedge z$ is a part of $x$) $\wedge$ $y$ is conjoint with $z$]$\}$ $\wedge$ $x$ is isolated$\rangle$].

## 7. *Determination*

### *7.1.*

An important triadic relation referring to time is that of determination. Assume that:

$\bigwedge x \bigwedge y \bigwedge V$[$x$ in period $V$ determines $y \equiv \bigwedge t \bigwedge u\langle\{$[($t$ is the earliest in $V \wedge u$ is the latest in $V$) $\vee$ ($t$ is the latest in $V \wedge u$ is the earliest in $V$)] $\wedge$ $x$ is at $t\} \to y$ is at $u\rangle$]

and, more generally, that:

$\bigwedge x \bigwedge y$[$x$ determines $y \equiv \bigvee V$($x$ in period $V$ determines $y$)].

For a dyadic determination relation we may also put:

$\bigwedge x \bigwedge y\{x$ determines $y \equiv \bigwedge t$[$x$ is at $t \to \bigvee u$($t$ is unidentical with $u \wedge y$ is at $t$)]$\}$;

when moment $t$ is earlier than moment $u$ we have progressive (prospective) determination, and when $t$ is later than $u$ we have retrogressive (retrospective) determination. When: $V = 0$ we have co-determination (functional determination).

The formal characteristic of determination remains a controversial issue. That is why the following concept of (mutual) independence is sometimes resorted to:

$\bigwedge x \bigwedge y$[$x$ is mutually independent of $y \equiv$ ($\sim x$ determines $y \wedge \sim y$ determines $x$)].



Here are the theorems pertaining to the generalized determination relation:

(a) $\bigwedge x \bigwedge y$($x$ determines $y$)
Everything is determined by everything

(b) $\bigvee x \bigwedge y$ ($x$ determines $y$)
Something determines everything

(c) $\bigvee y \bigvee x$($x$ determines $y$)
Something is determined by everything

(d) $\bigwedge y \bigvee x$($x$ determines $y$)
Everything is determined by something

(e) $\bigwedge x \bigvee y$($x$ determines $y$)
Everything determines something

(f) $\bigvee x \bigvee y$($x$ determines $y$)
Something is determined by something

Theorem (a) is, apparently, a formulation of the old thesis *de nexu cosmico* (absolute *monism*) which may be loosely interpreted as saying that the universe is an internally connected whole (strong omni-connection). Theorems (d) and (e), either separately or in conjunction, constitute the weaker version of this thesis (weak omniconnection) which in turn gets a more detailed form in the *determinacy principle*, i.e. in integral determinism.

Let us refer to the set of all contemporaneous properties of $z$ (i.e. those properties which reside in $z$ simultaneously) as the "state of $z$." The determinacy principle may be formulated thus:

$\bigwedge x \bigwedge y \bigwedge z$[($x$ is a state of $z \wedge y$ is a state of $z$) $\to$ $x$ determines $y$].

This leads to:

$\bigwedge x \bigwedge y \bigwedge z$[($x$ is a state of $z \wedge y$ is a state of $z$) $\to \bigvee V$($x$ in period $V$ determines $y$)].

Accordingly, the determinacy principle is sometimes expressed as a theorem saying that the state of a given system at a given moment is a certain function of the state of this system at another moment and the interval between these moments.

The empirical sense of the determinacy principle gives rise to various doubts. Firstly, the *ascertainment* of the state of a given object in a certain period is basically possible only when this object is a so-called isolated object (with the relevant set of all contemporaneous properties of this object being a detached system). This condition is sometimes formulated explicitly as follows:

$\bigwedge x \bigwedge y \bigwedge z\{[(x \text{ is a state of } z \wedge y \text{ is a state of } z) \wedge z \text{ is an isolated object}] \rightarrow x \text{ determines } y\}$.

Secondly, it is claimed that only the universe satisfies this condition. The determinacy principle thus takes the form:

$\bigwedge x \bigwedge y[(x \text{ is a state of the universe} \wedge y \text{ is a state of the universe}) \rightarrow x \text{ determines } y]$.

It is hard to imagine someone other than Laplace's demon who would be capable of giving a complete description of any state of the universe and who would know what is determined by this state. The laws of physics (indeterminacy principle) simply rule out the possibility of describing precisely certain components of the states of certain objects (e.g. the location and momentum of particles).

As can be seen from the definition of "determining", *knowledge* about the determination relation presupposes knowledge about a constant succession (and hence also repeatability) of relevant objects. That is why the (ontological) thesis of absolute monism and the (ontological) thesis of determinism must be clearly distinguished from the (epistemological) thesis of *previdism* saying that:

$\bigwedge o \bigwedge x \bigwedge y \bigwedge t \bigwedge u \bigwedge V\{[o \text{ knows that } x \text{ is at } t \wedge o \text{ knows that } x \text{ in period } V \text{ determines } y \wedge o \text{ knows that } (t \text{ is antecedent to } u \text{ at } V \vee t \text{ is anterior to } u \text{ at } V)] \rightarrow o \text{ may justifiably surmise that } y \text{ is at } u\}$.

Absolute monism is sometimes contrasted with the thesis of absolute *atomism*, equated with the negation of theorem (a) or with the theorem:

$\bigvee x \bigvee y(x \text{ is mutually independent with respect to } y)$,

and also with the negation of theorem (d), (e) or even (f).

The analogous *indeterminism* thesis would be:

$\bigvee x \bigvee y \bigvee z[(x \text{ is a state of } z \wedge y \text{ is a state of } z) \wedge \sim x \text{ determines } y]$,

or, in the developed form:

$\bigvee x \bigvee y \bigvee z\langle(x \text{ is a state of } z \wedge y \text{ is a state of } z) \wedge \bigvee t \bigvee u \bigvee V\sim\{[(t \text{ is anterior to } u \text{ at } V \wedge t \text{ is posterior to } u \text{ at } V) \wedge x \text{ is at } t] \rightarrow \sim y \text{ is at } u\}\rangle$.

Objects undetermined by anything (and not determining anything?) are called "ontic atoms." We may thus regard such ontic atoms as absolutely independent, with:

$\bigwedge x[x \text{ is absolutely independent} \equiv \bigwedge y(x \text{ is mutually independent from } y)]$.



Analogously, for absolute monism in semiotic interpretation we would have:

$\bigwedge x \bigwedge y \bigwedge P \bigwedge Q$ (the fact that $Px$ is logically dependent on the fact that $Qx$).

The absolute atomism thesis is sometimes also interpreted semiotically:

$\bigwedge x \bigwedge y \bigwedge P \bigwedge Q$ (the fact that $Px$ is logically independent from the fact that $Qx$),

with:

$\bigwedge x \bigwedge y \bigwedge P \bigwedge Q$ {the fact that $Px$ is logically dependent on the fact that $Qx \equiv \sim[\bigvee z(Pz \wedge Qz) \wedge \bigvee z(Pz \wedge \sim Qz) \wedge \bigvee z(\sim Pz \wedge Qz) \wedge \bigvee z(\sim Pz \wedge \sim Qz)]$}

with the reservation that:

$\bigwedge p \bigwedge q$ {the fact that $p$ is logically independent from the fact that $q \equiv [\sim(p \rightarrow q) \wedge \sim(q \rightarrow p)]$}.

## 7.2.

A problem directly connected to determination is that of regularity (of all dependences between objects).

Assume that:

$\bigwedge x \bigwedge y \bigwedge V \bigwedge W[x \text{ in period } V \text{ determines } y \text{ over period } W \equiv (x \text{ in period } V \text{ determines } y \rightarrow V \text{ belongs to } W)]$

and, more generally:

$\bigwedge x \bigwedge y \bigwedge W[x \text{ determines } y \text{ over period } W \equiv \bigvee V(x \text{ in period } V \text{ determines } Y \text{ over period } W)]$.

