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Appendix II: David McGoveran to Ted Bastin, April 12, 1990

I find the paper very interesting and do have a few comments. Some may not get into this response, but I'll complete them as time permits.

Your comparison of my thinking to Thomas Aquinas' systematic natural theology and revealed truth has potential. While I would agree that the ordering operator calculus (OOC hereinafter) might be akin to the former (at least in intent), I would say that laboratory physics is closer to the "revealed truth". For me, the combination of the hierarchy (CH hereinafter) together with Program Universe (or bit string physics more generally—and PU hereinafter) is to be a representation of laboratory physics (LP hereinafter) in terms of OOC. One of the reasons that I accelerated the development of OOC and then applied it to LP was that I did not find the foundations for either CH or PU compelling: the former is not mathematically rich enough for my taste and the latter was too loosely expressed.

OOC may not be acceptable to some, but it is my best effort to provide a rich and rigorous mathematical system which could then be used to combine all these various ideas with which we have played around, and detect and eliminate any contradictions or inconsistencies. If I have been elusive about the relationship between CH and OOC, I apologize. I thought it was clear. OOC can be used to express CH and its results, just as can the various other branches of mathematics which Clive has used to provide various "foundations" of CH. It is a formal system that happens to be context sensitive, and so leads to a different interpretation than other systems.

Please remember that "Foundations" was clearly split into two parts: the mathematical part and the application to LP. CH and PU only occur in the second part. They are not intimately bound to OOC and may have bearing on applications of OOC to other fields (though I think this unlikely). Certainly, I have not used concepts from CH or PU in my other attempts to apply OOC such as linguistics or computer science. For me, attempting to establish a priority between CH versus OOC is like trying to establish a priority between a tool (hammer) and the work (wood): they are both required to achieve anything.

If it is difficult to be precise about CH in terms of OOC it is because OOC makes it clear that the specific evolution of CH is missing: there are many ordering operators which can fill the bill—we only know their general characteristics. OOC deals with the detail of such evolution as well as both the general features and the statistical character. The former is the most important from my point of view. PU proposes no specific algorithm but a class of algorithms. This imprecision makes it impossible to satisfy certain key questions about our model of LP. Having been convinced by you, Clive, Pierre, and John that CH is a fine exoskeleton, I desired the putting in of flesh. CH, as in my fine structure and other constants computations, enters in an essential way as constraints on some of the ordering operators.

I am puzzled that you say that I start by requiring that a correct representation of dimensionality should "use a metric criterion which does not in any way distinguish one dimension from another." The Theorem introduces this notion only by way of constructing a discrete version of an n–dimensional d–space which is "homogeneous" and "isotropic". Prior to this theorem, in Foundations was introduced a definition of d–space and dimensionality which need not be either homogeneous or isotropic. The entire construction relies on these definitions.

I agree that the analogy (though it is more than this) to "homogeneity" and "isotropy" short–circuits several vital arguments. The prescription of synchronization (which occurs in my derivations of the Lorentz transformations, the fine structure, and 3–dimensionality) is far too brief and should have been used to provide formal definitions of discrete versions of these concepts. Once again, time, Oh for more time.

I was not aware that you had previously connected order with temporal indistinguishability or 'simultaneity'. The connection between distinguishability and ordering is a pervasive part of OOC.

I will not repudiate all you are saying, I like most of it.

I would like to understand how CH being an example from OOC (not quite how I see it) leads to difficulties and why recourse to a revelation role (what does this mean? As in Aquinas revealed truth?) for CH is tempting. Can you comment more fully?

I do not see that the cut–off to CH is statistical. For me it is clearly a matter of being unable to preserve certain (highly desirable for a number of reasons) mathematical properties beyond a certain level of complexity. The CH algorithm described in the ANPA 10 paper reveals this best and most intuitively for mathematical physicists.

Now regarding the difficulty of giving finite combinatorial meaning to Feller's Theorem vis–a–vis statistically unlikely circumstances. While I cannot avoid the statistical character of the proof, I can remove the problem of combinatorial interpretation. This problem arises because of the way Feller invokes convergence and difference theorems and therefore limit theorems. The asymptotic continuation of the combinatorial terms of the series seems to be essential. However, one need not resort to this method to see the validity of the theorem.

In particular, suppose that a $3 + n$ space has been generated up to some finite extent. Because of the probabilities involved, the most dense constructible 1–dimensional d–subspace will have a denser sequence of metric points than every constructible 2–dimensional d–subspace, and the most dense 2–dimensional d–subspace denser than every 3–dimensional d–subspace. However, this situation reverses at 4–dimensions so that the most dense $4 + n$–dimensional d–subspaces are now ordered as less dense than every 5+n-dimensional d-subspaces (where n is an element of 0, 1, 2, ...)! This means that every $4 + n$–dimensional d–subspace is separable into a number of isotropic and homogenous 1, 2, and 3–dimensional d–subspaces, but NOT into isotropic and homogenous 1, 2, 3 and 4–dimensional d–subspaces.

Again, there might be some (and indeed perhaps a large number) of "exceptional" generators of homogeneous and isotropic m–dimensional d–subspaces with $n > 3$. The algorithm for this generator would be deterministic. However, it is my claim that no such deterministic algorithm can be correct for other reasons as explained regarding "arbitrariness" and the very definition of ordering operator in Foundations: the complexity of the algorithm for an ordering operator is such that it cannot be given a full interpretation within the generated system.

For PU, the generators of our d–space, therefore, are of such complexity that the "next" metric mark cannot be represented in terms of all those generated so far. This precludes the possibility that the generation of the space is deterministic in the way required: namely that we can predict deterministically from the d–space generated so far and the distribution of metric marks where/when the next metric mark will be generated. Every c–dimensional d–space with $n > 3$ is not algorithmically extensible within the system. It is therefore subject only to statistical characterization. I realize this is not a formal argument and hope to make it formal in my next major effort: Foundations II.

Not long ago I questioned Pierre's reference to "McGoveran's Theorem" regarding there being only three conserved unique quantum numbers (which I take to mean that only three quantum units or parameters are possible for global descriptions and what you mean by Pierre's conservation theorem). I subsequently convinced myself that it was OK, with the fourth number being only a locally usable number. If this fourth number is color, we have "color confinement" and "asymptotic freedom". Conservation is not the issue here. (Indeed I insist that nothing ever gets "conserved" but that similar structures are recursively generated so that a "conserved property" is found to have the same "value" over some causal trajectory—see ANPA 11 paper.)

The argument is simple. PU generates strings with arbitrary quantum numbers (QNs hereinafter) selected from all those allowed. We can imagine a generation which orders the sets of strings with QNs of each type: a set of strings ordered by spin QN, another by angular momentum, etc. We now synchronize the generators so that a d–space is constructed with a diagonal of n strings, one with each of these QNs and therefore n–dimensions. Feller's Theorem now applies.

I agree that synchronization is the bridge between combinatorics and geometry—at least that is why and how I have used it.

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