

What is "Fundamental"?

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ABSTRACT

The author intuitis that the goal of this essay contest question is to shed possible light on a practical, if not totally new, line of thinking, with improved understanding about existence. As complicated, vast and accomplished as human knowledge is, and our explorations have achieved, it is indeed possible we might have missed some other "essential(s)", and that once we become alert to them, we can move beyond the seeming re-iterating set of ideas that traditional perspectives and perceptions have us mired in, with unresolved problems and problematic conceptual disjunctions, to break out from that set of un-resolved issues, and advance humanity and sentience beyond temporary recursive inertia.

PREFACE

The essay question, "What is fundamental?" is excellent to consider at the beginning of the 21st century. Indeed, humanity has actually been considering the notion in one form or another ever since the dawn of our species' thinking. Because the question has a deep connection with the more personal relevant concern, "What is the meaning, the purpose, of life and existence?"

But, here today we are tasked to not reflect on the esoteric, spiritual or metaphysical qualities of 'fundamental'. Nor, as the invocation instruction warns us, to address the particle primitives of physical existence; even though we are asked to discuss 'fundamental' specifically as a pragmatic scientific consideration and its likely material characteristics. Instead, we are asked to consider - hopefully in some new interesting way - properties of the cosmos in context to our thoughts, perceptions and scientific investigations of essential physics, even relevance to explorational mathematics, and even then, to other topics and fields of human experience and interests.

Such a deceptively simple 3 English words question; such potentially broad relevance.

It infers that we not only consider novel relationships or ideas, but that we also take a moment to reference and honor previous achievements based on prior understandings of 'fundamental' and knowledge generally. So this author defers for a moment before offering specific thoughts about "fundamental" he thinks could be worthy, to put this task into mindful context.

People have been ‘scientists’ from the earliest days of humanity, even though we say that the ‘scientific method’ is only a few centuries old in formal practice. The search for universals, for repetitive truth and reliable consistencies, enacted through hypotheses and testing actions is one of humanity’s best skills. Whereon we rate the validity of ideas on secondary predictability and utility, judging successes with correctness and failures with error. So that as we advance and improve, we discard the ‘lesser accurate’ and any ‘ineffective models’. But there is a context to consider, as we strive forward, something to remember, actually. Every human thinker through the ages made do with the knowledge environment they were embedded in. And did the best they could *with* those data environments.

To say that Copernicus revealed astromonic truth and that Ptolemy was wrong, or that Einstein was correct and replaced the errors of Newton, or any similar comparisons, is to do injustice to human thinking. There was value, practical value, in each of those men’s models of existence. Three thousand-plus years of humanity farmed and survived the seasons using a geocentric model of the cosmos. Utility was the only measure of ‘correctness’ humanity needed back then. Newton’s laws of motion were satisfactory at velocities far less than the speed of light, or not factoring in considerations involving light speed as a communication media~velocity.

Jumping to new frames of reference does not diminish the work done and ideas achieved at prior stages of understanding. And discounting failed scientific experiments even today as a waste of researchers’ time and life effort is in my view, an injustice. Because, as we now tend to acknowledge, we indeed can learn from mistakes. A mistake in an experiment is never *wrong* .. it is a *rung*. Important steps in knowledge are gained by incremental discoveries on our various ladders toward advancement, not just massive paradigm shifts. Even failures and errors effectively re-direct research towards correctness and truth.

So, discussing “What is fundamental?” is best done in that context. I point no egoistic finger at other thinkers for their achievements based on idea models that are different from mine. I do not claim special insight or wisdom. I simply participate here to suggest added relations that could be of value, not challenge others’ thought lines.

Additionally, as noted in the contest Criteria, “relations” are a primitive, a fundamental quality, of existence as well. So we have to discuss “relations” also; the ones between levels of complex organizations, observed things we need better clarity about. And further, I propose the relations within our tools~models that are supposed to match and map physical phenomena, are also fair game. In other words, even math is fair territory to identify ‘fundamental relations’ within. Just in case we’ve missed something there, to date.