Analogously:

$\bigwedge x \bigwedge y \bigwedge L\{x \text{ determines } y \text{ on area } L \equiv [x \text{ determines } y \rightarrow (x \text{ is within } L \wedge y \text{ is within } L)]\}$.

We can now formulate the *regularity principle*. It takes the form of temporal or spatial regularism. For *temporal regularism* we have:

$\bigwedge x \bigwedge y[\bigvee W(x \text{ determines } y \text{ over period } W) \rightarrow \bigwedge W(x \text{ determines } y \text{ over period } W)]$.

Temporal regularism may occur in weaker versions as preregularism:

$\bigwedge x \bigwedge y \bigwedge V \bigwedge W[(x \text{ determines } y \text{ over period } W \wedge V \text{ is anterior } \textit{sensu stricto} \text{ to } W) \rightarrow x \text{ determines } y \text{ over period } V]$,

or as postregularism:

$\bigwedge x \bigwedge y \bigwedge V \bigwedge W[(x \text{ determines } y \text{ over period } V \wedge W \text{ is posterior } \textit{sensu stricto} \text{ to } V) \rightarrow x \text{ determines } y \text{ over period } W]$.

For *spatial regularism* we have:

$$\bigwedge x \bigwedge y[\bigvee L(x \text{ determines } y \text{ on area } L) \rightarrow \bigwedge L(x \text{ determines } y \text{ on area } L)].$$

*Integral regularism* would assert that:

$$\bigwedge x \bigwedge y[\bigvee W \bigvee L(x \text{ determines } y \text{ over period } W \text{ on area } L) \rightarrow \bigwedge W \bigwedge L\,(x \text{ determines } y \text{ over period } W \text{ on area } L)],$$

or, putting it freely, that time and space are invariable with respect to dependences (determination relations in particular) between objects occupying them.

## 8. Change

### 8.1.

Change in its basic articulation – to which all other articulations are reducible – is a quadruple relation:

$$\bigwedge x \bigwedge P \bigwedge Q \bigwedge V[x \text{ in period } V \text{ changes from } P\text{-ed to } Q\text{-ed} \equiv \langle {\sim}\bigvee T(Px \text{ at } T \wedge Qz \text{ at } T) \wedge [\bigwedge t(t \text{ is earliest in } V \rightarrow Px \text{ at } t) \wedge \bigwedge u(u \text{ is latest in } V \rightarrow Qx \text{ at } u)] \wedge \bigwedge v\{[(t \text{ is unidentical with } v \wedge u \text{ is unidentical with } v) \wedge v \text{ belongs to } V] \rightarrow ({\sim} Px \text{ at } v \wedge {\sim} Qx \text{ at } v)\}\rangle],$$

(the suffix "-ed" in expressions like "$P$-ed" meaning "having property" – in this case property $P$).

Note straight away that this definition entails:

$$\bigwedge x \bigwedge P \bigwedge Q \bigwedge V(x \text{ in period } V \text{ changes from } P\text{-ed to } Q\text{-ed} \rightarrow \bigwedge v\{[({\sim} v \text{ is earliest in } V \wedge {\sim} v \text{ is latest in } V) \wedge v \text{ belongs to } V] \rightarrow ({\sim} Px \text{ at } v \wedge {\sim} Qx \text{ at } v)\}).$$

Let * stand for: $({\sim} v$ is earliest in $V \wedge {\sim} v$ is latest in $V) \wedge v$ belongs to $V$.

We now have:

$$\bigwedge v\{[*] \rightarrow ({\sim} Px \text{ at } v \wedge {\sim} Qx \text{ at } v)\} \equiv {\sim} v\{[*] \wedge (Px \text{ at } v \vee Qx \text{ at } v)\}.$$

Let us now substitute not-$P$ for $Q$ and accept that:

$$\bigwedge x \bigwedge P(\text{non-}Px \equiv {\sim} Px).$$

We now have:

$${\sim}\bigvee v[* \wedge (Px \text{ at } v \vee {\sim} Px \text{ at } v)].$$

Since:

$$Px \text{ at } v \vee {\sim} Px \text{ at } v$$



is a tautological pattern, the entire expression is untrue, and hence, in keeping with the assumed definition:

$$\bigwedge x \bigwedge P \bigwedge Q \bigwedge V{\sim}(x \text{ in period } V \text{ changes from } P\text{-ed to non-}P\text{-ed}).$$

As can be seen, a condition is imposed on $P$ and $Q$ that they are properties which *exclude* each other (being by no means contradictory), and another that the period between the earliest and the latest moment of the period when the change occurs is a transitory period in which the changing object has neither of these properties.

We now have *inter alia*:

$$\bigwedge P \bigwedge Q \bigwedge V\{P \text{ in period } V \text{ changes into } Q \equiv \bigvee x(x \text{ in period } V \text{ changes from } P\text{-ed to } Q\text{-ed})],$$

$$\bigwedge x \bigwedge Q \bigwedge V[x \text{ in period } V \text{ becomes } Q\text{-ed} \equiv \bigvee P(x \text{ in period } V \text{ changes from } P\text{-ed to } Q\text{-ed})],$$

$$\bigwedge x \bigwedge P \bigwedge V[x \text{ in period } V \text{ ceases to be } P\text{-ed} \equiv \bigvee Q(x \text{ in period } V \text{ changes from } P\text{-ed to } Q\text{-ed})],$$

$$\bigwedge P[P \text{ is a } \textit{primitive} \text{ property} \equiv (\bigwedge x \bigwedge V{\sim}\, x \text{ in period } V \text{ becomes } P\text{-ed} \wedge \bigwedge x \bigwedge V{\sim}\, x \text{ ceases to be } P\text{-ed})],$$

$$\bigwedge x \bigwedge y \bigwedge V\{x \text{ in period } V \text{ changes into } y \equiv \bigvee P \bigvee Q[x \text{ in period } V \text{ changes from being } P\text{-ed to being } Q\text{-ed} \wedge \bigwedge z(Qz \rightarrow z \text{ is identical with } y)]\},$$

$$\bigwedge x \bigwedge V[x \text{ in period } V \text{ changes} \equiv \bigvee y(x \text{ in period } V \text{ changes into } y)]$$

and:

$$\bigwedge x \bigwedge y[x \text{ changes into } y \equiv \bigvee V(x \text{ in period } V \text{ changes into } y)].$$

Note firstly that a given object cannot change into an object that is not identical with it (taking care not to confuse identicity with alikeness of all sections). Secondly, since a condition for one property changing into another is that this change occur on some *definite* object, we must necessarily have:

$$\bigwedge x \bigwedge V[x \text{ in period } V \text{ changes} \rightarrow \bigvee P(Px \text{ at } V)].$$

Thus, no change is *ex definitione* a complete change, i.e. one for which it would be true that:

$$\bigvee x \bigwedge y[x \text{ changes into } y \wedge \bigwedge P(Px \rightarrow {\sim}Py)].$$

We describe a change as "accidental" if the retained property is essential, that is to say one deciding that the changing object is this particular and no other object.

Assume now:

$$\bigwedge x[x \text{ is a } \textit{pre-origin} \equiv \bigwedge y(x \text{ changes into } y)],$$

$\bigwedge x[x \text{ is a } \textit{stuff} \equiv \bigvee y(x \text{ changes into } y)]$,
$\bigwedge y[y \text{ is an } \textit{omnifinal} \equiv \bigwedge x(x \text{ changes into } y)]$,
$\bigwedge y[y \text{ is a } \textit{transformation} \equiv \bigvee x(x \text{ changes into } y)]$.

