How to Build a Universe from Wheeler's Immaterial Source, in Nine Pages or Less.

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> It from bit symbolizes the idea that every item of the physical world has at bottom…an immaterial source and explanation… J.A. Wheeler [1]

Wheeler's surmise that all things physical are information-theoretic in origin is to suppose aspects of reality with which reality may not agree. The same may be said of all our best physical theories. This essay develops a generalized ontological framework able to absorb all possible world-models, and filter out all but the actual world, reality, as a well-founded model of what there is. If Wheeler is right, the nature of information ought to be evident in the model.

The aim is to build an imaginary universe founded on a necessary principle of foundation, which will prove to be a general principle of equivalence (GPE). Proving this *a priori* principle beyond Cartesian doubt conveys ontological power, meaning that the imaginary universe must and can only comply with it. This is causality in its deepest sense. Along the way, the origin and cause of space and time is illuminated. An open question is whether this imaginary universe is in fact a well-founded 1-space model of our actual universe.

Skeptical commitment as a door into reality

The ancient skeptics suspended judgment on the nature of things (neither in the affirmative *nor* the negative) because they were unable to resolve the differences among contrary arguments and apparent infinite regress of justification required to establish a truth [2]. However, the endpoint skeptic is obliged by skepticism itself to accept *indefeasibility* as a proof of the truth of a proposition, even when faced with seeming counterfactuals from the physical world.

By indefeasible I mean indubitable in Broughton's sense [3] that being indubitable–

> [C]oncerns not "the power of the human mind to enter into a state of doubtfulness about a proposition," but instead the condition whereby "it is impossible both that the proposition be false and that I be doubting whether it is true" (p. 100)

Because empiricism is necessarily fallible [4] the endpoint skeptic begins by quarantining all that might be proposed of the world inside a 'possible ontology'. 'Possible ontology,' is not a reference to metaphysical possibility, but dialectical possibility—what might be true of an ontology, rather than what is true, which aligns with the endpoint skeptic's stance. Because something is possible if it is a possible view [5], the possible ontology encompasses the totality of what-is, and what-might-be (but isn't). The *actual ontology* [5] may be populated by sieving through the possible ontology using Descartes' Method of Doubt (see [3]), wherein all that can be doubted, is doubted.

Accepting that reference to what-might-be is metaphysically vague, the endpoint skeptic begins with a sparse world of barely defined, essentially windowless objects, shrouded in doubt. We seek Wheeler's apparatus or immaterial source and explanation to bring these objects into focus.

The endpoint skeptic adopts a constructional ontology.

The apparent absence of givens in an endpoint skeptic's ontology, brought by the Method of Doubt, restricts the investigator's strategies. Consequently, the endpoint skeptic adopts a *constructional ontology* (see [5]) an ontology in which complexes are constructed from simples through the action of a constructor. With skeptical commitment, the Method of Doubt and a constructional ontology, the investigator is equipped to build a universe.

The General Principle of Equivalence

Terms like 'material objects' and 'information' are value laden, vague, and circularly defined [6]. The endpoint skeptic needs to develop a lexicon by which proper, non-judgmental, non-anthropocentric reference might be made to the contents of the possible and the actual ontology, to enable him or her to create valid propositions. Further, philosophical terminology comes with so much baggage [7] it cannot be used in a foundational work. Let us introduce two new terms, 'omnet' and 'asset'.

> *Omnet*: Denotes whatever there is, in its most liberal interpretation, in any possible world.
>
> *Asset*: Denotes whatever an omnet has, in its most liberal interpretation. Assets might be (if there is such), parts, properties, attributes, thisness, universals, identity, bits, the name or names we call what is, other omnets, or any specific that an omnet has.

We cannot, at the outset of our inquiry, make assumptions about the nature or number of omnets or assets that are in the world. This should be left flexible, and the plural be given equal priority to the singular.