Logic and pure math analysis have accomplished a lot. For example,. induction, deduction, associativity, commutativity, kinds of numbers, topologies, bases options, abelian~nonabelian, and optional geometries, to name a few representative ‘relations’ and qualia, have identified a rather large group of distinct, nee ‘fundamental’, associations. We assume the set to be complete. But, there could be more relations, of peer importance and utility.

So, the simple question, “What is fundamental?” puts a lot of notions and considerations on the table in front of us.

DISCUSSION

I have spent the better part of my 70 years thinking about *fundamental*, as a General Systems theorist, in the footsteps of George Sarton and Ludwig von Bertalanffy and their respective colleagues in the 20th century.

Typically, scientists, logicians and philosophers look to the ideas of famous practitioners and creative innovators in the essential sciences. But I propose we step outside the usual thought ways, and add to consideration the ideas of the American chemist/linguist Benjamin Lee Whorf (1897-1941)ⁱ to guide our discussions. [*Here, I suggest the reader review the Endnote writings of Whorf that I quote, before continuing with the body of this paper. It would be most helpful.* J.N.Rose, author]

The last sentence of quotes from Whorf's writings (*with this writer's emphasis and underlinings to highlight*) contains another 'fundamental' quality of existence and phenomena which we assume, but need to specify and formalize in considering a *weltanschauung* – holistic worldview. Whorf directs us to honestly question the requisite fundamental connectivity underscoring existence - the essential qualia of existential presence of our universe, the appreciation that 'calibration' (he cited that in reference to languages; we adapt it to calibrative comparing of data in general) vis a vis properties or measures, as being *the* pragmatic property of 'relation'. A mutuality of some sort *between* diverse aspects, be they physical or conceptual, has to exist to allow comparison at all, or, to even support existential co-presence. One of the *fundamentals* of existence is "interactability" .. whether physical-real, or modeled. Even extreme forms, like matter and anti-matter. Interactions there induce states destruction, but, interaction itself is an allowed event.

In that sense and umbrellaed context (connectivity) we now have encompassing identifications of the electromagnetic spectrum, and we have spacetime, and we have numberlines~dimensionality, all of these 'essential domains' as the fields of play, where all tiers of organization are in mutual shared presence, and so we can, within those domains, compare the individual specifics, and explore connectedness and holism in spite of extreme diversities of forms and functions.

Thus, we have a partial sense of the arena of 'existence', and, thoughtful encounter-observation-ideation -as- the key skill of the human minds. But how clearly do we understand that component, that essential nature and ability of ours?

Descartes addressed the challenge of consciousness and thinking trying to cope with physical phenomena outside the mind by describing the situation as the body-mind duality. He saw the separation and apartness. But more importantly, it is an interactional bridge -- the unavoidable encumbrance of our physical existence. Clinical neuroscience now knows some of it as time delays in neural processing, or, relationally recognized as the distinction that 'identified events' are not equal to experiences 'of' events. We think through the veil of sentience, including 'personal interpretations'. Subjectivity versus objectivity.

"Interpretations" is the next factor to consider ... the acknowledged challenge that to raise individual experiences and observations and measurements to the higher level of indisputable

agreed 'collective' informed data, we have settled on the scientific method .. repeatability, consistency, no matter who performs the testing/measuring .. and minimization of noise, of external variation factors. In other words, the diminishing of subjectivity, to arrive at 'objectivity'. Where 'objectivity' is still a physical attribute .. but the purest form of it we can identify. Hopefully, along with those 'objective' measures of phenomena and behaviors, we co-identify the eternal properties of behaviors .. the 'relationships' that we hope are universal and correct. And which we then call models and laws of behaviors and performances and juxtapositions and relationships.