Consider the following theorems:

(a) $\bigwedge x \bigwedge y(x \text{ changes into } y)$

(b) $\bigvee x \bigwedge y(x \text{ changes into } y)$
Something is a pre-origin

(c) $\bigwedge y \bigvee x(x \text{ changes into } y)$
Something is an omnifinal

(d) $\bigwedge y \bigvee x(x \text{ changes into } y)$
Everything is a transformation
Everything arose out of something
(*vs.*: Some objects arose out of nothing)

(e) $\bigwedge x \bigvee y(x \text{ changes into } y)$
Everything is a stuff
Everything turns into something
(*vs.*: Some objects do not turn into anything)

(f) $\bigvee x \bigvee y(x \text{ changes into } y)$

The principal opposing views concerning universality of changes are *variabilism* and *statism.* Proponents of the former view accept theorem (e), while advocates of the latter support the negation of theorem (f) or at least its consequence in the form of negations of (d) or (e). Note that both variabilists and statists sometimes employ the concept of "variable object" such that:

$\bigwedge x[x \text{ is a } \textit{variable} \text{ object} \equiv (x \text{ is a stuff} \vee x \text{ is a transformation})]$.

In this approach variabilism is an alternative of theorems (d) or (e), while (liberal) statism — a conjunction of negations of these theorems.

The variability of an object may also be described thus:

$\bigwedge x\{x \text{ is a } \textit{variable} \text{ object} \equiv \bigvee P \bigvee Q \bigvee T \bigvee U[T \text{ is unidentical with } U \wedge (Px \text{ at } T \wedge Qx \text{ at } U) \wedge \bigwedge y \bigwedge V(Py \text{ at } V \rightarrow \sim Qy \text{ at } V)]\}$.

This variability would, strictly speaking, consist in the fact that at least some (temporal) section differs in some respect from some other section. We thus have:

$\bigwedge x\{x \text{ is a variable object} \equiv \bigvee y \bigvee z[(y \text{ is a section of } x \wedge z \text{ is a section of } x) \wedge \sim y \text{ is alike } \textit{sensu stricto} \text{ to } z]\}$.



Thus, when speaking of variability of the universe understood as an object occupying the (entire) space-time, we do not want to say that it changes into something in a period outside the initial space-time, in some *extra-time*.

Natural connection (regularities) are listed among invariable objects. They are invariable in particular when constant values occurring in laws describing such connections are invariable.

Proceeding now to periods and areas, assume that:

$\bigwedge T[T \text{ changes} \equiv \bigvee x(x \text{ in period } T \text{ changes})]$

and:

$\bigwedge L[L \text{ changes} \equiv \bigvee x(x \text{ is in } L \wedge x \text{ changes})]$,

it being impossible to use these concepts to speak of one period or one area changing into another.

*8.2.*

Assume that:

$\bigwedge x \bigwedge t \bigwedge L\{x \textit{ arises} \text{ in moment } t \text{ on area } L \equiv [x \text{ is within } tL \wedge \bigwedge u \bigwedge M(u \text{ is anterior to } t \rightarrow \sim x \text{ is within } uM)]\}$,

$\bigwedge x \bigwedge u \bigwedge L\langle x \textit{ disappears} \text{ in moment } u \text{ on area } L \equiv \bigvee U\{u \text{ is latest in } U \wedge \bigwedge M \sim(x \text{ is within } uM) \wedge \bigwedge t[(t \text{ belongs to } U \wedge t \text{ is unidentical with } u) \rightarrow x \text{ is within } tL]\}\rangle$,

$\bigwedge x \bigwedge t[x \text{ arises in moment } t \equiv \bigvee L(x \text{ arises in moment } t \text{ on area } L)]$,

$\bigwedge x \bigwedge u[x \text{ disappears in moment } u \equiv \bigvee L(x \text{ disappears in moment } t \text{ on area } l)]$.

We have the following theorems:

(a) $\bigwedge x \bigwedge t(x \text{ arises/disappears in } t)$
Everything always arises/disappears

(b) $\bigvee x \bigwedge t(x \text{ arises/disappears in } t)$
Something always arises/disappears

(c) $\bigvee t \bigwedge x(x \text{ arises/disappears in } t)$
At some time everything arises/disappears

(d) $\bigwedge t \bigvee x(x \text{ arises/disappears in } t)$
Always something arises/disappears

(e) $\bigwedge x \bigvee t(x \text{ arises/disappears}$
Everything at some time arises/disappears

(f) $\bigvee x \bigvee t(x \text{ arises/disappears in } t)$
Something arises/disappears at some time

Note that the concepts of "arising" and "disappearing" let us considerably elaborate certain theorems concerning temporal objects, lending them greater precision. For example, we may now put:

$\bigwedge x\{x$ is fragile $\equiv [\bigvee t(x$ arises in $t) \vee \bigvee t(x$ disappears in $t)]\}$.

Using these concepts we may now also distinguish between change and conversion:

$\bigwedge x \bigwedge y \bigwedge V\{x$ in period $V$ *converts* into $y \equiv \bigvee L[\bigwedge t(t$ is earliest in $V \rightarrow x$ disappears in $t$ on $L) \wedge \bigwedge u(u$ is latest in $V \rightarrow y$ arises in $u$ on $L)]\}$.

As can be seen, unlike in the case of change, in conversion the (unidentical) objects concerned do not retain their space-time) continuity.

*8.3.*

We will distinguish gradable properties such that:

$\bigwedge P[P$ is a *gradable* property $\equiv \bigvee x \bigvee y(x$ is more $P$-ed than $y)]$.

Let $P^s$ stand for the expression: $P$ in degree $s$.
Assume that:

$\bigwedge x \bigwedge y \bigwedge P\{x$ is more $P$-ed than $y \equiv \bigvee s_1 \bigvee s_2[(P^{s_1}x \wedge P^{s_2}y) \wedge s_1$ is higher than $s_2]\}$.

Analogously:

$\bigwedge x \bigwedge y \bigwedge P(x$ is less $P$-ed than $y \equiv y$ is more $P$-ed than $x)$.

Assume now that:

$\bigwedge x \bigwedge P \bigwedge V[x$ in period $V$ changes *quantitatively* with respect to $P \equiv \bigvee s_1 \bigvee s_2(s_1$ is unidentical with $s_2 \wedge x$ in period $V$ changes from being $P^{s_1}$-ed to being $P^{s_2}$-ed)]

and

$\bigwedge x[x$ changes quantitatively $\equiv \bigvee P \bigvee V(x$ in period $V$ changes quantitatively with respect to $P)]$.

Depending on whether $s_1$ is smaller than $s_2$ or *vice versa*, the gradable change is either aa weakening or strengthening of the changing proprty.
Assume that:

$\bigwedge P \bigwedge s\{s$ is the upper terminal degree of property $P \equiv \bigwedge x \bigwedge y[(P^s x \wedge x$ is unidentical with $y) \rightarrow \sim y$ is more $P$-ed than $x]\}$,

$\bigwedge P \bigwedge s\{s$ is the lower terminal degree of property $P \equiv \bigwedge x \bigwedge y[(P^s x \wedge x$ is unidentical with $y) \rightarrow \sim y$ is less $P$-ed than $x]\}$



and:

$\bigwedge P \bigwedge s[s$ is a terminal degree of $P \equiv (s$ is the upper terminal degree of property $P \vee s$ is the lower terminal degree of property $P)]$.

There is a long-standing controversy about whether:

$\bigwedge x \bigwedge P \bigwedge Q \bigwedge V\langle x$ in period $V$ changes from being $P$-ed to being $Q$-ed $\rightarrow \bigvee U\{(U$ is anterior *sensu stricto* to $V \wedge x$ in period $U$ changes quantitatively with respect to $P) \wedge \bigwedge s \bigwedge v[(s$ is a terminal degree of property $P \wedge v$ is earliest in $V) \rightarrow P^s x$ at $v]\}\rangle$.

Ler us refer to nonquantitative changes as "qualitative changes". The above controversy is thus about whether every change of a given object — also a qualitative one — is preceded by some quantitative change of this object. To answer this question in the affirmative, one would have to assume that all variable properties are gradable. If they were not such, the property into which some gradable property would change could not itself undergo change.