Assuming that 'assets' is synonymous with 'properties' is not valid for the investigator. Nothing may be validly presupposed of omnets other than that they stand in for items of the possible ontology. These global concepts permit a fundamental shift in the nature of Leibniz's Law [8] from a supposedly contingent proposition to a global fact, here named the General Principle of Equivalence (GPE):

Every omnet that has all the assets of that omnet, is that omnet.

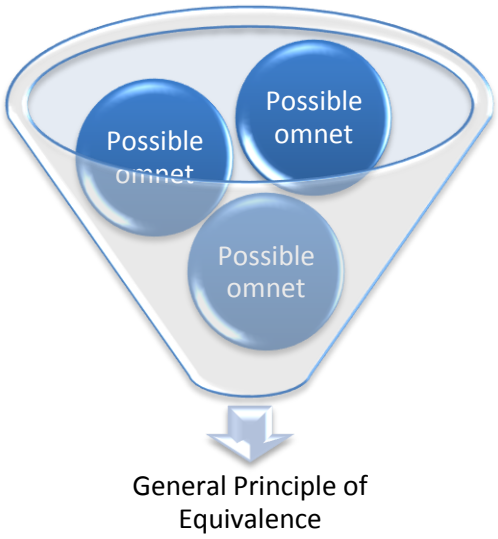
The GPE is our principle of foundation, and is the global tautology. In abstraction the GPE is reducible to 'omnet' through Leibniz's idea of 'in esse' in that an omnet holds its assets implicitly. Importantly, while for any particular tautology the statement is essentially vacuous to the investigator, the globalised concept is wholly different. It is our constructor.

The General Principle of Equivalence is immune to doubt.

Up to the limits of rational discourse, to doubt, one must have rational grounds for doubt, even if these are radical or 'hyperbolic doubts' [3,9] such as the evil genius argument among others. To demonstrate indefeasibility, all arguments must be struck down universally. The great value in Broughton's interpretation of the foundation of Descartes's method of doubt (set out above) lies in the recognition that *one is not justified in holding a doubt about some proposition if that doubt relies on the truth of the proposition for the doubt to be valid.*

The General Principle of Equivalence is indefeasible because for any doubt to be the doubt it purports to be, whether valid or invalid, whether it actually captures a condition of the world or not,

requires first that such proposition have what it has, all that it has and no less than what it has, otherwise it is not the doubt it purports to be. This follows directly from our innate idea of equivalence. Doubt is epistemologically subjugate to the GPE. Moreover, for any doubter to hold such a doubt to be valid, the doubter must first accept an equivalence between the doubt he wishes to express and components he uses or conceives to express that doubt, which tacitly relies on the GPE. Consequently, doubting the GPE is self-defeating. Hence the GPE passes he skeptic's filter and passes from the possible ontology to the actual ontology.



Consequently, the GPE is a well-founded model of a necessary condition of the world. Recognizing that all propositions are subjugate to the GPE, and that the GPE is global, implies that it is Wheeler's immaterial source and our principle of foundation. Because the GPE is global and necessary, the implications of the GPE and the actual ontology, our actual world, are in lockstep.

A cataclysmic collapse of the cosmos: the GPE as universal destructor.

Bundle theorists hold that physical things and minds are reducible to bundles of properties [10]. Bundled properties are connected or held to one another by a special relation or tie that is typically called compresence. In context, under the GPE an omnet is a bundle of assets in compresence.

Unfortunately, bundle theories have 'great difficulty with the metaphysics of the uniting principle or principle of bundling,' [11] because, if an entity is a bundle of its properties, and each property is different from each other property, one must invoke some kind of tie to hold the entity together.

This tie is problematic. Compresence must be a special bundle [10] which leads to an infinite regress with respect to finding what bundles the special bundle to the properties it is meant to bundle together. As such, if what there is, is made of properties, then the world if it accords with reason, falls apart.

Armstrong wonders what might bundle 'dispositions', and expresses that this problem is one of the most confounding for metaphysics. He likes the idea that every property should bestow power, or

provide the power to hold things together, but it is not clear how properties might achieve such power.

