ARTICLES

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DETERMINISMS*

Abstract: *Determinism is usually understood as a commonly clear and obvious thesis. In the most of the actual literature a character of determinism is rarely enough explicitly underlined and we believe that it is the reason why common uses of the term often leads to inconsistencies and present a source of misunderstandings of different sorts. Here we will try to show that that there are many forms of determinism; that the concept of determinism has a composite character; and that conceptions of determinism can be mutually discriminated and organized according to particular elements they are consisting of by applying the procedure of classification.*

Keywords: *classification, definition, determinism, logical determinism, scientific determinism.*

Introduction

Our impression is that determinism is usually understood as a commonly clear and obvious thesis. In the most of the actual literature a character of determinism is not enough explicitly underlined and we believe that this is the reason why a common use of the term often leads to inconsistencies and misunderstandings of different sorts.

In the article we put aside questions concerning soundness or deficiencies in philosophical conceptions we are dealing with here. We are interested here in some basic conceptual shapes that are present in different kinds of determinism and in the question: is it possible to sort them in some interrelated order for purposes of their better differentiation? Our main thesis here is essentially threefold: that there are *many forms* of determinism; that the concept of determinism has *composite character*; and that conceptions of determinism can be *mutually discriminated and organized* according to particular elements they are consisting of.

The basic step in our attempt and probably the most important one, is to show a presence of different ways of understanding the philosophical concept of determinism. For this reason, we will take as our primarily concern to present some collection of approaches as an evidence that could be enough persuasive for our claim. Lists that will be presented here have no ambition to be exhaustive compilation. We see our mission more in drawing attention to the problem and to sketch some of the ways out than to give full account of it. Extensive list able to compile the most variations of determinism would be the task that requires more space and different approach (that can rely on far better developed criteria for comparative or historical analysis of particular cases). Since there are no currently well formed and precise criteria for such mission our exposition has to be understood as a preliminary attempt that probably could lead toward such more elaborated work.

Certainly, it is possible to imagine more such lists that could include a different choice of persons and their conceptions. However, we hope that, even in this form, it will highlight our basic observations and be of help in transparency of our intention. Opinions reflected here are taken from different sides either in respect to the philosophical orientations of authors or in respect to the problems that are processed by some theories. We believe that those amended in the list will be sufficiently transparent to show the idea, that there are many forms of determinism – actually, that many among them present conceptually quite different claims.

An important question is how we are able to highlight differences among forms of determinism? We believe that to point up the differences it will be enough to identify these forms in regards to components they are consisting of. So we decided to attach some labels to components of these forms and to appropriately emphasize them. Even more such components can be found, we will here devote place only to some of them that are seen as crucial. We will take into account those that are dominant in respect to assessment of their role in particular composite forms of determinism or at least with respect to frequency of their common use. In some cases and to some extent these forms are evidently mutually related while in other cases their properties not quite obviously differ. However, we believe that it could be possible to expose them for the purpose of their appropriate understanding.

There is another question we are interested in: If there are more deterministic conceptions such that they are related according to some of their components is it possible to systematically classify them? By accentuate differences among them and by labeling them according to their 'most characteristic proprieties' we could finally obtain some typology of forms of determinism. However, we believe that it is possible to go further in this ambition of sorting. Typology itself will give us divided forms of determinism but sorting according to types will be result that does not give us relevant information about familiar relations among different sorted forms, how they are interconnected and to what extant. If there are some common particles in different forms of determinism then they could be organized by help of classification. This kind of sorting can be more informative

in respect to the nature of any member included in it. For this reason we prefer this last option as more fruitful than typology approach since, by this way, mutual dependence of different forms of determinism will stay distinguished, evident and more useful for detecting a character of particular philosophical theories and their conceptual basis.

1.

The most modern authors, when they want to label certain philosophical conception as deterministic, do not always feel need to additionally explicate what they mean by determinism. They simply take it as something clear and granted. However, meaning of the term varies – not only during the past but even nowadays. Besides, its actual use seems to tacitly assume different theoretical backgrounds, regardless of whether we have in mind philosophical conceptions or standard scientific practice.

The term has the Latin origin. In Roman authors we can find *determino* or *determinatio* with a following meaning: *to enclose within boundaries*, *to bound*; *to limit*, *to prescribe*, *to determine*; *to fix*, *to settle*. Livy uses it as a technical term in describing augur's procedure of dividing parts of heaven into regions (*determinavit regiones*) and for marking their boundaries [*Ab urbe condita libri*, i, 18, 7, 32]. Almost the similar example is in Gellius (Gellius 1927, 13, 14). In Cicero, "the conclusion [i.e. *peroration*] is the end and terminating of the whole speech (*determinatio totius orationis*)" (Cicero 1949, 1, 52, 98). A Greek equivalent of Latin *definire*, *determinare* would be ἀφωρισμένης. It has been used in approximately the same manner as in later Latin authors.

However, this terms during the ancient and medieval times nowhere has it usual nowadays sense. We does not encounter these terms in the contemporary philosophical debates related to the themes on determinism. Beside the fact that determinism, as philosophical conception, never lacked its advocates during history, especially the ancient history, sole term determinism comes to us from some later times.

2.

OED (*Oxford English Dictionary*) gives us the following formulation that has to cover sense of the term:

> "The philosophical doctrine that human action is not free but necessarily determined by motives, which are regarded as external forces acting upon the will."

This formulation is evidently complex and we will engage here in its details but it enough illustrate that determinism is here taken as a subject interlaced with agency. This formulation in some sense corresponds to words of W. Thomson (Lord Kelvin) from his *Oxford Essays*:

"The theory of Determinism, in which the will is regarded as determined or swayed to a particular course by external inducements and formed habits, so that the consciousness of freedom rests chiefly upon an oblivion of the antecedents to our choice" (Thomson 1855, 181).

OED situates first occurrence of the term in year 1846 when editor of Thomas Reid's collection, Sir William Hamilton, wrote in a brief footnote:

"There are two schemes of Necessity—the Necessitation by efficient—the Necessitation by final causes. The former is brute or blind Fate; the latter rational Determinism" (Hamilton 1846, 87n.†).

Hamilton here joins 'rational determinism' with 'final causes' while 'necessitation by efficient' is characterized as brute fate (let we say, fatalism).[1]

The history of the term is a little bit older. The term actually appears a few decades earlier then OED notes, following its English sources.

