The Cognitive-Theoretic Model of the Universe:
A New Kind of Reality Theory

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Contents

Abstract: Inasmuch as science is observational or perceptual in nature, the goal of providing a scientific model and mechanism for the evolution of complex systems ultimately requires a supporting theory of reality of which perception itself is the model (or theory-to-universe mapping). Where *information* is the abstract currency of perception, such a theory must incorporate the theory of information while extending the information concept to incorporate reflexive self-processing in order to achieve an intrinsic (self-contained) description of reality. This extension is associated with a limiting formulation of model theory identifying mental and physical reality, resulting in a reflexively self-generating, self-modeling theory of reality identical to its universe on the syntactic level. By the nature of its derivation, this theory, the *Cognitive Theoretic Model of the Universe* or CTMU, can be regarded as a *supertautological* reality-theoretic extension of logic. Uniting the theory of reality with an advanced form of computational language theory, the CTMU describes reality as a *Self-Configuring Self-Processing Language* or SCSPL, a reflexive *intrinsic language* characterized not only by self-reference and recursive self-definition, but full self-configuration and self-execution (reflexive read-write functionality). SCSPL reality embodies a dual-aspect monism consisting of *infocognition*, self-transducing information residing in self-recognizing SCSPL elements called *syntactic operators*. The CTMU identifies itself with the structure of these operators and thus with the distributive syntax of its self-modeling SCSPL universe, including the reflexive grammar by which the universe refines itself from *unbound telesis* or *UBT*, a primordial realm of infocognitive potential free of informational constraint. Under the guidance of a limiting (intrinsic) form of anthropic principle called the *Telic Principle*, SCSPL evolves by *telic recursion*, jointly configuring syntax and state while maximizing a generalized self-selection parameter and adjusting on the fly to freely-changing internal conditions. SCSPL relates *space, time* and *object* by means of *conspansive duality* and *conspansion*, an SCSPL-grammatical process featuring an alternation between dual phases of existence associated with design and actualization and related to the familiar wave-particle duality of quantum mechanics. By distributing the design phase of reality over the actualization phase, conspansive spacetime also provides a distributed mechanism for *Intelligent Design*, adjoining to the restrictive principle of natural selection a basic means of generating information and complexity. Addressing physical evolution on not only the biological but cosmic level, the CTMU addresses the most evident deficiencies and paradoxes associated with conventional discrete and continuum models of reality, including temporal directionality and accelerating cosmic expansion, while preserving virtually all of the major benefits of current scientific and mathematical paradigms.

Introduction

Among the most exciting recent developments in science are *Complexity Theory*, the theory of self-organizing systems, and the modern incarnation of *Intelligent Design Theory*, which investigates the deep relationship between self-organization and evolutionary biology in a scientific context not preemptively closed to teleological causation. Bucking the traditional physical reductionism of the hard sciences, complexity theory has given rise to a new trend, *informational reductionism*, which holds that the basis of reality is not matter and energy, but information. Unfortunately, this new form of reductionism is as problematic as the old one. As mathematician David Berlinski writes regarding the material and informational aspects of DNA: "We quite know what DNA is: it is a macromolecule and so a material object. We quite know what it achieves: apparently everything. Are the two sides of this equation in balance?" More generally, Berlinski observes that since the information embodied in a string of DNA or protein cannot affect the material dynamic of reality without being read by a material transducer, information is meaningless without matter.[1]

The relationship between physical and informational reductionism is a telling one, for it directly mirrors Cartesian *mind-matter dualism*, the source of several centuries of philosophical and scientific controversy regarding the nature of deep reality.[2] As long as matter and information remain separate, with specialists treating one as primary while tacitly relegating the other to secondary status, dualism remains in effect. To this extent, history is merely repeating itself; where mind and matter once vied with each other for primary status, concrete matter now vies with abstract information *abstractly representing* matter and its extended relationships. But while the formal abstractness and concrete descriptiveness of information seem to make it a worthy compromise between mind and matter, Berlinski's comment demonstrates its inadequacy as a conceptual substitute. What is now required is thus what has been required all along: a conc

constantly affirms the linguistic structure of nature by exploiting syntactic isomorphism to perceive, conceptualize and refer to it. Even cognition and perception are languages based on what Kant might have called "phenomenal syntax". With logic and mathematics counted among its most fundamental syntactic ingredients, language defines the very structure of information. This is more than an empirical truth; it is a rational and scientific necessity.

Of particular interest to natural scientists is the fact that the laws of nature are a language. To some extent, nature is regular; the basic patterns or general aspects of structure in terms of which it is apprehended, whether or not they have been categorically identified, are its "laws". The existence of these laws is given by the stability of perception. Because these repetitive patterns or universal laws simultaneously describe multiple instances or states of nature, they can be regarded as distributed "instructions" from which self-instantiations of nature cannot deviate; thus, they form a "control language" through which nature regulates its self-instantiations. This control language is not of the usual kind, for it is somehow built into the very fabric of reality and seems to override the known limitations of formal systems. Moreover, it is profoundly reflexive and self-contained with respect to configuration, execution and read-write operations. Only the few and the daring have been willing to consider how this might work…to ask where in reality the laws might reside, how they might be expressed and implemented, why and how they came to be, and how their consistency and universality are maintained. Although these questions are clearly of great scientific interest, science alone is logically inadequate to answer them; a new explanatory framework is required. This paper describes what the author considers to be the most promising framework in the simplest and most direct terms possible.

On a note of forbearance, there has always been comfort in the belief that the standard hybrid empirical-mathematical methods of physics and cosmology will ultimately suffice to reveal the true heart of nature. However, there have been numerous signals that it may be time to try a new approach. With true believers undaunted by the (mathematically factual) explanatory limitations of the old methods, we must of course empathize; it is hard to question one's prior investments when one has already invested all the faith that one has. But science and philosophy do not progress by regarding their past investments as ends in themselves; the object is always to preserve that which is valuable in the old methods while adjoining new methods that refine their meaning and extend their horizons. The new approach that we will be exploring in this paper, which might be colorfully rendered as "reality theory is wedded to language theory and they beget a synthesis", has the advantage that it leaves the current picture of reality virtually intact. It merely creates a logical mirror image of the current picture (its *conspansive dual*), merges the symmetric halves of the resulting picture, and attempts to extract meaningful implications. Science as we now know it is thereby changed but little in return for what may, if fate smiles upon us, turn out to be vast gains in depth, significance and explanatory power.

And on that note, I thank you for your kind attention and wish you a fruitful journey.

On Theories, Models and False Dichotomies

It has almost become embarrassing to point out that science is in a state of crisis…not because it is untrue, but because it has become a cliché too often accompanied by little or no remedial insight. For all of the magnificent achievements of science, its grander ambitions long ago succeeded in taxing its traditional models and organizational principles beyond their explanatory limits. In the search for ever deeper and broader explanations, science has reached the point at which it can no longer deny the existence of intractable conceptual difficulties devolving to the explanatory inadequacies of its fundamental conceptual models of reality. This has spawned a new discipline known as *reality theory*, the study of the nature of reality in its broadest sense. The overall goal of reality theory is to provide new models and new paradigms in terms of which reality can be understood, and the consistency of science restored as it deepens and expands in scope.

Mainstream reality theory counts among its hotter foci the interpretation of quantum theory and its reconciliation with classical physics, the study of subjective consciousness an

plot or character. However, there is a third alternative which has thus far remainedss a nd Tj 10.02 0 0 10.02 3246.719

If determinacy corresponds to an arrow of cau

specific property to any specific object). Through telic feedback, a system retroac

without Law and *It from Bit*, the self-excited circuit amounts to a preliminary but well-considered program for describing the physical universe. According to its mandate, the true description

established continuum physical law. (2) There is no such thing at the microscopic level as space or time or spacetime continuum. (3) The familiar probability function or functional, and wave equation or functional wave equation, of standard quantum theory provide mere continuum idealizations and by reason of this circumstance conceal the information-theoretic source from which they derive. (4) No element in the description of physics shows itself as closer to primordial than the elementary quantum phenomenon, that is, the elementary device-intermediated act of posing a yes-or-no physical question and eliciting an answer or, in brief, the elementary act of observer participancy. Otherwise stated, every physical quantity, every it, derives its ultimate significance from bits, binary yes-or-no indications, a conclusion which we epitomize in the phrase *it from bit*." [13]

How come the quantum? Why is the universe made up of apparently *propter hoc* nondeterministic, but *post hoc* informational, quantum events? As Wheeler observes, "Quantum physics requires a new view of reality."[14] What, then, is the exact logical relationship between the quantum and the new view of reality it demands? What is this new view, and how does the quantum fit into it?

How come the "one world" out of many observer-participants? Insofar as the term "observer-participants" embraces scientists and other human beings, this question invites a quasi-anthropological interpretation. Why should a universe consisting of separate observers with sometimes-conflicting agendas and survival imperatives display structural and nomological unity? Where observers are capable of creating evencm(ual a)Tj10.02 0 0 10.03448591257 469.2599 Try (huifold(e 7

which we think, and not conditions in which we live", regarding these modes as derivable from a proper theory of reality as idealized functions of an idealized continuum: "We will not feed time into any deep-reaching account of existence. We must derive time—and time only in the continuum idealization—out of it. Likewise with space."[18]

The boundary of a boundary is zero: In essence, this intuitive notion from algebraic topology says that closed structures embody a certain kind of "self-cancellative" symmetry. This can be illustrated in three dimensions by a tetrahedron, the simplicial "boundary" of which incorporates its four equilateral triangular faces. To find the boundary of this boundary, one would measure the clockwise- or counterclockwise-oriented edges around each face, thus measuring each edge of the tetrahedron twice in opposite directions. Because summing the measurements now cancels to 0 at each edge, the boundary of the boundary of the tetrahedron is zero. This property turns out to have extensive applications in physics, particularly the theory of fields, as regards the mutual "grip" of matter on space and space on matter (or less colorfully, the relationship of space and matter). In Wheeler's view, its ubiquity "inspires hope that we will someday complete the mathematics of physics and derive everything from nothing, all law from no law."[19] Thus, it is closely related to law without law and so-called *ex nihilo* creation.