Under the GPE, the problem of bundling is cataclysmic. *Every* contingent being must fall apart, for under the necessary condition that the General Principle of Equivalence models, all omnets are reducible to minimally simple omnets, each of which is different from every other. There is nothing left other than the GPE noumenon itself (meaning the condition of the world that the GPE models) that can bundle minimally simple omnets, as assets of complex omnets, together.

The GPE implies a universal origin

The globalised bundling problem implies that the items of all possible ontologies, spacetime, matter, even bits of information, collapse to unconnected simples. For convenience and brevity, taking from Leibniz's idea that monads are windowless, minimally simple omnets are similarly windowless to the endpoint skeptic. Consequently, all minimally simple omnets are initially indistinguishable within the ontology. Under the GPE, because these simples are indistinguishable, they are equivalent to—degenerate to—a single, minimally simple omnet, implying a unique origin.

Whether one accepts the GPE as being the ultimate origin, or the minimally simple omnet as the ultimate origin, this origin does indeed seem to suggest an immaterial source and explanation, which correlates to Wheeler's information theoretic basis.

Compresence of assets

Reference to 'minimally simple omnets' as opposed to simples is for a reason. While the 'internal nature' of a minimally simple omnet remains unknown, under the GPE, the said omnet has the assets of identity (being what it is) and completeness (having what it has and nothing else). We may also accept that it is *finite*, in that there is no background against which it can be infinite.

Now recognize that the asset of completeness has identity and is finite in meaning, and the same can be said of any other global assets, which follows from the GPE. We should admit that these are just different ways of looking at the same compresent bundle, meaning an entangled bundle of assets of the minimally simple entity that are not separately existent. So what seems to be a complex of identity, completeness, finity and so forth is in reality a minimal irreducible bundle that cannot degenerate into further simples. Then these global assets at least are not affected by the problem of bundling—they necessarily hold together and are inseparable. So there is no problem of bundling for these global assets.

The minimally simple omnet has a boundary, and every boundary is bounded

While humankind categorizes the entities of our world as being physical, mental, informational and so forth, these categories are those of humankind. We make a great fuss over the distinction of apparent objects. In the world of our intrepid investigator, such distinctions are not valid. Items like identity, completeness and so forth are just as real as our ideas of hot, cold, weak and strong, material and informational. All are just conditions of the world.

Bearing this in mind, at the limits of abstraction, while the minimal omnet has identity, under the GPE, identity too has identity, and this too has identity, and so forth. In the same way, completeness itself is complete, and this also is complete, and so forth. Because the minimally simple entity is complete, there is a place at which the entity ceases. By 'place' I am referring to Aristotle's idea of place, in which everything has its place, and place too has its place. We are down to ultimate foundations, endpoint abstractions. Spacetime and contemporary mathematics disappeared in the cataclysm. There is just the investigator observing what-must-be, through the lens of the General Principle of Equivalence.

Under the GPE the minimally simple omnet has an endpoint, a place where its identity stops. This end is at the boundary between what necessarily is, and what is not. The boundary is the condition that must exist due to this situation. Its nature is defined by the ontology, not the investigator. The nature of the boundary can remain vague.

If a boundary exists, it too has an end; it too has a boundary. Given that through the eyes of the GPE these have the same assets, they would, in the absence of difference collapse to a single boundary, except that the second boundary cannot be in the same 'place' as the first boundary due to *ontological priority*. Ontological priority is closely aligned to Lowe's [12] description and argument for ontological dependence, as asymmetrical existential dependence. Lowe argues that Socrates' life exists only because Socrates does. Similarly, the *boundary* of a foundational omnet exists only because the foundation does. The conjunction 'because', Lowe argues, expresses an *explanatory* relationship. Explanation, by Lowe's view, is asymmetrical—'Two distinct states of affairs cannot *explain each other*' [12, his emphasis]. He formulates this as a proposition [12, his emphasis]:

> If, necessarily, *x* exists only *because y* exists, then, necessarily, *x* exists only *if y* exists.