By leafing Krug's *Allgemeines Handworterbuch* we can find terms *Determinismus (Bestimmung, Predeterminismus)* and *die Deterministen* (Krug 1827, i, 500–501). Also, here is a note on the first appearance of these terms (Krug 1829, 100): Christian Wilhelm Snell used them in commenting Kant's moral themes, in his brochure *Über Determinismus und moralische Freiheit* (Snell 1789). At several other places in *Allgemeines Handworterbuch*, determinism is used with a sense of 'a philosophical necessity'. These lines refer to English sources, related to Joseph Priestley's concept of 'determination' (a correspondence with John Palmer is quoted as a source; cf. Priestley 1779; 1780). A year after Snell (in 1790), Carl Friedrich Bahrdt also reflects determinism as theoretical concept (Bahrdt 1790, 291). Soon after, the term appears in Kant's treatises on religion (Kant 1793). In a footnote, Kant considers determinism in a context of agency and person's determination by external forces and read it as *predeterminism*, at the same time rejecting it as an 'illusion'.[2]

Herbart uses the word once for the first time at the end of his and several times later (Herbart 1842). He claims that determinism is prerequisite for action – 'Determinismus ist Voraussetzung des Handelns' (Herbart 1843, 147, 152). Hegel [1816: ii, 206; 236] already uses the term as standard philosophical notion (in the context of mechanical processes and also religion and freedom) (Hegel 1816, ii, 206, 236). Extensive list of using the term in German can be found (with

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1   Mill, for example (during approximately the same period, even nowhere directly mentions determinism) claims something different from Hamilton's option when notes that "[i]f the whole prior state of the universe could occur again, it would again be followed by the present state" (Mill 1843, Bk. III, Chap. VII, §1).

2   "Die, welche diese unerforschliche Eigenschaft als ganz begreiflich vorspiegeln, machen durch das Wort Determinismus (dem Satze der Bestimmung der Willkür durch innere hinreichende Gründe) ein Blendwerk, gleich als ob die Schwierigkeit darin bestände, diesen mit der Freiheit zu vereinigen, woran doch niemand denkt; sondern: wie der Prädeterminismus, nach welchem willkürliche Handlungen als Begebenheiten ihre bestimmenden Gründe in der vorhergehenden Zeit haben (die mit dem, was sie in sich hält, nicht mehr in unserer Gewalt ist), mit der Freiheit, nach welcher die Handlung sowohl als ihr Gegenteil in dem Augenblicke des Geschehens in der Gewalt des Subjekts sein muß, zusammen bestehen könne: das ist's, was man einsehen will und nie einsehen wird" (Kant 1793, 58A).

minor shortcomings) in *Deutsches Fremdwörterbuch* (Schulz, Brasler, Strauss 1999, 442–3).

On the basis of 19th century OED formulations as well as on the basis of earlier German texts, it seems that we need to make distinction between determinism as *a term* and determinism as *a philosophical conception*. As we saw, not so long ago, the term determinism refers to the conception in a good part far from its modern sense. By following only historical appearances of the term we are not always on the path that could signify some unique philosophical conception or at least such corresponding to the modern sense of determinism. Besides, even in that age the term determinism is not always followed by representation of unique philosophical conception in its background.

3.

Let we continue here with recalling some historical background of this notion and its use. Cassirer seems to be the first who points to the term by reflecting discrepancies in its conceptual background. The term is, up to the second part of 19th century, regularly used in the context of free will and its determination by antecedent circumstances, usually seen as 'external causes' that determine agent decisions or as 'causa finalis'. Cassirer is aware of it and (in the opening pages of his *Determinism and Indeterminism in Modern Physics*, some kind of a chronicle of the epoch) comes to the conclusion that *the genuine meaning* of the term has to be searched on the other side (Cassirer 1956). He dates rebirth of determinism to 1872, to a year of public speech of Emil du Bois-Reymond on the limits of knowledge of nature (du Bois-Reymond 1886, 107). Why this lecture seems to be important? According to Cassirer, in 19th century accounts on determinism there is a gap in continuity of essential meaning of this notion. Du Bois-Reymond is a person who reflects Laplacean roots of the notion and who tries to restore a genuine philosophical conception of determinism, in a sense of completes causal physical determinism. In fact, du Bois-Reymond is simply refraining words from the key passage of *Essai philosophique sur les probabilités*. Let we only reminds here that Laplace's determinism, based on the principle of universal causal concatenation, was inspired by Leibniz principle of sufficient reason. This is the famous place from Laplace's book, where he writes:

> "We may regard the present state of the universe as the effect of its past and the cause of its future. An intellect which at a certain moment would know all forces that set nature in motion, and all positions of all items of which nature is composed, if this intellect were also vast enough to submit these data to analysis, it would embrace in a single formula the movements of the greatest bodies of the universe and those of the tiniest atom; for such an intellect nothing would be uncertain and the future just like the past would be present before its eyes" (Laplace 1902, 4).

Let us try for a moment to resume in brief these words and to see what could be essential to Laplacean determinism. This form of determinism relies on identification of *causation* and *lawfulness* with *determinism*. Laplace wishes

to say that *predictability* (*p*) (or better to say, *calculability*) has to be, at least in principle, grounded on the following postulation. It assumes existence of some form of *intellect* (*i*) equipped with such capacities that enable obtaining *all relevant data* for analysis (*d*), where data are consisting of information about *all forces* (*l*) and *all states* (position of all items at time *t*) of *the system* (*s*) and such that an intellect could be able to cover all these data by *a single formula* (*f*). In short, predictability (*p*) could be read as *result* of *ability* of applying a unique function (calculability) over the all relevant data. He mentions following conditions for predictability: <*i, d, f*>, where data (*d*) here consist of subset <*l, s, t*>. It is clear that Laplace determinism is the philosophical conception compounded from more different elements. Here we have a system; system is governed by causation; causations proceeds according to laws; we have several exceptional abilities (to obtain relevant data, to analyze them, to calculate them by a function, to predict the future), data are consisted of laws (!); laws are understood as active forces with abilities to cause occurrences; etc.

Determinism, as *the philosophical conception* Cassirer has in mind, never completely ceased to exist even some other interpretations of *the term* starts to be more dominant and more influenced. *Cassirer's thesis*, concerning du Bois-Reymond (about exact date of breaking point and of returning to the roots of some genuine determinism) is not quite reliable. The fact is that Ernst von Brücke and Emil du Bois-Reymond are advocating this conception in 1842, almost thirty years earlier than Cassirer situates a breaking point for determinism. Soon after, in 1847, they will be joined by Hermann von Helmholtz and Carl Ludwig. As Hacking shows in his article on 19th century standpoints on determinism,[3] these four has immense impact on the later authors, either for or against the thesis. Anecdote with Cassirer's assertion testifies enough that the term determinism concealed many different philosophical positions, whether those 'genuine' or of another kind. In any case, in the background of 19th century use of the notion there were different philosophical conceptions.

Cassirer prefers one among options and willing to find difference between new, 'critical', and old, 'metaphysical' determinism. The first is based on belief that causal relations and laws are mental in their origin – their source is in our experience. Natural laws are not the domain of objective things, as 'metaphysical' determinism believes, but about cognitions and their ordering. In that sense, causal relation is necessarily on epistemological platform (cf. Cassirer 1956, 114).

Toward the end of 19th century difference in approaches to determinism can be observed in another author. When he tries to demarcate some of deterministic standpoints, William James, motivated to find place for our free will, gives the next descriptions. There is *the old determinism*, claiming that:

> "...parts of the universe already laid down absolutely appoint and decree what the other parts shall be... Any other future complement than the one fixed from eternity is impossible. The whole is in each and every part, and welds it with the rest into an absolute unity, an iron block, in which there can be no equivocation or shadow of turning" (James 1907,150).