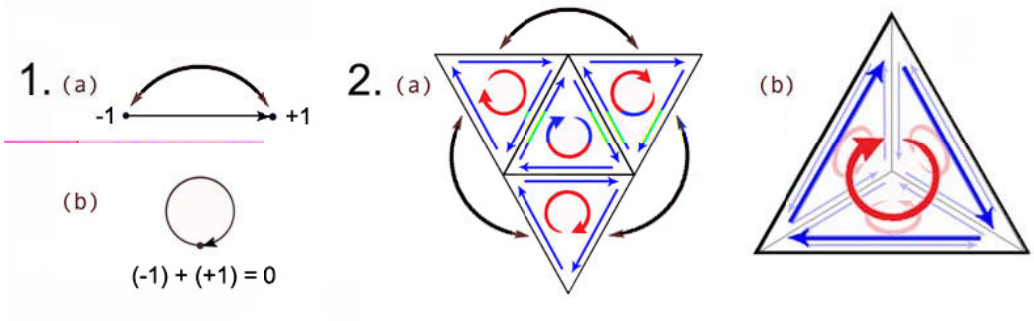

Diagram 4: **1a**: The boundary of a directed 1-dimensional line segment consists of its 0-dimensional endpoints, which separate the line from its complement (the space surrounding the line). The initial point represents the "debt" required to start the line and is thus given a value of -1, while the terminal point represents the "payoff" for completing the line and is given a value of +1. When the initial and terminal points of the line are identified as indicated by the curved arrow, the result is a closed line bounding a planar disk (**1b**). Because the endpoints now coincide, they sum to 0 and no longer separate the line from its complement; thus, the 0-dimensional boundary of the 1-dimensional boundary of the 2-dimensional disk is 0. **2a**: A triangular area can be decomposed into 4 smaller triangular areas. Introducing a uniform (in this case, clockwise) orientation to the areas (red arrows) imparts the same orientation to the outer perimeter (outer blue arrows), recreating the situation of 1b (notice that the blue arrows next to each interior edge point in opposite directions and therefore cancel). Again, the initial and terminal points of the perimeter coincide and cancel to 0 no matter where they lie. When adjacent perimeter segments are identified as indicated by the outer arrows, the triangle folds into a tetrahedron (**2b**). Its faces form a closed 2-dimensional boundary separating its 3-dimensional interior from its exterior, while its edges form a closed 1-dimensional boundary separating its faces from each other. But now the blue arrows cancel out at *every* edge, and the 1-dimensional boundary of the 2-dimensional boundary of the tetrahedron is 0. So for both the 2D disk and the 3D tetrahedron, the boundary of the boundary is 0. While physicists often use this rule to explain the conservation of energy-momentum (or as Wheeler calls it, "momenergy"[20]), it can be more generally interpreted with respect to *information* and *constraint*, or *state* and *syntax*2 48 7.9773 30 00.52 244.9798 191.1411 Tm(h)Tj8.5230 086.52 179.7754 19

which “give an answer”. Question

Some Additional Principles

Although insights regarding the ideal and/or perceptual basis of reality go back millennia, we may as well start with some their more recent proponents for the sake of continuity. First, Descartes posited that reality is mental in the sense of rationalism, but contradicted his own thesis by introducing *mind-body dualism*, the notion that mind and matter are irreducibly separate. The empiricist Berkeley then said that reality is perceptual in nature, a kind of intersect of mind and matter. This can be seen by mentally subtracting perception from one's conception of reality; what remains is pure subjective cognition, but without any objective grist for the perceptual mill. (Although attempts to cognitively subtract cognition from reality are far more common, they are a bit like trying to show that a sponge is not inherently wet while immersing it in water, and can never be successful on the parts of cognitive entities.) Hume then attempted to do away with cognition and causation entirely, asserting that both mind and matter inhere in perception and exist apart from neither it nor each other.

In disposing of mind, Hume made another salient "contribution" to reality theory: he attempted to dispose of causation by identifying it as a cognitive artifact, supporting his thesis with the *problem of induction*.[23] The problem of induction states that because empirical induction entails the prior assumption of that which it seeks to establish, namely the uniformity of nature, science is circular and fundamentally flawed. The problem of induction is very real; it is manifest in Heisenberg uncertainty and the cosmic horizon problem, finite limitations of scientific tools of microscopic and macroscopic observation, and is why no general theory of reality can ever be reliably constructed by the standard empirical methods of science. Unfortunately, many scientists have either dismissed this problem or quietly given up on the search for a truly general theory, in neither case serving the long-term interests of science. In fact, the problem of induction merely implies that a global theory of reality can only be established by the rational methods of mathematics, specifically including those of logic.

In response to Berkeley and Hume, Kant asserted that the unprimed cognition which remains when perceptual content is subtracted has intrinsic structure that exists *prior* to content; it comprises the *a priori* categories of perceptual or "phenomenal" reality.[24]

The first thing to notice about this question is that it involves the process of *attribution*, and that the rules of attribution are set forth in stages by mathematical logic. The first stage is called *sentential logic* and contains the rules for ascribing the

is at last reduced to (dual-aspect) monic form, short-circuiting the paradox of Cartesian dualism and eliminating the epistemological gap between mind and matter, theory and universe.

As complexity rises and predicates become theories, tautology and truth become harder to recognize. Because universality and specificity are at odds in practice if not in principle, they are subject to a kind of "logical decoherence" associated with relational stratification. Because predicates are not always tautological, they are subject to various kinds of ambiguity; as they become increasingly specific and complex, it becomes harder to locally monitor the heritability of consistency and locally keep track of the truth property in the course of attribution (or even after the fact). Undecidability,[26] LSAT intractability and NP-completeness, predicate ambiguity and the Lowenheim-Skolem theorem, observational ambiguity and the Duhem-Quine thesis[27] …these are some of the problems that emerge once the truth predicate "decoheres" with respect to complex attributive mappings. It is for reasons like these that the philosophy of science has fallen back on falsificationist doctrine, giving up on the tautological basis of logic, effectively demoting truth to provisional status, and discouraging full appreciation of the tautological-syntactic level of scientific inquiry even in logic and philosophy themselves.

In fact, the validity of scientific theories and of science as a whole absolutely depends on the existence of a fundamental reality-theoretic framework spanning all of science…a fundamental syntax from which all scientific and mathematical languages, and the extended cognitive language of perception itself, can be grammatically unfolded, cross-related and validated. Tautology, the theoretical basis of truth as embodied in sentential logic, is obviously the core of this syntax. Accordingly, reality theory must be developed through amplification of this tautological syntax by adjunction of additional syntactic components, the principles of reality theory, which leave the overall character of the syntax invariant. Specifically, in order to fashion a reality theory that has the truth property in the same sense as does logic, but permits the logical evaluation of statements about space and time and law, we must adjoin principles of extension that lend meaning to such statements while preserving the tautology property.

According to the nature of sentential logic, truth is tautologically based on the integrity of cognitive and perceptual reality. Cognition and perception comprise the primitive (self-definitive) basi

logician to mentally read, understand and apply it. On the other hand, nature (or cognitive-perceptual reality) requires no external logician to apply the rules of logic. Therefore, the proposed tautology-preserving principles of reality theory should put mind back into the mix in an explicit, theoretically tractable way, effectively endowing logic with "self-processing capability". This, after all, is exactly what it possesses in its natural manifestation, reality at large, and is an essential dimension of the closure property without which truth is insupportable. That is, reality must be able to recognize itself and impart this ability to its components as a condition of their existence and interaction.

Having explained the main technical issues in reality theory, we may now cut to the chase: the way to build a theory of reality is to identify the properties that it must unconditionally possess in order to exist, and then bring the theory into existence by defining it to possess these properties without introducing merely contingent properties that, if taken as general, could impair its descriptive relationship with the real universe (those can come later and will naturally be subject to empirical confirmation). In other words, the means by which the theory is constructed must be rational and tautological, while those by which it is subsequently refined may be empirical. Since we want our theory to be inclusive enough, exclusive enough and consistent enough to do the job of describing reality, these properties will certainly include *comprehensiveness* (less thorough but also less undecidable than completeness), *closure*, and *consistency*. To these properties, the "3 C's", we shall assign three principles that are basically tautological in form; that way, adjoining them to logic-based reality theory will preserve the tautology property of logic, rationally precluding uncertainty by the same means as logic itself. A theory of reality constructed in this way is called a *supertautology*.

Because our three principles correspond to the 3 C's, and because they all begin with the letter M, we might as well call them the "3 M's": M=R, MAP and MU, respectively standing for the *Mind Equals Reality Principle*, the *Metaphysical Autology Principle*, and the *Multiplex Unity Principle*. The M=R principle, a tautological theoretical property that dissolves the distinction between *theory* and *universe* and thus identifies the real universe as a "self-reifying theory", makes the syntax of this theory comprehensive by ensuring that nothing which can be cognitively or perceptually recognized as a part of reality is excluded for want of syntax. MAP tautologically renders this syntax closed or self-contained in the definitive, descriptive and interpretational senses, and in conjunction with M=R, renders the universe perfectly self-contained in the bargain. And MU tautologically renders this syntax, and the theory-universe complex it describes, coherent enough to ensure its own consistency (thus, the "C" corresponding to MU actually splits into two C's, *consistency* and *coherence*, and we have four altogether). To each of these principles we may add any worthwhile corollaries that present themselves.[30]

Since it is the lot of every reality theorist to use properties of reality to explain reality, and these properties are recursively defined, we will sometimes implicitly or explicitly refer to various properties in the descriptions of other properties. This precludes a neat series of cumulative definitions, which is possible in any case only by taking for granted the content and wherewithal of theorization (unfortunately, one can take nothing for granted in reality theory). As we will see below, the recursive nature of the CTMU is unavoidable. Secondly, the CTMU is developed "backwards" with respect to the usual deductive theories of science and mathematics, by first peeling away constraints and only then using the results to deduce facts about content. Most theories begin with axioms, hypotheses and rules of inference, extract implications, logically or empirically test these implications, and then add or revise axioms, theorems or hypotheses. The CTMU does the opposite, stripping away assumptions and "rebuilding reality" while adding no assumptions back.

The following principles are presented in three stages. The first stage includes the *Reality Principle*, the *Principle of Linguistic Reducibility* and the *Principle of Syndiffeonesis*, which may be considered preliminary to MAP, M=R and MU respectively (the order of presentation may differ slightly from that just given). The second stage consists of MAP, M=R and MU themselves, while the third stage consists of several auxiliary principles that can be viewed as their consequences.

The Reality Principle

Reality, i.e. the real universe, contains all and

if their difference is real, then they both reduce to a common reality and are to that extent similar. Syndiffeonesis, the most general of all reductive principles, forms the basis of a new view of the relational stru

system X, there exists a more basic set of laws ($nom_A X$ $nom_B X$) in terms of which this difference may be expressed. This shows that on some level, general covariance must hold. This is not merely true "up to isomorphism with X"; even if more than one valid set of laws can be distinguished, any one of which might be active at any given location (A,B,…) within X [X_A nom_1, X_B nom_2, …, where numerical indices denote nomological distinctness], any distinguishable difference between these sets *also* requires a common syntax. Informational coherence is thus a *sine qua non* of recognizable existence; any system in which it were to fail would simply decohere for lack of anything to hold it together.

In other words, (1) where informational distinctions regarding a system X are regarded as instantiations of law, they can also be regarded as expressions conforming to syntax; and (2) the expression of differences requires a unified expressive syntax (or set of "laws"), and this syntax must distribute over the entire set of differential expressions (or "instantiations of law"). E.g., where X is a "perceptual intersect" consisting of generally recognizable objects, attributes and events, the laws of perception must ultimately be constant and distributed. Where a putative nomological difference exists for some pair of loci (A,B), reductive syntactic covariance applies due to the need for an expressive medium, and where no such difference exists for *any* pair of loci (A,B), syntactic covariance applies *a fortiori* with no need for reduction.