It follows that if necessarily *x* exists only *because y* exists, then *y* is ontologically prior to *x*. This aligns with the method of construction in a constructional ontology.

Ontological priority implies a difference between the two boundaries that would otherwise be one, so there is conflict between common identity (same assets) and relative ontological position (a point of difference in the assets). This can be modeled as interacting boundaries and the system is composed of boundary assets and interaction assets, necessarily in compresence due to ontological dependence.

Dimensionality: foundations

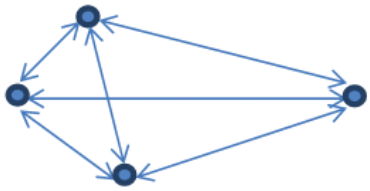
For our imaginary universe, such difference implies the existence of some kind of dimensionality, a space in which the boundaries exist, and exist separately. The causal dependence relation between boundaries prescribes an interaction, and that interaction has a value. Every new boundary has a boundary, but iteratively due to ontological dependence. This implies an evolution of the system.

This can be modeled in a graph-theoretic form as an evolving, completely connected digraph, with the boundaries represented as nodes, each connected to all others, and a new node and its connection appearing with each iteration.

Here then is the evolving structure shown for the first three iterations of the boundary omnets.

Then

Then



These digraphs are a *pre-geometry*. They do not represent any particular shape, and have no proper dimensionality. All they show is that every boundary is connected to every other through ontological necessity, meaning there is a condition that causes them to interact. The bi-directional arrows are a superposition of what are abstract vectors, one representing the tendency to common identity, the second being the response to this, which prevents degeneracy to a single minimally simple omnet.

The addition of each new node prescribes a different omnet, containing all prior omnets, so the history of this world is preserved in its sub-graphs, but for which future iterations may be regarded as potentialities of the Totality. Is this not just what we experience in our idea of history, but are closed off from 'knowing' the future in any certain way?

About time: foundation

Under the GPE, each iteration occurs due to the same cause, which implies a global metronome, one state of the world per iteration of boundaries, and no change of state between iterations. This is the immaterial foundation of time for our evolving imaginary universe. It is what time is, and time comes in minimum bits, similar to our own universe. Where our time seems to be subject to time dilation for objects moving at speed, one might suppose this to be a property that emerges from geometric or topological considerations within equivalent forms of the evolving system, considered shortly. This hints at there being several different kinds of time, the first global, the second local, and possibly a third related to our experience of it.

About spatial dimensions: foundation

Recall that we have not corralled 'assets' as human-centered ideas. We have not aligned assets to common notions. Through the eyes of Kant we recognize our tendency to see the world through the lens of the mind, our thoughts molded by input from our senses. We are all prisoners in Plato's cave. However, where Kant argued that this prevents humankind from accessing the true nature of reality, the world of the endpoint rationalist is a proper model of reality. This authorizes us, in recognizing that we have an anthropocentric viewpoint, to seek other proper models of this evolving structure.

The 1-space Harmony Set

Under the GPE, *any* model that is equivalent to this digraph is a proper model. It may be that there are several ways of describing the world that are equally valid, some of them information theoretic, some of them showing the characteristics of material objects. All may be simply different ways of

looking at the same thing, and are equally valid under equivalence. This is a similar notion to an empiricist choosing to describe a dog in terms of its anatomy, while another might suppose it has a description as its atoms at a certain place and time. For the investigator, the principle rule is that such structures be complete and consistent with the above pre-geometry.

One such structure is the iteration of boundaries in 1-space. Because this genesis of boundaries is iterative, we have an evolution that can be modeled in one dimension, projected into two dimensions in diagram below to show the nature of that evolution. The vertical lines represent nodes as point like structures, on a horizontally evolving system. Here is a model of the first iteration:

Vector representation Compresent equivalent

Figure 1. A one dimensional model of the first structure of the world. The line on the left represents the first 'boundary' (N_1) of the minimally simple entity, and the line on the right represents the second boundary (N_2). The left pointing arrow represents that, other than priority, they would each share the same place (hence be the same boundary) yet cannot, due to independent identity, hence the interaction. The model is completely symmetric in one dimension. Because, in one dimension, these vectors are inseparable, the two vectors can be replaced by a compresent equivalent, which, again, cannot degenerate into unconnected simples.