*8.4.*

We will use the term "development" to refer to a sequence of events (dyadic at least) such that, limiting ourselves for simplicity to a dyadic sequence, we have:

$\bigwedge x \bigwedge P \bigwedge R \bigwedge V\langle x$ in period $V$ *develops* from $P$-ed to $R$-ed $\equiv \bigvee Q \bigvee T \bigvee U$ $[(T$ belongs to $V \wedge U$ belongs to $V) \wedge T$ is anterior *sensu stricto* to $U] \wedge (x$ in period $T$ changes from $P$-ed to $Q$-ed $\wedge$ $x$ in period $U$ changes from $P$-ed to $Q$-ed$)]\rangle$.

Let us distinguish between two kinds of change, namely progress:

$\bigwedge x \bigwedge P \bigwedge V[x$ in period $V$ *progresses* with respect to $P \equiv \bigvee y(x$ in period $V$ changes into $y \wedge y$ is more $P$-ed than $x)]$,

and regress:

$\bigwedge x \bigwedge P \bigwedge V[x$ in period $V$ *regresses* with respect to $P \equiv \bigvee y(x$ in period $V$ changes into $y \wedge y$ is less $P$-ed than $x)]$.

Observe that the same change may be in some respect considered as progress, and in another — opposite to it — as regress. For example, the fact that something becomes more complex (thereby progressing with respect to complexity) is identical with the fact that it becomes less simple (thereby regressing with respect to simplicity). Also development, i.e. a certain sequence of changes, may be progessive or regressive. Certain development courses are neither progressive nor regressive but oscillatory:

$\bigwedge x \bigwedge V$($x$ in period $V$ undergoes *oscillatory* development $\equiv \bigvee P \bigvee T \bigvee U$ {[($T$ belongs to $V \wedge U$ belongs to $V$) $\wedge$ $Y$ is anterior *sensu stricto* to $U$] $\wedge$ ($x$ in period $T$ progresses with respect to $P \wedge x$ in period $U$ regresses with respect to $P$)}).

Note that a given object may in the same period undergo various changes (or go through development sequences); progressive in some respect, regressive in another, and oscillatory in still another.

Assume now that:

$\bigwedge x \bigwedge R \bigwedge V$[$x$ in period $V$ *tends* towards $R$-ness $\equiv \bigvee P$($x$ in period $V$ develops from $P$-ed to $R$-ed)]

and

$\bigwedge x \bigwedge R$[$x$ tends towards $R$-ness $\equiv \bigvee V$($x$ in period $V$ tends to $R$-ness)]

without going into whether this development is progressive, regressive or oscillatory. We have:

$\bigwedge P$[$P$ is a *super-final* $\equiv \bigwedge x$($x$ tends to $P$-ness)],

$\bigwedge P$[$P$ is a *final* $\equiv \bigvee x$($x$ tends to $P$-ness)],

$\bigwedge x$[$x$ is *omnidirected* $\equiv \bigwedge P$($x$ tends to $P$-ness)],

$\bigwedge x$[$x$ is *directed* $\equiv \bigvee P$($x$ tends to $P$-ness)].

Note that the final must be clearly distinguished from the *aim-purpose* for which we have:

$\bigwedge x \bigwedge P$[$P$ is an aim-purpose of action $x \equiv \bigvee o$($o$ decided that $x$ is to tend to $P$-ness)].

As we see, only actions of beings capable of experiencing decisions can have aims-purposes.

Assume also for simplicity's sake:

$\bigwedge x \bigwedge y${$x$ tends to $y \equiv \bigvee R$[$x$ tends to $R$-ness $\wedge \bigwedge z$($Rz \rightarrow z$ is identical with $y$)]}.

Let us also add that:

$\bigwedge x \bigwedge y$($x$ tends to $y \rightarrow x$ determines $y$).



Now consider the theorems:

(a) $\bigwedge x \bigwedge y$($x$ tends to $y$)
Everything is a super-final
Everything is omnidirected

(b) $\bigvee x \bigwedge y$($x$ tends to $y$)
Something is omnidirected

(c) $\bigvee y \bigwedge x$($x$ tends to $y$)
Something is a super-final

(d) $\bigwedge y \bigvee x$($x$ tends to $y$)
Everything is a final (of something)

(e) $\bigwedge x \bigvee y$($x$ tends to $y$)
Everything is directed (towards something)

(f) $\bigvee x \bigvee y$($x$ tends to $y$)
Something is a final (of something)
Something is directed (towards something)

Arguments focus mainly around theorem (e), that is to say around the *final cause principle*, also referred to as the *finalism* (teleologism) thesis. Its validity is discussed with reference to biological organisms at least.

## 8.5.

A special kind of change is change of location, i.e. displacement:

$\bigwedge x \bigwedge V \bigwedge L \bigwedge M$ | $x$ in period $V$ undergoes *displacement* from $L$ to $M \equiv$ [$\sim \bigvee T$($x$ is within $TL \wedge x$ is within $TM$) $\wedge \bigwedge t$($t$ is earliest in $V \rightarrow x$ is within $tL$) $\wedge \bigwedge t \bigwedge u$[($t$ is earliest in $V \wedge u$ is latest in $V$) $\rightarrow$ (($x$ is within $tL \wedge x$ is within $uM$) $\wedge \bigwedge v${[($t$ is unidentical with $v \wedge u$ is unidentical with $v$) $\wedge$ $v$ belongs to $U$] $\rightarrow$ ($\sim x$ is within $vL \wedge \sim x$ is within $vM$)})]] | .

We now have:

$\bigwedge x \bigwedge V$[$x$ in period $V$ undergoes displacement $\equiv \bigvee L \bigvee M$($x$ in period $V$ displaces from $L$ to $M$)]

and analogously:

$\bigwedge x \bigwedge V$($x$ in period $V$ *is at rest* $\equiv \sim x$ in period $V$ undergoes displacement), or, putting it differently:

$\bigwedge x \bigwedge V[x$ in period $V$ is at rest $\equiv \bigvee L \bigwedge v(v$ belongs to $V \rightarrow x$ is within $vL)]$

or simply:

$\bigwedge x \bigwedge V[x$ in period $V$ is at rest $\equiv \bigvee L(x$ is within $VL)]$.

Let us state plainly, however paradoxical it might sound, that in keeping with these definitions we have:

$\bigwedge x \bigwedge y\{x$ in period $V$ undergoes displacement $\rightarrow \bigvee T[(T$ is unidentical with $V \wedge T$ belongs to $V) \wedge x$ in period $T$ is at rest$]\}$.

Moreover if:

$\bigwedge x \bigwedge V[x$ in period $V$ undergoes displacement $\rightarrow \bigwedge v \bigvee L(v$ belongs to $V \rightarrow x$ is within $vL)]$

then:

$\bigwedge x \bigwedge V[\bigwedge v \bigvee L(x$ belongs to $V \rightarrow x$ is within $vL) \rightarrow \bigvee M(x$ is within $VM)]$

is not true, and it is likewise not so that:

$\bigwedge x \bigwedge V(x$ in period $V$ undergoes displacement $\rightarrow x$ in period $V$ is at rest$)$.

The concept of "instantaneous displacements" is sometimes mentioned, such that:

$\bigwedge x \bigwedge v \bigwedge L \bigwedge M\{x$ in period $v$ undergoes displacement *instantaneously* from $L$ to $M \equiv [L$ is unidentical with $M \wedge (x$ is within $vL \wedge x$ is within $vM)]\}$.

Such displacement would be indistinguishable from simultaneous occupation by a given object of two unidentical areas, and this is impossible *ex definitione*.

We must separately define the concept of "rotational displacement", which does not have to be accompanied by displacement *sensu stricto*:

$\bigwedge x \bigwedge V\{x$ in period $V$ *rotates* $\equiv [x$ in period $V$ is at rest $\wedge \bigvee y(y$ is a fragment of $x \wedge y$ in period $V$ undergoes displacement$)]\}$.