But still and all, maybe there is something more to consider within Whorf's admonition to take care, since we have to *account for experiences*, and, mesh those with words, ideas and expressions - language - meant to match those interactions best correctly .. as we search for 'reality', for 'truth', for accuracy.

Even etheric intangible ideas .. like the word 'concept' .. etymologically comes from hard physicality .. the Latin roots 'con-' meaning 'with' and '-cept/-ceive' meaning 'to gather', where 'concept' is literally *that which we 'take with and into' "ourselves"* .. and actively physically experientially make '*part of ourselves*'. The Descartes distinction was more tangible and coupled in the awareness of our language forebears, long before Descartes. Still, his notion remains with us, even as we yearn for the laws of existence that are pure and *not* dependent on human interpretation; invariant to local observations; invariant to frames of reference; invariant even in the face of noise and perturbations. Rules of behaviors that are relationships .. that are universal, essential, invariant .. "fundamental". Confirmed (or so we hope and presume) by our special language .. mathematics.

We cannot escape the physicality of phenomena. Even what are called 'heterotelic' phenomena ... an archaic 19th century word meant to convey 'that which arises because of other things and does not independently exist' on its own. Not in the sense of causal or emergent, but something as simple as 'between', a relationship that has no independent existence of its own, but comes into co-existence when there is space or time, and differential separations or occurrences, first. So part of what we are cued to recognize is that in searching for models and rules of behaviors, we are in truth looking to identify the 'how' sense of 'why' .. the underscoring 'relationships' of existence. Be they positional geometry or active dynamics.

With all the aforesaid in mind, I propose, a change of frame of reference in our way of appreciating the panorama of existence. 'Objectivity', I suggest, is not the most pure state of subjective data~knowledge encountered. Rather, it is a fundamental relational quality that is related to *intangible existence* that is unadulterated by physicality, not susceptible to noise or variability. When we parse essential relationships vis a vis "objectivity", the only 'thing(s)' that cannot be corrupted are the identified general relations, the intangible incorruptible "laws of nature", aka "rules of behavior".

We see and measure those (hopefully accurately stated) 'laws', through unavoidable subjectively vulnerable physical phenomena. And so, the invariant 'laws' .. the intangible heterotelically identified relations .. are the only things that are truly 'objective'. Objectivity is not our 'best state of subjectivity', as conventionally understood. Instead, it is the net *rules* of behavioral

performances, the intangible ‘fundamental essences’ of existence, which are what are ‘objective’ ... “fundamental”. To the extent that we can improve our understanding by stating, “Objectivity is not an ‘object’.” Such ‘objective’ rules of behaviors and relationships - that are either static in representative occurrences (geometric), or active in cladistic dynamic processes .. can only be known *through* physical subjective instantiations, but, are the asymptotic incorruptible relation statements educed from subjective physical enactments; true invariant non-physical intangibles.

Whorf alerted us to not presume that human instinctive understandings and thinking are best. They may be accurate to the extent that we have built on them and achieved wonderful things, including predictions of other/new behaviors. We have, and will continue to survive and advance on reliable dependable events and ideas. But, there is the potential to improve our ideas about the universe, if we are willing to consider another subtle shift in our understanding about our own physical~mental nature, and defining the *fundamental qualia* that are intrinsically referenced in our models and observations~descriptions.

Appreciating how we arrive at fundamental objective essences is as important as the destination of specifying what those universals~essentials are.

WHY ASK, “WHAT IS FUNDAMENTAL?” ??

I appreciate readers and contest judges for staying with this essay of mine so far. It has been a challenge for me to compose, because it is all new phrasings for me and I have had to avoid “shoehorning in (this) author’s pet topic”, which has been my personal scientific *raison d’etre*, and the theme of all my writings since 1972.

So part of the novelty within this essay (as the contest rules call for), I can see no better fun way, than to turn the question on the sponsors, wholly in applause for their decades and longer support of physics explorations and science inventiveness.

