

The Logical State of What Underlies our Reality

Marcel-Marie LeBel

The “fundamental” aspect of something often means its simpler constituents that are not evident or even hidden and that support the more complex emerging part that is readily accessible. With observers and instruments, physics studies our experience of the universe. The universe, on the other hand, is not made of “experience”. The universe is made of some “stuff” that exists and constitutes the domain that underlies our reality. In this paper, we will first make the case for the existence and importance of this domain. Then, we will argue that this underlying domain constitutes a knowledge domain by showing that it is “knowable”, in the sense that it can be logically deduced from the strict necessary conditions required for something to be created from nothingness, and for a logical system made of “stuff” to be operational. Some preliminary insights into such a logical system are obtained by examining the logical creation and logical operation of such existing elements.

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Introduction

One could ask how well we understand the universe. In order to answer this philosophical question, one would have to stand back from all that we know and consider what is being addressed and what is being missed. What does “understanding” the universe mean? Is it about having perfect descriptions of natural processes in the form of laws of physics? These laws allow us, for example, to predict a solar eclipse or to build a complex aircraft engine. These two examples appear to cover it all. They show that both how the universe works by itself and what we can do with the universe follow the same laws of physics.

We could then conclude that we do understand how the universe works and that this is a complete knowledge of the universe. But the philosophical exploration of our knowledge landscape does reveal a gap. Physics studies our experience of the universe, but the universe is not made of experience. We describe the universe like some sort of a “show” but the universe is not built as a show. The universe “exists” and is made of some stuff or “Substance” that exists and with which we interact to create the show. The usual dimensions required for the description of the show do not really exist, as in a “World without World” ([1], p. 9). It is not to say, for example, that a galaxy or a chair does not exist. We simply say that the picture or even the idea of a whole galaxy or of an entire chair is the result of the sentient mapping of our knowing about parts that are separated or extended. We may use space, fields or manifold to map out our “knowing” of separated or extended parts, but “knowing” is not a dimension of the universe. The universe exists and happens and we make our dimensional reality from interacting with it. Also, the laws of physics describe regularities between observational facts, “facts” that do not leave any place for the actual logical “cause” for some event to happen spontaneously.

This “ontological” gap in our knowledge of the universe consists in not knowing what type of “substance” constitutes its existence and what type of “cause” is behind its spontaneous evolution. These two philosophical concepts of substance and cause are necessary in order to support the existence and evolution of the universe for the past 13.8 billion years, before we showed up to experience it. How important is it to know what the universe is made of, and what principle makes it evolve spontaneously? It does not require much thinking before one realizes that, without the answer to these two questions, we don’t know what we are really doing. Irrespective of all that physics and science in general have accomplished, we do not know what it is exactly that we are doing. This shows especially when it comes to questions related to causality, time, and gravity. For most people, the answers to these two questions that would first come to mind, is that matter is a substance and that energy is a cause. Ontologically speaking, it is not so. In short, our reality is the sum of all our interactions, physical and mental, with the substance of the universe. On the other hand, the present fundamental ontological consideration must put aside all of our reality and start with the essential logical requirements for some substance to exist. The observer’s perception is simply not required. However, his intellect and knowledge are required in order to deduce the elements of this fundamental ontology. This approach should reveal the logical state of what underlies our reality.

Substance and Cause

We will now define what “substance” and “cause” are as understood for the purpose of this paper.

A “substance” is some stuff that exists by itself. When the observer (we) interacts with the substance, it creates in us an “experience”, e.g., colors, sounds, etc. An experience is always created from the interaction between the observer and the substance, i.e., an experience requires both in order to happen. But a substance does not need our interaction in order to exist. This means that a substance could exist in a form that we do not experience.

The “cause” is understood here as a logical reason for some event to happen spontaneously. By logical reason we mean some actual spontaneous logical operation between existing forms of the substance. Finally, as a fundamental ontology [\[2\]](#), we should not expect any direct empirical proof for either substance or cause.

Asking “why?”

It is difficult, at first, to conceive the type of question that one should use in order to explore the above ontological domain. Leaving our reality altogether is not a familiar approach, to say the least. From the start, we do not have to try to form any mental picture because this realm has none. Out there, it is “every point for itself”. The type of question required here is already built into our language. Instead of asking “how things work?”, we could ask “why things work?”. The question “why”, in a logical sense, removes the need for a description and the observer. It also calls for a logical answer which in turn requires a logical system, made of some substance motivated by some intrinsic logical cause.