Figure 2. A one dimensional model of the second iteration of structure. There is an interaction between each boundary and each other boundary and the value of each interaction is necessarily the same, because of equivalence.

The value or strength of the interaction between nodes or boundaries is a constant ('*A*') due to equivalence. One may assign a positive direction to the right pointing vector, and a negative direction to the left pointing vector. The compresent vectors superpose to a scalar value, in a one dimensional analysis. The investigator cannot correlate this value to our real world, but there is at least a potential basis for calibration. The separation of boundaries is an immaterial cause and explanation of what we call distance in this imaginary universe, in that the separation of boundaries has a value (a value of 1 separation). Under the GPE, nodes must be equal distances apart, again due to equivalence or symmetry. Considering 'it from bit,' a little thought may convince the reader that these immaterial interactions equate to the equivalent of material or physical interactions in the imaginary universe—it is the human-centered view that wants this to have sensory equivalence.

With this foundation one can model the interactions with values, for example as shown in Figure 3 to represent the 1-space model after three iterations of the system. Due to the fact that the system is a sum of partials of the harmonic series, I call this the Harmony Set. Equivalence also dictates that interactions are distributed across the gaps, leading to rational values.

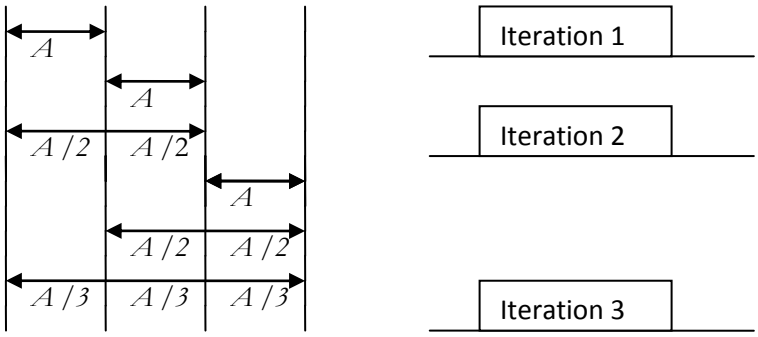


Figure 3 – Harmony Set – first three iterations, distributed values.

For the N_1 to N_2 gap (leftmost pair of lines, where 'N' stands for null element—boundaries of unknown, unknowable, and *irrelevant* content) we find the superposition of vectors that can be represented in familiar symbols as: $A + A/2 + A/3$. These vectors overlay each other in 1-space, meaning the space of all compresent one dimensional interpretations, hence the concept of superposition. Such a superposition will be referred to as *vector density*. So we say that the *vector density* for the third iteration between N_2 and N_3 is $1 + 1/2 + 1/2 + 1/3$, and the N_3 to N_4 gap as a vector density is the same as the same as the N_1 to N_2 gap.

The evolution of vector density in this one dimensional universe is shown here:

