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Without time, the world becomes Leibnizian

There is no agreement on whether Gödel's argument for the non-existence of time is valid. Nonetheless, if there is even a small chance that this can be the case it is surely worth to consider how the non-existence of time would change our world view. In this essay, I want to focus on the question of how would it affect our metaphysics, especially the notion of causality, if we assume the non-existence of time. I also argue that the best candidate for the metaphysics of the world without time is Leibniz' monadology.

1. Preliminary remarks

1.1 Time is 'directional'

Let me start with a couple of remarks concerning the notion of time. I want to stick to the Kantian conceptual framework which will serve as a background for further reflections[1]. According to Kant, one of the essential features of time is that "Time is in itself a series (and the formal condition of all series)" (B438-439[2]). Accordingly, time "has only one dimension: different times are not simultaneous, but successive (just as different spaces are not successive, but simultaneous)" (B47). Conversely, in space "there is no difference between progress and regress, because it constitutes an aggregate, but not a series, since all its parts exist simultaneously" (B439).

From these passages, I want to extract the simple intuition which lays behind our common-sense notion of time, namely that *time is 'directional'*. It simply means that time passes in a certain direction: from past to future and not in any different direction[3]. In other words - to use the term used by Gödel (see 1949/1995: 235) – "the flow" of time has a certain (fixed) direction. On the other hand, the things are different if it comes to space. As Kant puts it, space is "an aggregate", not a series and there are no differentiated directions in space[4]. It is also worth noting, that these considerations accord with Leibniz' view on space and time as specific kinds of *relations* between substances and not substances themselves.

Interestingly, one can also draw a connection between the 'directionality' of time and the classical Aristotelian notion of time. As Aristotle states: "Time is a measure of motion" (Aristotle 2004: 61). If time depends on motion in the strong sense then it seems reasonable to assume that if motion always has a direction, then its measure (time) should also have a direction, 'corresponding' to the direction of this motion.

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[1] Considering issues discussed here, I believe such an approach is well-motivated. Gödel as well as Einstein were 'raised' in the Kantian tradition which, surely, dominated the German-speaking world of their times.

[2] When referring to Kant's *Critique of pure reason* (1998), I give the pagination of the second original edition (B).

[3] If we assume that time is one-dimensional (which also seems to be the essential feature of intuitive time) it is enough to say that it doesn't go in the opposite direction, i.e. from future to past.

[4] I am considering here an intuitive, physical space – so three-dimensional Euclidean space.

1.2 Temporal series and causality

With some simplification, we can say that for Kant the causal relation between two objects is based on the idea of the 'temporal series' and this way of thinking can also be found in Gödel's philosophy. Wang in (Wang 1995) presents some of Gödel's remarks which he made in their private conversations. According to (Q6), Gödel said: "The real idea behind time is causation: the time structure of the world is just its causal structure. Causation in mathematics, in the sense of, say, a fundamental theorem causing its consequences, is not in time, but we take it as a scheme in time." (Wang 1995: 229). There is no doubt that the statement: "the time structure of the world is just its causal structure" accords with the Kantian view. But the relation between time and causation seems to be opposite for these two thinkers. For Kant the concept of time (as it is the "formal condition of all series") is a fundament of the concept of causation. On the contrary, for Gödel the relation goes in the opposite direction: it is the idea of causation that lays behind the concept of time. I believe that source of this disagreement comes from the fact that they had two opposite approaches to philosophy in general. Kant's starting point was the transcendental subject. We would say that from Kant's point of view, the subject *imposes* its categories on the world. According to this perspective, time is a transcendental form of the inner sense which constitutes the notion of causal series. Conversely, Gödel had more "objective" approach in the sense that he used to insist that our human concepts need to be derived from something objective – so in this case, that the concept of time should come from the objective causation which is the structure of the world in itself. This is why he claimed that "the real idea behind time is causation" (Wang 1995: 229).

1.3 Intuitive and metaphysical causation

This leads us to the terminological distinction which is crucial in the discussed issues. To put things in order, I want to sketch the distinction between two opposing notions of causation. First one is the *intuitive causation* and the second is the *metaphysical causation*.

To put it pictorially, *intuitive causation* is the 'causation of pool balls'[5]. It is a causal relation between objects (in most cases, physical objects like pool balls) which directly interact with each other. It can also be a causal relation between two events (like the explosion of the bomb causing the collapse of the bridge) which involve some physical objects (in this case: the bomb and the bridge). As well as it can be a relation between an agent and an object (or an event)[6]. I believe that it was this notion have its roots in the Newtonian physics and when Kant used the term 'causality' he probably had this notion of causation in mind. There are to distinctive features of the intuitive causation which I would like put emphasis on. First, usually in the case of intuitive causal relations we can easily distinguish the cause form effect and, what follows, we can easily put them in temporal order. Second, this 'direct interaction' is always local.