For example, we have something like the “how gravity works” of Newton, the “how gravity works” of Einstein, the “how gravity works” (MOND) of Milgrom, etc. Do we really need anymore “how gravity

works” theories? These theories are just a sample from a large number of possible theories or descriptions for the very same event. On the other hand, asking the question “why gravity works” would address the only possible logical reason for this one event to happen by itself.

Why should the ontological system be logical or logically driven? We know that the universe works according to rules of logic from the fact that it obeys the rule of non-contradiction and from the “unreasonable effectiveness” of (logic-based) mathematics in its description [3]. Logic is the basis of all our truth making activities, science, mathematics, etc. The ontological domain of the universe must be based on the existence of a logical substance and on the motivation of a logical cause.

A Suggested Approach

How do we proceed in order to answer the “why” question? Why can anything exist? The question “why” something exists demands a logical answer that would come from a logical system. So first, we have to consider the universe as a logical system, made of some substance(s) and operating via simple rules of logic. The boundary condition is the rule of non-contradiction (RNC), the same rule we use in logic and mathematics. The RNC determines the limit of what is possible or, what is impossible. We first address the requirements of a logical system operating with some substance. How many substances and how many causes are allowed in such system?

– A logical system that is operational in substance, allows only one type of substance and only one type of cause.

Here is why. If there were two different substances, say substance A and substance B, they would not be logically operational because they are not comparable. The RNC would stop at “A not equal B” which is just the definition of them being two different substances. On the other hand, substance A and one of its variations substance A+, are comparable and distinguishable by the RNC, meaning, they really exist with respect to each other and they may operate logically on each other, as will be shown below. Therefore, only one type of substance is allowed in a substantial logical system.

If there were two different types of causes in the logical system, there is no rule of logic to determine which one of the two causes has precedence over the other one. Also, two types of causes would present a choice, which is not conducive to a linear “choiceless” path required for the operation of a logical system. Therefore, only one type of cause is allowed in a substantial logical system. Also, since the substantial logical system is all made of only one type of substance, the cause can only be built into some aspect of that substance.

The Origin: Creation, not Assumption

It is a common practice to assume some early stage of some system as already set, containing elements already present or existing in some initial states. Here, the type of substance that will be allowed to exist in the logical system (universe) depends specifically on what is permitted by a logical creation according to the RNC. Since we are talking about substance and “existence”, the contrary of existence or “nothingness” must be the minimum initial condition. This way, “existence” has a logical definition with

respect to non-existence. Then, the problem is the following. According to the RNC, we can't get something to "exist" from nothingness. Nothing can come from nothing. Yes and no. Something "happening" is short of "existing" or "being". A dynamic process, for example, does not "exist" *per se*, it happens. A dynamic process should either not fail the RNC, or simply avoid it. So, the substance allowed to make up the logical system should be some sort of dynamic process. As a *dynamic* process, this substance "does something" *at a certain rate*, which "rate" is a possible variable. This variable could offer various comparable and distinguishable forms or variations of the same process, all remaining logically operational with each other. From here on, the word "form" will be used for any distinguishable forms of the dynamic process, either the basic or more complex forms. The word "variation" will be reserved for any distinguishable variations of the rate of the basic dynamic process. The original "spark" or reason initiating the dynamic process from nothingness is not discussed here. For now, we may look on the side of some quantum mechanical suggestion, e.g., [4].

Example of a Logical Operation

We will now present an example of a logical operation between two different forms of the dynamic process/substance. Let's assume that the simple or basic form of this dynamic process can make combinations to build more complex forms of the same process.

Let's say we have a background of this simple dynamic process. We then place within this background of simple process one of the more complex forms of this process. What will happen? The more complex form will replace locally the simple form of the process. This is a logical substitution. This happens because according to the RNC, the same type of dynamic process (comparable) in one place, cannot be both complex and not complex or, simple and not simple (RNC). We understand with this example that the reason for there being only one type of substance/process is that it allows only forms or variations that are comparable and distinguishable in order for the RNC to work. These conditions, along with the "co-location" of the forms involved in the operation, are essential for a system in substance to operate logically. As one can see, no metrics as quantities, shapes or geometry is inferred or required for a logical substitution. This explanation is why the logical substitution happens in every point of the operation, without the need for the overall picture as with a description. In order for any form to be able to exist by logical substitution "anywhere" within the system, we have to assume that the whole substantial system is made of a "background" of the variations of the simple dynamic process.