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3   For the story about rising of 19th century determinism cf. Hacking 1983.

This 'old determinism' he labels as 'hard determinism'. 'Hard determinism' is one that doesn't shrink from such words as fatality, bondage of the will, necessitation, and the like. However, from the other side, there is an alternative to this old determinism, it is *determinism of nowadays*, i.e. 'soft determinism':

> "Nowadays, we have a soft determinism which abhors harsh words, and, repudiating fatality, necessity, and even predetermination, says that its real name is freedom; for freedom is only necessity understood, and bondage to the highest is identical with true freedom" (Ibid.,149).

4.

When contemplates William James' "The Dilemma of Determinism", S. Langer conjoins fatalism and determinism, what is not unusual in philosophical practice (Langer 1936, 474). She relates forms of scientific determinism and fatalism and claims that there is a strong connection between these two. Fatalism is usually seen as an outcome of some kind of the full-fledged determinism. Determinism is a useful scientific conception based on assumption that every event has immediate cause, what is a tenable thesis for scientific purposes. Problem arises when this thesis is connected with a thesis of predictability. This very thesis, derived from above place from Laplace, is seen as a form of *the scientific fatalism*. The modern scientific fatalism is "the assumption that there is a theoretically knowable collection of causes for any act". The thesis is derivable, according to her, from determinism that includes false assumption (given through illustration of Laplace's demon) about ability to obtain knowledge about 'total state of the universe'. The last assumption is credited by Russell and Whitehead (1910, 40) as 'illegitimate totality' since "a whole cannot be theoretically constructed" and for these reason, such doctrine of determinism, in its philosophic form, is "a modern version of belief in Fate" (Langer 1936, 478). So, legitimate scientific conception of determinism, the scientific determinism, which forms the ground of everyday scientific practice, by adding the metaphysical thesis of unrestricted predictability, leads to *the scientific fatalism*. Langer wishes to make demarcation between predictability and existence of immediate causes since existence of immediate causes does not directly imply predictability. 'The scientific fatalism' is assumption that there is a theoretically knowable collection of causes for any act (Ibid.). However, even 'pure' determinism and fatalism commonly claim causal connection of the past and future, so that the future can be predicted from the past, they do not entail predictability of the future, for causality does not necessary implies predictability. Besides, even in the case of completely causal universe, unpredictability of human agency brakes down this contention (Ibid., 472), since human agency is not subject of knowability.

Bunge respect Langer's considerations. He also sees the idea 'that causality is fatalistic' as a wrong take while *the scientific determinism* presents as something different from *the fatalistic determinism* (even 'incompatible' with it). However, his view of fatalism, causality and determinism differs slightly from that of Langer. While causal determinism is rational theory "offering the means for

knowing, predicting, and consequently changing the course of events", fatalism is based of assumption that there is some lawless supernatural Fate that drives unknowable and inescapable Destiny. According to him, there is no fatalism without *fatum* – the power that is above the law, one that installs unconditional necessity and directs the course of events. Causality, on the other side, need not to assume any such transcendental or supernatural agency. Causality does not entail inevitability: some causes can, for example, interfere with one another; the background or hidden causes and conditions may be present; the human conscious may intervene; and so on. Bunge inclines to a conception known as agent-causation while presence of some of elements listed can result in different outcomes (what he interprets as a source of probability). So, 'general determinism' has not to be seen as something that pays unconditionally. It is enabling us to use the knowledge of laws with a purpose to change or modify the course of events and it also leaves a room for chance and freedom. Besides, Bunge firmly believes that statistical laws completely excludes determinism and they are incompatible with it, since they are based not on causal principles but on probability and generalized correlations obtained from data. He believes that "statistical law and probability destroys determinism" (Bunge 1959, 101–102).

5.

We see that *calculability*, *predictability* and *determinism* are usually covered by conception that circulates, during 20th century, under the name of *the scientific determinism*. K. Popper, who himself prefers to interpret determinism as an epistemological thesis, in his *Open Universe* summing up the doctrine of scientific determinism ("the doctrine much stronger than common sense") and considers it as a claim which "most physicians would have agreed at least prior to 1927" (Popper 1982, xx).[4] This doctrine states that:

> "the structure of the world is such that *any event can be rationally predicted, with any desired degree of precision, if we are given a sufficiently precise description of past events, together with all the laws of nature*" (Ibid., 1–2).

According to Popper, the idea of scientific determinism has its roots in 'religious determinism' and seems to be "a kind of translation of religious determinism into naturalistic and rationalistic terms" (Ibid., 6). On the other side, he placed *the metaphysical doctrine of determinism*. This one simply asserts that:

> "all events in this world are fixed, or unalterable, or predetermined. It does not assert that they are known to anybody, or predictable by scientific means. But it asserts that the future is as little changeable as is the past. Everybody knows what we mean when we say that the past cannot be changed. It is in precisely the same sense that the future cannot be changed, according to metaphysical determinism" (Ibid., 7).

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4   Here he has in mind the date of *Fifth Solvay International Conference on Electrons and Photons*.

'Metaphysical' determinism differs from 'scientific' determinism. It is entailed by both religious and 'scientific' determinism. However, metaphysical determinism (as well as 'metaphysical' indeterminism) is *not testable* since its lack of empirical content. In respect to testability, another difference that Popper makes is between a *weak* version of 'scientific' determinism and its *stronger* form (Ibid., 36*ff*).

'The weak' version supposes predictability of the state of any future instant of time of any close physical system ("even from within") "by deducing the prediction from theories in conjunction with initial conditions" (i.e. with conceivable initial conditions). Theories here play role of instruments of describing the world, asserting that the world has certain properties. However, this does not mean that, if the theory that describes certain properties of the world is true, that at the same time all what could be deduced from the theory has to have corresponding property of the world. This last would be position of 'the stronger' kind of determinism, marked by Popper as false, that will suppose predictability of "any given state, *whether or not the system in question will ever be in this state.*"

It has to add, that in the question of relation between causality and determinism Popper is not always consistent. In part of his book, it seems to identify causation and determinism (Ibid., 149), while at some other parts asserts them as different (Ibid., 4, 19, 23).

Even predictability is a form of testability of scientific theories Popper criticizes metaphysical form of determinism and the stronger form of determinism. However, there are more critics of formulation of determinism in a form of predictability.[5] Predictability, just one of proprieties of (Laplacean) determinism, is an epistemological concept while determinism should be analyzed as an *ontic* or *physical thesis* and for this reason it is necessary to distinguish determinism in *a proper sense* from determinism related to ability of making predictions. Suppes brings to mind examples of three body problem and Turing machine: both examples are *par excellence* illustrations of deterministic systems. It is known that there is no algorithm (that would support ability of prediction) in determining whether an arbitrary Turing machine in an arbitrary configuration will ever halt (Suppes 1993, 245–246). So he insists on *conceptual separation of two notions*: predictability and determinism. We have good reasons to interpret some systems as 'deterministic' even we are not always able to test it by means of predictability and by recalling mental aspects of the predictability thesis as component of determinism.

