From Distinction to Pregeometry, "It from Bit" and Topological Quantum Information

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The remarkable theoretical physicist John Archibald Wheeler coined the phrase “It from Bit” in 1989 and he wrote:

"*It from Bit* symbolizes the idea that every item of the physical world has at bottom, at a very deep bottom, in most instances — an immaterial source and explanation; that what we call reality arises in the last analysis from the posing of yes-no questions and the registering of equipment-evoked responses; in short, that all things physical are information-theoretic in origin and this is a participatory universe.”

Prior to that phrasing, Wheeler had already written a chapter (44.5) in his book “Gravitation” with Misner and Thorne (1970) entitled “PreGeometry as the Calculus of Propositions”. In which he says

“Among all the principles that one can name out of the world of science, it is difficult to think of one more compelling than simplicity; and among all the simplicities of dynamics and life and movement, none is starker than the binary choice yes-no, true-false.”

It is the thesis of this talk that Wheeler hit the nail on the head, that binary choice seen rightly leads directly to the most fundamental physics, to the qubit just as inevitably as the bit and that in that flowering of choice is the emergence of topology atthe base of physics. We will see how, starting with choice, emerge the formalisms of spin and the kets and bras of Dirac, the Temperley Lieb algebra, significant representations of the Artin Braid Group that suffice to generate enough unitary transformations for all of quantum information and quantum computing. These skeletal constructions acquire more substance as they grow physically and mathematically in relation to Chern-Simons Theory, the quantum Hall effect, Majorana Fermions in supercooled nano-wires and the categorical and tensor diagrammatic understanding of quantum mechanics. This talk will trace this view of the development and possibilities of physics from nothing but the emergence of a distinction.

Wheeler suggested a very deep bottom and we concur. This talk will begin in the emergence of distinction. We begin with the emergence of a calculus prior to the the calculus of propositions. A calculus due to G. Spencer-Brown in his work “Laws of Form” that is more elementary than elementary logic and that removes the problem faced by Ludwig Wittgenstein when he said (in the Tractatus)

"… the [negation]sign ~
corresponds to nothing in reality." (Tractatus 4.0621)

"How can the all-embracing logic which mirrors the world, use such special catches and manipulations? Only because all these are connected into an infinitely fine network, to the great mirror." (Tractatus 5.511)

There is no mirror and most particularly, the operation of negation can be seen as a value to be negated, just as one would apparently write in meta-language as

$$\sim\sim = \text{(nothing)}$$

Language and metalanguage are identical in the very deep bottom. It is possible to have the crochets and contrivances mirror with our mirrors and to begin the articulation of Thought, Language and The Real together on both sides of the Looking Glass.