Logical Substitution: An example

Here we offer a possible practical example for a logical substitution. If we were to assume that the dynamic process in its simplest form is *time* and that in one of its more complex form it is *matter*, then the logical substitution of *time* by *matter* would constitute the logical explanation for "why" matter makes gravity. We will understand better this explanation with Bill Unruh's statement below. In this example with time and gravity, we still have to figure out why a "local" substitution of time by matter produces a "non-local" effect away from the substitution as gravity does. This will be addressed in the discussion.

The Cause

As mentioned above, the cause has to be some aspect of the dynamic process/substance. The rate of evolution of this dynamic process could provide the variable for such a logical cause.

Let's assume, as in the above example of logical substitution, that the dynamic process is *time*. Such a type of cause based on a difference in the rate of evolution of time would be supported by general relativity, as it is explained here by the physicist Bill Unruh ([5], p. 4).

"... A more accurate way of summarizing the lessons of General Relativity is that gravity does not *cause* time to run differently in different places (e.g., faster far from the earth than near it). Gravity *is* the unequable flow of time from place to place. It is not that there are two separate phenomena, namely gravity and time and that the one, gravity, affects the other. Rather the theory states that the phenomena we usually ascribe to gravity are actually caused by time's flowing unequally from place to place..."

First, we will note that Unruh's statement presents "time" as something that does exist by itself and that may be evolving at different rates here and there. From this statement, we may say that the spontaneous gravitational fall of an object toward the ground is "caused" by some difference from place to place in the rate of evolution of time. We know that time does run slower closer to the ground. This in turn, tells us that a falling object is in fact moving spontaneously toward a slower rate of time. This says, in ontological terms, that existence is "relatively" more "probable" (motion) where the rate of time is relatively slower. The word "relatively" is used here in the sense of "from close to close". Also, the word "probable" is introduced here in order to reflect the fact that the fall is more of a tendency than a "certainty", since something like a hand could catch a falling apple. But *time* is something of our reality and it does not explain logically anything about the cause. A more complete suggested logical explanation of the cause, using only the dynamic process, will be found in the discussion below.

Discussion

The knowledge gap or underlying domain is real. In fact, it takes little or no philosophical training to admit that things exist and happen without the need for us to watch or be aware of them. Because these things exist by themselves, they simply do not bear the properties and dimensionalities that our experience attributes to them.

By starting with the two philosophical concepts of substance and cause, we are assuming that they are sufficient for the present purpose. There could be other concepts necessary for the understanding of the domain underlying our reality... Nothingness was introduced as the necessary opposite to "existence" in order for existence to have a logical meaning with respect to non-existence. This is in fact about setting the foundation of a logical system in substance. There are nowadays a few theories based on cyclic models that do not require a "creation" or "nothingness" as an initial condition (a review in [6]).

The substance was presented as a dynamic process because it was said that its “creation” from nothingness would avoid or not fail the rule of non-contradiction. Although this makes sense, a more elaborate demonstration is required.

Where does the RNC come from? The RNC is the “quality” of something that really exists. Anything that really exists obeys the RNC and does not suffer a contradiction. We will note that the system was born from a loophole in the *primitive* rule of non-contradiction “1 is not 0”. The created system obeys the *advanced* rule of non-contradiction that is “1 cannot also be 0 at the same time”, a rule that admits change. Does the advanced rule of non-contradiction also have a loophole?

If a form exists in one place within the logical system, then, that place is taken by logical substitution. Anything that exists makes a difference, somehow, anyhow. If “something” does not make any difference whether it is there or not, then it does not exist. This “something” that would not make any difference is either not part of our universe, as a different substance, i.e., not logically operational with the substance of our universe, or it is just a concept of the mind.

By taking the rate of evolution of this dynamic process/substance as a variable, we can propose the existence of different forms, more complex or even “extended” variations of the same basic dynamic process. For example, a continuous transition of the value of this rate could exist in every point as distinguishable variations or points of a “field”, as we conceive them. The logical substitution between the points of variations of this “field” would ensure their distinction as well as a possible influence from close to close. This transmitted influence could possibly explain the non-local effect of a local logical substitution.