6.

By beginning of 20th century the debates on determinism from the second half of 19th century continue. Russell joins the discussion on elucidating the notion of determinism in his well-known lecture on the notion of cause. He tries

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5   For example, Earman 1986, 9–10; Suppes 1993; Kellert 1993; Stone 1989.

to make transparent interconnection among several traditional philosophical notions. A source of philosophical misapprehensions is obscurity of these notions. The notion of determinism has to be demystified by showing its real nature – it has to be considered rather as *a functional relation*:

> "A system is said to be 'deterministic' when, giving certain data, e_1, e_2, . . ., e_n at times t_1 t_2..., t_n respectively [*s.c.* 'determinants'], concerning this system, if E_t, is the state of the system at any time t, there is a functional relation of the form E_1 = $f(e_1, t_1, e_2, t_2, ..., e_n, t_n)$.
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> The system will be 'deterministic throughout the given period' if t, in the above formula, may be any time within that period, though outside that period the formula may be no longer true. If the universe, as a whole, is such a system, determinism is true of the universe; if not, not" (Russell 1917, 199).
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> "Determinism in regard to the will ... Whether this doctrine is true or false, is a mere question of fact; no *a priori* considerations (...) can exist on either side" (Ibid., 205). "We were unable to find any *a priori* category involved: the existence of scientific laws appeared as a purely empirical fact, not necessarily universal, except in a trivial and scientifically useless form" (Ibid., 208).

For these reasons Russell insists on revision of notions of cause and necessity – two fundamental tools and backbones of the former science – since "there is no *a priori* category of causality" (but merely certain observed uniformities, (Ibid., 205)), the notion of necessity is "a confused notion not legitimately deducible from determinism" (Ibid., 207) and it has to be perceived simply as logical necessity driven by constitutive *determinants* as arguments of a necessary propositional function.

As we can see, Russell's definition is not only about determinism but it is in some sense about pairing determinism with ability of making predictions. Russell, though leaves the notions of cause and causality, his formulation leaves room for conjoining determinism and predictability: system is deterministic exactly if its previous states *determine* its later states in the exact sense in which the arguments of a function *determine* its values.

There is an important suggestion of Russell (which concerns validity of formula outside the period covered by formula) that reflects 'the principle of the irrelevance of time'. Our laws are not *a priori* principles that are applicable to the future besides the fact that they hitherto hold for the past facts. Our formulas are only 'methodological precepts' not 'real laws of Nature' that stands absolutely in respect to the time. It has to add, that Russell is not completely satisfied with his formulation of determinism. There are several reasons. Any set of data points, that are describable by some function, are in fact describable in other ways by infinitely many functions. Further, in the dynamic systems, the past state of a system to which our formula was hitherto applicable could be different in the future and our simplest way to cover facts would no more be the same as it was. Also, the way our system was described hitherto could be transformed to some advance form that will no more necessarily involve the same formula. For this

reason we have to bear in mind 'the principle of the irrelevance of time', "that the time must no enter explicitly into our formulae".[6]

Russell's attempt to revise the meaning of determinism seriously shaken the traditional image of science in scientific community. Traditional representation of determinism, by unlinking causes and natural laws from it, now results in the logical form of deterministic necessity.

7.

Even this title is not yet mentioned, Russell observations would be first marks of a rising conception later named by Schlick as *the logical determinism*. M. Schlick repeats Russell's position by following words:

> "Let us see how the scientist uses the word determination—then we shall find out what he means by it. When he says that the state E at the time t_1 is determined by the state C at the time t_0, he means that his differential equations (his Laws) enable him to calculate E, if C and the boundary conditions are known to him. Determination therefore means Possibility of Calculation, *and nothing else*" (Schlick 1932, 114).

His understanding of the natural laws and necessity corresponds to that of Russell. 'The natural law' of science, however, "is not a prescription as to how something should behave, but a formula, a description of how something does in fact behave" (Schlick 1939, 147). The natural laws are just descriptions and they have no force that would push things to move according to their prescriptions. The laws of planetary motion, for example, do not force the planets to move as they do, but only describe their actual motion.

Necessity of logical determinism is not necessity of *the causal nomological determinism*. It is necessity of *functional determination* that enables us, at the basis of determinants and covering function, to calculate (or. better to say, *to infer*) necessary relational dependences among determinants in respect to the function.

Both Russell and Schlick formulations shares one of crucial assumption, that *determinism* is firmly linked with *predictability* (and converse, the ability to make *retrodictions*). Schlick's 'possibility of calculation' corresponds with Laplace's condition for making predictions (though Laplace had in mind a singular function that could be able to cover complete universe). Here, in some sense, there is some sort of comparability among 'calculability', 'predictability' and 'to be determined', between epistemic aspects concerning sequence of state

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6   "In fact we might interpret the 'uniformity of nature' as meaning just this, that no scientific law involves the time as an argument, unless, of course, it is given in an integrated form, in which case *lapse* of time, though not absolute time, may appear in our formulas" (Russell 1917, 205). Extension of Russell's formula in respect to determinism in dynamical or evolutive systems is given in van Fraassen (1989, 254). Russell's function has to be extended to cover all possible trajectories of the system, *i.e.* to encompass changes in successive states of the system.

of affairs (or knowledge about it) and the relational connection with another sequence in different moment that is related to some previous sequence. If one state of affairs is determined, in above functional sense, there is a place for this state to be predicted or to be calculated in advance in respect to the knowledge about its previous states and function that covers all its consequent states.

Schlick's calculability (predictability) is a form of deducibility. It represents a standard understanding about what the logical determinism is – one state is propositionally connected with another state by inferential power. However, logical necessity has to be distinguished from physical necessity and causation: "what is called causal necessity is absolutely different from logical necessity" and "former philosophers so frequently made the mistake of confusing the two and believing that the effect could be logically inferred from the cause" (Schlick 1932, 108). Relationship between logical principles and reality Schlick titles as 'a problem of logical determinism'.[7] He located it in Aristotle's believing:

> "that the Principle of the Excluded Middle could not be applied to future events unless we assume the truth of Determinism."

Having probably Łukasiewicz in mind, Schlick adds that "there are even modern logicians who follow him in this" (Ibid., 115).

8.

Łukasiewicz's formulation of determinism (given more than one decade earlier than that of Schlick), is the following: "By determinism I understand the belief that if A is b at instant t it is true at any instant earlier than t that A is b at instant t" (Łukasiewicz 1990, 113). The outcome of this formulation, according to him, would be that the future has to be treated at the same way as the past and that it differs from the past 'only in so far as it has not yet come to pass'. Everything is fixed in advance. The way out from determinism consists in taking seriously suggestion to abandon this believe that leads to conception of eternal truth and to absence of free will.