The stumbling block for 80 or more years of physics~mathematical efforts has been the disjunction between relativity continuum mathematics and quantum mechanics statistics mathematics. So many interpretations, so many(worlds?) thoughtlines (pun intended). With the added mathematical thorns of ‘unwanted infinities’, undefined ‘division by zero’, and related math issues. And the conceptual pain is palpable. I have had more than my fair share of conversations with prestigious mathematicians and physicists over the years, whose faces freeze in pensive horror, or eyes glaze over as I can see them literally re-imagining days of chalk board dead-end equations, reliving the moment(s) in the past, even as they stand in front of me, mentioning the moments in soft whispers, but trying to avoid the recollections at the same time. “Oh, the humanity!” Never truer for all theoretical physicists~mathematicians hitting this brick wall of calamity in human scientific thinking, than the Hindenburg fire and loss.

And I presume, which core topic is the reason for this ongoing question of FQZi.org, in one phrasing or another for quite some time now. Ask some deep question, relevant to that disjunction, but maybe with a camouflaged sensibility, and it just might push a new thought to the prefrontal cortex of humanity’s global mind, or some conference podium.

So here goes, gentle readers, I will present the James N Rose notion of “what is fundamental” (as a statement) in that context of physic’s deepest conundrum, and will leave a lot for you yourselves to explore, once I open a new door a bit for you to look into a different room so to speak, if you wish. As a teaser, I can tell you it is related to, but different from, my own pet efforts, which is a fresh defining of entropy - a general theory that goes beyond thermodynamics - where thermodynamic aspects of recognized entropic trendings are only one sample instantiation of the ‘fundamental relations’ resting at the core of entropic correspondences. There are other forms which are less related to ‘work’ specifically, but instead highlight “states opportunities” and distribution trendings.

The Venn diagram shared space of my work, that overlaps the problem of QM vis a vis continuum disjunction, has to do with what I identify as missing mathematics. Both QM and continuum relativity are built on impressive deep mathematical truths and relations in each subject’s equations sets. But if we put aside all our historic presumptions of mathematics as we have learned them, accepted them without question – as you recall Whorf discussing, a person being so inured and embedded within some particular languaging mindset that they could not recognize, let alone formulate, a relational distinction or rule that is present around them - I put to you the notion that such a situation exists in essential mathematics ... a ‘relation or relations’ we’ve overlooked and left unaddressed. I intuit that Whorf’s ‘calibration’ criteria is missing between continuum mathematics and quantum mechanical statistics~probability mathematics. We have left certain real relationships there .. ‘not well defined’.

My reasoning that showcases the missing math goes like this.

We casually discuss numeric mathematical numberlines, such that no matter where we use numbers, computational values and variable markers – such numbers are always members of numeric continuums. Then again, our notations for certain mathematical relations includes separate exponent relationships. Which in some instances – based on experiential familiarity and habit of thinking – we label positive whole number exponents (sometimes) as ‘dimensions’. And in many uses of exponents, we treat them as other, more complicated computational relations - not considered ‘dimensions’ or parameters at all.

So let us begin to examine these variegated notions. If a bedrock aspect of sentient rational ideas is consistency, reliability, dependability when we see patterns in existence and in languaging models, then several things might be due fresh definitions. First, what if we rely on the ‘primacy’ of numberline consistency, wherever numbers are identified~assigned? Why not break from our shackling experiences of physical existence .. and associations inferred in math from them - orthogonal whole units? Let’s explore for a moment that in simple definition, exponential numberline is distinct from the base numberline, while retaining many associations conventionally well defined between them. Now, we add to the cooking recipe a touch of binder~coupling consistency – stating that *all* exponential relations are ‘dimensional’. This makes the mathematical architecture more uniform throughout, such that Mandelbrot was correct using the term ‘fractal’. Because he allowed that *‘fract-ion-al’* exponents have a dimensional quality about them, beyond positive whole numbers.