From here, the discussion will proceed in the form of simple questions and answers in order to offer a quick and speculative exploration of the subject.

– The operation of logical substitution raises the following question. “How much” basic dynamic process is being substituted? How would we measure the amount of dynamic process that is being replaced? The question actually addresses the variable(s) of the dynamic process. One such variable is the rate of evolution of the dynamic process. Could there be another variable? The question is in fact about whether or not there could be another *independent* variable. Logically speaking, the dynamic process/substance is whole and cannot have any (other) “independent” variable. Therefore, the dynamic process/substance has only one variable. Since the dynamic process has only one variable as its rate of evolution, this rate is the only valid “quantity” that can be affected by logical substitution. In other words, the removal of some basic dynamic process from the background by logical substitution results in a local reduction of the rate of evolution of the basic dynamic process.

– The word “logical” entails another “quality” of sort that was used in this paper. A logical operation in a dynamic system proceeds by itself, i.e., it is *spontaneous*. The “cause” is effectively the unique motivation for something to happen spontaneously in a substantial system. Conversely, we may say that a spontaneous change is the result of the cause, a logical operation within a dynamic system.

– We said above that the “cause” was a logical reason for something “to happen”. The words “to happen” mean that something changed. In our substantial system, forms of the basic dynamic process exist by making a difference, a change, by replacing locally the basic dynamic process by logical substitution. Let’s try something with this “background” of basic dynamic process, and assume that it is locally “non-uniform”, with rates of evolution varying from close to close. What would happen to “existence” by logical substitution in this non-uniform background? The result would be that the logical substitution or the “existence” of any form in it would also be “non-uniform”. A non-uniform existence, or existing more one way than any other, is a change that we call “motion”. Then, the “cause” for motion, a change, is a locally non-uniform rate of evolution of the basic dynamic process, from close to close, that translates into a non-uniform substitution or existence of any form present in it. Although Bill Unruh’s above explanation supports the assumption that *time* is this dynamic process/substance, the logical “cause”, as a locally non-uniform rate of the basic dynamic process, is not contingent on this assumption. In other words, at this fundamental level, the concept or name “time” is not necessary in order to explain logically why the cause produces a non-uniform existence and motion.

– The question remains as to what determines which direction the motion of this non-uniform existence will take for the substituting form. Would the substituting form move toward a slower rate of the basic process? Let’s try explaining this direction. Since the substitution is based on the rule of non-contradiction, we could posit that the substituting form moves spontaneously toward a slower rate of the basic dynamic process because it is a smaller difference that is being substituted or, a “lesser contradiction”. In other words, the spontaneous motion of the substituting form toward a slower rate of the basic process is a motion toward a more *logical state*, away from a “stronger contradiction”. Moving the other way, toward a higher rate of the basic process, would increase the contradiction. In a sense, we could say that this spontaneous motion is the *resolution in progress* of an “illogical state of affair”, which is here the non-uniform existence of the substituting form. Conversely, we could say that any spontaneous motion is the resolution in progress of an illogical state of affair, a non-uniform existence.

– Then, what is a logical state of affair? A logical state of affair “within” the present system, would be the uniform existence “in all directions”, or no motion, of the substituting form. Why would that be? The reason for the uniform existence in all directions to be a logical state of affair could be that the basic dynamic process being substituted “evolves” also in the same way, i.e., in all directions... Such evolution in all directions would be like an explosive process. Now, if we were to make this local non-uniformity of the rate of evolution of the dynamic process to become infinitely small, we would get the uniform logical substitution or existence of the form without motion. In other words, the cause for “uniform existence” and “non-uniform existence” is one and the same. Only the geometry of the substitution differs. The uniform existence, or no motion, proceeds by spherical (or symmetric) substitution of a uniform background of basic dynamic process while the non-uniform existence, or motion, proceeds by non-spherical (or non-symmetric) substitution of the non-uniform background of basic dynamic process. It would seem that the single operation of logical substitution is sufficient to explain both the uniform existence, or stable position, and non-uniform existence or motion.

– Considered from the “outside”, this spontaneously evolving system also represents an illogical state of affair *in progress of resolution*. Let’s note that “in progress of resolution” is only a direction and it does

not entail that the actual “resolution” will ever happen. Somehow, we already knew that the present substantial system is illogical because it was created from a loophole in the primitive rule of non-contradiction. Still, the system is internally logical by obeying the advanced rule of non-contradiction.