One can also consider circular displacement which does not satisfy the first condition for displacement which does not satisfy the first condition for displacement given above, namely:

$\sim\bigvee T(x$ is within $Tl \wedge x$ is within $TM)$.

The concept of "relative displacement" hinging on the concept of "distance" is also used sometimes:

$\bigwedge x \bigwedge y \bigwedge V[x$ in period $V$ undergoes displacement relative to $y \equiv$ the distance between $x$ and $y$ in period $V$ changes$)]$.



Relative displacement thus defined is an irreflexive, symmetric and nontransitive relation. For this reason one of the elements of this relation may be considered at rest only with respect to a third object. Thus, a given object may at once be undergoing displacement (with respect to a certain object) and be at rest (with respect to another).

Let "movement" means a sequence of displacementss (at least dyadic) such that:

$\bigwedge x \bigwedge V \bigwedge L \bigwedge N\langle x$ in period $V$ *moves* $\equiv \bigvee T \bigvee U \bigvee M\{[(T$ belongs to $V \wedge U$ belongs to $V) \wedge T$ is anterior *sensu stricto* to $U] \wedge (x$ in period $T$ undergoes displacement from $M$ to $N)]\}\rangle$.

Of course, the assumption that (one) displacement does not constitute movement is untenable if one accepts that time and space are nondiscrete. A peculier kind of movement is vibratory movement (cf. also oscillatory development):

$\bigwedge x \bigwedge V[x$ in period $V$ undergoes vibratory movement $\equiv \bigvee L \bigvee N(x$ in period $V$ moves from $L$ to $N \wedge L$ is identical with $N)]$.

Bear in mind that we are not speaking of displacement here but of vibratory *movement*, i.e. a certain *sequence* of displacements.

## 9. *Action*

### *9.1.*

Assume that:

$\bigwedge x \bigwedge y \bigwedge z \bigwedge V\langle z$ in period $V$ passes from $x$ to $y \equiv \bigvee t \bigvee u \bigvee L \bigvee M \bigvee N \bigvee O\{(t$ is earliest in $V \wedge x$ is in $tL) \wedge (u$ is latest in $V \wedge y$ is in $uM) \wedge [(N$ belongs to $L \wedge O$ belongs to $M) \wedge z$ in period $V$ undergoes displacement from $N$ to $O]\}\rangle$.

We then have:

$\bigwedge x \bigwedge y \bigwedge z \bigwedge V(z$ in period $V$ *acts* through $z$ on $y \equiv z$ in period $V$ passes from $z$ to $y)$

and finally:

$\bigwedge x \bigwedge y \bigwedge V[x$ in period $V$ acts on $y \equiv \bigvee z(x$ in period $V$ acts through $z$ on $y)]$

and:

$\bigwedge x \bigwedge y[x$ acts on $y \equiv \bigvee V(x$ in period $V$ acts on $y)]$.

In view of these definitions, action is a relation that is nonreflective (meaning that a given object can act on itself), nonsymmetric (mutual action is possible) and nontrasitive.

Assume now that:

$\bigwedge x[x$ is an *omniactive* object $\equiv \bigwedge y(x$ acts on $y)]$,

$\bigwedge x[x$ is an *active* object $\equiv \bigvee y(x$ acts on $y)]$,

$\bigwedge y[y$ is an *omnisusceptible* object $\equiv \bigwedge x(x$ acts on $y)]$,

$\bigwedge y[y$ is an *susceptible* object $\equiv \bigvee x(x$ acts on $y)]$.

Let us also add that:

$\bigwedge x\{x$ is a *refractory* object $\equiv [x$ changes $\rightarrow \bigvee y(x$ is unidentical with $y \wedge y$ acts on $x)]\}$.

Consider the following theorems:

(a) $\bigwedge x \bigwedge y(x$ acts on $y)$

(b) $\bigvee x \bigwedge y(x$ acts on $y)$
(*vs.*: Everything does not act on something)

(c) $\bigvee y \bigwedge x(x$ acts on $y)$
(*vs.*: On everything something does not act)

(d) $\bigwedge y \bigvee x(x$ acts on $y)$
On everything something acts
Every object is susceptible
(*vs.*: There are unsusceptible (objects)

(e) $\bigwedge x \bigvee y(x$ acts on $y)$
Everything acts on something
Every object is active
(*vs.*: There are passive objects)

(f) $\bigvee x \bigvee y(x$ acts on $y)$

If a certain finite velocity is unexceedable, then neither (a), (b) or (c) may be accepted since they would preclude the existence of sufficiently brief and sufficiently distant (in particular infinitely distant) objects.

*9.2.*

Using the concepts of "change" and "action" we may thus define "causality":

$\bigwedge x \bigwedge y \bigwedge V[x$ in period $V$ is a *cause* of $y \equiv \bigvee z(x$ in period $V$ acts on $z \wedge z$ in period $V$ changes into $y)]$,



$\bigwedge x \bigwedge y[x$ is a cause of $y \equiv \bigvee V(x$ in period $V$ is a cause of $y)]$,

$\bigwedge x \bigwedge y(y$ is an *effect* of $x \equiv x$ is a cause of $y)$.

It is sometimes said simply that an action itself is a cause of something. We then have:

$\bigwedge x \bigwedge y($the action of $x$ is a cause* of $y \equiv x$ is a cause of $y)$.

A debated issue is the extent of the field of the cause-effect relation. Observe that in keeping with the adopted definitions of "change" we can also put here:

$\bigwedge x \bigwedge y \bigwedge Q[x$ is a cause of that $Qy \equiv \bigvee P \bigvee V(x$ in period $V$ acts on $y \rightarrow y$ in period $V$ changes from $P$-ed to $Q$-ed$)]$.

It is worth noting that talking about the cause of the arising of an object is absurd.

Also debatable is the formal characteristic of the cause-effect bond. Here we assume it is an irreflexive (*nihil est causa sui*), asymmetric and intransitive relation. The intransitivity of this relation does not prevent us, however, from using the concept of "indirect cause" understood as follows:

$\bigwedge x \bigwedge y[x$ is an indirect cause of $y \equiv \bigvee z(x$ is a cause of $z \wedge z$ is a cause of $y)]$.

One must not forget, though, that an indirect cause of something is not the cause *sensu stricto* of that something.

The adopted definitions also fail to conclusively settle the question of whether the cause-effect bond is or is not one-one relation. In any case we have:

$\bigwedge x \bigwedge y(x$ is a cause of $y \rightarrow x$ determines $y)$.

A source of frequent confusion is the failure to distinguish between cause on the one hand and symptom and essence on the other. Both "symptom" and "essence" are epistemological notions, with:

$\bigwedge o \bigwedge x \bigwedge y[x$ is for person $o$ a *symptom* of $y \rightarrow (x$ is perceivable by $o \wedge \sim y$ is perceivable by $o)]$

and:

$\bigwedge o \bigwedge x \bigwedge y[x$ is for person $o$ the *essence* of $y \rightarrow (\sim x$ is perceivable by $o \wedge y$ is perceivable by $o)]$.

Assume now that:

$\bigwedge x[x$ is an *omnieffectgenic* object $\equiv \bigwedge y(x$ is unidentical with $y \rightarrow x$ is a cause of $y)]$.

$\bigwedge x[x$ is an *effectgenic* object $\equiv \bigvee y(x$ is a cause of $y)]$,

$\bigwedge y[y$ is an *omniderivative* object $\equiv \bigwedge x(x$ is unidentical with $y \rightarrow x$ is a cause of $y)]$

and:

$\bigwedge y[y$ is a *derivative* object $\equiv \bigvee x(x$ is a cause of $y)]$.

Let $^\circ$ be an abbreviation of the expression: $x$ is a cause of $y$, and let $*$ stand for: $x$ is unidentical with $y \rightarrow {}^\circ$.

