Reality is Digital, but Its Perception as Digital or Analog Depends on the Perspective of the Observer

Abstract

The subject of this essay contest is "Is Reality Digital or Analog?". Here, I suggest that reality, or what I call existence, is, at its base, digital (ie, discrete), but whether or not it is perceived by an observer as digital or analog (ie, continuous) depends on the perspective of the observer. The rationale for this argument is as follows. First, I propose that a thing exists because what is contained within, or meant by, that thing is completely defined. A complete definition is equivalent to an edge or boundary delimiting what is contained within the thing. If existent things require the presence of a complete definition/edge/boundary to exist, this means that existence comes in the form of discrete, or digital, chunks delimited by this edge. Next, I describe how an infinite set of discrete elements appears to an observer as either discrete or continuous depending on the perspective of the observer relative to the set. I show how this situation may relate to the perception of a discrete reality as either discrete or continuous depending on the perspective of the observer relative to reality. Finally, using the above definition of an existent thing as having a complete definition, I propose a discrete, cellular automata-like model for existence.

Results

Before presenting my proposed solution to the question of "Is reality digital or analog?", I first discuss some terminology. I consider, and will use interchangeably, "digital" and "discrete", "analog" and "continuous", "reality" and "the entirety of existence" and "real" things and "existent" things.

Why do things exist?

I suggest that for a thing to exist, the contents of, or what is meant by, that thing must be completely defined. For instance, books have edges and people have skin that completely define what is contained within. Even a concept or mathematical construct has a complete definition, or description, as to what is meant by that concept or construct. Would the mathematical construct "2+2=4" really exist if it didn't contain within it the idea that two groups of two existent things are put together to form one group of four things? If one tries to visualize an existent thing where one doesn't know what is contained within or meant by that thing, it is pretty hard to do. A complete definition is equivalent to an edge or boundary defining what is contained within. This complete definition, edge or boundary defines what is contained within and, thus, gives existence and "substance" to a thing. An example of this is that in mathematics, the curly braces, or edge, around a set signify that the elements contained within the set are completely defined. A set would not exist if the elements contained within it were not defined.

Some things may exist only in the brain (concepts, ideas, mental images, etc.), and others may exist only outside the brain (physical instantiation of a book, mountain, etc.). Some things

that exist only in the brain such as the mental image of Jill Smith's car may describe a corresponding, but different, existent thing outside the brain such as the physical instantiation of Jill Smith's car. The mental image of the car and its physical instantiation are two different, existent things. Stated more generally, the mind's conception of a thing is not the same as the thing itself. This point will be discussed more in the following sections.

One may argue against this materialist view and say that some things can exist neither in the brain nor in the physical world outside the brain but, instead, in some sort of abstract, Platonic realm. I respond: Please show me this realm. Point it out right now. Or, at least, provide some physical evidence for its existence other than one's say so. Mathematicians and physicists often use this type of assumption-based reasoning when they say that mathematical and physical truths exist independent of anything physical[1,2]. Again I say: Show me this place where these truths exist. Until that can be done, this viewpoint cannot be argued rationally and certainly cannot be the basis of a hypothesis for explaining why anything exists.

Others have questioned the role of the edge, or periphery, in defining an existent state. For instance, Goldstick[3] writes "There is no more basis for identifying a hole with its periphery than for doing the same with a bump. Rather, a hole and a bump are what are contained within those spatial bounds." This statement incorrectly denies the importance of the spatial bounds in two ways:

- Without the spatial bound (ie, the edge or boundary), there would be no "contained within". To use the word "within" requires the spatial bound in order to specify within what. The bound or edge defines "within what" and, thus, gives existence to what is "contained within".
- When visualizing a bump such as a pile of dirt covered by a thin, peripheral layer of asphalt, it is easy to say that the bump is the dirt contained within the asphalt and that the asphalt periphery does not give existence to the bump. But, now try to imagine the pile of dirt without the asphalt and without any spatial bounds defining the dirt particles or how much dirt there is. It's not as easy. Then, try to imagine the atoms, and then the electrons and quarks that compose the dirt where those atoms, electrons and quarks do not have any spatial bounds defining what is contained within or meant by them. It is even less easy. Thus, it seems evident that as one digs deeper and deeper to more and more fundamental levels of existent states, the importance of the edge in defining what is contained within and in giving existence to a thing becomes more clear.

Taken together, the above suggests that a thing exists because it has a complete definition, edge, or boundary that defines what is contained within and that gives existence to the thing. If existent, or real, things require the presence of a complete definition, edge, or boundary in order to exist, this means that existence, or reality, comes in the form of discrete, or digital, chunks, each delimited by their edges.