Łukasiewicz offers two arguments against determinism. One is based on 'the logical principles' while another is based on 'the principle of causality' (and he uses it also in his interpretation of stoical conception of determinism). We will not discuss here in details his attempt to prove determinism on the grounds of propositional calculus as bivalent logical system. We wish only to emphasize his position that *bivalent nature of propositional calculus leads to determinism*. As it is known, the proof relies on identifying two principles: the principle of bivalence and law of excluded middle. Even this proof appears to be valid logically, on the basis of propositional calculus, it has to be abandon for other reasons. The critical moment of argumentation against determinism he summarizes in the following comment: "Although this solution appears to be logically valid, I do

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7   On the other place he formulates it as *the paradox*: "Aristoteles zum Opfer gefallen ist und das noch gegenwärtig Verwirrung stiftet. Es ist das Paradoxon des sog. 'logischen Determinismus'" (Schlick 1931, 159).

not regard it as entirely satisfactory, for it does not satisfy all my intuitions" (Ibid., 124). Attitude against determinism "finds its justification both in life and in colloquial speech" [1990:125]. The principle of bivalence is not applicable to future oriented propositions, to not yet existing things that we use to designate as future and possible. Such propositions have no equal 'real correlates' as those propositions oriented to presence and past. The third, 'neutral', value would be more appropriate to future contingents and they "ontologically have possibility as their correlate".

To sum it up, on the logical basis determinism is consistent conception with its logically valid consequences but chosen logical base is unacceptable in respect to our common intuitions. In such its form, with bivalent assumption embodied, it is not only inappropriate for dealing with future contingents but also has unintuitive consequences in respect to human agency.

Waismann prefers for logical determinism more expressive term, *the logical Predestination,* since, according to this conception, it seems "that indeed the entire future is somehow fixed, logically preordained" (Waismann 1959, 352). Jordan (Jordan 1963, 18), following Waismann, interprets Łukasiewicz's formulation of logical determinism as *the semantic formulation of strict determinism* ("where the strict causal determinism implicitly assumes that an unending sequence of events has no limit") (Ibid., 23). Principle of causality is not necessary outcome of the principle of bivalence but it gives a firm link to real correlates that secure necessary truth of future propositions and at the same time, justify the thesis of eternal truth. In that sense, 'the strict determinism' is the outcome of (a) *the principle of bivalence*, in combination with two additional assumptions: (b) *the correspondence theory of truth* and (c) *the timelessness or absolute character of truth* (Ibid., 1). According to Jordan's representation, 'the strict determinism' occupies the following relative place in the transitive chain of principal dependence: "If the principle of bivalence entails strict determinism and strict determinism entails fatalism, the principle of bivalence entails fatalism" (Ibid., 3). In the same spirit, Wołenski (1996) recently interprets the logical determinism as *the radical determinism.*

9.

Above transitive order suggested by Jordan, during the time, proceeds toward representation of the logical determinism under the standard name of *logical fatalism*. Discussions on Aristotle's the sea-battle example and the future contingent propositions support anchoring of this tradition. Ryle's lecture "It Was to Be" (1953) or Taylor's articles and wide discussion that follows it during the sixties,[8] Ayer's (1963) and Dummett's (1964) texts of fatalism, are among many that certainly contribute to this custom. *Logical necessity* starts to be more frequently interpreted as one that leads to *inevitability*. Even alert to confusion between the logical determinism and fatalism is given yet in the late fifties by

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8   Articles from this polemics on Taylor's article are now collected in the book devoted to D. F. Wallace (cf. Wallace 2011).

Bradley, the tradition of interpreting logical determinism as fatalism (or at least a kind of fatalism) continues and still is present in many modern approaches, especially in those dealing with question of the logical status of future contingents.

Bradley (1959) in his article restates some of Schlick earlier warnings that logical necessity need to be discriminated from causal necessity and also, that truth of logical propositions and their relations have different character from truth of empirical evidence. He criticizes usual assumption that logical determinism *implies* (logical) fatalism. It is not true since *what is timeless* and *what is empirical* are different claims. The failure in this inference consists in *ascribing logical necessity* to *causal necessity* and *causal necessity* to *fatalism*. We can accept as valid that if '*x is causally determined*' it implies '*x is logically determinate*'. However, '*x is logically determinate*' not implies '*x is causally determined*'. There is no equivalence between two claims, one concerning causality and the other concerning logical necessity. Three logical principles we can find in Aristotle's discussion about the sea-battle – *the law of identity*, *the law of noncontradiction* and *the law of exuded middle* – that form kernel of logical determinism are not enough strong basis for projection of logical necessity to causal necessity or (actual) necessity of the future truths.

Let we remind that Aristotle in *de Interpretatione* (Ackrill 1963) conclusion of his opponents – that things happen of necessity – reaches apparently by reference to the premise, that of two contradictory predictions: 'one is true' (Ibid., 18b7); 'one is earlier true' (Ibid., 18b10); 'one has always been true' (Ibid., 18b10–11); 'one has been true for the whole of time' (Ibid., 19al-2). It is evident that determinist, to whom Aristotle replies, makes no explicit appeal to either causality or laws. He reckons on only logical matters. In additional inexplicit principles that Aristotle assumes (the asymmetry of time, the conservation of the past and the time direction, from left to right) it is hard to find some that leads toward the causes and causal necessity.

10.

The term (*logical*) *fatalism* – formulated across the symmetry of time and reduction of all possible worlds to the actual one – completely replaces former term the (*logical*) *determinism*. In his 'standard' argument for (logical) fatalism Taylor (1962) nowhere recalls determinism, logical or any other. It is interesting that Taylor, in the first version of his argument for fatalism, nowhere mentions laws. He only stresses the presence of causes. Latter, he declares opinion that fatalist is in fact the determinist – but such that has a certain attitude. Demarcation between *fatalism* (that claims only, in some its essential form, that future is unavoidable) and *determinism* (that lays on the causal assumption) principally seems to be superfluous. Fatalism as claim that certain events are going to happen *no matter what* and *regardless of causes* is, for him, 'enormously contrived' – "it would be hard to find in the whole history of thought a single fatalist, on that conception of it" (Taylor 1974, 55). Fatalistic claim about *unavoidability* and deterministic claim of *truth* and *necessity* coincides and are

different only in regards to perspective. In the same manner as Taylor, S. Cahn identifies fatalism with a thesis that:

> "the laws of logic alone suffice to prove that no man has free will, suffice to prove that the only actions which a man can perform are the actions which he does, in fact, perform, and suffice to prove that a man can bring about only those events which do, in fact, occur and can prevent only those events which do not, in fact, occur" (Cahn 1967, 8).

This attempt is fully present today. Similar formulation of fatalism is supported by many authors. According to van Inwagen fatalism is claim that:

> "the thesis that it is a logical or conceptual truth that no one is able to act otherwise than he in fact does; that the very idea of an agent to whom alternative courses of action are open is self-contradictory" (van Inwagen 1983, 23).

Similarly, Horwich sets fatalism by these words:

> "What was true in the past logically determines what will be true in the future; therefore, since the past is over and done with and beyond our control, the future must also be beyond our control; consequently, there is no point in worrying, planning and taking pains to influence what will happen" (Horwich 1988, 29).

For J. M. Fischer fatalism is: "the doctrine that it is a logical or conceptual truth that no person is ever free to do otherwise" (Fischer 1989, 8).

11.