Consider the following theorem:

(a) $\bigwedge x \bigwedge y *$

Everything is a cause of everything
Everything is an effect of everything
(*vs.*: Something is not a cause of something
Something is not an effect of something)

(b) $\bigvee x \bigwedge y *$

Something is a cause of everything
Something is omnieffective
(*vs.*: Everything is not a cause of something)

(c) $\bigvee y \bigwedge x *$

Something is an effect of everything
Something is omniderivative
(*vs.*: Everything is not an effect of something)

(d) $\bigwedge y \bigvee x *$

Everything has a cause
Everything is derivative
(*vs.*: Something has no cause)

(e) $\bigwedge x \bigvee y *$

Everything has an effect
Everything is effectgenic
(*vs.*: Something has no effect)

(f) $\bigvee x \bigvee y *$

Something has some cause
Something has some effect
(*vs.*: Nothing has any cause
Nothing has any effect)

Theorem (b) — *monocausalism* — is sometimes interpreted theistically, with God being omnieffective (omnipotent) and acting as the direct cause of everything. This interpretation requires an existentialist conception of God according to which He is divisible and changeable, among other things, and hence also temporal. Theorem (d) is here an explication of the *causalism* thesis (*nihil sine causa*) while theorem (e) — of the *effectualism* thesis. As we see, both the theses are logically independent. Note that contrary to occasional opinions, the effectualism thesis does not imply the theorem that nothing cannot become nothing if



by "become nothing" we mean "to disappear" (cf. above), for before disappearing an object may become a cause of something.

The negation of (f) is sometimes expressed colloquially as the view that everything is accidental, this view being described as "*accidentalism*" or "tychism". The word "accident" is of course used here in a meaning such that:

$\bigwedge x[x$ is an accident $\equiv \sim\bigvee y(y$ is a cause of $x)]$.

Let "cause-effect sequence" mean a sequence of such objects that:

$\bigwedge x \bigwedge y \bigwedge C\{[x$ belongs to a cause-effect sequence $C \wedge (y$ is a direct or indirect cause of $x \vee y$ is a direct or indirect effect of $x)] \rightarrow y$ belongs to $C\}$.

We have:

$\bigwedge x \bigwedge C(x$ is an accident with respect to a cause-effect sequence $C \equiv \sim x$ belongs to $C)$.

This does not of course preclude the possibility that something which is a relative accident is nevertheless derivative (with respect to some other sequence).

Note further that an analysis of theological texts justifies the assumption that:

$\bigwedge x[x$ is a miracle $\equiv \sim\bigvee y(y$ is a cause of $x \wedge y$ belongs to the universe$)]$,

or, in the theistic interpretation:

$\bigwedge x(x$ is a miracle $\equiv$ God is the direct cause of $x)$.

Coupled with theistic monocausalism, this would give the view that everything is a miracle.

*9.3.*

Causalism and monocuasalism must be distinguished from *unicausalism* asserting that:

$\bigwedge y \bigvee x[x$ is a cause of $y \wedge \bigwedge z(z$ is a cause of $y \rightarrow z$ is identical with $x)]$,

while effectualism must not be confused with *unieffectualism*:

$\bigwedge x \bigvee y[x$ is a cause of $y \wedge z(x$ is a cause of $z \rightarrow z$ is identical with $y)]$.

The question of whether the cause-effect bond is or is not a one-one relation is still open. In any event causalism cannot also be confused with *fatalism*. Let us distinguish among causes those that are internal, such that:

$\bigwedge x \bigwedge y\{x$ is an *internal* cause of $y \equiv [x$ is a cause of $y \wedge \bigvee z(x$ is a fragment of $y \wedge y$ is a fragment of $y)]\}$.

According to fatalism:

$\bigwedge x \bigwedge y \sim (x$ is an internal cause of $y)$,

and hence all causes are internal causes. A particular case of fatalism is ethical fatalism according to which all causes of human behaviour are located outside the acting person who does only what he or she is compelled to do (thus at all times acting under the influence of external factors). Fatalism is neither identical with nor a consequence of causalism.

It is important that causalism be not confused with causal *infinitism* claiming that:

$\bigwedge x \bigwedge T(x$ is at $T \wedge \bigvee y\{y$ is at $T \wedge [(y$ is a direct cause of $x \vee y$ is an indirect cause of $x) \vee (y$ is a direct effect of $x \vee y$ is an indirect effect of $x)]\})$,

meaning that cause-effect sequences are everlasting (i.e. at once eternal and perpetual). Causal infinitism implies determinism, and for this reason it is described by some as simply "determinism."

Causalism and effectualism must lastly be distinguished from the principle of regularity for the cause-effect bond (cf. discussion of determination above) and the schemes of causal law and causal theorem.

Assume that:

$\bigwedge x \bigwedge y \bigwedge V \bigwedge W[x$ in period $V$ is a cause of $y$ over period $W \equiv (x$ in period $V$ is a cause of $y \rightarrow V$ belongs to $W)]$

and that:

$\bigwedge x \bigwedge L\{x$ is a cause of $y$ in area $L \equiv [x$ is a cause of $y \rightarrow (x$ is on $L \wedge y$ is on $L)]\}$.

The thesis of integral (temporal-spatial) *regularism* with respect to the cause-effect bond would be as follows:

$\bigwedge x \bigwedge y[\bigvee W \bigvee L(x$ is a cause of $y$ over period $W$ on ares $L) \rightarrow \bigwedge W \bigwedge L(x$ is a cause of $y$ over period $W$ on area $L)]$;

in ordinary language this means that similar causes have similar effects always and everywhere.

Let $P$, $Q$, $a$, $b$ stand for certain chosen constants (predicative and individual respectively). The causal law may now be written as:

$\bigwedge x \bigwedge y[(Px \wedge Qy) \rightarrow x$ is a cause of $y]$,

and the causal theorem connected with it as:



$a$ is a cause of $b$

if the condition that there is simultaneously: $Pa \wedge Qb$ is satisfied.

*9.4.*

*Physical objects* are sometimes identified with objects at once effectgenic and derivative. At first glance this has a seemingly paradoxical consequence that the universe as a noneffectgenic and nonderivative object is not a physical object. This impression of the paradoxical stems from the fact that the universe is commonly confused with some (temporal) section or even (spacial-temporal) cutting thereof. To avoid this *quasi*-paradox we may assume that:

$\bigwedge x[\bigvee y(y$ is a cutting of $x \wedge y$ is a physical object$) \rightarrow x$ is a physical object$]$.

The following relations occur:

$$\bigwedge x$$
$$\{(x \text{ is effectgenic} \wedge x \text{ is derivative})$$
$$\downarrow$$
$$x \text{ is tight}$$
$$\downarrow$$
$$x \text{ is refractory}$$
$$\downarrow$$
$$x \text{ is spatial-temporal}$$
$$[\textit{scil. } x \text{ exists}]\}.$$

Physical fields are, admittedly, regarded by some as nontight but nonetheless effectgenic. Despite this I do not think that nontightness of fields (networks!) is indisputable. Moreover, the above relations might perhaps be strengthened to equivalence form, for although we may *conceive* in our minds objects that would be spatial-temporal but not nonrefractory, or refractory but nontight, tight but nonactive, active but noneffectgenic, the question is whether in fact there are such objects.

However, the indicated conditional dependences suffice to classify as redundant the following definitions of "physical object":

(a) spatial-temporal object, refractory (inert), tight (impermeable) and at the same time active and open (i.e. variable, and in particular undergoing displacement), and also both effectgenic and derivative, or:

(b) spatially-temporally localized causal (i.e. effectogenic or derivative) object, or:

(c) spatially-temporal, inert object undergoing displacement.

Similarly, if physical objects (bodies) are said to be (spatially-temporally) extensive, inert and impermeable, then the *definiens* of the term "matter" as the smallest set of bodies, closed to mutual actions, may be reduced to a set of objects closed to these actions.