Both an infinite set of discrete elements and a discrete reality can appear as either discrete or continuous depending on the perspective of the observer

In this section, I discuss how an infinite set, N, would appear to different observers and show how this can also apply to our perception of reality. First, consider a set, N, defined as containing existent (ie, discrete), finite-sized elements such as balls whose numbers extend outward an infinite amount relative to any location and orientation of any one of the elements designated as internal observer O. That is, whereever O is in the set and in whichever direction O is "looking", the elements of the set extend without bounds the same potentially infinite distance in all directions relative to O. O is one of the elements of N, and it can be any one of them. Given this, then:

- O sees the contents of the set as being discrete and finite-sized balls.
- O sees its size relative to the entire set as approaching, but never quite reaching, zero. It never reaches zero because no matter how far O looks, it can never see an actually infinite endpoint of the set. From O's viewpoint, the set is always potentially infinite and, thus, its size gets smaller and smaller relative to the whole set but never quite reaches zero. If O were ever able to see the whole set in its entirety, then O's size would finally reach zero relative to that whole. Luckily, for O, that can't happen!
- No matter how far O travels within its reference frame (ie, the set, N), it will never reach the edge, boundary or "exit door" of the set due the unending nature of infinity.
- By definition of this set, relative to any element/observer O, the other elements progress radially away from it the same potentially infinite distance in all directions. This is reminiscent of the definition of a sphere. That is, relative to any O, the potentially infinite distance radiating away from O towards a potential edge of the set would be the same in all directions, and, thus, O would view the set as a potentially infinite sphere. It will be an odd sphere because the observer, or center point, O can be and at every point inside the sphere. Of course, elements within the sphere can never view the edge, so that, for them, the shape of the overall set only approaches that of an infinite sphere.

Thus, relative to finite-sized internal observer O, set N would appear as a potentially infinite space composed of discrete elements.

Next, the view of set N relative to a hypothetical, external observer is discussed. Again, consider set N, which was defined above as having an infinite number of elements relative to any location and orientation of an element/observer, O, within the set. However, now assume that there is a second observer, P, outside this set and that P's size relative to O is actually infinite. That is, P is of the same size "scale" as the entire set N, which is actually infinite relative to O. Therefore, P views the entire set N itself as of finite size, which means that P can see set N in its entirety. Given this, then:

- If P's size relative to O is actually infinite, then O's size relative to P is infinitely small, or zero. Not just approaching zero, but zero itself. Because it is a part of O, O's boundary that defines it and separates it from the other elements, is also infinitely small relative to P. The O elements still exist, by definition of set N, but they are of infinitely small size relative to the actually infinite observer P, and, thus, individual O elements and their

boundaries become indiscernable to P. These elements, therefore, don't disappear because they do exist but instead merge into a continuous space from P's perspective. That is, P would observe the inside of set N as a continuous space, as opposed to O's view of it as a space filled with discrete elements.

- P can see the whole or entire amount of N and, thus, can see the edge or boundary of N, which means that set N, in its entirety, is seen as an existent, discrete thing by P.
- P cannot "step inside" N and hope to be able to see its elements as discrete. This is because P is of a different size scale than the elements inside the set. P's scale is the same as that of the entire set, that is, actually infinite relative to O. So, even if P tried to step inside N, it would still be infinitely big relative to the elements and would, therefore, still just see a continuous space. Thus, P is "trapped" in its reference frame, or "dimension", just as O is trapped in its reference frame inside the set.

Thus, relative to infinite-sized, external observer P, set N would appear as a finite-sized, discrete, existent thing with an interior continuous space. An important point is that these arguments don't prove the necessity of an external observer, they just suggest how this observer, if it existed, would view the set.

Now, how does the appearance of infinite set N relate to our perception of reality? For one, the dichotomy between finite-sized, internal observer O's view of set N as discrete and infinite-sized, external observer P's view of set N as continuous is analogous to the dichotomy between the quantum physics-based view of reality as discrete and quantized and the general relativity-based view of reality as smooth and continuous. This analogy implies that both quantum physics and relativity can be thought of as different views from different perspectives of the same set. In this case, the observer is the mind of the scientist, and the set being observed is the infinite expanse of existence.

It is important for both quantum physics and relativity, as well as for any theory, to use an internally consistent perspective throughout the theory. For instance, if a theory describes space-time as discrete, indicating that the scientist/observer's perspective is similar to that of internal observer O, then it should ideally use the same perspective in its calculations, such as in its calculations of probabilities. Assuming a continuous, real number-like distribution of probabilities while also assuming a discrete space-time would mean that the theory is switching back and forth in its perspective of reality. Conversely, if a theory assumes a smooth, continuous, infinitely divisible space-time, indicating that the scientist/observer's perspective is similar to that of external observer P, then quantities that appear infinite in size relative to internal observers would be finite in size relative to P and the observer and thus would be attainable. In sum, perspective-switching within a theory may be warranted in some cases, but it can also cause internal inconsistencies, and the scientist should be aware of these and be cautious in their use.