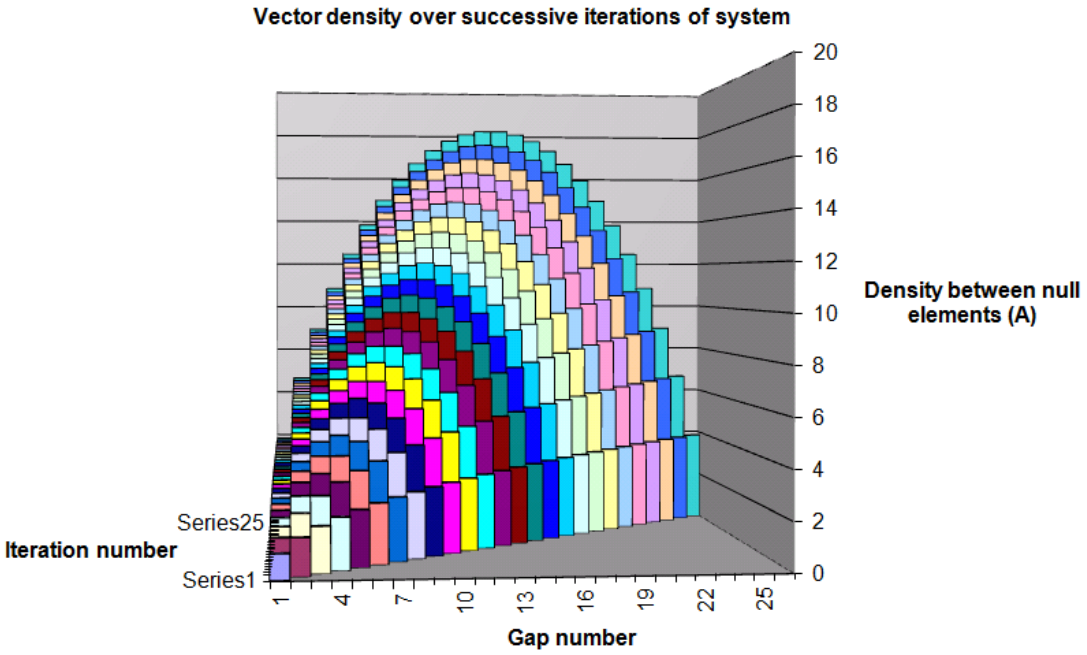


Figure 4 – Vector density: successive iterations of Harmony Set construction. The first state of the universe is at the front, and is absorbed into and replaced by the one behind it.

All gap vector densities are sums of partials of the harmonic series. With each iteration, each gap receives a contribution from the last added null element interaction, equivalent to a partial harmonic series (e.g. 1/5 + 1/6 + 1/7 + 1/8). So each gap becomes a sum of partials of the harmonic series. In a physical sense we would talk about a superposition of vector duals (pairs of omnets that have both magnitude and direction). Together these prescribe a *scalar field*. Distribution of the vector duals into higher dimensions may change the field in important ways.

Characteristics of the Harmony Set.

It can be shown that the rate of change of the first gap approaches e^{-n} where n is the number of iterations of the self-generating set. The rise is nearly logarithmic, deducible from the nature of the harmonic series.

It can also be shown that the rate of rise of the central peak approaches ln 2. That said, for this imaginary world, the number *e* will never be, for the Harmony Set is constructed wholly from rational values. For this 1-space interpretation of the universe, there is no such a thing as an irrational number, and the continuum is not smooth, implying that a Schrödinger type equation relating to this world might be a Riemann sum, rather than a differential equation.

But where is *i* our beloved imaginary number? One finds that distributing values into a Euclidean 3-space implies that the negative valued vectors map to imaginary numbers if one distributes the value to the surface of a sphere at distance A', where A' is a new minimum increment of distance. But we have now stepped too far for our newly birthed universe.

Conclusion: what information is

So, back to Wheeler. A universe has been modeled based on an immaterial source, cause and explanation. The Harmony Set and its equivalent forms, for example higher dimensional mappings of the vector sets, or perhaps Fourier transforms (hence wave solutions) of the many top-hat functions represented, or perhaps a variation of Causal Dynamical Triangulations, are all there is to this imaginary world. For the endpoint skeptic the real world is necessarily one of these or possibly a superposition of several or all interpretations, suggesting that our favorite but inharmonious theories will find a neat correspondence to different but equivalent models, some that accentuate the large scale, some that accentuate the small. There is already evidence that our universe can be reduced to lower dimensions in the form of a holographic universe. Perhaps there is a further reduction to the one developed here.

Either way, if this is all there is, then these models are the foundation of information, and in that context, the universe is informational by nature.

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