On the other hand, a characteristic of the physical object limited, for example, to location and displacement (with specific velocity) seems inadequate. Suppose that a certain body undergoing displacement has inside it a hole filled (to put it colloquially) with vacuum. It is a matter for thought whether this fragment of space-time, enclosed in a way, is also localized and undergoing displacement.

### *10. Final remarks*

Diverse logical dependences occur between definitions and theses of classical ontological problems. Some of these dependences have been indicated explicitly. A reconstruction of the complete network of these dependences would require a complete list of theses that can be formulated with each of the introduced predicates. In some cases the lists that have actually been given are only schematic outlines.

I am not pleased with many of the solutions I propose here, and I have serious doubts about many others. I hope, however, that my work will inspire others to continue my efforts, being firmly convinced that my results are basically sound. For those who embark on this road, my work will at least provide an effective remedy against the constantly recurring philosophical scourge of purely verbal controversies.

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## REFERENCES

The list features only those works which significantly affected the views presented here. The list is not complete. Among other things, it does not include non-Polish language publications from which I benefitted no less than from Polish works.

### 1. PRELIMINARIES

Ajdukiewicz, K. (1949). *Zagadnienia i kierunki filozofii* (Problems and trends of philosophy). Warszawa: Czytelnik.

Czeżowski, T. (1948). *O metafizyce, jej kierunkach i zagadnieniach* (On metaphysics, its trends, and its problems). Toruń: Księgarnia Naukowa T. Szczęsnego i S-ki.

Łukasiewicz, J. (1961). Logistyka a filozofia (1936). In: J. Łukasiewicz *Z zagadnień logiki i filozofii*, pp. 195-210. Warszawa: PWN.

Łukasiewicz, J. (1937). W obronie logistyki. In: *ibid.*, pp. 210-219.

Perzanowski, J. (1989). Logika a folozofia. Uwagi o zasięgu analizy logicznej w naukach filozoficznych (Logics and Philosophy. Remarks on the range of logical analysis in philosophical sciences). In: J. Perzanowski (Ed.), *Jak filozofować* (How to philosophize), pp. 229-261. Warszawa: PWN.

Zawirski, Z. (1945). Dotychczasowe próby aksjomatyzacji systemów metafizycznych (The hitherto attempts at axiomatization of metaphysical systems). *Sprawozdania PAU* XLVI, 6, pp. 107-110.

### 2. RESIDING

Augustynek, Z. (1990). Trzy realizmy (Three realisms). *Studia Epistemologiczne*, pp. 43-65.

Bigaj, T. (1989). Logiczne konsekwencje istnienia (The logical consequences of existence). (Unpublished manuscript). Warszawa.

Borowski, M. (1920). Co to jest przedmiot (What is an object). *Przegląd Filozoficzny* XXIII, pp. 55-86.

Borowski, M. (1922). O przedmiotach względnych i bezwzględnych (On relative and absolute objects). *Przegląd Filozoficzny* XXV, 3, pp. 316-352.

Czeżowski, T. (1958). Uwagi historyczne o tzw. najwyższych prawach myślenia (Historical remarks on so-called the most significant laws of thinking). In: Czeżowski *Odczyty filozoficzne*, pp. 218-229. Toruń: PWN.

Czeżowski, T. (1977). Transcendentalia – przyczynek do ontologii (Transcendentalia – a contribution to ontotology). *Ruch Filozoficzny* XXXV, 1/2, pp. 54-56.

Ingarden, R. (1972). W sprawie istnienia przedmiotów idealnych (1923) (On the existence of ideal objects). In: Ingarden *Z teorii języka i filozoficznych podstaw logiki*, pp. 483-507. Warszawa: PWN.

Jadacki, J. J. (1984). O co chodzi w tzw. sporze o powszechniki (What is the matter in the despute about universals). *Studia Filozoficzne* 10, pp. 63-70.

Jadacki, J. J. Kłopoty z konkretami i abstraktami (Problems with concrets and abstracts). *Principia* I, pp. 46-64.

Kotarbiński, T. (1958). Sprawa istnienia przedmiotów idealnych (The case of the existence of ideal objects). In: Kotarbiński *Wybór pism* II, pp. 7-39. Warszawa: PWN.

Leśniewski, S. (1912). Próba dowodu ontologicznego zasady sprzeczności (An attempt of logical demonstration of the principle of contradiction). *Przegląd Filozoficzny* XV, 2, pp. 202-226.

Leśniewski, S. (1913). Krytyka logicznej zasady wyłączonego środka (The critique of the logical principle of excluded middle). *Przegląd Filozoficzny* XVI, 3/4, pp. 315-352.

Łukasiewicz, J. (1987). *O zasadzie sprzeczności u Arystotelesa* (1910) (Aristotle's concept of principle of contradiction). Warszawa: PWN.

Madejski, P. (1988). O koncepcji cechy i podobieństwa (On the concept of an attribute and similarity). *Studia Filozoficzne* 8, pp. 39-51.

Nowaczyk, A. (1989). Ontologia teoriomnogościowa a przedmioty fizyczne (Set-theoretical ontology and physical objects). In: J. Perzanowski (Ed.). *Jak filozofować* (How to philosophize), pp. 347-359. Warszawa: PWN.

Nowak, L. (1989). Byt i myśl. Przyczynek do metafizyki unitarnej (Being and thinking. A contribution to the unitary metaphysics). *Studia Filozoficzne* 1, 5-18.

Przełęcki, M. (1974). O świecie rzeczywistym i światach możliwych (On the real world and possible worlds). *Studia Filozoficzne* 7, 47-56.

Przełęcki, M. (1978). Zasada wyłączonego środka a zagadnienie idealizmu (The principle of the excluded middle and the problem of idealism). *Studia Filozoficzne* 7/8, 89-99.

Strawiński, W. (1989). Atomistyczne uniwersa indywiduów (Atomistic universa of individuals). *Studia Filozoficzne* 5, 145-158.

Woleński, J. (1987). Uwagi o momentach bytowych (Some remarks on the ontic moments). *Ruch Filozoficzny* 44, 2, 145-147.

Wolniewicz, B. (1968). *Rzeczy i fakty* (Things and facts). Warszawa: PWN.

Żabski, E. (1982). Próba aksjomatycznego ujęcia pojęcia cechy (An attempt at axiomatization of the concept of an attribute). *Poznańskie Studia z Filozofii Nauki* 7, 233-244.

## 3. PERSISTENCE

Ajdukiewicz, K. (1947). Czas prawdziwy (The true time). In: Ajdukiewicz (1965), *Język i poznanie* (Language and knowledge). Vol. II, pp. 29-33. Warszawa: PWN.

Ajdukiewicz, K. (1963). Czas (Time). In: Ajdukiewicz (1965), pp. 384-387.

Augustynek, Z. (1970). *Własności czasu* (Properties of time). Warszawa: PWN.

Augustynek, Z. (1975). *Natura czasu* (The nature of time). Warszawa: PWN.

Augustynek, Z. (1979). *Przeszłość, teraźniejszość, przyszłość* (Past, present, future). Warszawa: PWN.

Życiński, J. (1976). Zagadnienie czasowego charakteru wszechświata w ujęciu teorii kosmologicznych (The problem of temporal character of the universe in cosmological theories). *Analecta Cracoviensia* 8, 49-55.

## 4. LOCALITY

Augustynek, Z. (1961). Czas i przestrzeń a materia (Time and space with reference to matter). In: H. Eilstein (Ed.), *Jedność materialna świata* (The material unity of the world), pp. 205-254. Warszawa: KiW.

Heller, M. (1980). Filozoficzne zagadnienia geometrii (Philosophical problems of geometry). In: M. Heller, M. Lubański, and W. Ślaga (Eds.), *Zagadnienia filozoficzne współczesnej nauki* (Philosophical problems of contemporary science), pp. 167-189. Warszawa: ATK.