The appearance of set N also has implications for mathematics, which is another way of perceiving and describing reality. The example of set N implies, at the very least, that the cardinality of an infinite set depends on the perspective, or reference frame, of the observer

relative to the set. For example, within infinite set N, observer O would assign the set's cardinality as equal to that of the set of integers, omega. However, outside set N, observer P would assign it a cardinality equal to that of the real numbers. Furthermore, the case of set N says that the perception of the integers as being a potentially infinite set of finite, discrete chunks (ie, 0-to-1, 1-to-2, etc.) and the real numbers within an integral range as being a continuum will vary depending on the perspective of the observer. That is, if the observer could decrease his size scale to that of the real numbers, they would appear as finite-sized and discrete elements instead of their usual external observer-based description as infinitesimally small. Additionally, a hypothetical external observer of infinite size would view the set of integers as a continuous, infinitely divisible space similar to how we observe the real numbers.

Together, the above reasoning suggests while reality is, at its base, discrete or digital, the appearance of reality as discrete or continuous will depend on the perspective of the observer (ie, the scientist's mind) relativity to reality. Additionally, the perspective of the observer should be taken into account when using infinities in physics.

Why is there "something" rather than "nothing"?

In this section, I propose a solution to the question of "Why is there something rather than nothing?" and show how this solution leads to a cellular automata-like formation of a universe filled with discrete, or digital, chunks. The proposed solution is based on the definition of an existent thing given in the first section as having a complete definition.

In the first part of this section, "something", "nothing" and "non-existence" will often appear in quotes because, as will be come evident, the distinction between them is not as clear as previously thought. Now, consider the question "Why is there something rather than nothing?". Two choices for addressing this question are:

A. "Something" has always been here.
B. "Something" has not always been here.

Choice A is possible but does not explain anything (however, it will be discussed more below). Therefore, choice B is the only choice with any explanatory power. With choice B, if "something" has not always been here, then "nothing" must have been here before it. By "nothing", I mean complete "non-existence" (no energy, matter, volume/space, thoughts/concepts, mathematical truths, time, minds, etc.). The mind of the reader trying to visualize this would be gone as well. But, in this complete "nothing", there would be no mechanism present to change this "nothingness" into the "something" that is here now. Because we can see that "something" is here now, the only possible choice is that "nothing" and "something" are one and the same thing. This is logically required if we go with choice B.

If "something" and "nothing" being one and the same thing is logically required for choice B, then instead of saying "That cannot be. Something and no thing are not the same.", it would be better to accept what is required and try to figure out how it could be rather than continuing to deny it. So, how can "something" and "nothing" be one and the same? First, consider

"nothing", or "non-existence". This was defined above as the lack of energy, matter, volume/space, thoughts/concepts, mathematical truths, time, minds, etc. In other words, the lack-of-all. This lack-of-all means that the mind of the reader trying to visualize this would also be gone. The lack-of-all, in and of itself, completely defines the entirety of what is present, that is, nothing at all. In fact, the lack-of-all *is* the complete definition of what is present. It tells you exactly what is there. It is completely self-defining. Nothing else is needed to say or define exactly what is present. As described above, a complete definition or description is equivalent to an edge or boundary defining what is present and giving existence to a thing. Therefore, the lack-of-all, or what has previously been referred to as "non-existence", is actually an existent state.

If non-existence is an existent state, why is so hard to visualize it as such? One reason is that we visualize non-existence within our minds, which exist. Next to our existent minds, nothing just looks like nothing. But, in doing this, as described in the first section, we are confusing our mind's conception of non-existence with non-existence itself. This cognitive artifact makes it appear as if non-existence is just nothing and not the complete definition of what is present and, thus, an existent state. If we could somehow see non-existence itself (which we, of course, cannot) and not just our mind's conception of it, we would see that only once all, including the mind, is gone, does non-existence completely define the entirety of what is present and, therefore, become an existent state.

Another way of saying the above is that because our minds exist, our mind's conception, or visualization, of non-existence is dependent on existence; that is, we must define non-existence as the lack of existence. But, non-existence itself does not have this requirement; it is independent of our mind and of existence. Only non-existence itself, in which the mind is gone, completely describes, or defines the entirety of what is present and is thus an existent state. This idea of distinguishing our mind's conception of a thing and the thing itself of course applies to all issues and not just to non-existence.