The notion of *metaphysical causation* can be understood in various ways, depending on the given metaphysical theory, but the key idea behind it is that there exists a specific structure – namely the *causal* structure – in the world in itself (the world of objects, events or substances that in their existence are independent from any cognitive subject). This kind of causal structure can be

[5] Famously brought up by Hume (1964: 164) in his *Treatise on Human Nature* where he discusses the nature of causality. See the section "Of the idea of necessary connexion" (Hume 1964: 155-172).

[6] In this case, causal relation can also involve non-physical entities like mental states (e.g. my desire to know Gödel's theorem better can be a cause of me grabbing the handbook of mathematical logic). Anyway, I would still claim that we should call the 'agentic causation' an intuitive causation.

broader and more general then the intuitive causal structure. Especially, it is not limited to physical objects or agents. We can come back here to cited passage from Gödel, where he speaks of the mathematical theorem causing its consequences (Wang 1995: 229). At first glance, this concept seems counterintuitive because in this example there is no interaction between any objects – we don't see here any 'action' and hence any 'causation' (in intuitive sense). There is rather a logical relation between propositions. But when we go deeper, we can see that there is a strong analogy between the relation of logical consequence and the intuitive relation between cause and effect. Both have the structure of the *series*, both have fixed direction, and both provide a specific type of ordering, which we can call the *metaphysical causation*.

The essential difference between these two types of causation is that the intuitive causation (so the direct interaction action between objects) always take place *in time*. On the contrary, the metaphysical causation is not limited to that. According to the 'classical view'[7], in the world of mathematical objects (or mathematical truths) there is no change – therefore there is no need for time there. But, and this is a crucial insight, there still can be a time-like (or series-like) ordering in this world and this is exactly what 'metaphysical causality' stands for in the context of mathematics.

2. Non-existence of time and metaphysics

Having set the grounds, let me consider now 'the Question' of this essay: *What does it mean for our world view if, according to Gödel, we also assume the non-existence of time?* I want to focus here on the matter of how the non-existence of time would affect our metaphysics[8], especially in the one of the most fundamental of its aspects, namely: in the matter of causation. It is because I believe that causality plays a crucial role in our world view (let alone the role it plays in the scientific world view!) as it expresses one of the most basic aspects of the way we think about how the things are related to each other. Furthermore, the concept of cause in the essence is attached to the category of *explanation*, since to explain something – so to answer the question: why? – is to tell what is the cause[9].

Moreover, much deeper connection between causality and metaphysics can be drawn. When speaking of causal law as the condition of possibility of experience, Kant explicitly says: "This causality leads to the concept of action, this to the concept of force, and thereby to the concept of substance" (B249). So if Kant's right here, the concept of causality constitutes the concept of the substance (arguably the most important concept in the history of metaphysics). One can also see the 'Newtonian theme' in this quotation, namely the crucial role of the concept of *force* – absolutely central in classical (and not only classical) physics.

2.1 No time, no intuitive causation

So, if we assume that there is no objective time, how does it affect the concept of the world's causal structure? As it was pointed out earlier, time is directional and so is the intuitive causality. Furthermore, in our intuitive world view the direction of causal chains perfectly corresponds to the direction of the flow of time. Hence, without the objective time there would be no objective ordering of events, and the direction of causality would not be fixed.

[7] Also Gödel's view which sometimes he would call "Platonism" (see Gödel 1951: 311).
[8] In this essay I perpetually use the term 'metaphysics', but I suppose that in most cases it can be exchanged for the term 'ontology'.
[9] This is actually the traditional, Aristotelian view of what the cause is. See, e.g., Aristotle (M: 4).

Let us consider the simple example: the explosion of the bomb (let us call this event 'A') causing the collapse of the bridge (the event 'B'). From the intuitive perspective, it is absolutely obvious that A can cause B and that B cannot cause A. Saying that the collapse of the bridge can cause the explosion of the bomb seems ridiculous. And, what it far more significant here, it seems pointless to use the category of 'cause' (in the intuitive sense) in such case.

But if we consider the special case within Gödel's rotating universe with closed temporal loops (see Yourgrau 1991: 129-133), in principle it is possible that the time order of two events can get inverted: if we imagine that A and B are connected by the time-like loop, it is true to say both: that A happened before B, and that B happened before A.