And though we have yet to totally define many of the new seen ‘fundamental relations’ within the tiered transfinite architecture of mathematics - where everything is connected - we can pose the notion that what was previously defined as non-dimensional or scalar, are in fact ‘exponent zero’ variables modifiers .. dimensional rather than scalar. The continuum of mathematics is actually mapping and modeling a universe of interrelated dimensional continuum domains.

What we have to learn and teach ourselves about is what is in the undiscovered country of additional math relations, and how to navigate the tiers of organizations there. Because there are additional valid ‘frames of reference’ in there, depending on where we find utility locating our focus on different topics.

CONFUSING NOTIONS – BUT CLEARING AWAY THE FOG

Having presented those hypothetical fundamental relations and definitions, let me bring you back to the real context problem: continuum math vs. statistics~probability math.

Imagine now any set of data measurements, accumulated randomly over time. The data is more noise than patterned information. But then we accumulate and reorganize the data, to try to find ‘information’. And lo and behold, we often find patterns and associations in the re-grouped data. Such as statistical Gaussian bell curves, for one kind.

But what have we done, practically, in such re-groupings? We have -removed- the time ‘dimension’ of ‘sequence of data measures’. If relativity gives us time as a valid dimension, then we arrive at the statistical patterns by reducing/compacting cybernetically translating from (x) dimensions considerations to (x-1) dimensions frame of reference. [Which leads to an intriguing conundrum, that if such a pattern holds as valid, we seem to *gain* information by *reducing* the data space. I mention this only as an aside relation that needs better parsing. I don’t specifically hold that ‘less is more’, absolutely. ☺]

However, to the point, as the physicist Thad Roberts words the situation, there are “interpretations of quantum mechanics that believe that the statistical nature of quantum mechanics is due to an ignorance of the underlying more fundamental real dynamics”ⁱⁱ. Activities occur in realms we are restricted from by Heisenberg’s Uncertainty Principle. So, we mosh together the smoothed over real dynamics, and do brilliant work otherwise, using statistical renderings that we *can* cobble and interpret.

But importantly, using the logical associations above, we need to recognize that improvement is needed in *basic* mathematics, because I believe that is where we can finally resolve the QM vs continuum disjunction. We do it with a better inclusive expanded appreciation for the associated fundamental relationships among statistical math and continuum math – how they ‘relate’ to one another. The previously perceived disjointed models really have deep connections and correspondences and related accessibility.

CONCLUSION

This starts page eight of the maximum nine allowed in the contest rules ; a tad over 19,000 characters (not including endnotes, as permitted), so far.

“What is fundamental?” has been a great question to think on, to write about. So I want to thank FQXi Community, the Fetzer Franklin Fund, and the Peter and Patricia Gruber Foundation, for opening the contest to the planet; and I thank whoever it was who put my email address into the FQXi announcement system a month ago (mid December 2017), when I first learned about the organizations, the prior contests, and this one – to me an event of wonderful serendipity.

As the contest Guidelines discuss, humanity is exploring an encyclopaedic range of subjects and topics, each with their own take on ‘fundamental’. I have, prodded by important people in my life, Benjamin Whorf being not the least of them, explored many of those topics, seeking to find their essential similarities of properties, that overt distinctiveness and differences mask and make non-obvious. There are notions about them that I have to leave un-discussed here because of contest rules and constraints, but I hope I have presented ideas and relations many of you might never have considered before, but find intriguing enough to adapt to your own research and explorations and understandings.

We live in a “one song”, a “uni-verse”. (Apologies to ‘many worlds’ theorists in the readership audience; if I have one prejudice, it is that even in many-worlds interpretations of existence, those ‘many’ are unavoidably resident in a larger shared-space frame of reference and are related there, and so you are back to an existence which in its grandeur, has to be a one-place wholeness. Sorry, sad but true, logically my friends.)