Syndiffeonic relations can be regarded as elements of more complex *infocognitive lattices* with spatial and temporal (ordinal, stratificative) dimensions. Interpreted according to CTMU duality principles, infocognitive lattices comprise logical relationships of *state* and *syntax*. Regressing up one of these lattices by unisection ultimately leads to a syntactic medium of perfect generality and homogeneity…a universal, reflexive "syntactic operator".

In effect, syndiffeonesis is a metalogical tautology a.02 0 0 1010.10.02 0 0of0.0006 Tc 0 Tw 10.9w 10.02 0 0 10.02 90.

language is fundamental. The fact that most such theories, e.g. theories of physics, point to the fundamental status of something "objective" and "independent of language", e.g. matter and/or energy, is quite irrelevant, for the very act of pointing invokes an isomorphism between theory and objective reality…an isomorphism that is subject to the Reality Principle, and which could not exist unless reality shared the linguistic structure of the theory itself.

Perhaps the meaning of this principle can be most concisely expressed through a generalization of the aphorism "whereof one cannot speak, one must be silent": *whereof that which cannot be linguistically described, one cannot perceive or conceive*. So for the observational and theoretical purposes of science and reality theory, that which is nonisomorphic to language is beyond consideration as a component of reality.

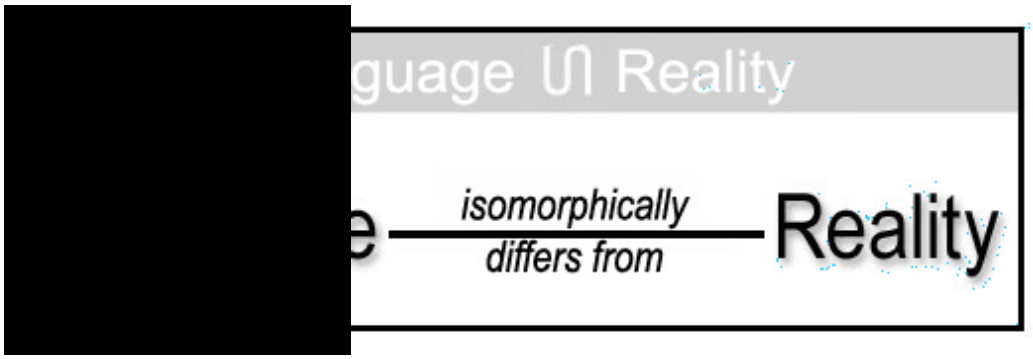

Diagram 7: In this syndiffeonic diagram, the assertion "Language differs from reality" is laid out along an extended line segment representing the supposed difference between the relands. Just as in the generic diagram above, both relands possess the attribute "inclusion in the relational syntactic medium (Language Reality)". Because they are both manifestations of the same underlying medium, their difference cannot be absolute; on a fundamental level, reality and language share common aspects. This is consistent with the nature of the "difference" relationship, which is actually supposed to represent a semantic and model-theoretic isomorphism.

As we have already seen, the Reality Principle says that reality contains all and only that which is real. As defined by this statement, the predicate *reality* is primarily a linguistic construct (
confor

The Principle of Linguistic Reducibility provides a mandate to add an advanced form of language theory to the mathematical arsenal of reality theory. The reality-theoretic benefits of this addition are incalc

Now we know that the closed, single-predicate definition of the Reality Principle is actually a closed descriptive manifold of linked definitions in principle containing the means of its own composition, attribution, recognition, processing and interpretation. But this is still somewhat au[redacted]atomic. What about *mind*? Since it is through our minds that we understand anything at all, understanding remains incomplete until we understand more about the relationship between mind and reality. So, having equipped ourselves with a MAP, we now attend to the correspondence between the MAP and the terrain.

Syntactic Comprehensiv

is irrelevant. (Although this is a trivial observation insofar as “unrelated” and “irrelevant” are synonymous, it seems to have been largely ignored by many who should have known better.)

To put it another way: if the “noumenal” (perceptually independent) part of reality were truly unrelated to the phenomenal (cognition-isomorphic) part, then these two “halves” of reality would neither be coincident nor share a joint medium relating them. In that case, they would simply fall apart, and any integrated “reality” supposedly containing both of them would fail for lack of an integrated model. Where M (mind) is identified with cognition and R (reality) with physically-embodied information, M=R says that reality everywhere consists of a common substance, *infocognition*, having the dual nature of mind and (informational) reality.

The M=R property takes up where the Principle of Linguistic Reducibility leaves off in eliminating the distinction between theory and universe. By its light, the theoretical description of reality by human beings contained in reality amounts to reality describing itself. (Bearing in mind that a theory is a mental construct, this can be illustrated by simply replacing Mind and Reality in the above diagram by Theory and Universe, and *Mind* *Reality* by *Theory* *Universe*.) It thus makes the theory reflexive and thus inclusive enough by definition to describe the entire universe, including that which is rational, abstract and subjective, and that which is empirical, concrete and objective. The dissolution of this distinction can be viewed as a reduction.

So now we know that reality is more than just a linguistic self-contained syndiffeonic relation comprising a closed descriptive manifold of linked definitions containing the means of its own configuration, composition, attribution, recognition, processing and interpretation. ffff14lso a self-processing theory identical to its universe.

Syntactic Coherence and Consistency: The Multiplex Unity Principle (MU)

The universe topologically contains that which descriptively contains the universe. MU, the minimum and most general informational configuration of reality, defines the relationship holding between unity and multiplicity, the universe and its variegated contents. Through its structure, the universe and its contents are mutually inclusive, providing each other with a medium.

In other words, we can equivalently characterize the contents of the universe as being topologically “inside” it (topological inclusion), or characterize the universe as being descriptively “inside” its contents, occupying their internal syntaxes as acquired state (descriptive inclusion). The universe generically includes its contents by serving as their syntactic unisect, while the contents contain the universe in a more specific sense involving specific event histories that become “entangled” by interaction. From the first viewpoint, the syntactic coherence of the overall medium enforces mutual consistency of contents, while from the second viewpoint, the coherent syntaxes of its contents contain and consistently recognize and transform the medium. Thus, the universe enforces its own consistency through dual self-containment.

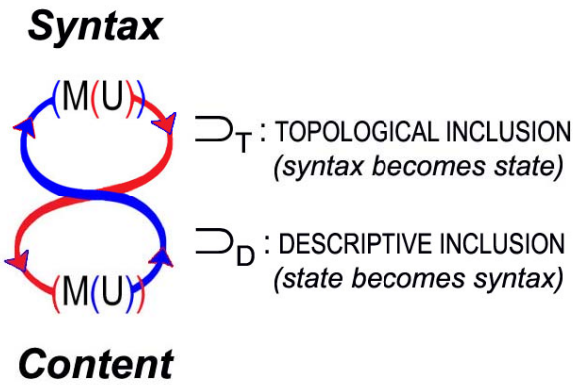

Diagram 10: In the syndiffeonic diagram [Diagram 6], we can plainly see the containment of objects by the medium, but we cannot see the containment of the medium by the objects. Bearing in mind that the terms *syntax* and *content* are to some extent relative designations, the upper node in Diagram 10 corresponds to the global medium (global syntactic unisect or "metasyntax" of reality), while the lower node corresponds to the objects therein (syntactic operators contained in the medium); each is a multiplex unity. Coherence flows from global syntax into local content by way of global topological containment, thereby enforcing unity across diverse locales, and back to global syntax in multiple entangled streams generated by cross-transduction of content. Syntax becomes state, and state becomes syntax (where "syntax" is understood to encompass an "ectosyntactic" distribution of syntactic operators). The universe thus remains coherent and consistent in the course of evolution.

MU expresses syndiffeonic symmetry of syntax and content on the spatiotemporal level of reality. Just as syndiffeonesis can be regarded as a paradox identifying difference with sameness, MU can be regarded as an ultimate form of paradox identifying spatiotemporal multiplicity and unity (the MU diagram is an explosion of the syndiffeonic relation diagram in which the stratification dimension is split into descriptive and topological strands or "temporal dimensions"). MU structure resolves the MU paradox *in situ* by dual stratification, providing closure as the open-ended informational stratification of type theory cannot. Because MU can thus be regarded as the resolution of the paradox it describes, its meaning, like that of syndiffeonesis, can be expressed as follows: *reality is a self-resolving paradox*.

MU, by the way, need not be regarded as the ultimate guarantor of consistency; that honor can safely go to the stability of perceptual reality itself. Quite simply, the syntactic stability of reality overrides any and all objections regarding the limitations of formal systems. MU merely describes how reality, considered as a reflexive SCSPL theory, achieves intrinsic stability in the course of evolving. Thus, it is not functioning as an algorithm guaranteed to terminate on consistency but not on inconsistency, and is therefore not in conflict with undecidability. The stability of reality affirms its consistency regardless of whether or not any lesser theory happens to be consistent.

MU serves as a unifying concept for a complex of ideas having to do with coherence and consistency in the reality-theoretic context, including hology and several CTMU duality principles.

The Principle of Hology (Self-composition)

Hology, a logical analogue of holography characterizing the most general relationship between reality and its contents, is a form of self-similarity whereby the overall structure of the universe is everywhere distributed within it as accepting and transductive syntax, resulting in a homogeneous syntactic medium. That is, because reality requires a *syntax* consisting of general laws of structure and evolution, and there is nothing but reality itself to serve this purpose, reality comprises its own self-distributed syntax under MU (which characterizes the overall relationship between syntax and content).

The hology property itself is distributed over reality. That is, the informational boundary of a coherent object (syntactic operator) is hologically multiplexed with respect to state (attribute and value) in orde

topology and its geometric refinements ($_T$), or in terms of descriptive distribution relationships, as in the Venn-diagrammatic grammar of logical substitution ($_D$).[37]

Attributive or TD duality is reflected in the fact that sets and logic are described by the same algebraic structure, Boolean algebra, which expresses their dual relationship in the relationship between its two operations. Expressed in set-theoretic terms, these operations are union and intersection (,); in logical terms, they are OR and AND (,). (,) and (,) are related as follows: the *union* (A B) of two sets A and B consists of all and only the elements that belong to either A *or* B or both (x A B: x A x B), while the *intersect* (A B) of A and B consists of all and only the elements that belong to both A *and* B (x A B: x A x B). This kind of duality is well known; it relates to the fact that every attributive statement defining a relation of predicates can be rephrased as a statement about sets (and vice versa).

But the relationship of set theory and logic is even more interesting than this, for each has a particular representational affinity for just one of these operations. That is, set theory tends to focus on *objects* (sets and elements), while logic tends to focus on *attributes*, or informational "boundary constraints" that objects must satisfy. Thus, set theory ultimately defines sets in terms of the objects they contain, while logic tends to define them "from the outside in" on the intersecting boundary constraints to which they conform. The difference hinges on the univalent *not* functor (~), on which complementation and intersection, but not union, are directly or indirectly defined.