Problems occur if we still claim that events A and B are causally related. In intuitive sense, it means that the causal order corresponds to the temporal order. In this example, it would follow that it is true that A caused B and it is true that B caused A. But 'B caused A' means that for example: (p): 'the collapse of the bridge caused the explosion of the bomb'. Again, if we use the term 'caused' in the intuitive sense, this seems ridiculous and I believe everyone would agree that (p) is just false and furthermore, that it cannot be true.

Let me summarise this argumentation. We assumed that:

(1) in Gödel's universe with time loops it is possible that for some pairs of events A and B, A happened before B and B happened before A;
(2) according to intuitive view, there is a strong *correspondence* between temporal and causal order. So, if two events A and B are causally related and A happened before B then it follows that A caused B;
(3) according to intuitive view, if A caused B then B could not have caused A and vice versa[10].
(4) A and B are causally related.

If we then combine these four assumptions we arrive at the conclusion that: A caused B and B caused A. But if we consider our bomb-bridge example 'B causes A' is false. This example shows that the intuitive concept of causality doesn't apply to such cases in Gödel's universe. Furthermore, it seems that it doesn't apply to the 'world without objective time'. In such world there would be no objective flow of time and therefore no objective causation [in intuitive sense].

2.2 Need for different notion of causality

But maybe if we broaden the concept of causality and make it independent from temporal order, causation in the world without time can be maintained?

First, I want to start with aforementioned Kant's insight: if we were to change the concept of causation, then we really need to change our concept of interaction between objects, therefore also the concept of the object itself, and, eventually, the concept of substance. Hence, we need to change our metaphysics.

Let me say something about the metaphysics of intuitive causation, so the 'metaphysics of the pool balls' – the 'everyday-life metaphysics' of macroscopic objects, which, I believe, lays behind

[10] For the matter of simplicity, I leave aside the problem of 'reflective causation' so the question whether given event A can be the cause of itself. Logically speaking, if A = B and we assume the possibility of reflective causation, then it is possible that A caused B and B caused A (what contradicts (3)).

classical, Newtonian physics. For the time being, we can stick to the image of pool balls which serves as a paradigmatic example of objects that interact with each other *causally*. These kind of objects have well-defined space-time position and momentum, and interact with each other directly – by contact. Through this interaction they pass some of their properties to each other – like velocity and kinematic energy. It is very easy to apply the concept of causality in case of pool balls as we can trace their interaction moment by moment and distinguish the series of causes and effects.

But one can easily see that this intuitive metaphysics cannot be applied so efficiently to other kinds of interactions (other than this basic 'kinematic' ones). Let us consider Newtonian gravity. It is still an interaction between two macroscopic objects, but the nature of this interaction is significantly different than the one described above. First, the interaction is not *direct* as there is no need for any contact, for there to be a gravitational interaction. Second, it is not so easy to apply the concept of *causality* to this interaction. Let us consider the Sun and the Earth going around it. Maybe, it seems right to say that the force of gravity *makes* the Earth follow the orbit (and not escaping it), so we can say that this force is the *cause* of this particular form of motion of the Earth. But keeping in mind the view shared by Kant and Gödel that causality has the time-like structure of a series, we can see that this notion of a cause is in this respect different than in the 'pool balls causation'. It is very hard to impose any kind of 'serial causation' on the gravitational interaction. There is no straightforward causal chain that we can trace back in order to find out *why* the Earth is now in this particular position in reference to the position of the Sun.

Few years before Einstein's Special Relativity has been published, Bertrand Russell wrote:

> All philosophers, of every school, imagine that causation is one of the fundamental axioms or postulates of science, oddly enough, in advanced sciences such as gravitational astronomy, the word 'cause' never occurs (Russell 1912: 1)
> (…) In the motions of mutually gravitating bodies, there is nothing that can be called a cause, and nothing that can be called an effect (Russell 1912: 14)

Russell's conclusion is that the notion of 'cause' is not applicable to the world as it was described by science of his time. Fully geometricised General Relativity and Quantum Mechanics with its indeterministic processes in a way have even worsen the situation for the usage of the notion of causality in contemporary physics.

So the question is even more imperative: if there is no time, how do we need to alter our notion of causation in order to maintain the basic idea laying behind it, namely that there is an order in the objective world or, in other worlds, that the objects are related to each other in the ordered way?

3. Answer: Leibniz' monadology

As we have seen, in the world without time there would be no room for an intuitive causation and therefore no room for intuitive interaction between objects (vel. substances). Therefore, considering non-existence of time, we are looking for a metaphysical system in which there are no interacting substances and no intuitive causation. But, as stated at the end of previous section, it should be a system that allows us to preserve the idea of the order of things.