Taylor is only partly right when he says that "it would be hard to find in the whole history of thought a single fatalist", one who would make difference between unavoidability and necessity of universal causation. For example, during the ancient times we can find a wide range of such conceptions where *Fate* is conceptually treated different than *Necessity*. Some examples we are able to find, among others, in Cicero's *de fato* and *de divinatione*. If we wish to state some common features of different ancient sorts of fatalism we will need to represent it accord to some topological points. In the cases of so-called event-fatalism, future events are presented there as unavoidable in respect to either *time* or *place* or some *mean* (*the way* of its realization) or some *kind* of event (as it is some necessary realization of disposition, etc...) (Marko 2011a; 2011b). In some other cases, it goes only on correlation between a sign and thing signed, like in Stoical example of predictive sentence '*If Fabius was born during the Dogstar he will not die at the sea,*' where relation between antecedent state and consequent state has to be interpreted not by classical propositional implication but as some sort of *connectedness* or rather as relevant connection (or sort of responsibility relation). Since fatalism it is not always about fixed point in time, in many cases it is not always connected with examination of causes, laws, logical laws, etc. Many of these conceptions not even set aside possibility of agency, like in the case of *the conditional fate*. What ancient fatalisms have in common can be summarized

by claim that it is about truth in advance – that once in the past it was true that *at least one kind of entity* (*event, occurrence, disposition* or *truth of proposition*) inevitable *will be actualized* (by this or that way).[9] Ancient cases of fatalism are only illustrations of treating inevitability of future without taking into account causes or laws of nature and also, in many cases, without help of supernatural forces that drives its realization.

Some forms of ancient fatalisms correspond with, for example, Earman's *naturalistic fatalism* – an event will occurs in every physically possible world, 'no matter what happened' – "for instance, that the laws of biology dictate that I am naturalistically fated to die". But in this case there is no basis for claim that this event rely on deterministic assumption: "Naturalistic fatalism in this sense neither entails nor is entailed by determinism" (Earman 1986, 18).

Logical determinism (at least in Bradley's sense) and logical fatalism (in a sense of Taylor and Cahn) seems that conceptually correspond. However, logical determinism or logical fatalism are theses that do not necessarily correspond with all forms of fatalism. Also, some particular forms of fatalism cannot simply be identified with determinism based on the principle of universal causation, as Taylor used to suppose.

Furthermore, difference between *the theological fatalism* (determinism) and *logical fatalism* Haack (1974) presents as an upgrading of argument for the logical fatalism with addition of proposition(s) with theological content (as for example 'The God is omniscient' or 'The God is omnipotent' and so on), that is formally inessential for the proof of logical part of the argument. Since the logical premisses are independent of theological this additional premiss has no role in the argument except as redundant detour from the logical character of the argument for (logical) fatalism.

12.

Several modern arguments for incompatibilism rely on explicit deterministic assumptions: for example, *The Direct Argument* and *The Consequence Argument* (van Inwagen 1983).[10] We will not here deal with these arguments and how they are inferred and defended. We are interesting only in character of its deterministic bases. Let we just see how determinism is presented in van Inwagen exposition (Ibid., 184–8).

Van Inwagen starts from a simple assumption that the past determines unique future and understands it as the thesis that there is at any instant exactly one physically possible future. According to him, determinism as a thesis

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9   It is interesting, that these approaches to fatalism are not endemic cases of ancient times. The term fatalism in above sense can be very often recognized in a current medical practice and literature devoted to analyses of patient attitudes toward hope in outcomes of treatment of their illness.

10   Among rare exception in modern arguments for incompatibilism is, for example, Frankfurt (1969) with his cases against 'principle of alternative possibilities' where are explicitly mentioned neither causes nor laws (although conditional connector 'because' is used).

about propositions is necessary to distinguish from determinism based on the principle of universal causation. He does not feel obliged to accept the principle of universal causation and doubts that this principle even entails determinism or that determinism entails causation (place for *immanent causation* could be retain besides the fact that in complex physical events it is open question how and does causation can be distinguished). However, laws presents a firm constrain that limits our abilities. Laws are propositions that are simply *de dicto* true and they are defined as

> "any set of worlds that has as a subset the set of all worlds in which the laws of nature are the same as those of the actual world, or, as we might say, are *nomologically congruent* with the actual world."

Determinism is presented as conjunction of these two theses:

> "For every instant of time, there is a proposition that expresses the state of the world at that instant;
>
> If *p* and *q* are any propositions that express the state of the world at some instants, then the conjunction of *p* with the laws of nature entails *q*" (Ibid., 65).[11]

In respect to human agency (P) and in respect to *inability* to either change the laws of nature or the past truths, determinism is consisting in antecedental conjunction of *the past truths* (Po) and *the laws of nature* (L) and agency is conditioned by this conjunction [*i.e.* $\Upsilon((\text{Po \& L}) \rightarrow \text{P})$].

Along this conception, claiming that human agency is determined by the past truths and the natural laws, we could find also a wide range of approaches accepting similar basis for determinism but, now in compatibilistic manner, that will allow *agent-causation* option as an intercessor link that keeps on deterministic chain. Here, the notion of causality has dominant weight and forms a central layer in these approaches. Some of compatibilists, that continues 'soft determinism' interpretation of James, will often hold both *causal determinism* and *logical determinism* to be true while others will hesitate to fully accept either the first or the second.

Frequently, contrary to formulations given above by Schlick, the laws of nature used to be understood and qualified as causes. In the recent book of Maudlin (2007, 1) we can find a thesis, widely accepted in scientific practice, that since laws are explanatory engine of occurrences in physical world they can be in some sense interpreted as responsible for occurrences: "laws of nature stand in no need of 'philosophical analysis'; they ought to be posited as ontological bedrock."[12] When we are using the laws of nature we are not analyzing or reducing one set of terms into another but we are starting from a point that these *are* actually laws. The laws cannot be reduced to other, more primitive, notions, they *are* basic ontological notions since "our world is governed by laws". In this sense, as Hoefer (2010) summarizes this position, *laws are causes* "that makes things happen in a certain ways."

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11   *Cf.* Ibid., 58; and van Inwagen 2004, 344.

12   This position is usually called the *ontic conception* of scientific explanation according to Salmon 1998, 54.

Do we need laws if we wish to advocate determinism? Could we represent determinism without laws? It depends on how we are interpreting laws. Some interpretations of laws of nature not necessary count on the notion of cause. For example, Nagel syntactical formulation of laws of nature interprets them according to their logical function. Laws, relative to class of proprieties of some isolated system together with given the state of the system in one time *logically determine* a unique state of the system for any other time (Nagel 1999, 281). Laws are theoretical notions. According to him,

> "a theory is deterministic if, and only if, given its state variables for some initial period, the theory logically determines a unique set of values for those variables for any other period" (Ibid., 292).

If we wish to see the relation between two states as causally connected and to assume a causal version of determinism this step will pull us toward *the ontological determinism*. For this reason, Nagel insists, causality should be kept apart from determinism if we wish to escape ontological determinism. Some authors, however, prefer to retain causality, even 'a pure theoretical notion', as useful concept that has some indubitable explanatory advantages (Tooley 1987, ch. 11).