For example, while it is easy enough to identify an individual element or set by constructively naming or "enumerating" it, e.g. "X", identifying its complement often requires that its name be used as the basis of a restrictive constraint that can be applied across an entire finite or infinite context in one attributive operation, e.g. "not-X". The duality relationship holding between names and constraints is nicely captured by *De Morgan's laws*, ~A ~B=~(A B) and ~A ~B=~(A B), which express it by permuting the objective and attributive operations and .

Because states express topologically while the syntactic structures of their underlying operators express descriptively, attributive duality is sometimes called *state-syntax duality*. As information requires syntactic organization, it amounts to a valuation of cognitive/perceptual syntax; conversely, recognition consists of a subtractive restriction of informational potential through an additive acquisition of information. TD duality thus relates information to the informational potential bounded by syntax, and perception (cognitive state acquisition) to cognition.

In a Venn diagram, the contents of circles reflect the structure of their boundaries; the boundaries are the primary descriptors. The interior of a circle is simply an "interiorization" or self-distribution of its syntactic "boundary constraint". Thus, nested circles corresponding to identical objects display a descriptive form of containment corresponding to syntactic layering, with underlying levels corresponding to *syntactic coverings*.

This leads to a related form of duality, *constructive-filtrative* duality.

Constructive-Filtrative Duality

Any set that can be constructed by adding elements to the space between two brackets can be defined by restriction on the set of all possible sets. Restriction involves the Venn-like superposition of constraints that are subtractive in nature; thus, it is like a subtractive color process involving the stacking of filters. Elements, on the other hand, are additive, and the process of constructing sets is thus additive; it is like an additive color process involving the illumination of the color elements of pixels in a color monitor. CF duality simply asserts the general equivalence of these two kinds of process with respect to logico-geometric reality.

CF duality captures the temporal ramifications of TD duality, relating geometric operations on point sets to logical operations on predicates. Essentially, CF duality says that any geometric state or continuous transformation is equivalent to an operation involving the mutual “filtration” of intersecting hological state-potentials. States and objects, instead of being constructed from the object level upward, can be regarded as filtrative refinements of general, internally unspecified higher-order relations.

CF duality is necessary to show how a universe can be “zero-sum”; without it, there is no wayrrrrrrrrr

the diagram corresponds to conspansive dualization, converting a spatiotemporal lattice of worldlines and events to a layered series of Venn diagrams.

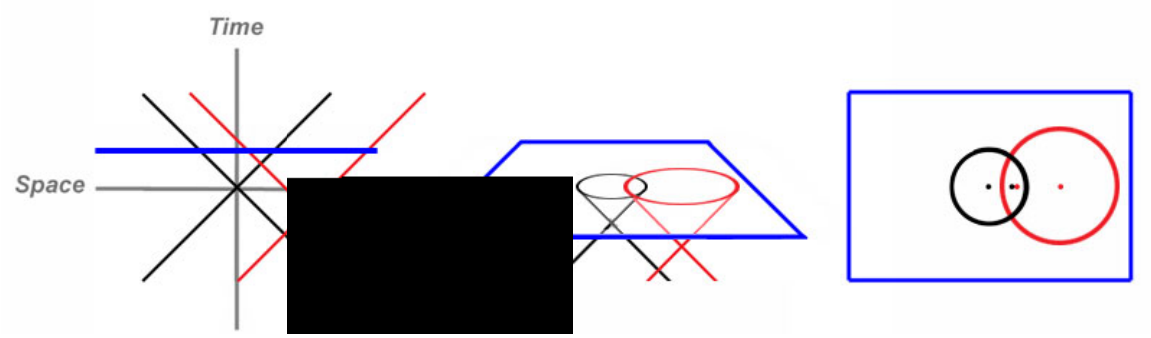

Diagram 11: In the above illustration, a spatial cross section of a spacetime diagram (blue line) is rotated toward the viewer and displayed along the time axis (blue rectangle). The result is a Venn diagram in which circles represent objects and events, or (n>1)-ary interactive relationships of objects. That is, each circle depicts the "entangled quantum wavefunctions" of the objects which interacted with each other to generate it. The small dots in the centers of the circles represent the initial events and objects from which the circles have arisen, while the twin dots where the circles overlap reflect the fact that any possible new event, or interaction between objects involved in the old events, must occur by mutual acquisition in the intersect. The outward growth (or by conspansive duality, mutual absorption) of the circles is called *inner expansion*, while the collapse of their objects in new events is called *requantization*. The circles themselves are called IEDs, short for *inner expansive domains*, and correspond to pairs of interactive *syntactic operators* involved in generalized-perceptual events (note the hological "evacuation" and mutual absorption of the operators). Spacetime can be illustrated in terms of a layering of such Venn diagrams, mutual contact among which is referred to as "extended superposition" (in the real world, the Venn diagrams are 3-dimensional rather than planar, the circles are spheres, and "layering" is defined accordingly). Extended superposition "atemporally" distributes antecedent events over consequent events, thus putting spacetime in temporally-extended self-contact. In light of the *Telic Principle* (see below), this scenario involves a new interpretation of quantum theory, *sum over futures*. Sum over futures involves an atemporal generalization of "process", *telic recursion*, through which the universe effects on-the-fly maximization of a global self-selection parameter, *generalized utility*.

In a Venn diagram, circles represent sets through their definitive attributes. The attributes represented by the circles are synetic (syntactically distributed and homogeneous with respect to potential differences of state), and the attribute represented by a particular circle is uniformly heritable by the elements of the set represented by any circle inside it. In the spatiotemporal Venn diagram just described, the circular lightcone cros

common value of an observable state parameter, position. The circle corresponding to the new event represents an attribute consisting of all associated nomological relationships approp

This has certain interesting implications. First, whereas it is ordinarily assumed that the sizes of material objects remain fixed while that of the whole universe "ectomorphically" changes around them, conspansion holds the size of the universe changeless and endomorphically changes the sizes of objects. Because the universe now plays the role of invariant, there exists a global standard rate of inner expansion or mutual absorption among the contents of the universe ("c-invariance"), and due to syntactic covariance, objects must be resized or "requantized" with each new event according to a constant (time-independent) rescaling factor residing in global syntax. Second, because the rate of shrinkage is a constant function of a changing size ratio, the universe appears from an internal vantage to be accelerating in its "expansion", leading to the conspansive dual of a positive cosmological constant.[39]

Conspansive duality, the role of which in the CTMU is somewhat analogous to that of the Principle of Equivalence in General Relativity, is the only escape from an infinite ectomorphic "tower of turtles". Were the perceptual geometry of reality to lack a conspansive dual representation, motion of any kind would require a fixed spatial array or ectomorphic "background space" requiring an explanation of its own, and so on down the tower. Conspansion permits the universe to self-configure through temporal feedback. Each conspanding circle represents an event-potential corresponding to a certain combination of law and state; even after one of these intrinsically atemporal circles has "inner-expanded" across vast reaches of space and time, its source event is still current for anything that interacts with it, e.g. an eye-catching one of its photons. At the same time, conspansion gives the quantum wave function of objects a new home: *inside the conspanding objects themselves*. Without it, the wave function not only has no home, but fails to coincide with any logically evolving system of predicates or "laws of physics". Eliminate conspansion, and reality becomes an inexplicable space full of deterministic worldlines and the weighty load of problems that can be expected when geometry is divorced from logic.

Where reality is characterized by dual-aspect infocognitive monism (read on), it consists of units of infocognition reflecting a distributed coupling of transductive syntax and informational content. Conspansion describes the "alternation" of these units between the b10.02 0 0 10.02 210.000f82 112 4.5498 388.7999

the last states of a pair of interacting particles are generally insufficient to fully determine their next states. This, of course, raises a question: how are their next states actually determined? What is the source of the extra tie-breaking measure of determinacy required to select their next events ("collapse their wave functions")?

The answer is not, as some might suppose, "randomness"; randomness amounts to acausality, or alternatively, to informational incompressibility with respect to any distributed causal template or ingredient of causal syntax. Thus, it is either no explanation at all, or it implies the existence of a "cause" exceeding the representative capacity of distributed laws of causality. But the former is both absurd and unscientific, and the latter requires that some explicit allowance be made for higher orders of causation…more of an allowance than may readily be discerned in a simple, magical invocation of "randomness".

The superposition principle, like other aspects of quantum mechanics, is based on the assumption of physical *Markovianism*.[40] It refers to mixed states between adjacent events, ignoring the possibility of nonrandom temporally-extensive relationships not wholly attributable to distributed laws. By putting temporally remote events in extended descriptive contact with each other, the Extended Superposition Principle enables coherent cross-temporal telic feedback and thus plays a necessary role in cosmic self-configuration. Among the higher-order determinant relationships in which events and objects can thus be implicated are utile state-syntax relationships called *telons*, telic attractors capable of guiding cosmic and biological evolution.

Given that quantum theory does not seem irrevocably attached to Markovianism, why has the possibility of higher-order causal relationships not been seriously entertained? One reason is spacetime geometry, which appears to confine objects to one-dimensional "worldlines" in which their state-transition events are separated by intervening segments that prevent them from "mixing" in any globally meaningful way. It is for this reason that superposition is usually applied only to individual state transitions, at least by those subscribing to conservative interpretations of quantum mechanics.

Conspansive duality, which incorporates TD and CF components, removes this restriction by placing state transition events in direct descriptive contact. Because the geometric intervals between events are generated and selected by descriptive processing, they no longer have separative force. Yet, since worldlines accurately reflect the distributed laws in terms of which state transitions are expressed, they are not reduced to the status of interpolated artifacts with no dynamical reality; their separative qualities are merely overridden by the state-syntax dynamic of their conspansive dual representation.

In extending the superposition concept to include nontrivial higher-order relationships, the Extended Superposition Principle opens the door to meaning and design. Because it also supports distribution relationships among states, events and syntactic strata, it makes cosmogony a distributed, coherent, ongoing event rather than a spent and discarded moment from the ancient history of the cosmos. Indeed, the usual justification for observer participation – that an observer in the present can perceptually collapse the wave functions of ancient (photon-emission) events – can be regarded as a consequence of this logical relationship.

Supertautology

Truth, a predicate representing inclusion in a domain, is the logical property by virtue of which one thing may be identified and distinguished from another at any level of resolution. All theories aim at truth, and reality theory is no exception. With respect to science, there is a problem with truth: beyond the level of direct observation, it cannot be certified by empirical means. To blame are various forms of uncertainty, model-theoretic ambiguity, and the problem of induction: scientific generalizations are circular insofar as they are necessarily based on the assumption

that nature is uniform. The problem of induction effectively limits certitude to mathematical reasoning.