Overall, what we have always called "nothing", or "non-existence", is actually an existent state, or "something". The reason we have considered them to be different is the artifactual confusing of our mind's conception of non-existence and non-existence itself. Furthermore, because the existent state formerly called non-existence contains no parts, it is the most fundamental of existent states and is, indeed, the fundamental building block of existence. Referring back to the original question of "Why is there something rather than nothing?", this also suggests that both choices A and B were correct: "Something" has always been here, but it is one and the same as "nothing".

Now, how can the equality of "something" and "nothing" be used to build a model of existence? If what used to be called non-existence is actually an existent state and is indeed the fundamental building block of our existence, then it is also the most fundamental of "physical" particles that compose our existence. As such, it must have physical properties that allow it to function as this most fundamental of physical particles. Thus, by discussing the question of "Why is there something rather than nothing?", we are actually discussing

fundamental physics. Somewhat similar ideas have been proposed by Tegmark and others[1,2] . So, what can we say about the physical properties of a complete definition or existent state?

- First, to have physical existence, an existent state must have three dimensions. I cannot conceive of any physically existent state that has either zero height, depth or length. If any one of these dimensions were literally zero, the state would not be there.
- Second, the edge, boundary or complete definition of this existent three-dimensional state defines what is contained within and is, therefore, the same as the surface of that state. The completeness of its definition suggests that this surface would be closed, that is, it would have no openings.
- Next, this three dimensional state with a closed surface contains no information other than its being completely defined. What does this imply about its shape? Because there is no information to define corners, angles or differences in any dimension, the state would be identical in all three dimensions. That is, it would be a sphere.
- Additionally, because non-existence is the lack-of-all; then, by definition, there would be lack-of-all next to the edge of this first existent state. That is, its edge would create a new instance of the lack-of-all all around its surface. Because this new instance of lack-of-all, or non-existence, is an existent state, this means that the original spherical existent state would cause the formation of additional identical spherical existent states all around its surface. These additional existent states would then cause the formation of yet more existent states around them. This process would continue ad infinitum and would lead to an infinite expansion of identical, existent states starting from a single, initial existent state. This cellular automata-like process is similar to the big bang and its expansion to form the universe.
- Finally, it has been shown that when twelve identical, tangentially touching, non-overlapping spheres are packed around the surface of another sphere of the same size, there will be some left-over space but not enough to fit in a thirteenth sphere[4] . If the central sphere is the existent state previously called non-existence; then, as mentioned above, it will cause the formation of identical spheres around its entire surface. However, in order to cover its entire surface, thirteen spheres are needed, but, as just described, there is not enough room to fit all thirteen spheres without some overlap. Because none of the newly formed spheres would be favored, all would have an equal "right" to be there, and, thus, there would be some overlap between some of the spheres. This overlap of spheres, which all have an equal "right" to be there and are all "trying" to assume their natural spherical state, would be an initial asymmetry and would seem to be natural source of pressure and energy in the universe.

I refer to the above type of thinking, that merges philosophy with physics, as philosophical engineering. I believe this type of bottom-up, logic-based reasoning offers the best path forward for both metaphysics and physics for understanding the nature of existence. Like all physical theories, philosophical engineering must be internally consistent, be able to explain physical phenomena and provide testable predictions. This work is currently being pursued by the author.

If at this point, you are having some doubts, remember that no one knows what is inside what are currently considered to be the most fundamental of physical particles: electrons, photons, and quarks. All we really know is that these particles are existent states. As such, they are no different than the existent state that has been previously referred to as non-existence. Furthermore, no one has yet explained where energy comes from in the universe. There must be some physical mechanism. Finally, whatever the mechanism of our universe's formation and expansion, there must be, at its base, something that exists, some mechanism that this existent thing can produce more existent things and some way that these things can interact to cause energy and motion. The mechanism proposed here is not only logical but meets all these criteria.

Conclusion

In conclusion, I am proposing that existence is, at its base, discrete or digital, but its perception as digital or analog/continuous depends on the perspective of the observer. Also, the most fundamental discrete building block of existence is the existent state previously called non-existence. Finally, a cellular automata-like model of the universe was proposed based on the properties of the existent state previously called non-existence.

References

1. Max Tegmark, “The Mathematical Universe”, Foundations of Physics, 38 (2008): 101-150, especially p. 16.

2. Dean Rickles, “On Explaining Existence”, “Foundational Questions Institute Essay Contest”, 2010, http://www.fqxi.org/data/essay-contest-files/Rickles_Rickles_fqxi_2.pdf

3. Daniel Goldstick, “Why is There Something Rather than Nothing?”, Philosophy and Phenomenological Research, 40, 2 (Dec. 1979):265-271, especially p. 270.

4. In J.H. Conway and N.J.A. Sloane, “Sphere Packings, Lattices and Groups”, 3rd ed., (Springer-Verlag: New York, 1999), especially p. 21.