Cartwright also thinks that there are reasons to leave a notion of causation. It could be abandon in favor of theoretically more fruitful notions like capacities and structures that could be stronger scientific tools for explaining the events and for making predictions. These more appropriate notions could also replace laws and their role in science: "Capacities will do more for us at a smaller metaphysical price" (Cartwright 1989, 8). For her, all these philosophical notions (like 'universal determinism', 'law' and 'causality') are outcomes of the idea of 'nomological machine' – what is simple title for a way of organizing knowledge, "a way of categorising and understanding what happens in the world" (Cartwright 1999, 57). Science will survive without these notions.

13.

Some formulations of determinism are based on quite vaguely and controversially formulations in terms of 'event', causation', 'laws of nature' or 'prediction'. It is not always clear what the genuine characteristics of these formulations are and, besides, whether they are related to some theories or they include a wider metaphysical background. Furthermore, some of the elements used in definition (for example, 'predictability') are epistemologically oriented – like in Laplace's case – and related to scope of *abilities* (of 'intelligence' to obtain knowledge about the system in question).

More precise definition (one that partly could overrun above deficiencies) comes from Montague (in 1974, later slightly reformulated by Earman in 1986). Montague develops earlier formulations of Nagel (1953) and his idea is that determinism can be seen as propriety of a theory. Briefly, theory is interpreted by a formal semantics approach and is associated with a *class of models*. *Objects* of

theory are represented as 'systems', *properties* are 'states' while *regularities* could be represented as a function ascribing a value to some point on *t* axis (and could be interpreted as 'the laws of the theory'). A theory *T* is deterministic if any of at least two histories (*S* and *S'*) that realize (satisfy – *Rl*)[13] theory *T* and which are identical at a given time t_0 are identical at all times *t*. Theory *T* is deterministic *if and only if* all *models* of the theory that agree on the state of the world at one time [*state of S at t – st$_S$(t)*], also agree at certain other times.

Let we suppose that *S* is history, where $S = <D_1,..., D_n>$ and *D* is one argument function defined at least for all real numbers $\bar{R}$, and that *state of S at t* is defined as $st_S(t) = <D_1(t),..., D_n(t)>$. Then,

a theory is *historically determined*:	a theory is *futuristically determined*:
If *S, S' ∈ Rl(T), t_0, t ∈ R, t_0 <t, and $st_S(t_0)$ = $st_{S'}(t_0)$* *then* $st_S(t) = st_{S'}(t)$;	*If* *S, S' ∈ Rl(T), t_0, t ∈ R, t <t_0, and $st_S(t_0)$ = $st_{S'}(t_0)$* *then* $st_S(t) = st^{S'}(t)$.

A theory is *deterministic* if it is both *historically* determined and *futuristically* determined, that is:

If S, S' ∈ Rl(T), t_0, t∈R, and $st_S(t_0) = st_{S'}(t_0)$ then $st_S(t) = st_{S'}(t)$.

Earman re-reads above Montague's formulations of the basis of *deterministic theory* in terms of *physically possible worlds*. The determinism is here allowed by *the theory* by quantifying over all the physically possible worlds. Earman's modification of Montague enables additional alternative approaches, where determinism can be interpreted not only as propriety of *the theory* alone, but also either as propriety of *the set of laws* or as propriety of *the world* or through given *the actual state of the universe* (where the history is settled by the laws even they do not determine future state of the universe) and so on.

14.

Russell's above noted alert, related to applicability of formula outside the stabile period (where system is in process of change), today is analyzed as a wider question concerning ability to apply determinism to linear and non-linear (chaotic) dynamic systems. Montague's approach to determinism, through its characterization as *deterministic theory* and *deterministic system*, enables some improvement in respect to Russell's earlier forbearing. Determinism can be

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13   A formula *φ* of L is *realized by* a history *S* just in case there is a standard model *M* of language L such that *S* is *partial model corresponding to M (S = Pm(M))* and *φ* is true in *M*. *S realizes a class of formulas* or *theory K* (in symbols, *S ∈ Rl(K)*) if there is a single standard model M such that *S = Pm(M)* and K holds in M.

compatible with description of the system that endures linear change. Linearity, as a product of differential equations, interpreted as 'additive', works well with dynamic systems seen within continual change. With linear equations, the 'state' of the system in one moment can determine the 'state' of the system at a later (or earlier) moment. It is possible by incrementally changing the variables: by adding some smaller values at lower level for the purpose to obtain higher level values of a final solution that covers the whole evolutive period.

Let we remind to above Russell's suggestion concerning 'the principle of the irrelevance of time'. His approach is suggest attempt to define determinism of changing system in terms of *actual* trajectories alone, not those *possible* (that could be infinite in number and has to be avoided). According to Montague, this approach will abolish deterministic condition that given state is always followed by the same history of state transition. Taking determinism as a modal notion van Fraassen tries to refine Russell's formulation, taking into account not only actual but possible trajectories (van Fraassen 1989, 254). The system is deterministic if two possible worlds have the same history of state transitions:

> "If u and v are possible histories, and $u(t) = v(t')$ then for all positive numbers b, $u(t + b) = v(t' + b)$."

Stone (1989) and Kellert (1993), by analysis of Laplacean determinism, attempted to notice and extract key properties of determinism that would be necessary and sufficient condition for determinism:

> "(a) there exists an algorithm which relates a state of the system at any given time to a state at any other time, and the algorithm is not probabilistic;
>
> (b) the system is such that a given state is always followed by the same history of state transitions;
>
> (c) any state of the system can be described with arbitrarily small (nonzero) error" (Stone 1989, 125).

According to them, determinism is necessary condition for predictability *but not vice versa*. Stone, Clark (1989) and Kellert, extend deterministic interpretation from *linear* to *non-linear systems* (systems usually interpreted as not fully stable or not transforming continually because they are affected by occasional 'jumps'). These systems are deterministic though predictable not *locally* but only *globally*. Their feature is that, even they behave chaotically, periodically they jump into some patterned (deterministic) behavior: even these systems have infinite possibility for movements, they are oscillating inside some steady and predictable macro patterns. Chaotic behavior of the system is due rather to epistemic reasons (or to lack of Laplacean 'demonic' abilities of observer) in respect to computability and to inability to give precise initial conditions. Determinism is here accepted as explanatory tool because some aspects of the system's evolution are coverable (not statistically or probabilistically, but) by strictly deterministic differential equations, enabling 'predictability-of-higher-order-characteristics' in respect to certain deterministic aspects of the system (related, for example, to its qualitative or topological character; (Kellert 1993).

Deterministic proprieties also could be analyzed in the scope of quantum theory, including there quantum field theory. Some newer results support the thesis that quantum theory also can be interpreted as deterministic and that this interpretation could be entirely coherent (Butterfield 2005).

15.

