

Are natural numbers sacred in the universe?

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There is a profound principal in the universe that says there is no central entity or notion anywhere, and that everything has no special significance than any other things in physics terms. This principal dispelled 'earth-centric' idea and later the Newtonian absolute time-space concept. It is a universally accepted principal in modern science. If math and physics are intertwined inextricably then it seems natural numbers ought to have an equal standing as any other numbers, irrational, complex, or even numbers yet to be invented.

Is there any physical underlying reason for natural numbers' special status? Or are the natural numbers just a convenient way for people to count and were invented by macro intelligent beings like us?

Since all natural numbers are mere derivatives of the number '1', so let's look closely at what this number one really means. There are two broad meaning of the number one, corresponding to different mental construct to define '1'. First it registers a definitive state of some physical attribute, such as 'presence' or 'non-presence'. We can find its application in information theory, statistical physics, counting and etc. The second interpretation of number one is that it denotes the 'wholeness' of an entity. Yet another definition arises from set theory. Still another arises from the order of which one element in a sequence related to the other elements. Remarkably the concept of natural numbers can come from many different constructs, just as remarkable that natural numbers come from many different domains in the physical world.

In physics, natural numbers virtually have no sacred places prior to the establishment of quantum mechanics. After all, we don't need any natural numbers in our gravity functions or the Maxwell electromagnetic wave functions. Some sharp observers would argue that the 'R squared' contains a natural number 2. However on close examination the number 2 is merely a mathematical notation for a number multiplying by itself, and it has no actual physical corresponding object or attribute. The fact that there is no natural number in the formulae represents the idea that time-space is fundamentally smooth. For instance there is no such law in physics that requires 7 bodies (non quantum mechanical) to form a system in equilibrium.

Had we obtained calculus capability before we can count our fingers, we probably would have been more familiar with the number  $e$  than 1-2-3. We might have used  $e/2.718$  to represent the mundane singletons. There is no logical requirement that we couldn't or shouldn't do it. It is all due to the accident that people happened to need to count

their fingers earlier than the invention of calculus. There is no physical evidence that the number '2' is more significant than the any other numbers in the natural world.

However with the standard model of quantum mechanics, energy is quantized, that is, it can only take natural numbers. This idea profoundly altered the status of natural numbers in physics and is a direct contradictory of the notion of 'no center in the universe' principal. In this sense it is far more unorthodox than the two relativity theories combined because the latter in fact enhance the 'no center in the universe' law. Why does the quantum have to be integer times of a certain energy level, and not an irrational number like square root of 17, or the quantity  $e$ ? Does it really mean there are aristocrats in the number world, where some are nobler than others? Were the ancient Greek mathematicians right after all, who worshiped the sacredness of natural numbers and even threw the irrational number discoverer into the sea? From this standpoint we can almost say that quantum theory has some bad taste among all branches of natural science.

Before the quantum theory got its germination, actually people should have noticed the unusual role natural numbers play in rudimentary chemistry. For instance, why two hydrogen atoms and not five, are supposed to combine with one oxygen atom to form a water molecule? If scientists are sharp enough back then they ought to be able to be alarmed by the oddity underlying the strange status of natural numbers. It could almost be an indirect way to deduce the quantized nature of electrons.

Fundamentally if natural numbers indeed play a very unusual role in nature, then nature resembles a codebook not just from a coarse analogy standpoint. It is the ultimate codebook filled with rules for a limited number of building block codes. The DNA code is an excellent example.

If it's a codebook, inevitably it takes us to surmise if information itself is the ultimate being in the universe. It is probably not electrons, strings, quarks or whatever 'entities' people have claimed. It is the information that is the only tangible and verifiable entity out there. Everything else is a mirage or manifestation of some underlying information, the codebook.

In this sense physics has somewhat gone awry by focusing on the wrong things, the 'attributes' such as momentum, position and etc. Instead, information is what contemporary physicists talk about and experiment with. Otherwise, the physicists would have no right to laugh at the medieval scholars who based their intellectual work on the measurement of the distance between a subject and God's throne. The nature has revealed her latest hand of cards to us. It looks like it's the final hand but no one can be sure of course.

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### **Follow ups:**

Ancient Greeks had pondered exactly the same questions for long. People like Pythagoras adamantly asserted 'yes' to this question. We are back to square one after 2 or 3 millenniums. Natural numbers is a set of math objects and it happened to have a very well defined physical correspondence with it. The question is whether this set is fundamental in math? If so, it is the fundamental set for physics? I inclined to think it is NOT a fundamental set in math. In this physical world we occupy, maybe natural numbers got some fundamental role to play, or maybe not. Quantum mechanics seems to give us some clue to this question.

I don't know the universes that humans do not occupy and the relevant status of natural numbers there.

The math as we know now is built on a number of self-evident axioms. The problem with these axioms is that they are seemingly correct with our everyday experience. However, that does not grant these axioms any immunity or validity. If we are as small as an electron, I'd bet we will be accustomed to a completely new type of math, a math where calculus is the heredity.

Further the notion that the whole universe runs on the math we have invented/discovered is nothing more than hubris, a distinctive characteristic of mammals.

Quantum mechanics, relativities and many other yet to be invented theories ought to use a new type of math. The difficulties for people to understand or relate these theories are in the root of the math they use.

Sequence is assumed in natural numbers, i.e., one is the next math construct after 0. Sequence is also exclusive, i.e., there is only single symbol to denote what's after 0. However, it doesn't have to be so. In the quantum world, there is no definition of sequence, hence no concept of natural numbers as we understand.

In the realm of speed of light world, we do not have addition either; and we may see  $c+c=c$ .

Modern physics calls for new type of math ever since the early 20th century, and so far no mathematicians dare to risk careers to venture outside the conventional wisdom.

Of course the details are much complicated and I am no expert to explain. Everything is just a conjecture here. I found it far easier and gratifying to point out others' insufficiencies, than to improve one's own understanding. This is human nature, just like why people prefer being fed than being hungry.

It may be unnecessary to bang one's head over the space-time conundrum, if a different math is adopted. I think it is the math that is behind all the awkwardness in modern physics. We just need to change the unchallenged math axioms to fit the new physical reality. See my post: Are natural numbers sacred in the universe?

Prime numbers have some mysterious properties. Are they more fundamental than the natural numbers? Natural numbers can be mapped through a set of rules from the set of prime numbers. Is there a math system that utilizes prime numbers as the base set? Does prime number set have any physical mapping that has not be discovered in the past?

The universe that we now live in has some remarkable feature: Seemingly complexity stems from a relatively few math/physics principals. Observation selection looks attractive to me. But unless there is proof of possibility that the other unknown universe can have any effect on our universe, this conjecture is meaningless. The same guideline is also relevant in this thread about math systems.

Another interesting idea is that math never implies causality but physics does. This is because the time element in physics. There is no place or treatment for time in math. What does that tell us about time? My guess is that time is the culprit of a lot of misunderstanding in physics. Time essentially is a psychology quality in living organisms. It's not a physical entity at all. Is there is physics that exorcizes time vector? I tend to think that the high-energy physics, cosmology (including big bang theories, black holes and etc) today are more close to scams than science. The science community is in collusion to cover this up to milk public funds. "Emperors' New Clothes" is a precise description of this phenomenon.