The separation argument and the logical impossibility of intrinsically discrete reality

One of the oldest questions in science and philosophy is whether reality is fundamentally discrete, or fundamentally continuous. In this short essay I show that this question should first be classified into two main categories. 1) Intrinsic existence, 2) Behavioral existence. I show that the first category should be continuous by definition, while the second category could probably be either continuous or discrete.

Introduction

Questioning the structure of reality is as old as philosophy itself. While at first reality looks continuous and infinite, many ancient Greek and Indian philosophers envisioned a discrete reality made of ‘’*atomos”:* uncuttable separate parts that constitute reality, just like discrete bricks constitute a building. Since then philosophers have been debating, with chemistry and physics entering the debate much later.

Abstractly speaking, a continuous reality necessarily means infinite and unending, it cannot have a smallest size or biggest number of parts. While a discrete reality necessarily means finite an ending, there should be a smallest part in which nothing can be smaller, or cannot get any smaller, it should have boundaries.

A common misconception is that a continuous reality should only be made of continuous fields (or things) and cannot be made of discrete uncuttable parts, this cannot be totally true. A reality made of infinite unending number of discrete units, let us call it an infinitely discrete reality (IDR), is a continuous reality that behaves discretely. in other words, the physics and mathematics describing the change and motion of this reality will be discrete. It is important to note that although it is true that discrete mathematics can describe IDR, these will be minor descriptions for certain emergent phenomena, but a theory of everything for an IDR reality would certainly require continuous mathematics, since it will include infinities.

Intrinsic existence and behavioural existence

The previous example leads us to a very important distinction between the intrinsic existence of things, and the behavioural existence of things. The intrinsic existence is the pure existence of things apart from what they do or how they behave, while the behavioural existence is the existence of the behaviour of these things, or in other words, the physics of these things.

Some schools of philosophy argue that the behavioural existence defines the intrinsic existence, in which things exist only when they ‘’do’’ something, this behaviour could be in itself, or relational to other things. This could be the case, although it is hard to think about behavioural existence as the only possible existence. This point will be the focus of another essay.

A fundamentally discrete reality should both be intrinsically discrete and behaviourally discrete, and here in this essay I argue that our universe cannot be fundamentally discrete either intrinsically or behaviorally.

The separation argument

Let us assume a finite discrete reality (FDR) made of two indivisible parts, such reality necessarily meets all the requirements for discreteness; 1) A limited number of parts, and 2) The parts cannot physically be divided or be smaller.

In order for these two parts constituting the FDR to meet the second requirement of discreteness, they have to be separated from each other, since if they are not separated in any way, then they become one bigger continuous part that can be divided into two parts, which contradicts the very definition of a discrete reality. But a fundamental question emerges here; separated by what?

They are either separated by smaller parts of reality, which also contradicts the main definition of discreteness, since it was assumed that the two parts constituting this reality are the basic building blocks of this reality. Or one can say that they are separated by pure empty space, but this space is not nothing. The space having the ability to separate the two points of reality necessarily implies that it is something that has a structure which enables it to separate the two parts, otherwise it will not be able to separate the two parts and we are back to the one bigger divisible point. This space either has its own continuous reality, which again contradicts the main definition of discreteness, or this space is another discrete indivisible part of this reality, which needs to be ‘’separated’’ from the other two parts to meet the requirement of a discreteness.

Here we are faced with circular, logically fatal contradictions about this intrinsically discrete reality. Which implies, based on pure logic, that such reality is impossible to exist, just like a circular square is impossible to exist.

A question confronts us here; could an intrinsically continuous reality be described by discrete mathematics? The answer is both yes and no.

Any discrete description for any continuous reality, although easier to model and more predictive, will always be partial and temporary, only describing part of reality and cannot possibly describe the whole of reality.

What current theories tell us about our own reality

Almost all of our experimentally verified theories describe a continuous reality, both intrinsically and behaviorally.

Classical mechanics and relativity, both assume continuous space, and continuous laws of motion. Quantum mechanics was considered at its birth a theory fo discreteness, but a closer look at its development and evolution actually goes in the direction of continuity.

The schrodinger equation describes a continuous distribution and evolution of a discrete particle in time. But the schrodinger equation was not complete, it wasn't considering space, which has its own fundamental existence that can't be ignored. Dirac developed the equation and provided us with a more complete relativistic schrodinger equation. The dirac equation is not just continuously describing the evolution of a discrete elementary particle, it is actually describing an elementary field, which led to the development of our best theories so far, quantum field theory. Quantum field theory describes a continuous reality with continuous fields constituting this reality, so even the theory which was invented to discretize physics, ended up being continuous similar to its ancestor theories, relativity and classical mechanics.

Our universe is intrinsically continuous, there should be no doubt about that. Our theories are also pointing in the direction of continuity in regards to its behavioural existence, which means that it cant be partially modelled by discrete mathematics like an IDR.

Our universe is most probably continuous down from the deepest levels all the way up, discreteness is only a successful trick that we use to model and predict things in the real world.