Up to now, we tried to briefly expose some persuasive picture of factual state in modern philosophy. Determinism is not a unique philosophical conception. There is no any representative, distinct and consensually approved formulation of determinism. More such conceptions are currently in circulation and we seen that they are different not only for the simple reason. To interpret some of these conceptions consistently it is not enough to call it merely by its common name without some additional designation. Under its common name we are usually able to find that particular segments of these conceptions can be in conflict or are mutually exclusive. To draw distinction among conceptions that we usually put in the same basket under the name of determinism, we have to stress on some necessary differences, at least by roughly highlighting their partially distinct proprieties. Our estimation is that the classification of different forms of determinisms (ranged from *ontic* to *semantic*) could be solution to keep the visibility of these differences.

Our suggestion is that the classification of different forms of determinism needs to be formed from bottom up and so we have to find a candidate for minimal common denominator of these different forms. As it seems, the basic level could rest only on notion of 'the functional determination'. Such layer will be equipped with 'order' of variables but without excessive additional features such as time-direction, as it is usually supposed by introducing indexed entities like '*state* plus *time* (of occurrence)'. This option could retain order of entities and guarantee that entities are sorted according some covering linear function. Such deterministic kernel, equipped only with *transitivity* and *continuity* (*i.e. ceaselessness*), later can ensure upgrading toward other forms of determinism that are currently in circulation among philosophers. This minimal essential form as a kernel could be compared with McTaggart's (1908, 462) idea of a 'flat' series of time or C-series. The basic kernel of determinism needs not to be understood as the determinism itself but only as a condition that enables different forms of determinism to be developed as upgrades on this basic level.

If to this grounding block we put another conceptual brick, consisting in, for example, *the universal principle of causation*, we will obtain *the causal determinism*. Further, by adding to this new composition of causal determinism another brick consisted of 'the laws of nature', new block results in *the nomological causal determinism*. Starting from the basic level again, by adding to the minimal deterministic kernel another layer, consisting of so-called 'Aristotelian laws of thought' (Principle of non-contradiction, Principle of Excluded the Middle, Principle of Bivalence, Principle of Identity), it leads to *the logical determinism*,

while by adding to this composition *the principle of correspondence* (to the so called 'real correlates') we will obtain the form of *the metaphysical* version of *logical determinism* that Łukasiewicz had in mind in his critics of determinism.

Other forms of determinism can be seen as composed in the similar manner on the basic layer that retains only minimal features of the incessantness and transitive chain of ordering as a kernel.

Another our suggestion here is concerned with *a minimal formulation of fatalism*, such that would retain essential propriety the most of fatalisms have in common – *inevitability*. In that sense, minimal conditions for determinism and fatalism obviously differs. Inevitability not necessary crosses the minimal deterministic kernel. The crossing of two kernels is possible by some further layer additions. This would require one or more layer assumptions connected with either causal, logical or any other propriety of added layer. Upgrading the minimal kernel for fatalism to traditional forms, we mentioned above, that not shares some of deterministic proprieties, are possible by the same procedure of upgrading this basic sense of fatalism. If the minimal level for fatalism we seek on any more complex level, some known distinctions among fatalisms will be lost. However, in so-called logical form of fatalism usually we find some same layers that form the logical determinism where, additionally, *the logical necessity* is interpreted as *the logical inevitability*. In that sense, the term logical fatalism, as an extension of logical determinism, would be appropriate.

In both cases, either regarding determinism or fatalism, we are able to add some other features as a building block that will shape appropriate intended conception: temporal direction, causality, logical or physical proprieties, laws (laws of nature, statistical laws, probabilistic laws, etc.). Adding any of these distinct additions results in different philosophical conception and many of them are mentioned above.

Numerous composite combinations of elemental notions in a like manner, which leads to different philosophical conceptions, seem to be possible. Our suggestion here is that these combinations grown up on and are combined from the more elemental layers that need to be further investigated as the composite particles of complex conceptual structures. Every of these combinations, in whatever manner could resemble to some other compound of deterministic sort, have different meaning and leads to different philosophical standpoints.

Our primary interest here is to draw attention to various philosophical approaches to determinism and to sketch a way out for their explicit and transparent presentation but there is an open question, for some further discussion: is it possible to form exhaustive list of determinisms or fatalisms and their components?

16.

Determinisms we have outlined so far are composite in their character. Reducing them to their more elemental building blocks would be of help both for better understanding these composite conceptual structures as well as for better understanding of theories grounded on such compositions.

Could proposed classification of this sort be useful and philosophically relevant? Our position is that it can make more precise meaning of wide range of theories usually put under the same roof. Applying the proposed method it is possible to show how lot of misunderstandings could be escaped by appropriate bearing the concept of determinism and that heedless use of the notion easily leads to oversimplified results. Here we will take just one illustrative example from domain favored to scholars involved in debates on determinism.

Aristotle, in Ch. 9 of his *De Interpretatione*, seems to wish to acquaint us with his deterministic opponent. He introduces several illustrations and, among others noted there, well-known the sea-battle example, frequently studied by scholars. Commentators usually presume that mysterious Aristotle's opponent has to be some Megarian philosopher. They are simply taking over some features from proposed picture for making a profile of so-called hard exponent of determinism, *i.e.* the *(logical)* fatalism. This qualification without doubt corresponds with another example given, about truth of the future statements. Aristotle brings it into debate when imputed to his opponent claim that 10.000 years ago "it has been true that it will be true". But if to this deterministic picture we add 'the lazy argument example', the things now changes. With inclusion of this another example, the outcome would be that either Aristotle had no enough clear and refined picture about character of determinism he struggles with or his opponent is inconsistent. The most commentators of the issue, the ancient as well as modern, guided by spirit of loyalty, usually pass over this difficulty without its necessary elucidation.

Conflicted conceptual position can be exceeded only by an alternative interpretation of Aristotle text that will respect the fact that he fights there with several philosophical conceptions about the truth of future contingents. In respect to a way Aristotle exposes his problem either there are some inconsistencies in picturing his opponent *or* there is *not only one* but *at least two rivals* Aristotle is faced with. In that sense, the most acceptable exposition of the text would be, that even Aristotle is consistently faced here with *one problem* – the problem of truth of future contingencies – he fights with *two mutually different opponents*, one deterministic in orientation and another who is representative of fatalism. However, it is necessary to add here that Aristotle's fatalist is not an exponent of fatalism that rests on some deterministic layers, in the above sense of the logical fatalism. His fatalist there advocates inevitability of some future event but at the same time he allows empty space for intermediate agency maneuver period, that is, for (some restricted) free choice between alternative possibilities. This fatalism not rests on deterministic layers neither on deterministic kernel in the above sketched sense. Two conceptual profiles introduced by Aristotle, one deterministic and another fatalistic, are obviously mutually in the conflict.

Such interpretation, in some aspects, changes usual and traditional picture of this well-known text. If Aristotle polemicizes with several rivals supporting different mutually conceptions, then his intention could be understood rather as the general attack to those (who *at all* or at least *partially*) claim the actual truth of statements related to future contingents. We believe that this is its more

probable version (in accordance with the principle of charity) than believing that he wastes his time by confronting with a strikingly inconsistent and unconvincing opponent.

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