This is hardly surprising, for truth is ultimately a mathematical concept. In logic, truth is defined [redacted] distinctive properties: it is descriptively universal, it is closed under recursive self-composition, and it is internally and externally consistent on the syntactic and semantic levels of reference. Since logic is the theory of truth, the way to construct a fully verifiable theory is to start with logic and develop the theory by means of rules or principles under which truth is heritable. Because truth is synonymous with logical tautology, this means developing the theory by ad>0.02 0 0 10.02 502lfc7.2- 166 1h7l

and reduced to more basic concepts that can be reformed into more basic and expressive signatures. However, the informational part of the regress terminates where further reduction

senders, receivers, messages, channels and transmissive media is already conveniently given, complete with all of the structural and dynamical laws required to make them work together. Moreover, the bit structure specified in this model relates to the actual structure of information the way propositional logic relates to logic as a whole, including the predicate calculus and model theory. To wit, only a single level of structure and functionality is considered, and attribution is primarily limited to just a pair of central predicates common to both theories, *True* / *False* = 1 / 0. Just as sentential logic concerns itself only with the functorial relationships of sentential variables and ignores their content, information theory concerns itself only with the probabilities of symbols in message strings and ignores the details of syntactic and semantic structure and processing.

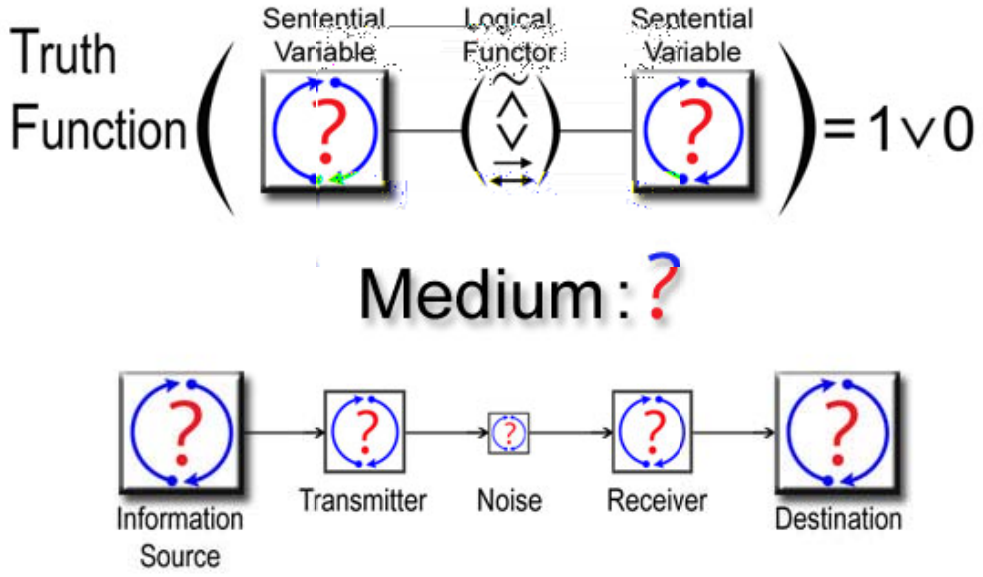

Diagram 12: Sentential logic and information theory both ignore entire levels of structure in order to reduce the universe to 1s and 0s. In sentential logic, sentential variables are distinguished only by whether they are true or false (1 or 0), while the standard theory of information, along with the theories of computation and cybernetics, deals with "raw data" expressed or "encoded" in the most basic possible terms, namely the binary digits 1 and 0. While the role of these "bits" is to reduce uncertainty regarding specific items of content, certain essential details of syntactic and semantic structure and processing, and more specific relationships among variables and data, are conveniently omitted. The red question marks indicate that neither sentential logic nor information theory fully explains itself, its model or its medium. [Diagram partially adapted from Shannon, C.E. (1948), "A Mathematical Theory of communication", *Bell System Technical Journal,* vol. 27, pp. 379-423 and 623-656.]

However, the most interesting part of the analogy is its logical extension. Just as sentential logic is naturally extended to encompass the levels of attribution associated with predicate logic and model theory, the theory of information can be naturally extended to encompass deeper levels of attribution…in fact, the same two levels adjoined to sentential logic.

Retooling the information concept consists of three steps. First, it must be equipped with the means of its own *transduction* or transformative processing. Where information transduction is (cognitively) recognized as *generalized cognition*, this amounts to replacing it with a dual-aspect quantum of reflexivity, *infocognition*, which embodies telic feedback. Second, its bit structure, a simplistic and rather uninspired blend of 2-valued propositional logic and probability theory, must be extended to accommodate logic as a whole, including (1) predicate logic, (2) model theory and (3) language theory, broadly including the theories of mathematical languages, metalanguages and generative grammars. After all, since information does nothing but attribute *linguistically*-organized *predicates* to objects in the context of *models*, its meaning involves the mathematics of

predicates, languages and models. And third, it must be generalized to an ultimate ancestral medium, *telesis*, from which cognitive syntax and its informational content arise by specificative feedback as part of a unified complex…a recursive coupling of information and *metainformation*, or transductive syntax.

This retooling is accomplished by associating information with reflexive *syntactic operators* (units of coherent infocognition) in a reflexive linguistic structure, *Self-Configuring Self-Processing Language* (SCSPL), that incorporates its own model and is thus identical to its universe. SCSPL evolves by *conspansion* (material contraction *qua* spatial expansion), a structured grammatical alternation between a linguistic "output" phase (classical reality) consisting of the observable states or external relationships of syntactic operators, and a "production phase" that transforms one state to another.

This being said, there is a sense in which infocognitive monism well agrees with the thesis that bits are universal descriptors of reality: because the bit values 1 and 0 are analogous to the truth values of 2-valued logic, the fact that perceptual reality is described by 2-valued logic implies that it can be described in terms of bits. However, while reality at large is defined by relevance to perceptual reality in the relativistic sense, it does not consist of perceptual reality alone.

Telic Reducibility and Telic Recursion

Telic recursion is a fundamental process that tends to maximize a cosmic self-selection parameter, *generalized utility*, over a set of possible syntax-state relationships in light of the self-configurative freedom of the universe. An inherently "quantum" process that reflects the place of quantum theory in SCSPL, telic recursion is a "pre-informational" form of recursion involving a combination of hology, telic feedback and recursive selection acting on the informational potential of MU, a primal syndiffeonic form that is symmetric with respect to containment.

Where perceptual reality consists of infocognition (self-transducing information), explaining the genesis and evolution of reality amounts to explaining the genesis and evolution of infocognition. Because generalized cognition (information processing) is *temporal*, while information locates objects or message units in attributive *spaces*, information and cognition are respectively spatial and temporal in nature; infocognition is analogous to spacetime, and spacetime is infocognitive. It follows that perceptual reality consists not merely of infocognition but of spacetime, and that seeking an explanation of the genesis and evolution of reality amounts to seeking an explanation of the genesis and evolution of spacetime *qua* infocognition…i.e., to cosmology in the context of information transduction.

Cosmology, humanity's grand attempt to explain the origin and nature of the universe, has traditionally amounted to the search for a set of "ultimate laws" capable of explaining not only how the universe currently functions, but how it came to be. Unfortunately, even were such a set of laws to be found, the associated explanation could not be considered adequate until the laws themselves were explained, along with the fundamental objects and attributes on which they act. This gives rise to what seems like an imponderable question: how can a set of laws, objects and attributes be explained except by invoking another set of laws in the form of an explanatory syntax that would itself demand an explanation, and so on *ad infinitum*?

The answer is hiding in the question. Laws do not stand on their own, but must be defined with respect to the objects and attributes on which they act and which they accept as parameters. Similarly, objects and attributes do not stand on their own, but must be defined with respect to the rules of structure, organization and transformation that govern them. It follows that the active medium of cross-definition possesses logical primacy over laws and arguments alike, and is thus pre-informational and pre-nomological in nature…i.e., *telic*. *Telesis*, which can be characterized as "infocognitive potential", is the primordial active medium from which laws and their arguments and parameters emerge by mutual refinement or *telic recursion*.

In other words, telesis is a kind of “pre-spacetime” from which time and space, cognition and information, state-transitional syntax and state, have not yet separately emerged. Once bound in a primitive infocognitive form that drives emergence by generating “relievable stress” between its generalized spatial and temporal components - i.e., between state and state-transition syntax – telesis continues to be refined into new infocognitive configurations, i.e. new states and new arrangements of state-transition syntax, in order to relieve the stress between syntax and state through telic recursion (which it can never fully do, owing to the contingencies inevitably resulting from independent telic recursion on the parts of localized subsystems). As far as concerns the primitive telic-recursive infocognitive MU form itself, it does not “emerge” at all except intrinsically; it has no “external” existence except as one of the myriad possibilities that naturally exist in an unbounded realm of zero constraint.

Telic recursion occurs in two stages, *primary* and *secondary* (global and local). In the primary stage, universal (distributed) laws are formed in juxtaposition with the initial distribution of matter and energy, while the secondary stage consists of material and geometric state-transitions expressed in terms of the primary stage. That is, where universal laws are syntactic and the initial mass-energy distribution is the initial state of spacetime, secondary transitions are derived from the initial state by rules of syntax, including the laws of physics, *plus* telic recursion. The primary stage is associated with the global telor, reality as a whole; the secondary stage, with internal telors (“agent-level” observer-participants). Because there is a sense in which primary and secondary telic recursion can be regarded as “simultaneous”, local telors can be said to constantly “create the universe” by channeling and actualizing generalized utility within it.

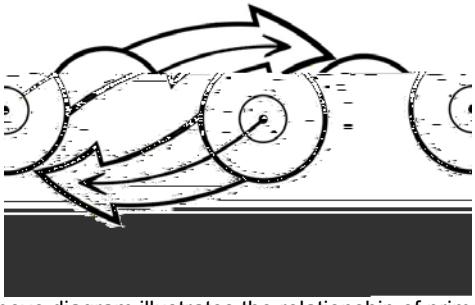

Diagram 13: The above diagram illustrates the relationship of primary and secondary telic recursion, with the latter “embedded in” or expressed in terms of the former. The large circles and arrows represent universal laws (distributed syntax) engaged in telic feedback with the initial state of spacetime (initial mass-energy distribution), while the small circles and arrows represent telic feedback between localized contingent aspects of syntax and state via conspansion. The primary stage maximizes global generalized utility on an *ad hoc* basis as local telors freely and independently maximize their local utility

self-actualizatively coordinates events in light of higher-order relationships or *telons* that are

here to observe the universe! Unfortunately, the anthropic principles lack something that they would need to make this work: a circular model to which their loop-like reasoning can be consistently mapped. Quite simply, the type of causal circularity they suggest is at odds with the "arrow of time" and other aspects of the prevailing non-circular models of time and space.

Because circular arguments are self-justifying and resistant to falsification, it is frequently assumed that tautology and circular reasoning are absolute theoretical evils. But this is far from the case, for logic and mathematics are almost completely based on circularity. Truth and logical tautology, recursion and iteration, algebraic and topological closure…all involve it to some degree. The problems arise only when circular reasoning is employed without the assurance of full mathematical generality, incorporating false claims of universality on (what may be) non-universal premises.