Such, J. (1987). Czas i przestrzeń (Time and space). In: Z. Cackowski (Ed.), *Filozofia a nauka* (Philosophy and science), pp. 61-75. Wrocław: Ossolineum.

## 5. EXISTENCE

Ajdukiewicz, K. (1951). W sprawie pojęcia istnienia (On the notion of existence). In: K. Ajdukiewicz (1965), *Język i poznanie* (Language and knowledge). Vol. II, pp. 143-154. Warszawa: PWN.

Jadacki, J. (1980). Spiritus metaphysicae in corpore logicorum. *Studia Filozoficzne* 9, 111-140.



Przełęcki, M. (1979). O tym, czego nie ma (On that what does not exists). *Studia Filozoficzne* 10, 13-21.

Przełęcki, M. [1980]. Nie ma tego, co nie istnieje (There is nothing that does not exist). *Studia Filozoficzne* 9, 141-148.

Sady, W. [1982]. Co to znaczy, że coś istnieje (What does it mean that something exists). *Studia Filozoficzne* 11/12, 3-20.

## 6. BELONGING

Lejewski, Cz. (1955). A contribution to Leśniewski's mereology. *Rocznik Polskiego Towarzystwa Naukowego na Obczyźnie* 5, 43-50.

Lejewski, Cz. (1988). Co filozofia zawdzięcza apostacie filozofii (What does the philosophy owe to the apostate of the philosophy). *Studia Filozoficzne* 6/7, 15-23.

Leśniewski, S. (1916). *Podstawy ogólnej teorii mnogości* (The foundations of the general set-theory). Vol. I. Moskwa: A.P. Popławski.

Sobociński, B. (1955). Studies in Leśniewski's mereology. *Rocznik Polskiego Towarzystwa Naukowego na Obczyźnie* 5, 34-43.

## 7. DETERMINATION

Ajdukiewicz, K. (1928). Zasada determinizmu (The principle of determinism). In: K. Ajdukiewicz (1960), *Język i poznanie* (Language and knowledge). Vol. I, pp. 72-75. Warszawa: PWN.

Kalinowski, M. (1977). Determinizm fizyczny a holizm (Physical determinism and holism), *Studia Filozoficzne* 5, 87-99.

Kotarbiński, T. (1958). Zagadnienia istnienia przyszłości (The problem of existing future). In: Kotarbiński (1958). *Wybór pism* (Selected papers). Vol. I, pp. 116-144. Warszawa: PWN.

Leśniewski, S. (1913). Czy prawda jest tylko wieczna, czy też i wieczna i odwieczna (Is the truth only secular or is it secular as well as eternal). *Nowe Tory* 10, 493-528.

Łukasiewicz, J. (1922). O determinizmie (On determinism). In: Łukasiewicz (1961), *Z zagadnień logiki i filozofii* (Some problems of logics and philosophy), pp. 114-126. Warszawa: PWN.

Misiek, J. (1987). Zasada nieoznaczoności (The principle of the uncertainty). In: Z. Cackowski (Ed.), *Filozofia a nauka* (Philosophy and science), pp. 428-432. Wrocław: Ossolineum.

Życiński, J. (1976). Problem absolutnego początku czasowego wszechświata a zasada determinizmu (The problem of the absolute begining of the universe in time and the principle of determinism). *Częstochowskie Studia Teologiczne* 4, 375-386.

## 8. CHANGE

Ajdukiewicz, K. (1948). Zmiana i sprzeczność (Change and contradiction). In: Ajdukiewicz (1965), *Język i poznanie* (Language and knowledge). Vol. II, pp. 90-108. Warszawa: PWN.

Czeżowski, T. (1951). Identyczność a indywiduum i jego trwanie (Indentity and the existence of an individual). In: Czeżowski [1958], *Odczyty filozoficzne* (Philosophical lectures), pp. 160-168. Toruń: PWN.

Placek, T. (1989). Paradoksy ruchu Zenona z Elei a problem continuum (The paradoxes of motion by Zeno of Elea and the continuum problem). *Studia Filozoficzne* 4, 57-73.

## 9. ACTION

Ajdukiewicz, K. (1948). Z dziejów pojęcia materii (From the history of the notion of matter). In: Ajdukiewicz (1965), *Język i poznanie* (Language and knoewledge). Vol. II, pp. 61-76. Warszawa: PWN.

Augustynek, Z. (1962). Determinizm fizyczny (Physical determinism). *Studia Filozoficzne* **3**, 3-65.

Augustynek, Z. (1984). Wersje materializm (Versions of materialism). *Studia Filozoficzne* **11/12**, 3-10.

Bandrowski, B. (1904). O metodach badania indukcyjnego (On methods of inductive studies). *Sprawozdania Gimnazjum Franciszka Józefa we Lwowie*, 1-43.

Borowski, M. (1907). Krytyka pojęcia związku przyczynowego (The criticism of the notion of causal relation). *Przegląd Filozoficzny* **10**, 4, 492-508.

Czarnocka, M. (1986). *Kryteria istnienia w naukach przyrodniczych* (The criteria of existence in natural sciences). Wrocław: Ossolineum.

Czerwiński, Z. (1960). O pojęciu przyczyny i kanonach Milla (On the notion of cause and Mill's methods). *Studia Logica* **9**, 37-60.

Czeżowski, T. (1933). *Jak powstało zagadnienie przyczynowości* (How did the problem of causality rise). Wilno: Wileńskie Towarzystwo Filozoficzne.

Jordan, Z. (1963). O logicznym determinizmie (On the logical determinism). *Studia Logica* **12**, 59-98.

Kotarbiński, T. (1929). Analiza materializmu (Analysis of materialism). In: Kotarbiński (1958), *Wybór pism* (Selected papers). Vol. II, pp. 90-96. Warszawa: PWN.

Kotarbiński, T. (1971). Determinizm i fatalizm w obliczu sprawstwa (Determinism and fatalism in the face of efficiency). *Studia Filozoficzne* **2**, 3-12.

Krajewski, W. (1967). *Związek przyczynowy* (Causal connection). Warszawa: PWN.

Łukasiewicz, J. (1907). Analiza i konstrukcja pojęcia przyczyny (Analysis and construction of the notion of cause). In: Łukasiewicz (1961), *Z zagadnień logiki i filozofii* (Some problems of logic and philosophy), pp. 9-62. Warszawa: PWN.

Misiek, J. (1973). O pojęciu materii (On the notion of matter). *Studia Filozoficzne* **3**, 183-185.

Pański, A. (1934). Uwagi o zagadnieniu definicji związku przyczynowego (Some remarks on the definition of causal relation). In: *Fragmenty filozoficzne* (published by disciples of T. Kotarbiński), pp. 84-96. Warszawa: Kasa im. Mianowskiego.

Pogonowski, J. and Wiśniewski, J. (1977). Kilka propozycji dotyczących formalnego modelu związku przyczynowego (A few proposals concerning the formal model of causal connection). *Studia Filozoficzne* **11**, 89-107.

Sztejnbarg, D. (= Kotarbińska, J.) (1934). Analiza pojęcia przypadku (Analysis of the notion of chance). In: *Fragmenty filozoficzne* (published by disciples of T. Kotarbiński), pp. 161-179. Warszawa: Kasa im. Mianowskiego.

Trzęsicki, K. (1988). Teza determinizmu a zasady przyczynowości i skutków (The thesis of determinism with reference to the principles of causality and of effects). *Studia Filozoficzne* **6/7**, 189-205.

Zawirski, Z. (1912). Przyczynowość a związek funkcjonalny (Causality and functional relation). *Przegląd Filozoficzny* **15**, 1, 1-66.

## 10. FINAL REMARKS

Wiśniewski, A. (1983). Charakterystyka pewnych związków między problemami filozoficznymi (Characteristics of some connection between philosophical problems). *Studia Filozoficzne* **8/9**, 211-225.