“Fundamental” intones and deals with the best purist shared generalities of relations and relationships, even as we identify them through exemplified subjective, local ‘specifics’. Essences of similarity that conjoin everything into a “one song”. And even as we search for those supreme essentials, hoping our descendents achieve higher quality understandings and omniscience – to improve how our species lives in the universe – I take the opportunity to enjoin you all with one last thought of importance. Superior ‘specificity’ and exactness is only one of the important goals of searching for knowledge. Life .. and mathematics .. embodies another, on-balance, equally as important fundamental qualia and property of existence: degrees of freedom, opportunity space .. for the unexpected, the unusual, the explorable. A saturated RAM computer hard drive, is tantamount to a functionless brick or boat anchor. The universe is a functional wonderment because imperfection is as important as perfection ; incompleteness is as behaviorally valuable as continuity and repeatability and exact specificity.

I wish you all well, on your respective journeys through existence, my friends. Stay open.

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ENDNOTES

- ⁱ 1) "Language, Thought, and Reality; selected writings of Benjamin Lee Whorf", 1956, John B. Carroll (Ed.), Technology Press of Massachusetts Institute of Technology; NY.

'Benjamin Lee Whorf' (April 24, 1897 – July 26, 1941) American chemist & linguist. Whorf is widely known as an advocate for the idea that differences between the structures of different languages shape how their speakers perceive and conceptualize the world. This principle has frequently been called the "Sapir–Whorf hypothesis", after him and his mentor Edward Sapir, but Whorf called it the principle of "linguistic relativity", because he saw the idea as having implications similar to Albert Einstein's principle of general relativity.

Citing from the book's text, Whorf had written:

"The familiar saying that the exception proves the rule contains a good deal of wisdom, though from the standpoint of formal logic it became an absurdity as soon as "prove" no longer meant "put on trial." The old saw began to be profound psychology from the time it ceased to have standing in logic. What it might well suggest to us today is that, if a rule has absolutely no exceptions, it is not recognized as a rule or as anything else; it is then part of the *background of experience of which we tend to remain unconscious*. Never having experienced anything to contrast to it, we cannot isolate it and formulate it as a rule until we enlarge our experience and expand our base of reference that we encounter an interruption of its regularity."

"For instance, if a race of people had the physiological defect {aka: "*limitation*" } of being able to see only the color blue, they would hardly be able to formulate the *rule* that they saw only blue. The term *blue* would convey no meaning to them, their language would lack color terms, and their words denoting various sensations of blue would answer to, and translate, our words "light, dark, white, black", and so on, not our word "blue". ... The phenomenon of gravitation forms a rule without exceptions; needless to say, the untutored person is utterly unaware of any law of gravitation, for it would never enter his head to conceive of a universe in which bodies behaved otherwise than they do at the earth's surface. ... The law could not be formulated until bodies which always fell were seen in terms of a wider astronomical world in which bodies moved in orbits or went this way and that." ...

... "When linguists became able to examine critically and scientifically a large number of languages of widely different patterns, their *base of reference was expanded*; they experienced an interruption of phenomena hitherto held universal, and a whole new order of significances came into their ken. It was found that the background linguistic system (in other words, the grammar) of *each language is not merely a reproducing instrument for voicing ideas but ... is itself the shaper of ideas, the program and guide for the individual's mental activity, for his analysis of impressions, for his synthesis of his mental stock in trade.*" ...

... "This fact is very significant for modern science, for it means that **no individual is free to describe nature with absolute impartiality but is constrained to certain modes of**

interpretation even while he thinks himself most free. The person most nearly free in such respects would be ... familiar with very many widely different ... systems. ... **We are thus introduced to a new principle of "relativity", which holds that all observers are not led by the same physical evidence to the same picture of the universe ... unless their linguistic backgrounds are similar, or can in some way be calibrated.**"

ⁱⁱ Roberts, Thad. <http://einsteinsintuition.com/what-is-qst/overview>
"Overview of Quantum Space Theory", (2011).