Unfortunately, not even valid tautologies are embraced by the prevailing school of scientific philosophy, falsificationism. While non-universal tautologies are rightly forbidden due to their resistance to falsificative procedures that would reveal their limitations, universal tautologies are pronounced "scientifically uninteresting" for much the same reason. But in fact, science could exist in no way, shape or form without them. The very possibility of a scientific observation is utterly dependent on the existence of tautological forms on which to base a stable, invariant syntax of perception. This raises the possibility that falsificationist thinking has accidentally obscured the true place of tautological reasoning in cosmology.

If the universe is really circular enough to support some form of "anthropic" argument, its circularity must be defined and built into its structure in a logical and therefore universal and necessary way. The Telic principle simply asserts that this is the case; the most fundamental imperative of reality is such as to force on it a supertautological, conspansive structure. Thus, the universe "selects itself" from *unbound telesis* or UBT, a realm of zero information and unlimited ontological potential, by means of *telic recursion*, whereby infocognitive syntax and its informational content are cross-refined through telic (syntax-state) feedback over the entire range of potential syntax-state relationships, up to and including all of spacetime and reality in general.

The Telic Principle differs from anthropic principles in several important ways. First, it is accompanied by supporting principles and models which show that the universe possesses the necessary degree of circul

Some Background

A review of the standard computational theory of language may prove useful. Computation theory recognizes two general types of automata, *transducers* and *acceptors*. Transducers convert input to output, while acceptors classify or "recognize" input consisting of strings of symbols without necessarily producing output.

A *finite transducer* is a 5-tuple (,Q,Γ, ,), where is a finite nonempty input alphabet, Q is a finite nonempty state set, Γ is a finite nonempty output alphabet, :Q Q is the state transition function, and :Q Γ is the output function. To this we can add a start state q_0. Finite transducers ultimately rely on mechanical laws to function, transforming informational input to informational output by transforming their own states.

A *finite acceptor* is a 5-tuple (Q, , ,q_0,A), where Q is a nonempty finite set of internal states, is an alphabet, q_0, is the start state, and A Q is the set of accepting states. The range of the transition mapping determines the type of acceptor; it is *deterministic* if :Q Q, and *nondeterministic* if :Q 2^Q (where 2^Q represents the power set of possible states). A deterministic finite acceptor (Q, , ,q_0,A) *accepts* a string x * iff (q_0,x) A. A *language* is the set of strings accepted by a given automaton or class of automata.

Languages are generated by grammars. In the computational theory of language, a *generative* (or *phrase structure*) *grammar* G is a 4-tuple (N,T,P,) consisting of (1) a finite set N of *nonterminals*; (2) a finite nonempty set T of *terminals*, with N T= and N T = A (the total *alphabet* of the grammar); (3) a finite set of *productions* P ((N T)*\T*) (N T)* consisting of nonterminal arguments and their possibly terminal transforms; and (4) an element of N called the *starting symbol*. The implementation of such a grammar is a deductive process leading from the general to the specific; starting from the most general symbol (which stands for "sentence"), increasingly specific productions lead to a terminal configuration. The production (x,y), often written x y, signifies replacement of x by y, or equivalently, the *substitution* of y for x. Where A* denotes the set of all strings or "words" in A, and A*\T* denotes the complement of T* in A*, a word w (A*\T*) *generates* another word w' if w=w_1Xw_2, w'=w_1X'w_2, and X X' is a production.

The theory of generative grammars classifies them according to the least powerful acceptor that can recognize the languages they generate. Type 0 grammars generate unrestricted languages requiring a universal computer (Turing machine) with unlimited memory; type 1 grammars generate context-sensitive languages requiring a linear-bounded automaton with memory proportional to word length; type 2 grammars generate context-free languages requiring a pushdown automaton with a memory stack in which a fixed number of elements are available at any point; and type 3 grammars generate regular languages requiring a finite deterministic automaton with no memory.

There is an obvious parallel between the states and state transitions of automata, and the strings and productions of a grammar. An automaton processes input strings through its internal states, expressing them in terms of its own "internal language". Indeed, a physical automaton in the act of processing an input string can be seen as a dynamic linguistic stratification incorporating the input language, the mutable programming of the automaton (including assembly and machine code), its hard-wired architecture, the nomological language consisting of the laws of physics according to which the hardware functions, and any "metaphysical" level of language necessary to define and maintain the laws of physics themselves. Since each language in this sequence is expressed in terms of the next one after it, the languages form a "descriptive nesting" in which the syntax of each distributes over all of those preceding it.

The *syntax* of a language consists of its grammar and the structure of its expressions. That is, a syntax is a compilation of the spatial (structural) and temporal (grammatical, transformational) rules of the associated language; its rules are invariant, general, and distributive with respect to

the entire set of expressions comprisin

of tranducers, we need merely adjoin to the syntax

transformation which inverts this picture, turning it “outside-in”. This results in a “distributed subjectivization” in which everything occurs *inside* the objects; the objects are simply defined to consistently internalize their interactions, effectively putting every object “inside” every other one in a generalized way and thereby placing the *contents* of space on the same footing as that formerly occupied by the containing space itself. Vectors and tensors then become descriptors of the internal syntactic properties and states of objects. In effect, the universe becomes a “self-simulation” running *inside* its own contents.

This view, which is complementary to the conventional geometric one, is called *transductive algebra*. The “dual” relationship between geometry and transductive algebra is called *conspansive duality*. In conjunction with other principles including hology and SCSPL-infocognitive-telic reducibility, conspansive duality can afford fresh insight on the nature of reality and the physical world. One simply takes the conventional picture, turns it outside-in, puts the two pictures together, and extracts the implications. The relationship of this new picture to the old one is extensional rather than competitive, embedding the geometric model in a larger and more complete conspansive model uniting it with its dual model. In any case, all equivalent models are on an equal footing, and the only scientific hypotheses on which doubt could be shed as a result of this extension are those based on the fallacious assumption that the geometric model is the “whole story”.

Introduction to SCSPL

According to the Reality Principle, the universe is self contained, and according to infocognitive monism, it regresses to a realm of nil constraint (*unbound telesis* or UBT) from which it must refine itself. According to the Telic Principle, which states that the universe must provide itself with the means to do this, it must make and realize its own “choice to exist”; by reason of its absolute priority, this act of choice is identical to that which is chosen, i.e. the universe itself, and thus reflexive. I.e., “existence is everywhere the choice to exist.” Accordingly, the universe must adopt a reflexive form in which it can “select itself” for self-defined existence, with the selection function identical to that which is selected. This means that it must take a certain general or “initial” form, the *MU form*, which contains all of the requisites for generating the contents of reality. D“ins3d23ins3d23ins3d2 to

SCSPL is not an ordinary language, and grammar is not an ordinary generative grammar. The reasons come down to the inherent limitations of computational language theory. In standard computation theory, a language consists of the set of strings accepted by a given automaton or class of automata; e.g., a language L is called "regular" if there is a finite-state automaton that accepts it. However, this approach is inadequate for SCSPL. First, it centers on *computation*, a general type of information processing associated with an abstract automaton, the Turing machine or "universal computer", that could never have generated the informational structure of the real universe. Being an informational and metainformational (syntactic) construct, the universal computer can itself account for the genesis of neither syntax nor information. Second, unlike ordinary languages, the reality-language cannot rely on an external mind or automaton or preexisting hardware substrate for recognition and processing. Since any processor real enough to recognize and process reality is necessarily a *part* of reality, the language-processor distinction is without ontological force.

Thus, while ordinary discrete models of reality rely heavily on the language-processor distinction, SCSPL incurs no such debt. For example, cellular automaton models typically distinguish between a spatial array, the informational objects existing therein, and the distributed set of temporal state-transition rules by which the array and its contents are regulated. In contrast, SCSPL regards language and processor as aspects of an underlying infocognitive unity. By conspansive (ectomorphism-endomorphism) duality, SCSPL objects contain space and time in as real a sense as that in which spacetime contains the objects, resulting in a partial identification of space, time and matter. SCSPL is more than a reflexive programming language endowed with the capacity for computational self-execution; it is a protocomputational entity capable of telic recursion, and thus of generating its own informational and syntactic structure and dynamics.

Whereas ordinary computational models are informational and syntactic in character, the protocomputational nature of SCSPL requires a generalization of information and syntax. With respect to the origin or ultimate nature of perceptual reality, explanation is a reductive/inductive process that regressively unbinds constraints in order to lay bare those of highest priority and generality. This process eventually leads to the most basic intelligible descriptor that can be formulated, beyond which lies only the unintelligible. This marks the transition from information and syntax to a convergent reductive generalization, *telesis*.[46]

This points to a universal property of language: it is dynamic. While it is often conveniently assumed that languages are timeless Platonic ideals that waft around waiting to be processed by external acceptors, they can be treated in terms of static information only by users or processors that provide them with an external transductive syntax, and only then by neglecting certain underlying necessities. For example, to physically realize the informational structure of a language in a printed or electronic medium, it must be expressed in terms of physical particles that dynamically recognize each other's locations to the extent required to maintain the spatial relationships comprising its informational structure. This is a general requirement, extending from the physical and concrete to the mathematical and abstract.

Thus, languages are ultimately self-processing; they must either contain their processors in their expressions, or be expressed in terms of a more basic language fulfilling this requirement. Accordingly, the expressions of SCSPL are dynamic informational configurations of information-processors, implying that SCSPL everywhere consists of information and acceptive-transductive syntax in a state of logical intersection. Together, information and syntax comprise *infocognition*, self-transducing information in the form of SCSPL *syntactic operators* that cross-absorptively "communicate" by acquiring each other's informational states as cognitive-syntactic content. It is to the common basis of these two components that information may be reduced in the SCSPL context. Where the term *telesis* denotes this common component of information and syntax, SCSPL grammar refines infocognition by binding or constraining telesis as infocognition.

To the extent that any grammar functions by the recursive application of syntactic rules, SCSPL grammar is recursive ("self-calling"). However, SCSPL grammar is not merely deterministically or

nondeterministically recursive, but telic-recursive. While an ordinary grammar recursively processes information or binds informational potential to an invariant syntax that distributes over its prod gram itive potential rang ssib ips of syntax and state, by cross-refining syntax and its informational content through telic recursion. Telic recursio ce e for nfiguri tent relationship ationa its existence is an cal requirement of ss-refine ax - MU form, which embodie ial for perfe mplementarit nd

Since this potential can only be specifically realized through the infocog s, and localized ng is freely and independently effected by localized, mutually decoherent telic ope rfect complem ous. SCSPL evolution, which can be viewed as an attempt to help this complementarity emerge from its potential status in MU, inco a global (syntactic) invaria rks to minimize t tion from perfect compl mentarity of syntax and state as syntactic operators fre ly and independ tly bind telesis. This primary SCSPL invari *Telic Principle*, takes the form of election function with a quantitative parameter, *generalized utility*, related to the deviation. The Telic Principle can be regarded as the primary component of SCSPL syntax…the spatiotempo ally distributed self-selective "choice to exist" coinciding with MU.