– Why is it that the dynamic process “happening”, was able to avoid the RNC and allowed to make up the system? Since a logical operation in substance requires the co-location of the elements of the operation, it is possible that the basic dynamic process happening consists in keeping separate somehow “nothingness” and some sort of excitation, so that no co-location is offered for the RNC to fail. So, what should we call this process of separation between nothingness and this excitation? Would it be space or time? We said above that “space” was just the sentient mapping of our knowing about extended or separated parts. Then, we are left with “time” as a name for this process of separation or avoidance. Or, maybe the co-location of nothingness and the excitation does happen but is too brief for the RNC to operate? The equations of logic we normally write on paper are “instantaneous” operations. It is possible that there is a maximum “speed of logic” when this logic happens in a substantial system.

– The dynamic process based on logic does not seem to require any “numbers” or units in order to work and yet, the “quantum” of quantum mechanics begs the question. Why is a quantum unit “required”? It is possible that the quantum unit is the result of the law of the excluded middle which is required for the rule of non-contradiction to operate decisively about what exists and what doesn’t. We have to assume here, that the quantum is the basic unit of substitution or logical existence. Such a unit of existence would ensure the digital logic operation of the RNC working in a substantial system.

– As far as we know, the Planck quantum has the same value throughout the universe. The Planck would then be a “fixed value” or “property” of the dynamic process. For the same logical reasons invoked above for there being only “one *independent* variable” there can be only one “property”. The property being the same everywhere, it defines specifically all the forms of the dynamic process/substance as the same type of substance, “operational” with each other, or existing within the same logical system or universe. If there was another similar dynamic process but with a different value for the Planck quantum, it would constitute a *logically different* substance, not logically operational within our universe. In other words, this different substance would only exist in its own universe, which universe could well be “co-located” with our own universe, and yet without any interaction whatsoever with our own. Also, it is possible that the uncertainty in quantum mechanics is a sort of “vacuum Brownian motion”, coming from the imprecise existence of small forms (same order of magnitude) of the dynamic process, due to the logical substitution of a basic dynamic process agitated with fluctuations in its rate.

We could then summarize this logical substantial system by saying that it is an “illogical state of affair” made of various forms of only one type of a dynamic process/substance, which substance has only one “variable” and only one “property”, the forms of which are operating with each other using only one logical spontaneous operation, the logical substitution or the motivating cause.

The above discourse is a speculative exploration of the subject, offered as examples of the ways and directions in which we could work with such subject matter and address some questions of physics. We could sum up with a bit of a philosophical overview. Logic is scale invariant. By this we mean that the

rules of logic that animate the underlying reality should remain valid at all levels of complexity of the substance and should emerge and translate into our logical perception of those levels.

Conclusion

The purpose of this paper was twofold. First, it was about making the case for the existence and importance of the domain that underlies our reality. Secondly, it was about showing that it is a knowledge domain in that it is knowable in the sense that it can be deduced logically from a few necessary initial conditions. A substance, a cause and logical operation were proposed for this domain. This perspective, or rather this conception, is not a familiar one and speculations and examples were provided in order to suggest ways to navigate within such domain and address some of the numerous questions raised. The greatest hurdle that this conception faces is the poorly understood (or accepted) relationship between our reality and this ontological domain. A domain that may have appeared impossible to explore and know, as was once stated by the physicist and philosopher of science Sir James Jeans [7]:

“To sum up, physics tries to discover the pattern of events which controls the phenomena we observe. But we can never know what this pattern means or how it originates; and even if some superior intelligence were to tell us, we should find the explanation unintelligible. Our studies can never put us into contact with reality, and its true meaning and nature must be for ever hidden from us.”

With the present paper, we beg to differ with Sir James Jeans’ statement. The domain is knowable and the explanation is intelligible and based on logic. As for the “superior intelligence”, what is in fact required is a true willingness to address this domain and the mental attitude to do it.

From the above discourse, we understand that the questions of “Why” and “How” things happen are both necessary. Such is, it seems, our relationship with the universe. The answers to the questions of why (logically) and how (metrically) something happens come from two different approaches that are mutually exclusive, but complementary. Many arguments presented above require further demonstration. A formalized logical system will have to be developed, with mathematics, logic, and the “how” side of physics helping us stay in line.

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