The Informational Deficiency of the "Big Bang"

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Abstract: This essay presents a possible deficiency of the "Big Bang" theory from the position of quantity of information. The essay poses an ultimate question: how many bits of pre-set information the Universe requires to evolve from the "Big Bang" further?

The "Big Bang" theory is an interesting concept which gives a framework for discussions about the way the Universe came to being. The "Big Bang" is built around the concept of singularity, an ultra-small area of space with ultra-large amount of energy, and its ultra-fast sub-second expansion which happened in the first moments of "life" of the Universe.

What is not immediately covered by the "Big Bang" is the further evolution of the Universe. We know that any biological organism or evolving system not only requires energy and material resources to grow, but it also needs a program of growth. Without this program (DNA) the resources won't even be taken from the environment to build the organism.

In the light of this, what program the Universe had in the first moments after the "Big Bang"? The obvious answer: none, since no much structured differentiation existed at this step. But this is not entirely correct, because the Universe had pre-set physical laws: several dozen equations plus several dozen particle parameters, give or take. These laws can be squeezed into let's say 100,000 bits of information. However, if you try to use this set of information to model the further evolution of Universe, it may become apparent that this quantity of information is not enough. Every second of evolution, then every year of evolution, then every million years of evolution requires an increasing number of information that differentiates star A from star B, galaxy C from galaxy D, etc. All these little "asymmetries" and "differences" required to be taken into account to proceed from step 1 to step 2 of Universe's evolution are a quantitative, logical or structural information. Observable repetitiveness or "fractalness" may reduce the estimated amount of this information, but how much the Universe is really repetitive and fractal?

One can assume that the Universe evolved randomly, with a lot of Brownian-like motion and based on the pre-set physical laws alone, and this is what is usually assumed. But what randomness really is? Randomness is found by comparing a similar feature across the population. We call a feature as having a random appearance when we cannot discern exact factors that influence its appearance or when an increasingly large number of factors influence it. For example, to us the mass, position and the spectrum of stars can be considered randomized features. Randomness itself is not equivalent to diversity, and it does not carry information beside several statistical values: so, it can be hard to squeeze the visible Universe's diversity into random operators.

If we look at the human body, it also has randomized features: body height, hair color, blood type, constitution, etc. And it has a lot of non-randomized, pre-set, features as well: cell types, organs, the way each organ works and how the organs are interconnected. The same applies to the Universe: while the mass of stars and other features are randomized, the construct, the inner processes, the life-cycle and physical laws that govern stars and galaxies are non-randomized, pre-set, features.

Now, the ultimate question is: how many bits of information the Universe had before the moment of the “Big Bang”? Can this number be squeezed into the said 100,000 bits that only cover the non-random physical laws, or much more information was required to produce the known evolution of the Universe? (Note that the human DNA contains more than 6 billion bits of information with at least 20% having a known function.)

And if the answer appears to be “much more information was required”, what the source of this information was? Can we talk about the “Big Bang” being merely a breaking of an “egg” placed by a higher-level entity: be it some “pregnant” meta-universe or some other source? Can we talk about star’s, galaxy’s, Universe’s program of growth or DNA? If so, where and how this meta-information is stored or provided?