SCSPL incorporates the concepts of syntactic ntactic di u example, be thematics everywhere apply with respect to the laws of physics, the former distribute over the latter in the syntactic sense. Thus, where the laws of mathematics and physics are denoted by S1=LMS and S2 respectively, S1 *distributes over* S2, a *syntactic covering* for S2. Essentially, this means that the laws of mathematics are everywhere a required syntactic component of the language of physics. With S2 is associated an SCSPL "sublanguage" called L_O (with a letter O subscript). L_O constitutes the world of perception, the classical objective universe of sense data traditionally studied by science. L_O is contained in the telic-recursive, pre-informational phase of SCSPL, L_S, which encompasses the cross-refinement of L_O syntax and L_O content from the pre-infocognitive aspect of SCSPL. The part of SCSPL grammar confined to L_O incorporates certain restrictions to which L_S is not subject; e.g., the grammatical portion of L_O (S2) is fixed, distributed and supposedly continuous, while that of L_S can also be mutable, local and discrete…in a word, telic.

grammar is the generative grammar of SCSPL = (L_S L_O). grammar is unlike an ordinary grammar in that its processors, products and productions coincide and are mutually formed by telic recursion. Syntax and state, loosely analogous to *form* and *content* (or *productions* and *products*), are mutually refined from telesis through telic recursion by infocognitive processors. Production rules include the Telic Principle, distributed elements of syntax formed in the primary phase of telic recursion, and more or less polymorphic telons formed by agent-level telors. The corresponding modes of production are global telic recursion, informational recursion by distributed syntax, and local telic recursion.

The "words" produced by grammar are not strings of symbols, but L_O spatial relationships among parallel processors that can read and write to each other's states. In effect, the states of its processors are roughly analogous to the symbols and strings of an ordinary language. The processors of grammar thus function not only as transducers but as symbolic placeholders for observables and values, while their external states correspond to products and their state transitions realize the productions of the grammar. In other words, the states and state transitions of the processors of grammar comprise a representation of grammar, rendering SCSPL a dynamic self-modeling language or "interactive self-simulation".

In the following description, products are limited to the physical end products associated with L_O. This is in no way to be interpreted to mean that the only SCSPL products are physical products;

on

t is implicit in the "seed grammar, the s the potent y of syntax a state, law an

in fact, everything in SCSPL is to some extent a telic-recursive “product” of everything else. However, where the primary explanand

recursion is merely informational and computational; there is no allowance for infocognition or telic recursion. SCSPL shares none of these limitations.

grammar generates SCSPL according to the utility of its sentient processors, including the self-utility of and the utility of its L_O relations to telors in A. and A generate telons on the global and local level respectively; thus, they must be capable of recognizing and maximizing the selection parameter (in the case of human telors, for example, this requires the QPS and ETS components of the HCS). As such, they are responsible for telic recursion and may be regarded as the "generators" of grammar, while the set Q of elementary physical objects are freely and competitively acquired by telons and thus occupy an ontologically secondary position.

grammar is conspansive. Non-global processors alternate between the generation and selective actualization of possible productions, and thus between the generative and selective (inner expansive and requantizative) phases of conspansion. The selective phase of an operator coincides with interactive mutual-acquisition events, while the generative phase coincides with the generation and selective actualization of possible productions through hological multiplexing. In conjunction with extended spatiotemporal superposition, conspansion provides the means of local (telic and informational) recursion.

Conspansion is a global process which cannot be locally differentiated as to rate. Its rate is thus a globally invariant "time-space conversion factor", and because all changes of local state must be expressed in terms of it, it is maximal. This invariant maximal rate of production is referred to as the *rate of conspansion* c and can be physically identified with the speed of light *in vacuo.*[48] The implications of the constancy of c and N in light of MAP have already been noted with respect to internally

space, its relationship to which yields explanatory value regarding the internal state or condition of the universe itself. SCSPL conspansive duality suggests that the putative "externality" of such a space is not a meaningful property; if such a space exists and is sufficiently relevant to the universe in which we live to be of explanatory value to us, then it is by definition an ingredient of SCSPL syntax and can therefore be regarded as residing *within* SCSPL syntactic operators. In fact, this is a direct consequence of the Reality Principle.

Although it would be possible to go on at length, this paper is intended to present a general outline of the theory rather than an exhaustive development. In conjunction with the principles and features enumerated above, the given framework should suffice to characterize SCSPL on an introductory basis and distinguish it in flavor and content from other theories.

SCSPL as the Self-Excited Circuit

We are now in a position to draw a few parallels between Wheeler's vision of reality theory and the CTMU.

The **Self-Excited Circuit**, the informational logic loop through which physics engenders observer participation, which engenders information, which engenders physics, is a tight characterization of SCSPL…so tight that it would be difficult if not impossible to replace SCSPL with anything else and neither violate nor fall short of Wheeler's description. SCSPL is logical in construction, has a loop-like dynamic, and creates information and syntax, including the laws of physics, through telic recursion generated by agent-level syntactic operators whose acts of observer-participation are essential to the self-configuration of the **Participatory Universe**. These acts are linked by telic recursion to the generalized cognitive-perceptual interactions of quantum-level syntactic operators, the minimal events comprising the fabric of spacetime.

Through telic feedback, state and syntax are cross-refined from unbound telesis or UBT, a zero-information domain of ontological potential, under the guidance of a higher-order law called the Telic Principle…a protean "**law without law**" through which order is extracted from disorder as laws are configured according to the generalized utility of state-syntax relationships for agent-level operators or observer-participants. The binary yes-or-no indications prescribed by **It from Bit** are demanded by infocognitive monism and the fundamental status of two-valued sentential logic in SCSPL syntax. The world is not merely a cybernetic monstrosity, a "giant machine ruled by preestablished law", but a metacybernetic system with logical priority over machines and the laws they obey.

How come existence? is answered by the fact that the universe is a global SCSPL operator amounting to one vast, self-selective, self-expressive act of reflexive observer-participation, while **how come the quantum?** is answered by the hological self-replication of the universe in each one of its microscopic syntactic operators and agent-level telors. **Many observer-participants** yield **one coherent world** because, through MU, the universe relates to its contents as a homogeneous distributed syntax that syndiffeonically supports and expresses their distinctions even as they help it evolve through observer-participation and telic recursion. Individual solipsism becomes *distributed solipsism* through the mutual absorption of SCSPL syntactic operators, made possible by a combination of distributed SCSPL syntax and shared teleology.

The Reality Principle, along with MAP, M=R and other logical guarantors of cosmic self-containment, shows that the syntactic stability of reality rules out any infinite reptilian regress of **turtle on turtle**, while the familiar **continuum** of classical physics corresponds to a syntactic (LMS) interpolation of the conspansive manifold generated by discrete SCSPL grammatical operations. Where **space and time** correspond to *information* and *generalized cognition* respectively, and where information and cognition are logically entwined in infocognitive SCSPL syntactic operators intersecting in states and state-transition events, space and time are entwined in a conspansive event-lattice connected by syntax and evolving through mutual absorption

events among syntactic operators, symmetric instances of generalized observation influenced by

The CTMU says that reality is a language…a self-explanatory, self-theorizing, self-modeling structure iden

Furthermore, its critics claim, its central hypothesis is not only beyond proof, but unrealistic and not amenable to empirical confirmation.

In all fairness, it must be noted that insofar as science has itself spectacularly failed to agree on a global model of reality, this is really nothing more than an exercise in hypocrisy. Science observes, relates and extrapolates from observations with what often turns out to be great efficiency, but has time and time again proven unable to completely justify its reductions or the correspondences between its theories and the real universe as a whole. Although some critics claim that beyond a certain point, explanation is pointless and futile, they do not speak for science; the entire purpose of science is explanation, not rationally unsubstantiated assertions to the effect that a closed-form explanation is “unavailable” or “unnecessary”. In seeking a coherent explanation for existence – an explanation incorporating an ontological design phase that is rational, coherent and therefore intelligent – the ID program is in fact perfectly consistent with science.

However, being perfectly consistent with science means merely that something is in line for a model, not that it already has one. It has thus been possible for dedicated critics of ID to create the illusion, at least for sympathetic audiences, that they have it at a critical disadvantage. They contend that while science must be instrumental to society, yield specific predictions, and thus cite specific structural and dynamical laws that nontrivially explain its contexts of application, ID is nothing more than a Trojan horse for religious ideology, makes no nontrivial predictions, and is devoid of theoretical structure. Due to the number of sympathetic ears that such claims have found in Academia, this illusion has all but promoted itself to the status of a self-reinforcing mass delusion in certain closed-minded sectors of the intellectual community. Obviously, it would be to the advantage of the ID movement, and society as a whole, to end this contagion by putting forth something clearly recognizable as a model.

The problem, of course, is that as long as science in general lacks a fundamental model, so do all particular strains of science *including* Intelligent Design. Due to the close connection between fundamentality and generality, ID or any other field of scientific inquiry would ultimately have to provide *science in general* with a fundamental model in order to provide one for itself. This might have led some people, in particular those who doubt the existence of a stable fus

lesser problems are necessarily formulated). This is unsurprising, for intelligence itself is a natural phenomenon that could never have emerged in humans and animals were it not already a latent property of the medium of emergence. An object does not displace its medium, but embodies it and thus serves as an expression of its underlying syntactic properties. What is far more surprising, and far more disappointing, is the ideological conflict to which this has led. It seems that one group likes the term "intelligent" but is indifferent or hostile to the term "natural", while the other likes "natural" but abhors "intelligent". In some strange way, the whole controversy seems to hinge on terminology.

Of course, it can be credibly argued that the argument actually goes far deeper than semantics… that there are substantive differences between the two positions. For example, some proponents of the radical Darwinian version of natural selection insist on randomness rather than design as an explanation for how new mutations are generated prior to the restrictive action of natural selection itself. But this is untenable, for in any traditional scientific context, "randomness" is synonymous with "indeterminacy" or "acausality", and when all is said and done, acausality means just what it always has: *magic*. That is, something which exists without external or intrinsic cause has been selected for and brought into existence by nothing at all of a causal nature, and is thus the sort of something-from-nothing proposition favored, usually through voluntary suspension of disbelief, by frequenters of magic shows.

Inexplicably, some of those taking this position nevertheless accuse of magical thinking anyone proposing to introduce an element of teleological volition to fill the causal gap. Such parties might object that by "randomness", they mean not acausality but merely causal ignorance. However, if by taking this position they mean to belatedly invoke causality, then they are initiating a causal regress. Such a regress can take one of three forms: it can be infinite and open, it can terminate at a Prime Mover which itself has no causal explanation, or it can form some sort of closed cycle doubling as Prime Mover and that which is moved. But a Prime Mover has seemingly been ruled out by assumption, and an infinite open regress can be ruled out because its lack of a stable recursive syntax would make it impossible to form stable informational boundaries in terms of which to perceive and conceive of reality.