Surprisingly, it is the Leibniz' monadology (one of the most 'exotic' metaphysical systems!) that comes with help. Let me then present some of the fundamental tenets of this system which answer 'our needs'.

First, in Leibnizian metaphysics there is no interaction between substances – no monad can cause any change in the other: "Monads have no windows (…) the natural changes in monads come from an internal principle, since an external cause could not influence [*influer dans*] their interior" (Leibniz 1989: 643-644). Moreover, there is no genuine *physical* interaction between them as monads are simple spiritual, hence not material, substances (see Leibniz 1989: 643-644). The change (essentially associated with time) of monad's attributes comes from its 'interior'. Hence, Leibniz' metaphysics is not limited to the idea of temporal ordering of causal relations (which intuitively refer to the interaction between objects)[11].

Second, there is a specific ordering in the world of monads – specific 'harmony' as it is in the Leibniz' concept of "pre-established harmony" (Leibniz 1989: 651). This harmony sets relations between substances but these are not causal relations (in the intuitive sense). Even though substances don't interact with each other, changes of their attributes are perfectly 'harmonised'. Moreover, this harmony is established independently from the perspectives of individual substances.

Third, Leibniz speaks of causes (and describes several types of them: efficient, final and formal) but he uses this term in a different sense than we usually do. In simple words, I would say that for him the notion of cause has more *formal* character. With his rather bizarre metaphysics he is not limited to the physical causes and local interaction. From the historical point of view, I believe that he inherited the notion of cause from the Scholastic tradition which roots go back to Aristotle himself (who introduced four types of causes: the same as Leibniz, plus the material cause[12]). Moreover, his philosophy is considered to be *deterministic*. But it is crucial to see, that this is a significantly different determinism than e.g. Laplace's determinism based on classical physics. In monadology, the determination doesn't come from causal interactions between substances which follow some necessary laws. It is established by the universal harmony and hence is independent from causality and the 'time parameter' present in dynamical laws of classical physics.

Fourth, finally let us consider the Leibnizian notion of time. By my lights, Leibniz' metaphysical system is absolutely consistent with the non-existence of the 'cosmic time' as it is described by Gödel[13]. According to Leibniz, the world in itself is the world as it is perceived by God. But from God's perspective, there is no change and, hence, no flow of time. In monadology, time is only a phenomenon of finite substances and their 'subjective' perspectives what fits surprisingly well

[11] Furthermore, it is not limited to *locality* as well: "It follows that this communication extends to any distance whatever. As a result, every body responds to everything which happens in the universe, so that he who sees all could read in each everything that happens everywhere, and, indeed, even what has happened and will happen, observing in the present all that is removed from it, whether in space or in time." (Leibniz 1989: 649). So maybe it can also help to set the metaphysical background for non-local interactions in quantum mechanics. If that would be the case, it would also show that Leibniz' monadology not only serves as a good ground for theory of relativity but also quantum mechanics – two most important paradigms in contemporary physics.

[12] See Aristotle (2004: 19-21).

[13] The term 'cosmic time' is used by Gödel in order to refer to the 'objective' or 'real' time in models of General Relativity (see Gödel 1946/9-B2). This 'cosmic time' in principle is supposed to be independent form the 'subjective' time of any particular observer. For Gödel it is the time of the world in itself.

to the conceptions of the 'relative time' of Einstein's theory and the 'subjective time' in Kantian philosophy[14]. And in case of Einstein, it is not of coincidence as it is argued in Agassi (1969), where author writes that "Einstein professed himself a Leibnizian and declared (…) the superiority of Leibnizianism [over Newtonianism]" (Agassi 1969: 331).

Furthermore, we can see a deep connection between Leibniz' view on the world in itself and Godel's idea of world without time. It is worth noting here, what Wang writes about Gödel's own view on his philosophy, that: "On several occasions Gödel said that his philosophy is, in its general outline, like the monadology of Leibniz."[15] (Wang 1995: 233). Reading Wang's memories from conversations with Gödel, one can get the impression that Gödel would insist on the irrelevance of time in our perception of the world. For instance, when speaking of Hegel, Gödel was supposed to say that Hegel "[took] time too seriously" (Wang 1995: 229).

4. Summary

I've been trying to show that in the world without time there would be no causality in the intuitive sense. But, it doesn't have to mean that we need to abandon this fundamental notion. It rather forces us to consider broader concept of causality which can be found in Gödel's as well as Leibniz' philosophy. The disappearance of intuitive causality leads us to counterintuitive metaphysics of non-interacting substances which are the base of Leibniz' monadology.

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[14] About the connection between conceptions of time in theory of relativity and Kantian philosophy, see Gödel (1946/9-B2).

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