What about the cyclical solution? If one uses laws to explain states, then one is obliged to explain the laws themselves. Standard scientific methodology requires that natural laws be defined on observations of state. If it is then claimed that all states are by definition caused by natural laws, then this constitutes a circularity necessarily devolving to a mutual definition of law and state. If it is then objected that this circularity characterizes only the *process* of science, but not the objective universe that science studies, and that laws in fact have absolute priority over states, then the laws themselves require an explanation by something *other than* state. But this would effectively rule out the only remaining alternative, namely the closed-cycle configuration, and we would again arrive at…magic.

It follows that the inherently subjective process of science cannot ultimately be separated from the objective universe; the universe must be self-defining by cross-refinement of syntax and state. This brings us back to the CTMU, which says that the universe and everything in it ultimately evolves by self-multiplexing and self-selection. In the CTMU, design and selection, generative and restrictive sides of the same coin, are dual concepts associated with the alternating stages of conspansion. The self-selection of reality is inextricably coupled to self-design, and it is this two-phase process that results in *nature*. Biological evolution is simply a reflection of the evolution of reality itself, a process of telic recursion mirroring that of the universe as a whole. Thus, when computations of evolutionary probability are regressively extrapolated to the distributed instant of creation, they inevitably arrive at a logical and therefore meaningful foundation.

The CTMU says that on logical grounds, reality has generative and restrictive phases, and that evolution has generative and restrictive phases that are necessarily expressed in terms of those of reality. It asserts that the meta-cybernetic mechanism of evolution is telic recursion, an atemporal process which sets up a stratified dialectic between syntax and state, organism and

environment, with mutually consistent mutable and invariant levels. It says that this process, though subject to various forms of noise, interference and competition predicated on the internal freedom of reality, tends to maximize the utility of the universe and its inhabitants. And it thus says that evolution is much more than a mere environmental dictatorship in which inexplicable laws of nature call the tune as biology slavishly dances the jig of life and death.

The CTMU says that by its self-generative, self-selective nature, which follows directly from the analytic requirement of self-containment, reality is its own "designer". Other features of the generative grammar of reality imply that reality possesses certain logical properties traditionally regarded as theological or spiritual, and that to this extent, the self-designing aspect of reality is open to a theological or spiritual interpretation. The CTMU, being a logical theory, does not attempt to force such an interpretation down anyone's throat; not all semantic permutations need affect theoretical structure. What it does do, however, is render any anti-theological interpretation *a priori* false, and ensures that whatever interpretation one chooses accommodates the existence of an "intelligent designer"…namely, reality itself. In light of the CTMU, this is now a matter more of logic than of taste.

In any case, it should be clear that the CTMU yields new ways of looking at both evolution and teleology. Just as it is distinguished from other theories of cosmic evolution by its level of self-containment, particularly with regard to its preference for self-determinacy rather than external determinacy or indeterminacy, so for its approach to biological evolc for selflr

Notes

[1] David Berlinski, “What Brings a World into Being?”, *Commentary,* Vol. 111, No. 4, 2001, p. 17.

[2] Robert H. Wozniak, “Mind and Body

[17] *ibid.,* p. 9.

[18] *ibid.,* p. 10.

[19] *ibid.,* p. 10.

[20] John A. Wheeler, *Gravity and Spacetime*, New York: Scientific American Library, 1990, ch. 6.

[21] Wheeler, "Information, Physics, Quantum", p. 15.

[22] *ibid.,* p. 16.

[23] We will ignore for now the fact that if the mind is illusory, then so is all philosophy including Hume's, and if causation is illusory, then so is the form of causation represented by logical implication, including Hume's use of logical implication to define his philosophy.

[24] Bertrand Russell, *History of Western Philosophy*, London: Unwin Paperbacks, 1979.

[25] Christopher M. Langan, "Of Trees, Quads, and God", *Noesis-E*, Vol. 1, No. 4, 2001.

[26] Kurt Gödel, *On Formally Undecidable Propositions of Principia Mathematica and Related Systems*. Meltzer, B., transl., New York: Basic Books, 1962.

[27] For more on the Lowenheim-Skolem theorem and Duhem-Quine thesis, see Christopher M. Langan, "The Theory of Theories", *Noesis-E*, Vol. 2., No. 1, 2002.

[28] The Many Worlds interpretation of quantum mechanics, in claiming to circumvent the problem of quantum mechanical wave function collapse, in effect claims to circumvent the problem of split consciousness as well. However, since MW is itself necessarily formulated in terms of two-valued logic, the problem regresses to that of how the "hyperuniverse" associated with MW itself "collapsed" out of the sea of all potential "meta-realities". On this score, MW has little insight to offer on its own behalf. MW thus lacks justificative self-containment and is therefore no basis for a fundamental theory of reality. In any case, since the theory we are describing in this paper is designed to address reality in its most basic form, and thus to address all conceivable realities as its possible instantiations, it supersedes any explanation afforded by MW alone.

[29] Several millennia ago, Aristotle proposed (categorical) logic as the formal rules of correct reasoning. Now as then, "reasoning" is inferential, mental and subjective in nature. After standing largely changeless until the nineteenth century, the field of logic began to undergo additional progress. But although this progress has been considerable, it has left the inferential, mental and subjective nature of logic essentially intact.

[30] Note that while this seems to imply that the 3 M's are "axioms" and therefore independent, the premise of axiomatic independence is itself a rather flimsy concept. These principles are actually rather strongly related in the sense that they can to some extent be inferred from each other in a reality-theoretic context.

[31] In physics, the phrase "Reality Principle" has sometimes been associated with the idea that objective reality exists independently of human observation, at least to the extent that it does not suddenly disappear when not being directly watched. As used in this paper, the phrase "Reality Principle" is to be interpreted as described in this section unless otherwise indicated.

[32] Note: the type-theoretic resolution of this paradox is incomplete; full resolution requires MU, a kind of "meta-syndiffeonesis" endowing the infocognitive lattice of spacetime with a higher level of closure.

[33] A syndiffeonic regress ultimately leads to a stable closed syntax in which all terms are mutually defined; mutual definition is what stabilizes and lends internal determinacy (internal identifiability of events) to the system through syntactic symmetry. I.e., relational closure orthogonal to the (temporal) dimension of regress amounts to the distribution of a systemic identity, and unless this identity is fully defined, the identities of system components cannot be defined or recognized by or with respect to each other. Thus, the dynamic identity is a self-identification function with definitive, descriptive and interpretative dimensions.

[34] It is tempting to note that "relativity" means roughly the same thing in the General Theory of Relativity as it does here. That is, using a distributed-syntactic "tangent space", the structure of spacetime is tensorially defined in terms of the masses and relative positions of its own material contents, resulting in an intrinsic MAP-like definition of spacetime. Unfortunately, the basic formalism of GR, differential geometry, is not self contained with respect to time; as currently formulated, it tacitly relies on an embedding (conspansive) medium to provide it with temporal potential.

[35] What such a question really asks is "why does the habitation and observation relationship holding between the observer/questioner and the universe exist?" The Weak Anthropic Principle goes halfway toward an answer by applying a probabilistic selection function: "the relationship has been logically selected by the fact that only certain kinds of universe can accommodate acts of observation and an observer like the questioner." This is right as far as it goes, but omits the generative, pre-selective phase of the explanation … the part that accounts for the selection function and the domain to which it is applied. In this respect, the WAP is a bit like natural selection; it weeds the garden well enough, but is helpless to grow a single flower.

[36] Note that the M=R Principle does not assert (e.g.) that the fruits of human imagination are "real" except as neural firing patterns with no necessary relevance to anything outside the brain, or that we can immediately make things "real" just by thinking of them. The M=R principle merely says that where mind is the engine of cognition and perception, and these processes are jointly regarded as a "language" obeying rules of syntax, this syntax - the rules of cognition and perception - necessarily distributes over percipient and percept.

[37] Christopher M. Langan, "Introduction to the CTMU", *Ubiquity,* Vo.1, No.1, 1999. Also available at: http://www.megafoundation.org/CTMU.html

[38] Arthur S. Eddington, *The Expanding Universe*, Cambridge University Press, 1933.

[39] Christopher M. Langan, "Physics and Metaphysics", *Noesis-E*, Vol. 1, No. 3, 2001.

[40] A Markoff process is a stochastic process with no memory. That is, it is a process meeting two criteria: (1) state transitions are constrained or influenced by the present state, but not by the particular sequence of steps leading to the present state; (2) state transition contains an element of chance. Physical processes are generally assumed to meet these criteria; the laws of physics are defined in accordance with 1, and because they ultimately function on the quantum level but do not fully determine quantum state transitions, an element of chance is superficially present. It is in this sense that the distributed laws of physics may be referred to as "Markovian". However, criterion 2 opens the possibility that hidden influences may be active.

[41] Christopher M. Langan, *The Art of Knowing: Expositions on Free Will and Selected Essays*, Eastport, NY: Mega Foundation Press, 2002.

[42] Gellert, W., Kustner, H., Hellwich, M., and Kastner, H., *The VNR Concise Encyclopedia of Mathematics*, New York: Van Nostrand Reinhold Company, 1977, p.334.

[43] Not all expressions are propositions; propositions are expressions with no free (unquantified) variables. Permitting the quantification of unary (one-place) predicates and treating them as individuals results in a generalization of the elementary languages to a more expressive class of languages, the monadic languages of the second order. Further generalizations are possible along these lines.

[44] Lest the inclusion of utility, qualia or feelings seem "unscientific", we need merely observe that it would be vastly more unscientific to ignore things that are subjectively known to exist on the wishful and rationally unjustifiable assumption that subjectivity and subjective predicates play no part in the self-definition of reality. Insofar as subjectivity merely refers to the coherent intrinsic identities of the elements of objective relationships, this would be logically absurd. But in any case, our aim at this point is merely to classify the basic elements in terms of which we view the world, whether or not they have thus far proven accessible to standard empirical methodology, and this means recognizing the reality of qualic and emotional predicates and adjoining the corresponding nonlogical constants to SCSPL syntax. If QPS and ETS predicates turn out to be reducible to more fundamental STOS/LMS predicates, then very well; it will permit a convenient reduction of the syntax. But this is certainly not something that can be decided in advance.

[45] Cognitive-perceptual syntax consists of (1) sets, posets or tosets of attributes (telons), (2) perceptual rules of external attribution for mapping external relationships into telons, (3) cognitive rules of internal attribution for cognitive (internal, non-perceptual) state-transition, and (4) laws of dependency and conjugacy according to which perceptual or cognitive rules of external or internal attribution may or may not act in a particular order or in simultaneity.

[46] To see how information can be beneficially reduced when all but information is uninformative by definition, one need merely recognize that information is not a stand-alone proposition; it is never found apart from syntax. Indeed, it is only by syntactic acquisition that anything is ever "found" at all. That which is recognizable